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U.S. ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL FINANCIAL ADVISORY BOARD
APRIL 2021

Joanne Throwe, Chair
Ed Chu, Designated Federal Officer

MEMBERS

NAME	AFFILIATION	REPRESENTED GROUP
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Brent Anderson	Chief Executive Officer, RESIGHT, Littleton, CO	Business – Industry
Janice Beecher	Director, Institute of Public Utilities, Michigan State University, East Lansing, MI	Academic Expert (Special Gov't Employee)
Steven J. Bonafonte	Assistant District Counsel, The Metropolitan District of Hartford, Hartford, CT	State/Local Government
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Theodore Chapman	Senior Director, U.S. Public Finance Infrastructure Group, S&P Global Ratings, Farmers Branch, TX	Business - Financial Services
Zachary Davidson	Director of Underwriting, Ecosystem Investment Partners, Baltimore, MD	Business – Financial Services
Jeffrey R. Diehl	Chief Executive Officer, Rhode Island Infrastructure Bank, Providence, RI	State/Local Government

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Craig Holland	Senior Director of Urban Investments, The Nature Conservancy, Arlington, VA	Environmental/Non-governmental Organization
Craig A. Hrinkevich	Managing Director, Public Finance Team - New Jersey, Robert W. Baird & Company Inc., Red Bank, NJ	Business – Financial Services
John L. Jones	Member of the Board, New Mexico Rural Water Association, Albuquerque, NM	State/Local Government
Margot M. Kane	Chief Investment Officer, Spring Point Partners LLC, Philadelphia, PA	Business – Financial Services
George W. Kelly	Global Client Strategy Officer, Earth & Water Strategies, Denver, CO	Business – Financial Services
Cynthia Koehler	Executive Director, WaterNow Alliance, San Francisco, CA	Environmental/Non-governmental Organization
Colleen Kokas	Executive Vice President, Environmental Liability Transfer, Inc., Lahaska, PA	Business – Industry
Pamela Lemoine	Principal Consultant, Black & Veatch Management Consulting, LLC, Chesterfield, MO	Business – Financial Services

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Eric Letsinger	Founder and Chief Executive Officer, Quantified Ventures, Chevy Chase, MD	Business – Financial Services
James McGoff	Director of Environmental Programs, Indiana Finance Authority, Indianapolis, IN	State/Local Government
Christopher Meister	Executive Director, Illinois Finance Authority, Chicago, IL	State/Local Government
Kerry E. O'Neill	Chief Executive Officer, Inclusive Prosperity Capital, Inc., Stamford, CT	Environmental/Non-governmental Organization
James (Tony) Parrott	Executive Director, Metropolitan Sewer District of Louisville, Louisville, KY	State/Local Government
MaryAnna H. Peavey	Grants and Loans Supervisor, Idaho Department of Environmental Quality, Boise, ID	State/Local Government
Dennis A. Randolph	Director of Public Works, City of Grandview, Grandview, MO	State/Local Government
Eric Rothstein	Principal, Galardi Rothstein Group, Chicago, IL	Business – Financial Services
William Stannard	Chairman of the Board, RAFTELIS, Kansas City, MO	Business – Financial Services
Carl Thompson	Vice President, Sales and Marketing, Infiltrator Water Technologies, Old Saybrook, CT	Business – Industry
David Zimmer	Executive Director, New Jersey Infrastructure Bank, Lawrenceville, NJ	State/Local Government

U.S. Environmental Protection Agency

Environmental Financial Advisory Board

Public Meeting
Location: Virtual

April 20-21, 2021
11:00 a.m. – 3:00 p.m. Eastern

Day 1 - April 20

11:00 am	**I. WELCOME AND REVIEW OF AGENDA** – Ed Chu, EFAB Designated Federal Officer – Joanne Throwe, EFAB Chair – Roll Call/Member Introductions
11:15 am	**II. WELCOME AND Q&A** – Rosemary Enobakhare, Associate Administrator, Office of Public Engagement and Environmental Education
11:30 am	**III. OPPORTUNITY ZONES WORKGROUP** – Report from Workgroup Co-chairs and Program Office representative
12:05 pm	**IV. EPA STRATEGIC FORESIGHT** – Kathy OBrien and Lek Kadeli, Office of the Chief Financial Officer
12:35 pm	**BREAK** (15 min)
12:50 pm	**V. OPPORTUNITY ZONES CHARGE DISCUSSION and NEXT STEPS**
1:25 pm	**VI. STORMWATER CREDIT TRADING WORKGROUP** – Report from Workgroup Co-chairs
1:40 pm	**VII. STORMWATER CHARGE DISCUSSION and NEXT STEPS**
2:05 pm	**VIII. ENVIRONMENTAL RISK and COST OF CAPITAL WORKGROUP** – Report from Workgroup Co-chairs
2:20 pm	**IX. ENVIRONMENTAL RISK and COST OF CAPITAL CHARGE DISCUSSION and NEXT STEPS**
2:45 pm	**X. PUBLIC COMMENT** – Registered speakers
3:00 pm	**RECESS**

(Day 2 agenda on next page)
Day 2 – April 21

11:00 am	**I. RECONVENE** – Ed Chu, EFAB Designated Federal Officer – Roll Call
11:10 am	**II. EFAB CHAIR'S CORNER** – Joanne Throwe, EFAB Chair
11:30 am	**III. UPDATE FROM ENVIRONMENTAL FINANCE CENTER NETWORK (EFCN)** – Jen Cotting, EFCN President, University of Maryland EFC – Martha Sheils, New England EFC – Khris Dodson, Syracuse University EFC – Tonya Bronleewe, Wichita State University EFC
12:00 pm	**IV. PRESENTATION OF NEW PROPOSED CHARGES** – Financing Small Manufacturer Pollution Prevention Projects: David Widawsky, Director, Data Gathering and Analysis Division, Office of Pollution Prevention and Toxics
12:20 pm	**V. DISCUSSION OF PROPOSED CHARGES AND NEXT STEPS**
12:40 pm	**VI. EPA POLICY PRIORITIES** – Philip Fine and Al McGartland, Office of Policy
1:10 pm	**BREAK** (20 min)
1:30 pm	**VI. UPDATE FROM THE CHIEF FINANCIAL OFFICER** – David Bloom, Office of the Chief Financial Officer (invited)
2:00 pm	**VII. EPA RESPONSE TO RECENT EFAB ADVICE** – DFO will provide update on all recent advice and possible programmatic updates as appropriate o Water system regionalization o Alternative service delivery options for public utility projects o Alaska backhaul o Evaluating stormwater infrastructure funding and financing – Member Questions and Discussion
2:50 pm	**VIII. PUBLIC COMMENT** – Registered Speakers
3:00 pm	**ADJOURN**

Rosemary Enobakhare
Associate Administrator, Office of Public Engagement and Environmental Education

Rosemary Enobakhare was appointed by President Biden to serve as the Associate Administrator for the Office of Public Engagement and Environmental Education at the United States Environmental Protection Agency (EPA).

Prior to joining the EPA, Rosemary served on the Energy and Environments appointments team for the Biden-Harris Transition. She also served as Campaigns Director with The Hub Project where she designed and managed large-scale progressive campaigns. Prior to joining the team at the Hub Project, Rosemary served as the Coalition Director for the Clean Water for All Coalition, where she helped build one of the most diverse federal coalitions to defend bedrock clean water protections at the federal level.

Rosemary was previously appointed by the Obama Administration to serve as the Deputy Associate Administrator for Public Engagement and Environmental Education in the Office of the Administrator at the United States Environmental Protection Agency. Prior to joining the Administration, Rosemary served as the Director of African American Outreach for the Democratic National Committee, leading the party's efforts around engaging the African American Community in the 2012 election.

Rosemary is a native of Jackson, Mississippi and received her Bachelors' Degree in Economics from Spelman College.

Lek Kadeli
Senior Advisor to EPA's Chief Financial Officer

Lek Kadeli is currently the Senior Advisor to EPA's Chief Financial Officer. Lek has over 30 years of environmental and human health related experience in the government and the private sector, with broad experience in leading organizational change and improvement, policy development, planning and budgeting, resource management, and information management. Prior to joining the OCFO, he served as the Acting Deputy Assistant Administrator for Management in the Office of Chemical Safety and Pollution Prevention. From 2016-2018, Lek worked at the World Bank Group in Washington, D.C. as the co-program manager of the Pollution Management and Environmental Health Program, Environment and National Resources Global Practice. His work at the EPA has also included serving as the Acting Assistant Administrator, Principal Deputy Assistant Administrator, Director of the Office of Resource Management and Administration, and Chief of the Resources Planning and Execution Staff, all in the Office of Research and Development. Prior to that, he worked as a Senior Budget Officer in the Office of International Activities and as a Budget Analyst in the Office of Administration and Resource Management.

Lek has a B.A. in International Relations from George Mason University and an M.A. in National Security Studies from Georgetown University.

Environmental Finance Center Network

Speakers for the April 2021 Environmental Financial Advisory Board Meeting

Jen Cotting, Environmental Finance Center Network President

After fifteen years with the Environmental Finance Center (EFC), Jen was appointed Director in 2018. She had previously served as the EFC's first Research Associate for Green Infrastructure, managing the Center's portfolio of green infrastructure projects, as well as the Associate Director managing the day-to-day operations of the Center and staff and overseeing more than three dozen programs and projects. Her own projects over the past ten years have involved research and analysis on resource management, financial business planning, and public education and community engagement, particularly in the water quality regulatory arena. Current and recent projects include support and promotion of multi-municipal water quality efforts in a number of Pennsylvania communities, climate and sea level rise planning in the towns of Calvert County, Maryland, and collaborative watershed financing in Virginia's Elizabeth River Watershed. She holds an MS in Sustainable Development and Conservation Biology from the University of Maryland and a BA in Communications from Marymount University.

Tonya Bronleewe

Tonya Bronleewe serves as the Director of the Environmental Finance Center (EFC) at Wichita State University. Tonya has been with the EFC since 2015. Tonya is committed to enabling the EFC to help communities and organizations build capacity so that they can tackle environmental challenges. Prior to joining the EFC, Tonya worked at City of Wichita as an air quality specialist and at K-State Research and Extension as a natural resources extension agent and environmental education program coordinator. Tonya completed a Master's of Science in Environmental Science at Friends University, holds a BA from Tabor College in Environmental Biology and International Studies.

Khristopher Dodson

Khristopher Dodson is the Associate Director of the Syracuse University Environmental Finance Center. Khris provides technical assistance to local government on topics related to water, wastewater and stormwater management. He provides technical assistance and training on topics such as Infrastructure funding & resiliency, Leadership, Management and Finance. Khris has a master's degree from the SUNY College of Environmental Science and Forestry and a Master of Arts from Syracuse University.

Martha Sheils

Martha Sheils is the Director of the New England Environmental Finance Center at the University of Southern Maine in Portland. Martha manages NE EFC's program areas with a focus on financing stormwater management and critical infrastructure, climate adaptation, source water protection, sustainable craft brewery practices, and more. The NE EFC also manages EPA's Southeast New England Program's Technical Assistance Network (SNEP Network) of local partners that provide training and technical assistance to Rhode Island and Southeast Massachusetts communities. Martha has over 20 years of experience in the resource economics field including international work in Russia and Kazakhstan with the Harvard Institute for International Development. She has a BA from Rutgers University in economics and a Master of Environmental Management degree from Duke University's Nicholas School of the Environment.

DAVID WIDAWSKY, Ph.D.

Dr. Widawsky is the Director of the Data Gathering and Analysis Division, in the Office of Chemical Safety and Pollution Prevention at EPA. He provides leadership for the EPA's mission focus on chemical safety and sustainability in the implementation of the Toxic Substances Control Act, the Pollution Prevention Act, and the Emergency Planning and Community Right to Know Act. The multi-disciplinary staff under his leadership provide expertise, analysis, method development, and innovation in a number of key disciplines. He leads several pollution prevention programs at EPA, including grants to states and tribes for working with businesses to promote source reduction and an environmentally preferable purchasing program for federal procurement. He also leads programs in sustainability through safer and sustainable chemistry and chemical products, including EPA's Green Chemistry Challenge Awards and EPA's Safer Choice labeling program for safer chemical products. Dr. Widawsky is a graduate of the University of California with B.Sc. degrees in Political Economy of Natural Resources and in Plant and Soil Biology, received his M.S. from Colorado State University (Agricultural Economics), and earned his Ph.D. at Stanford University (Applied and Development Economics). He has worked at the U.S. EPA since 1998, where he has served in a number of leadership roles across the Agency. He has lived and worked in six different countries.

Philip Fine
Principal Deputy Associate Administrator for Policy

Dr. Fine joins EPA after a 15 year career at the South Coast Air Quality Management District in Southern California. He most recently served as the Deputy Executive Officer for the Planning, Rule Development & Area Sources Division, where he oversaw all activities of the Division, including development of State Implementation Plans and Air Quality Management Plans, strategies and regulations for air pollution control, meteorology and forecasting, air quality evaluation, air toxics risk assessment, emissions inventories, socioeconomic analyses, transportation programs, and enforcement for area sources. Prior to this role, Dr. Fine's previous responsibilities at South Coast AQMD included oversight of ambient air monitoring, laboratory services, quality assurance, and source testing. Dr. Fine served on the California Air Resources Board's legislatively-mandated Research Screening Committee, and has also served on several EPA Clean Air Scientific Advisory Committee expert panels. Before joining the South Coast AQMD, Dr. Fine was a Research Assistant Professor at the University of Southern California, Los Angeles where he taught courses and conducted extensive research on particulate pollution, air monitoring technologies, and exposure assessment. He has over 50 peer-reviewed scientific publications to date. He received his Ph.D. from the California Institute of Technology in Environmental Science & Engineering, and his bachelor's degree in Mechanical Engineering and Materials Science & Engineering from the University of California, Berkeley.

Al McGartland
Director, National Center for Environmental Economics

Al McGartland is the Director of the National Center for Environmental Economics and the lead economist at the U.S. Environmental Protection Agency. Al advises EPA's senior leadership on regulatory analyses, science, and environmental policy. He is responsible for insuring EPA's analyses reflects the latest science and develops interdisciplinary risk, benefit assessment, and environmental justice methods to be used in EPA's regulatory analyses. Most recently, Al has been focusing on improving quantification of the Social Cost of Greenhouse Gases and examining ways to enhance financial information available on risks from climate change, including financial risks due to the transition to a low-carbon economy. As the director of NCEE, Al advises senior policy-making officials on the economics of environmental policies and helps translate research into applied policy contexts. Under Al's leadership, EPA's National Center for Environmental Economics issues EPA's Guidelines for Preparing Economic Analyses and conducts numerous studies to assess the benefits and costs of environmental programs. The Center also conducts key research on environmental economic issues. Al also supports numerous interagency and White House initiatives, including projects on agriculture and environmental risks, the Social Cost of Greenhouse Gases, and the valuation of reduced health risks from environmental contaminants.

Prior to EPA, Al worked at the Office of Information and Regulatory Affairs in the Office of Management and Budget. Al also served as the economic advisor to the Chairman at the Commodity Futures Trading Commission. He is a Fellow of the Association of Environmental and Resource Economists and has published in numerous journals, including *Science*, the *American Economic Review*, the *Canadian Journal of Economics*, the *Journal of Environmental Management*, the medical journal, *Lancet*, and the *Journal of Environmental Economics and Management*.

David A. Bloom
Acting Chief Financial Officer

David Bloom is the Acting Chief Financial Officer at the EPA, having oversight of EPA's annual budget and performance plan, strategic planning efforts, and financial operations, policy, and financial information systems for the agency. He also oversees environmental finance activities and the E-Enterprise for the Environment initiative.

David began his federal career at the Office of Management and Budget in 1985. In 1991, David joined the EPA's Office of Budget, where he worked in a number of capacities until his appointment as Budget Director in 2003. As Director of the Office of Budget, he managed and directed staff overseeing the budget execution and budget formulation activities for the agency and was responsible for the preparation of the Agency's Annual Plan and Budget. David was appointed the agency's Deputy Chief Financial Officer in September, 2014. Prior to that, he served from April, 2013 to August, 2014 as the Acting Deputy Chief Financial Officer for the agency. He also served as Acting Chief Financial Officer from September 2014 to July 2015, from January 2017 to November 2017, from September 2019 to March 2020, and from January 2021 to the present. He has been at the forefront of improving the agency's financial efficiencies and accountability, working closely with the Office of Management and Budget, Congressional staff, and the EPA's State, local, and tribal partners.

David received a Bachelor's degree in Business Administration from the University of Florida and a Master's Degree in Business Administration from The George Washington University. He was a recipient of the Presidential Rank Meritorious Executive Award in 2012.

Environmental Financial Advisory Board

Opportunity Zones Workgroup

Margot Kane and Bill Stannard, co-chairs

Brent Anderson
Steve Bonafonte
Sonja Favors
Craig Holland
John Jones
Chris Meister
Dennis Randolph
David Zimmer

OPPORTUNITY ZONES WORKGROUP
THE CHARGE

- EFAB Approved Proposed Charge With Refinements by the Workgroup
- Workgroup Was Formed
- Refinements following EFAB Operating Manual
  - Alignment With EFAB Role
  - EPA Desired Schedule
  - Alignment with Workgroup Interest and Expertise
  - Narrow Scope of Charge
- Final Charge to be Addressed

Environmental Financial Advisory Board

OPPORTUNITY ZONES WORKGROUP
THE CHARGE

- **Facilitating Investment (Marketplace/Matchmaking):** Advise EPA on how to enhance the Agency's approach to encourage increased OZ funds investment into both rural and urban communities alongside existing EPA funding tools, programs, regulatory/permitting flexibility and federal and state partners. Provide examples and advice and support to communities, including ways to minimize risk for investors, and to investors seeking to direct OZ Fund investment into low-income, minority, and/or otherwise vulnerable communities, reflecting environmental justice (EJ) principles.
  - Note where community benefits standards and guidance have been developed [or are so far lacking] that may be relevant to OZ-funded projects in these communities and the value of such community benefits can be achieved.
  - Provide recommendations on where EPA may *uniquely* be situated to coordinate with investors and other agencies in encouraging/identifying OZ investment opportunities in high-priority communities from an environmental justice standpoint, including low-income, minority, tribal, and indigenous communities that bear disproportionate environmental risks and damages.

OPPORTUNITY ZONES WORKGROUP
SUBGROUPS

- Community Benefits
  - Dennis Randolph – Lead
  - Steve Bonafonte
  - Sonja Favors
  - John Jones
  - Bill Stannard
- EPA Enabling Roles
  - Chris Meister – Lead
  - Brent Anderson
  - Craig Holland
  - Margot Kane
  - David Zimmer

OPPORTUNITY ZONES WORKGROUP
DRAFT WORKPLAN

- Monthly assignments / meetings for the subgroups
- May panel discussion with OZ fund managers working in low-income communities
- June 30, August 5 draft outlines/components from each group, including any requested EPA research/feedback
- Anticipate draft deliverable ahead of Aug/Sept board meeting for board discussion/approval

Environmental Financial Advisory Board

Environmental Financial Advisory Board

EFAB Discussion

Foresight

Strategic Discussion with the Environmental Finance Advisory Board

April 20, 2021

Lek Kadeli, Senior Advisor,
USEPA Office of the Chief Financial Officer

Foresight In Strategic Planning

- Systematically considers a longer time horizon and broader scope of issues.
- Facilitates a systems approach to problem solving that encourages organizational communication to avoid “silo effect.”
- Strengthens an agency’s strategic perspective by analyzing and preparing for multiple possible futures.
- Helps agencies prepare for future threats or take early advantage of emerging opportunities.
- A framework that provides valuable strategic insights for key decision-makers to inform policy decisions. (should be a part of strategic planning efforts).
- About making better-informed decisions, NOT predicting the future.

Foresight Impacts on Agency Strategic Plans

Foresight efforts informed issues discussed in EPA's 2006–2011, 2011–2015, 2014–2018, and 2018-2022 Strategic Plans

- Population growth and water scarcity
- Nanotechnology
- Waste from mining rare earth elements
- Remote sensing
- Distributed sensor networks
- Information technology
- Climate change
- Sea level rise and storm surge
- Biotechnology
- Genomics
- Computational toxicology
- Pharmaceuticals in wastewater
- Renewable energy
- Biofuels
- Monitoring, sensing, measurement technologies
- Data sciences
- Social science research
- Emerging chemical and biological contaminants

Key Foresight Questions and Discussion

- What changes have you seen in environmental finance over the past 20 years?
- What are the key forces or developments that you think might affect environmental finance over the next 20 years? (Any kind – social, policy, regulatory, technological, economic, environmental, political, etc)
- What could go wrong or get worse? What actions could help head off negative developments?
- What do you think a preferred future for environmental finance would look like in 15-20 years? What actions could we take together to move toward it?

BRIEFING ROOM

Executive Order on Tackling the Climate Crisis at Home | and Abroad

JANUARY 27, 2021 • PRESIDENTIAL ACTIONS

The United States and the world face a profound climate crisis. We have a narrow moment to | pursue action at home and abroad in order to avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents. Domestic action must go hand in hand with United States international leadership, aimed at significantly enhancing global action. Together, we must listen to science and meet the moment. |

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

PART I — PUTTING THE CLIMATE CRISIS AT THE CENTER OF UNITED STATES FOREIGN POLICY AND NATIONAL SECURITY

Section 101. Policy. United States international engagement to address climate change — which has become a climate crisis — is more necessary and urgent than ever. The scientific community has made clear that the scale and speed of necessary action is greater than | previously believed. There is little time left to avoid setting the world on a dangerous, potentially catastrophic, climate trajectory. Responding to the climate crisis will require both significant short-term global reductions in greenhouse gas emissions and net-zero global emissions by mid-century or before. |

It is the policy of my Administration that climate considerations shall be an essential element of United States foreign policy and national security. The United States will work with other countries and partners, both bilaterally and multilaterally, to put the world on a sustainable climate pathway. The United States will also move quickly to build resilience, both at home and abroad, against the impacts of climate change that are already manifest and will continue to intensify according to current trajectories. |

Sec. 102. Purpose. This order builds on and reaffirms actions my Administration has already taken to place the climate crisis at the forefront of this Nation's foreign policy and national

security planning, including submitting the United States instrument of acceptance to rejoin the Paris Agreement. In implementing — and building upon — the Paris Agreement's three overarching objectives (a safe global temperature, increased climate resilience, and financial flows aligned with a pathway toward low greenhouse gas emissions and climate-resilient development), the United States will exercise its leadership to promote a significant increase | in global climate ambition to meet the climate challenge. In this regard:

(a) I will host an early Leaders' Climate Summit aimed at raising climate ambition and making a positive contribution to the 26th United Nations Climate Change Conference of the Parties (COP26) and beyond.

(b) The United States will reconvene the Major Economies Forum on Energy and Climate, beginning with the Leaders' Climate Summit. In cooperation with the members of that Forum, as well as with other partners as appropriate, the United States will pursue green recovery efforts, initiatives to advance the clean energy transition, sectoral decarbonization, and alignment of financial flows with the objectives of the Paris Agreement, including with respect to coal financing, nature-based solutions, and solutions to other climate-related challenges.

(c) I have created a new Presidentially appointed position, the Special Presidential Envoy for Climate, to elevate the issue of climate change and underscore the commitment my Administration will make toward addressing it.

(d) Recognizing that climate change affects a wide range of subjects, it will be a United States priority to press for enhanced climate ambition and integration of climate considerations across a wide range of international fora, including the Group of Seven (G7), the Group of Twenty (G20), and fora that address clean energy, aviation, shipping, the Arctic, the ocean, sustainable development, migration, and other relevant topics. The Special Presidential Envoy for Climate and others, as appropriate, are encouraged to promote innovative approaches, including international multi-stakeholder initiatives. In addition, my Administration will work in partnership with States, localities, Tribes, territories, and other United States stakeholders to advance United States climate diplomacy.

(e) The United States will immediately begin the process of developing its nationally determined contribution under the Paris Agreement. The process will include analysis and input from relevant executive departments and agencies (agencies), as well as appropriate outreach to domestic stakeholders. The United States will aim to submit its nationally determined contribution in advance of the Leaders' Climate Summit.

(f) The United States will also immediately begin to develop a climate finance plan, making strategic use of multilateral and bilateral channels and institutions, to assist developing

countries in implementing ambitious emissions reduction measures, protecting critical ecosystems, building resilience against the impacts of climate change, and promoting the flow of capital toward climate-aligned investments and away from high-carbon investments. The Secretary of State and the Secretary of the Treasury, in coordination with the Special Presidential Envoy for Climate, shall lead a process to develop this plan, with the participation of the Administrator of the United States Agency for International Development (USAID), the Chief Executive Officer of the United States International Development Finance Corporation (DFC), the Chief Executive Officer of the Millennium Challenge Corporation, the Director of the United States Trade and Development Agency, the Director of the Office of Management and Budget, and the head of any other agency providing foreign assistance and development financing, as appropriate. The Secretary of State and the Secretary of the Treasury shall submit the plan to the President, through the Assistant to the President for National Security Affairs and the Assistant to the President for Economic Policy, within 90 days of the date of this order.

(g) The Secretary of the Treasury shall:

(i) ensure that the United States is present and engaged in relevant international fora and institutions that are working on the management of climate-related financial risks;

(ii) develop a strategy for how the voice and vote of the United States can be used in international financial institutions, including the World Bank Group and the International Monetary Fund, to promote financing programs, economic stimulus packages, and debt relief initiatives that are aligned with and support the goals of the Paris Agreement; and

(iii) develop, in collaboration with the Secretary of State, the Administrator of USAID, and the Chief Executive Officer of the DFC, a plan for promoting the protection of the Amazon rainforest and other critical ecosystems that serve as global carbon sinks, including through market-based mechanisms.

(h) The Secretary of State, the Secretary of the Treasury, and the Secretary of Energy shall work together and with the Export–Import Bank of the United States, the Chief Executive Officer of the DFC, and the heads of other agencies and partners, as appropriate, to identify steps through which the United States can promote ending international financing of carbon-intensive fossil fuel-based energy while simultaneously advancing sustainable development and a green recovery, in consultation with the Assistant to the President for National Security Affairs.

(i) The Secretary of Energy, in cooperation with the Secretary of State and the heads of other agencies, as appropriate, shall identify steps through which the United States can intensify

international collaborations to drive innovation and deployment of clean energy technologies, which are critical for climate protection.

(j) The Secretary of State shall prepare, within 60 days of the date of this order, a transmittal package seeking the Senate's advice and consent to ratification of the Kigali Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer, regarding the phasedown of the production and consumption of hydrofluorocarbons.

Sec. 103. Prioritizing Climate in Foreign Policy and National Security. To ensure that climate change considerations are central to United States foreign policy and national security:

(a) Agencies that engage in extensive international work shall develop, in coordination with the Special Presidential Envoy for Climate, and submit to the President, through the Assistant to the President for National Security Affairs, within 90 days of the date of this order, strategies | and implementation plans for integrating climate considerations into their international work, as appropriate and consistent with applicable law. These strategies and plans should include an assessment of:

(i) climate impacts relevant to broad agency strategies in particular countries or regions;

(ii) climate impacts on their agency-managed infrastructure abroad (e.g., embassies, military installations), without prejudice to existing requirements regarding assessment of such infrastructure;

(iii) how the agency intends to manage such impacts or incorporate risk mitigation into its installation master plans; and

(iv) how the agency's international work, including partner engagement, can contribute to addressing the climate crisis.

(b) The Director of National Intelligence shall prepare, within 120 days of the date of this order, a National Intelligence Estimate on the national and economic security impacts of climate change.

(c) The Secretary of Defense, in coordination with the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, the Chair of the Council on Environmental Quality, the Administrator of the Environmental Protection Agency, the Director of National Intelligence, the Director of the Office of Science and Technology Policy, the Administrator of the National Aeronautics and Space Administration, and the heads of other agencies as appropriate, shall develop and submit to the President, within 120 days of

the date of this order, an analysis of the security implications of climate change (Climate Risk Analysis) that can be incorporated into modeling, simulation, war-gaming, and other analyses.

(d) The Secretary of Defense and the Chairman of the Joint Chiefs of Staff shall consider the security implications of climate change, including any relevant information from the Climate Risk Analysis described in subsection (c) of this section, in developing the National Defense Strategy, Defense Planning Guidance, Chairman's Risk Assessment, and other relevant strategy, planning, and programming documents and processes. Starting in January 2022, the Secretary of Defense and the Chairman of the Joint Chiefs of Staff shall provide an annual update, through the National Security Council, on the progress made in incorporating the security implications of climate change into these documents and processes.

(e) The Secretary of Homeland Security shall consider the implications of climate change in the Arctic, along our Nation's borders, and to National Critical Functions, including any relevant information from the Climate Risk Analysis described in subsection (c) of this section, in developing relevant strategy, planning, and programming documents and processes. Starting in January 2022, the Secretary of Homeland Security shall provide an annual update, through the National Security Council, on the progress made in incorporating the homeland security implications of climate change into these documents and processes.

Sec. 104. Reinstatement. The Presidential Memorandum of September 21, 2016 (Climate Change and National Security), is hereby reinstated.

PART II — TAKING A GOVERNMENT-WIDE APPROACH TO THE CLIMATE CRISIS

Sec. 201. Policy. Even as our Nation emerges from profound public health and economic crises borne of a pandemic, we face a climate crisis that threatens our people and communities, public health and economy, and, starkly, our ability to live on planet Earth. Despite the peril that is already evident, there is promise in the solutions — opportunities to create well-paying union jobs to build a modern and sustainable infrastructure, deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050.

We must listen to science — and act. We must strengthen our clean air and water protections. We must hold polluters accountable for their actions. We must deliver environmental justice in communities all across America. The Federal Government must drive assessment, disclosure, and mitigation of climate pollution and climate-related risks in every sector of our economy, marshaling the creativity, courage, and capital necessary to make our Nation resilient in the face of this threat. Together, we must combat the climate crisis with bold, progressive

action that combines the full capacity of the Federal Government with efforts from every corner of our Nation, every level of government, and every sector of our economy.

It is the policy of my Administration to organize and deploy the full capacity of its agencies to combat the climate crisis to implement a Government-wide approach that reduces climate pollution in every sector of the economy; increases resilience to the impacts of climate change; protects public health; conserves our lands, waters, and biodiversity; delivers environmental justice; and spurs well-paying union jobs and economic growth, especially through innovation, commercialization, and deployment of clean energy technologies and infrastructure. Successfully meeting these challenges will require the Federal Government to pursue such a coordinated approach from planning to implementation, coupled with substantive engagement by stakeholders, including State, local, and Tribal governments.

Sec. 202. White House Office of Domestic Climate Policy. There is hereby established the White House Office of Domestic Climate Policy (Climate Policy Office) within the Executive Office of the President, which shall coordinate the policy-making process with respect to domestic climate-policy issues; coordinate domestic climate-policy advice to the President; ensure that domestic climate-policy decisions and programs are consistent with the President's stated goals and that those goals are being effectively pursued; and monitor implementation of the President's domestic climate-policy agenda. The Climate Policy Office shall have a staff headed by the Assistant to the President and National Climate Advisor (National Climate Advisor) and shall include the Deputy Assistant to the President and Deputy National Climate Advisor. The Climate Policy Office shall have such staff and other assistance as may be necessary to carry out the provisions of this order, subject to the availability of appropriations, and may work with established or ad hoc committees or interagency groups. All agencies shall cooperate with the Climate Policy Office and provide such information, support, and assistance to the Climate Policy Office as it may request, as appropriate and consistent with applicable law.

Sec.203. National Climate Task Force. There is hereby established a National Climate Task Force (Task Force). The Task Force shall be chaired by the National Climate Advisor. |

(a) Membership. The Task Force shall consist of the following additional members:

(i) the Secretary of the Treasury; |

(ii) the Secretary of Defense;

(iii) the Attorney General;

(iv) the Secretary of the Interior;

(v) the Secretary of Agriculture;

(vi) the Secretary of Commerce;

(vii) the Secretary of Labor;

(viii) the Secretary of Health and Human Services;

(ix) the Secretary of Housing and Urban Development;

(x) the Secretary of Transportation;

(xi) the Secretary of Energy;

(xii) the Secretary of Homeland Security;

(xiii) the Administrator of General Services;

(xiv) the Chair of the Council on Environmental Quality;

(xv) the Administrator of the Environmental Protection Agency;

(xvi) the Director of the Office of Management and Budget;

(xvii) the Director of the Office of Science and Technology Policy;

(xviii) the Assistant to the President for Domestic Policy;

(xix) the Assistant to the President for National Security Affairs;

(xx) the Assistant to the President for Homeland Security and Counterterrorism; and

(xxi) the Assistant to the President for Economic Policy.

(b) Mission and Work. The Task Force shall facilitate the organization and deployment of a Government-wide approach to combat the climate crisis. This Task Force shall facilitate planning and implementation of key Federal actions to reduce climate pollution; increase resilience to the impacts of climate change; protect public health; conserve our lands, waters, oceans, and biodiversity; deliver environmental justice; and spur well-paying union jobs and economic growth. As necessary and appropriate, members of the Task Force will engage on

these matters with State, local, Tribal, and territorial governments; workers and communities; and leaders across the various sectors of our economy.

(c) Prioritizing Actions. To the extent permitted by law, Task Force members shall prioritize action on climate change in their policy-making and budget processes, in their contracting and procurement, and in their engagement with State, local, Tribal, and territorial governments; workers and communities; and leaders across all the sectors of our economy.

USE OF THE FEDERAL GOVERNMENT'S BUYING POWER AND REAL PROPERTY AND ASSET MANAGEMENT

Sec. 204. Policy. It is the policy of my Administration to lead the Nation's effort to combat the climate crisis by example — specifically, by aligning the management of Federal procurement and real property, public lands and waters, and financial programs to support robust climate action. By providing an immediate, clear, and stable source of product demand, increased transparency and data, and robust standards for the market, my Administration will help to catalyze private sector investment into, and accelerate the advancement of America's industrial capacity to supply, domestic clean energy, buildings, vehicles, and other necessary products and materials.

Sec. 205. Federal Clean Electricity and Vehicle Procurement Strategy. (a) The Chair of the Council on Environmental Quality, the Administrator of General Services, and the Director of the Office and Management and Budget, in coordination with the Secretary of Commerce, the Secretary of Labor, the Secretary of Energy, and the heads of other relevant agencies, shall assist the National Climate Advisor, through the Task Force established in section 203 of this order, in developing a comprehensive plan to create good jobs and stimulate clean energy industries by revitalizing the Federal Government's sustainability efforts.

(b) The plan shall aim to use, as appropriate and consistent with applicable law, all available procurement authorities to achieve or facilitate:

(i) a carbon pollution-free electricity sector no later than 2035; and

(ii) clean and zero-emission vehicles for Federal, State, local, and Tribal government fleets, including vehicles of the United States Postal Service.

(c) If necessary, the plan shall recommend any additional legislation needed to accomplish these objectives.

(d) The plan shall also aim to ensure that the United States retains the union jobs integral to and involved in running and maintaining clean and zero-emission fleets, while spurring the

creation of union jobs in the manufacture of those new vehicles. The plan shall be submitted to the Task Force within 90 days of the date of this order.

Sec. 206. Procurement Standards. Consistent with the Executive Order of January 25, 2021, entitled, "Ensuring the Future Is Made in All of America by All of America's Workers," agencies shall adhere to the requirements of the Made in America Laws in making clean energy, energy efficiency, and clean energy procurement decisions. Agencies shall, consistent with applicable law, apply and enforce the Davis-Bacon Act and prevailing wage and benefit requirements. The Secretary of Labor shall take steps to update prevailing wage requirements. The Chair of the Council on Environmental Quality shall consider additional administrative steps and guidance to assist the Federal Acquisition Regulatory Council in developing regulatory amendments to promote increased contractor attention on reduced carbon emission and Federal sustainability.

Sec. 207. Renewable Energy on Public Lands and in Offshore Waters. The Secretary of the Interior shall review siting and permitting processes on public lands and in offshore waters to identify to the Task Force steps that can be taken, consistent with applicable law, to increase renewable energy production on those lands and in those waters, with the goal of doubling offshore wind by 2030 while ensuring robust protection for our lands, waters, and biodiversity and creating good jobs. In conducting this review, the Secretary of the Interior shall consult, as appropriate, with the heads of relevant agencies, including the Secretary of Defense, the Secretary of Agriculture, the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, the Secretary of Energy, the Chair of the Council on Environmental Quality, State and Tribal authorities, project developers, and other interested parties. The Secretary of the Interior shall engage with Tribal authorities regarding the development and management of renewable and conventional energy resources on Tribal lands.

Sec. 208. Oil and Natural Gas Development on Public Lands and in Offshore Waters. To the extent consistent with applicable law,the Secretary of the Interior shall pause new oil and natural gas leases on public lands or in offshore waters pending completion of a comprehensive review and reconsideration of Federal oil and gas permitting and leasing practices in light of the Secretary of the Interior's broad stewardship responsibilities over the public lands and in offshore waters, including potential climate and other impacts associated with oil and gas activities on public lands or in offshore waters. The Secretary of the Interior shall complete that review in consultation with the Secretary of Agriculture, the Secretary of Commerce, through the National Oceanic and Atmospheric Administration, and the Secretary of Energy. In conducting this analysis, and to the extent consistent with applicable law, the Secretary of the Interior shall consider whether to adjust royalties associated with

coal, oil, and gas resources extracted from public lands and offshore waters, or take other appropriate action, to account for corresponding climate costs.

Sec. 209. Fossil Fuel Subsidies. The heads of agencies shall identify for the Director of the Office of Management and Budget and the National Climate Advisor any fossil fuel subsidies provided by their respective agencies, and then take steps to ensure that, to the extent consistent with applicable law, Federal funding is not directly subsidizing fossil fuels. The Director of the Office of Management and Budget shall seek, in coordination with the heads of agencies and the National Climate Advisor, to eliminate fossil fuel subsidies from the budget request for Fiscal Year 2022 and thereafter.

Sec. 210. Clean Energy in Financial Management. The heads of agencies shall identify opportunities for Federal funding to spur innovation, commercialization, and deployment of clean energy technologies and infrastructure for the Director of the Office of Management and Budget and the National Climate Advisor, and then take steps to ensure that, to the extent consistent with applicable law, Federal funding is used to spur innovation, commercialization, and deployment of clean energy technologies and infrastructure. The Director of the Office of Management and Budget, in coordination with agency heads and the National Climate Advisor, shall seek to prioritize such investments in the President's budget request for Fiscal Year 2022 and thereafter.

Sec. 211. Climate Action Plans and Data and Information Products to Improve Adaptation and Increase Resilience. (a) The head of each agency shall submit a draft action plan to the Task Force and the Federal Chief Sustainability Officer within 120 days of the date of this order that describes steps the agency can take with regard to its facilities and operations to bolster adaptation and increase resilience to the impacts of climate change. Action plans should, among other things, describe the agency's climate vulnerabilities and describe the agency's plan to use the power of procurement to increase the energy and water efficiency of United States Government installations, buildings, and facilities and ensure they are climate-ready. Agencies shall consider the feasibility of using the purchasing power of the Federal Government to drive innovation, and shall seek to increase the Federal Government's resilience against supply chain disruptions. Such disruptions put the Nation's manufacturing sector at risk, as well as consumer access to critical goods and services. Agencies shall make their action plans public, and post them on the agency website, to the extent consistent with applicable law.

(b) Within 30 days of an agency's submission of an action plan, the Federal Chief Sustainability Officer, in coordination with the Director of the Office of Management and Budget, shall review the plan to assess its consistency with the policy set forth in section 204 of this order and the priorities issued by the Office of Management and Budget. |

(c) After submitting an initial action plan, the head of each agency shall submit to the Task Force and Federal Chief Sustainability Officer progress reports annually on the status of implementation efforts. Agencies shall make progress reports public and post them on the agency website, to the extent consistent with applicable law. The heads of agencies shall assign their respective agency Chief Sustainability Officer the authority to perform duties relating to implementation of this order within the agency, to the extent consistent with applicable law.

(d) To assist agencies and State, local, Tribal, and territorial governments, communities, and businesses in preparing for and adapting to the impacts of climate change, the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric | Administration, the Secretary of Homeland Security, through the Administrator of the Federal Emergency Management Agency, and the Director of the Office of Science and Technology Policy, in coordination with the heads of other agencies, as appropriate, shall provide to the Task Force a report on ways to expand and improve climate forecast capabilities and information products for the public. In addition, the Secretary of the Interior and the Deputy Director for Management of the Office of Management and Budget, in their capacities as the Chair and Vice-Chair of the Federal Geographic Data Committee, shall assess and provide to the Task Force a report on the potential development of a consolidated Federal geographic mapping service that can facilitate public access to climate-related information that will assist Federal, State, local, and Tribal governments in climate planning and resilience activities.

EMPOWERING WORKERS THROUGH REBUILDING OUR INFRASTRUCTURE FOR A SUSTAINABLE ECONOMY

Sec. 212. Policy. This Nation needs millions of construction, manufacturing, engineering, and skilled-trades workers to build a new American infrastructure and clean energy economy. These jobs will create opportunities for young people and for older workers shifting to new professions, and for people from all backgrounds and communities. Such jobs will bring opportunity to communities too often left behind — places that have suffered as a result of economic shifts and places that have suffered the most from persistent pollution, including low-income rural and urban communities, communities of color, and Native communities.

Sec. 213. Sustainable Infrastructure. (a) The Chair of the Council on Environmental Quality | and the Director of the Office of Management and Budget shall take steps, consistent with applicable law, to ensure that Federal infrastructure investment reduces climate pollution, and to require that Federal permitting decisions consider the effects of greenhouse gas emissions and climate change. In addition, they shall review, and report to the National Climate Advisor on, siting and permitting processes, including those in progress under the auspices of the Federal Permitting Improvement Steering Council, and identify steps that can be taken,

consistent with applicable law, to accelerate the deployment of clean energy and transmission projects in an environmentally stable manner.

(b) Agency heads conducting infrastructure reviews shall, as appropriate, consult from an early stage with State, local, and Tribal officials involved in permitting or authorizing proposed infrastructure projects to develop efficient timelines for decision-making that are appropriate given the complexities of proposed projects.

EMPOWERING WORKERS BY ADVANCING CONSERVATION, AGRICULTURE, AND REFORESTATION

Sec. 214. Policy. It is the policy of my Administration to put a new generation of Americans to work conserving our public lands and waters. The Federal Government must protect America's natural treasures, increase reforestation, improve access to recreation, and increase resilience to wildfires and storms, while creating well-paying union jobs for more Americans, including more opportunities for women and people of color in occupations where they are underrepresented. America's farmers, ranchers, and forest landowners have an important role to play in combating the climate crisis and reducing greenhouse gas emissions, by sequestering carbon in soils, grasses, trees, and other vegetation and sourcing sustainable bioproducts and fuels. Coastal communities have an essential role to play in mitigating climate change and strengthening resilience by protecting and restoring coastal ecosystems, such as wetlands, seagrasses, coral and oyster reefs, and mangrove and kelp forests, to protect vulnerable coastlines, sequester carbon, and support biodiversity and fisheries.

Sec. 215. Civilian Climate Corps. In furtherance of the policy set forth in section 214 of this order, the Secretary of the Interior, in collaboration with the Secretary of Agriculture and the heads of other relevant agencies, shall submit a strategy to the Task Force within 90 days of the date of this order for creating a Civilian Climate Corps Initiative, within existing appropriations, to mobilize the next generation of conservation and resilience workers and maximize the creation of accessible training opportunities and good jobs. The initiative shall aim to conserve and restore public lands and waters, bolster community resilience, increase reforestation, increase carbon sequestration in the agricultural sector, protect biodiversity, improve access to recreation, and address the changing climate.

Sec. 216. Conserving Our Nation's Lands and Waters. (a) The Secretary of the Interior, in consultation with the Secretary of Agriculture, the Secretary of Commerce, the Chair of the Council on Environmental Quality, and the heads of other relevant agencies, shall submit a report to the Task Force within 90 days of the date of this order recommending steps that the United States should take, working with State, local, Tribal, and territorial governments, |

agricultural and forest landowners, fishermen, and other key stakeholders, to achieve the goal of conserving at least 30 percent of our lands and waters by 2030.

(i) The Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, and the Chair of the Council on Environmental Quality shall, as appropriate, solicit input from State, local, Tribal, and territorial officials, agricultural and forest landowners, fishermen, and other key stakeholders in identifying strategies that will encourage broad participation in the goal of conserving 30 percent of our lands and waters by 2030.

(ii) The report shall propose guidelines for determining whether lands and waters qualify for conservation, and it also shall establish mechanisms to measure progress toward the 30-percent goal. The Secretary of the Interior shall subsequently submit annual reports to the Task Force to monitor progress.

(b) The Secretary of Agriculture shall:

(i) initiate efforts in the first 60 days from the date of this order to collect input from Tribes, farmers, ranchers, forest owners, conservation groups, firefighters, and other stakeholders on how to best use Department of Agriculture programs, funding and financing capacities, and other authorities, and how to encourage the voluntary adoption of climate-smart agricultural and forestry practices that decrease wildfire risk fueled by climate change and result in additional, measurable, and verifiable carbon reductions and sequestration and that source sustainable bioproducts and fuels; and

(ii) submit to the Task Force within 90 days of the date of this order a report making recommendations for an agricultural and forestry climate strategy.

(c) The Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, shall initiate efforts in the first 60 days from the date of this order to collect input from fishermen, regional ocean councils, fishery management councils, scientists, and other stakeholders on how to make fisheries and protected resources more resilient to climate change, including changes in management and conservation measures, and improvements in science, monitoring, and cooperative research.

EMPOWERING WORKERS THROUGH REVITALIZING ENERGY COMMUNITIES |

Sec. 217. Policy. It is the policy of my Administration to improve air and water quality and to create well-paying union jobs and more opportunities for women and people of color in hard-hit communities, including rural communities, while reducing methane emissions, oil and

brine leaks, and other environmental harms from tens of thousands of former mining and well sites. Mining and power plant workers drove the industrial revolution and the economic growth that followed, and have been essential to the growth of the United States. As the Nation shifts to a clean energy economy, Federal leadership is essential to foster economic revitalization of and investment in these communities, ensure the creation of good jobs that provide a choice to join a union, and secure the benefits that have been earned by workers. |

Such work should include projects that reduce emissions of toxic substances and greenhouse gases from existing and abandoned infrastructure and that prevent environmental damage that harms communities and poses a risk to public health and safety. Plugging leaks in oil and gas wells and reclaiming abandoned mine land can create well-paying union jobs in coal, oil, and gas communities while restoring natural assets, revitalizing recreation economies, and curbing methane emissions. In addition, such work should include efforts to turn properties idled in these communities, such as brownfields, into new hubs for the growth of our economy. Federal agencies should therefore coordinate investments and other efforts to assist coal, oil and gas, and power plant communities, and achieve substantial reductions of methane emissions from the oil and gas sector as quickly as possible. |

Sec. 218. Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization. There is hereby established an Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization (Interagency Working Group). The National Climate Advisor and the Assistant to the President for Economic Policy shall serve as Co-Chairs of the Interagency Working Group.

(a) Membership. The Interagency Working Group shall consist of the following additional members:

(i) the Secretary of the Treasury;

(ii) the Secretary of the Interior;

(iii) the Secretary of Agriculture;

(iv) the Secretary of Commerce;

(v) the Secretary of Labor;

(vi) the Secretary of Health and Human Services; |

(vii) the Secretary of Transportation;

(viii) the Secretary of Energy;

(ix) the Secretary of Education;

(x) the Administrator of the Environmental Protection Agency;

(xi) the Director of the Office of Management and Budget;

(xii) the Assistant to the President for Domestic Policy and Director of the Domestic Policy Council; and

(xiii) the Federal Co-Chair of the Appalachian Regional Commission.

(b) Mission and Work.

(i) The Interagency Working Group shall coordinate the identification and delivery of Federal resources to revitalize the economies of coal, oil and gas, and power plant communities; develop strategies to implement the policy set forth in section 217 of this order and for economic and social recovery; assess opportunities to ensure benefits and protections for coal and power plant workers; and submit reports to the National Climate Advisor and the Assistant to the President for Economic Policy on a regular basis on the progress of the revitalization effort.

(ii) As part of this effort, within 60 days of the date of this order, the Interagency Working Group shall submit a report to the President describing all mechanisms, consistent with applicable law, to prioritize grantmaking, Federal loan programs, technical assistance, financing, procurement, or other existing programs to support and revitalize the economies of coal and power plant communities, and providing recommendations for action consistent with the goals of the Interagency Working Group.

(c) Consultation. Consistent with the objectives set out in this order and in accordance with applicable law, the Interagency Working Group shall seek the views of State, local, and Tribal officials; unions; environmental justice organizations; community groups; and other persons it identifies who may have perspectives on the mission of the Interagency Working Group.

(d) Administration. The Interagency Working Group shall be housed within the Department of Energy. The Chairs shall convene regular meetings of the Interagency Working Group, determine its agenda, and direct its work. The Secretary of Energy, in consultation with the Chairs, shall designate an Executive Director of the Interagency Working Group, who shall coordinate the work of the Interagency Working Group and head any staff assigned to the Interagency Working Group. |

(e) Officers. To facilitate the work of the Interagency Working Group, the head of each agency listed in subsection (a) of this section shall assign a designated official within the agency the authority to represent the agency on the Interagency Working Group and perform such other duties relating to the implementation of this order within the agency as the head of the agency deems appropriate.

SECURING ENVIRONMENTAL JUSTICE AND SPURRING ECONOMIC OPPORTUNITY

Sec. 219. Policy. To secure an equitable economic future, the United States must ensure that environmental and economic justice are key considerations in how we govern. That means investing and building a clean energy economy that creates well-paying union jobs, turning disadvantaged communities — historically marginalized and overburdened — into healthy, thriving communities, and undertaking robust actions to mitigate climate change while preparing for the impacts of climate change across rural, urban, and Tribal areas. Agencies shall make achieving environmental justice part of their missions by developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts. It is therefore the policy of my Administration to secure environmental justice and spur economic opportunity for disadvantaged communities that have been historically marginalized and overburdened by pollution and underinvestment in housing, transportation, water and wastewater infrastructure, and health care.

Sec. 220. White House Environmental Justice Interagency Council. (a) Section 1-102 of Executive Order 12898 of February 11, 1994 (Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations), is hereby amended to read as follows:

"(a) There is hereby created within the Executive Office of the President a White House Environmental Justice Interagency Council (Interagency Council). The Chair of the Council on Environmental Quality shall serve as Chair of the Interagency Council.

"(b) Membership. The Interagency Council shall consist of the following additional members:

(i) the Secretary of Defense;

(ii) the Attorney General;

(iii) the Secretary of the Interior;

(iv) the Secretary of Agriculture; |

(v) the Secretary of Commerce;

(vi) the Secretary of Labor;

(vii) the Secretary of Health and Human Services;

(viii) the Secretary of Housing and Urban Development;

(ix) the Secretary of Transportation;

(x) the Secretary of Energy;

(xi) the Chair of the Council of Economic Advisers;

(xii) the Administrator of the Environmental Protection Agency;

(xiii) the Director of the Office of Management and Budget;

(xiv) the Executive Director of the Federal Permitting Improvement Steering Council;

(xv) the Director of the Office of Science and Technology Policy;

(xvi) the National Climate Advisor;

(xvii) the Assistant to the President for Domestic Policy; and

(xviii) the Assistant to the President for Economic Policy.

"(c) At the direction of the Chair, the Interagency Council may establish subgroups consisting exclusively of Interagency Council members or their designees under this section, as appropriate.

"(d) Mission and Work. The Interagency Council shall develop a strategy to address current and historic environmental injustice by consulting with the White House Environmental Justice Advisory Council and with local environmental justice leaders. The Interagency Council shall also develop clear performance metrics to ensure accountability, and publish an annual public performance scorecard on its implementation.

"(e) Administration. The Office of Administration within the Executive Office of the President shall provide funding and administrative support for the Interagency Council, to the extent permitted by law and within existing appropriations. To the extent permitted by law, including the Economy Act (31 U.S.C. 1535), and subject to the availability of appropriations,

the Department of Labor, the Department of Transportation, and the Environmental Protection Agency shall provide administrative support as necessary.

"(f) Meetings and Staff. The Chair shall convene regular meetings of the Council, determine its agenda, and direct its work. The Chair shall designate an Executive Director of the Council, who shall coordinate the work of the Interagency Council and head any staff assigned to the Council.

"(g) Officers. To facilitate the work of the Interagency Council, the head of each agency listed in subsection (b) shall assign a designated official within the agency to be an Environmental Justice Officer, with the authority to represent the agency on the Interagency Council and perform such other duties relating to the implementation of this order within the agency as the head of the agency deems appropriate."

(b) The Interagency Council shall, within 120 days of the date of this order, submit to the President, through the National Climate Advisor, a set of recommendations for further updating Executive Order 12898. |

Sec. 221. White House Environmental Justice Advisory Council. There is hereby established, within the Environmental Protection Agency, the White House Environmental Justice Advisory Council (Advisory Council), which shall advise the Interagency Council and the Chair of the Council on Environmental Quality.

(a) Membership. Members shall be appointed by the President, shall be drawn from across the political spectrum, and may include those with knowledge about or experience in environmental justice, climate change, disaster preparedness, racial inequity, or any other area determined by the President to be of value to the Advisory Council.

(b) Mission and Work. The Advisory Council shall be solely advisory. It shall provide recommendations to the White House Environmental Justice Interagency Council established in section 220 of this order on how to increase the Federal Government's efforts to address current and historic environmental injustice, including recommendations for updating Executive Order 12898.

(c) Administration. The Environmental Protection Agency shall provide funding and administrative suppdrt for the Advisory Council to the extent permitted by law and within existing appropriations. Members of the Advisory Council shall serve without either compensation or reimbursement of expenses. |

(d) Federal Advisory Committee Act. Insofar as the Federal Advisory Committee Act, as amended (5 U.S.C. App.), may apply to the Advisory Council, any functions of the President under the Act, except for those in section 6 of the Act, shall be performed by the Administrator of the Environmental Protection Agency in accordance with the guidelines that have been issued by the Administrator of General Services.

Sec. 222. Agency Responsibilities. In furtherance of the policy set forth in section 219:

(a) The Chair of the Council on Environmental Quality shall, within 6 months of the date of this order, create a geospatial Climate and Economic Justice Screening Tool and shall annually publish interactive maps highlighting disadvantaged communities.

(b) The Administrator of the Environmental Protection Agency shall, within existing appropriations and consistent with applicable law:

(i) strengthen enforcement of environmental violations with disproportionate impact on underserved communities through the Office of Enforcement and Compliance Assurance; and

(ii) create a community notification program to monitor and provide real-time data to the public on current environmental pollution, including emissions, criteria pollutants, and toxins, in frontline and fenceline communities — places with the most significant exposure to such pollution.

(c) The Attorney General shall, within existing appropriations and consistent with applicable law:

(i) consider renaming the Environment and Natural Resources Division the Environmental Justice and Natural Resources Division;

(ii) direct that division to coordinate with the Administrator of the Environmental Protection Agency, through the Office of Enforcement and Compliance Assurance, as well as with other client agencies as appropriate, to develop a comprehensive environmental justice enforcement strategy, which shall seek to provide timely remedies for systemic environmental violations and contaminations, and injury to natural resources; and

(iii) ensure comprehensive attention to environmental justice throughout the Department of Justice, including by considering creating an Office of Environmental Justice within the Department to coordinate environmental justice activities among Department of Justice components and United States Attorneys' Offices nationwide. |

(d) The Secretary of Health and Human Services shall, consistent with applicable law and within existing appropriations:

(i) establish an Office of Climate Change and Health Equity to address the impact of climate change on the health of the American people; and

(ii) establish an Interagency Working Group to Decrease Risk of Climate Change to Children, the Elderly, People with Disabilities, and the Vulnerable as well as a biennial Health Care System Readiness Advisory Council, both of which shall report their progress and findings regularly to the Task Force.

(e) The Director of the Office of Science and Technology Policy shall, in consultation with the National Climate Advisor, within existing appropriations, and within 100 days of the date of this order, publish a report identifying the climate strategies and technologies that will result in the most air and water quality improvements, which shall be made public to the maximum extent possible and published on the Office's website.

Sec. 223. Justice40 Initiative. (a) Within 120 days of the date of this order, the Chair of the Council on Environmental Quality, the Director of the Office of Management and Budget, and the National Climate Advisor, in consultation with the Advisory Council, shall jointly publish recommendations on how certain Federal investments might be made toward a goal that 40 percent of the overall benefits flow to disadvantaged communities. The recommendations shall focus on investments in the areas of clean energy and energy efficiency; clean transit; affordable and sustainable housing; training and workforce development; the remediation and reduction of legacy pollution; and the development of critical clean water infrastructure. The | recommendations shall reflect existing authorities the agencies may possess for achieving the 40-percent goal as well as recommendations on any legislation needed to achieve the 40-percent goal.

(b) In developing the recommendations, the Chair of the Council on Environmental Quality, the Director of the Office of Management and Budget, and the National Climate Advisor shall consult with affected disadvantaged communities.

(c) Within 60 days of the recommendations described in subsection (a) of this section, agency heads shall identify applicable program investment funds based on the recommendations and consider interim investment guidance to relevant program staff, as appropriate and consistent with applicable law.

(d) By February 2022, the Director of the Office of Management and Budget, in coordination with the Chair of the Council on Environmental Quality, the Administrator of the United States

Digital Service, and other relevant agency heads, shall, to the extent consistent with applicable law, publish on a public website an annual Environmental Justice Scorecard detailing agency environmental justice performance measures.

PART III — GENERAL PROVISIONS

Sec. 301. General Provisions. (a) Nothing in this order shall be construed to impair or otherwise affect:

(i) the authority granted by law to an executive department or agency or the head thereof; or

(ii) the functions of the Director of the Office of Management and Budget, relating to budgetary, administrative, or legislative proposals.

(b) This order shall be implemented consistent with applicable law and subject to the availability of appropriations.

(c) This order is not intended to, and does not, create any right or benefit, substantive or procedural, enforceable at law or in equity by any party against the United States, its departments, agencies, or entities, its officers, employees, or agents, or any other person.

JOSEPH R. BIDEN JR.

THE WHITE HOUSE, |

January 27, 2021. |

EFAB Opportunity Zones Workgroup

EFAB Opportunity Zones Charge Refinement

April 13, 2021

EFAB Opportunity Zones Workgroup

EFAB Opportunity Zones Charge Refinement

- **Facilitating Investment (Marketplace/Matchmaking):** Advise EPA on how to enhance the Agency's approach to encourage increased OZ funds investment into both rural and urban communities alongside existing EPA funding tools, programs, regulatory/permitting flexibility and federal and state partners. Provide examples and advice and support to communities, including ways to minimize risk for investors, and to investors seeking to direct OZ Fund investment into low-income, minority, and/or otherwise vulnerable communities, reflecting environmental justice (EJ) principles.
    - Note where community benefits standards and guidance have been developed [or are so far lacking] that may be relevant to OZ-funded projects in these communities and the value of such community benefits can be achieved.
    - Provide recommendations on where EPA may *uniquely* be situated to coordinate with investors and other agencies in encouraging/identifying OZ investment opportunities in high-priority communities from an environmental justice standpoint, including low-income, minority, tribal, and indigenous communities that bear disproportionate environmental risks and damages.

EFAB OPPORTUNITY ZONES WORKGROUP MEMBERS

Joanne Throwe, EFAB chair	joanne@throwe-environmental.com
Margot Kane, co-chair	margot.kane@thespringpoint.com
Bill Stannard, co-chair	wstannard@raftelis.com
Brent Anderson	banderson@resight-ai.com
Steve Bonafonte	sbonafonte@themdc.com
Sonja Favors	environmentdirector@nsbe.org
Craig Holland	cholland@TNC.ORG
John Jones	entranosa@aol.com
Chris Meister	CMeister@il-fa.com
Dennis Randolph	dr2340787@gmail.com
David Zimmer	dzimmer@njib.gov

EPA SUPPORT TEAM

Ed Chu, Designated Federal Officer	chu.ed@epa.gov
Tara Johnson, lead staff support for EFAB	johnson.tara@epa.gov
Addison Chau, staff support for EFAB	chau.addison@epa.gov
David Doyle, EPA Region 7 Community Revitalization Coordinator	doyle.david@epa.gov
Jon Grosshans, EPA Region 5 Community Planner	grosshans.jon@epa.gov
Michelle Madeley, EPA Office of Community Revitalization	madeley.michelle@epa.gov
Joshua Tapp, EPA Region 7 Office of Intergovernmental Affairs	tapp.joshua@epa.gov

- **Facilitating Investment (Marketplace/Matchmaking):** Advise EPA on how to enhance the Agency's approach to ~~facilitate~~ encourage increased ~~community~~ OZ funds ~~re~~investment ~~with a focus on~~into both ~~EJ and~~ ~~SJ~~rural and urban ~~-~~communities ~~through~~ alongside existing EPA funding tools, programs, regulatory/permitting flexibility ~~staff,~~ and federal and state partners. ~~How to create better matchmaking conditions between~~Provide examples and advice and support to communities, including ways to minimize risk for investors, and to investors ~~to~~ seeking ~~trying~~ to ~~encourage~~direct OZ Fund investment into low-income, minority, and/or otherwise vulnerable ~~EJ~~ communities, ~~focusing~~reflecting ~~on~~ environmental justice (EJ) principles.
    - Note where community benefits standards and guidance have been developed [or are so far lacking] that may be relevant to OZ-funded projects in these communities and the value of such community benefits can be achieved.
    - Provide recommendations on where EPA may *uniquely* be situated to coordinate with investors and other agencies in encouraging/identifying OZ investment opportunities in high-priority communities from an environmental justice standpoint, including low-income, minority, tribal, and indigenous communities that bear disproportionate environmental risks and damages.
    - ~~Note: During agenda planning discussions, the co-chairs refined this portion of the charge to use "investment" as opposed to "reinvestment". "Reinvestment" had been highlighted in the original language for potential revision.~~
- ~~**Community Benefits:** Advise EPA on development/deployment of its resources to prepare communities through planning/code updates and community benefit agreements to better capture benefits associated with external investments.~~

Attracting Private Investment to Opportunity Zones: A Role for EPA

EPA Efforts in Opportunity Zones

In December 2018, the White House Opportunity and Revitalization Council (WHORC) was established by Executive Order 13853 to implement administrative reforms and initiatives to target, streamline, and coordinate Federal resources in economically distressed communities. EPA is a member of the Council and is included in two separate work streams: Safe Neighborhoods and Economic Development. In addition to tax incentives for development in designated Opportunity Zones (OZ) provided by the Tax Cuts and Jobs Act of 2017, a new feature on grants.gov beginning in March 2020 will enable applicants to search for available grants/programs across the federal government that benefit OZs. This will benefit OZ stakeholders by increasing general awareness of federal programs with OZ benefits.

Problem/Question Statement: Maximizing the Impact of EPA Investment in Distressed Communities

The OZ initiative creates incentives for equity investments in real estate and infrastructure projects as well as new or expanded businesses located in the designated OZs. It is principally an economic development initiative that is designed to support the revitalization of communities to address chronic and acute problems that result from economic decline. Many of these problems relate to the environment and human health.

Our experience with community-focused programs suggests that economic investments from the private sector are far more likely and attractive when environmental quality is maintained at healthy levels. Potential environmental liability and uncertainty about environmental quality can also discourage private sector investment in a community. We believe that additional environmental infrastructure and improvement is a necessary condition for attractive private sector investment in many communities, even with OZ incentives.

Investing in distressed communities is not new for EPA. The agency has historically provided support to communities through mechanisms that have included grants, tools, training, education, and technical assistance. Despite these efforts and investments, EPA cannot always determine, in advance, whether its limited resources will be effectively leveraged to make a measurable environmental and public health improvement for these communities.

The EPA would appreciate any strategic advice from the EFAB on ways to encourage private investment in OZs. Specific questions include:

1) First, which specific federal/EPA incentives (monetary or otherwise) are most likely to increase public/private investment in OZs?

2) Looking at existing EPA incentives, including funding programs such as environmental justice, or brownfields grants which incentives, programs or approaches are better suited to achieve desired community outcomes while reducing risk, liability and/or

regulatory uncertainty for investors in OZs?

3) Does the EFAB have recommendations on readily implementable adjustments to existing Agency programs to make them more effective in reducing risk, liability and/or regulatory uncertainty? Are there more complicated adjustments that should be also considered by the Agency?

4) What regulatory/liability/risk data could be provided to allow investors to compare OZs and determine which OZ might be a best fit for their investment?

5) Does the EFAB have any recommendations on how we share information and resources in a way that would ensure that the programmatic resources we leverage for OZ purposes lead to improvements in local health and environmental outcomes for the existing community.

EPA Mission Fit:
The EPA Office of Policy (OP), located in the Office of the Administrator, is the primary policy arm of EPA. Among other duties, OP is responsible for coordinating all of EPA's Opportunity Zone (OZ) work across the agency. OP has extensive experience in working in economically distressed communities across the country to support locally led, community-driven strategies that improve economic development and environmental and human health outcomes. OP uses this expertise in coordinating across EPA programs and in collaboration with other federal agencies to assist communities' efforts to ensure that public and private sector investments support community goals.

Type of EFAB Engagement: to be determined

EPA REGIONS

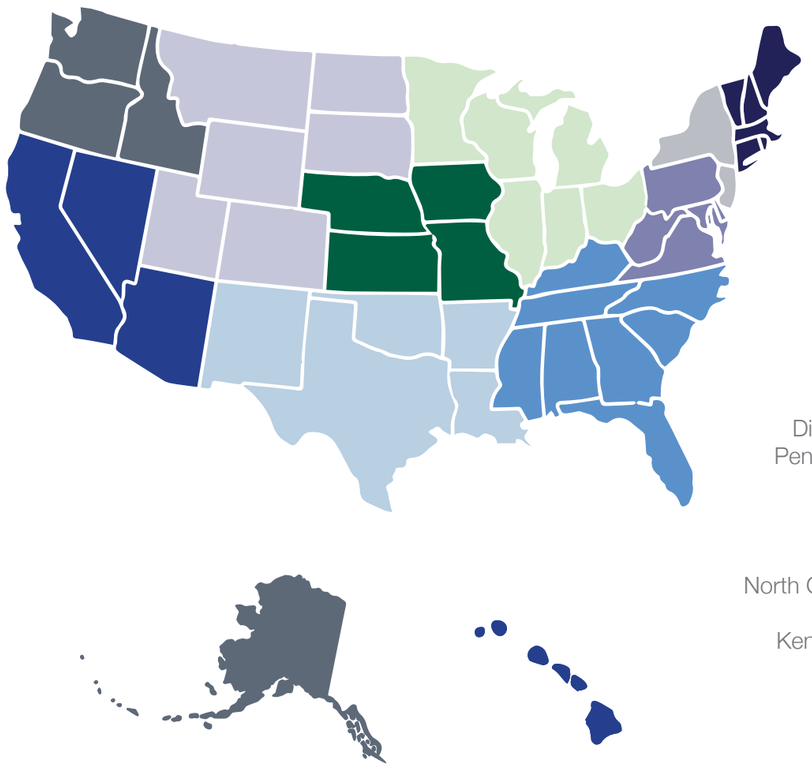
6
New Mexico, Arkansas, Louisiana, Oklahoma, Texas 66 Tribes

7
Kansas, Iowa, Missouri, Nebraska

8
Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming

9
California, Arizona, Guam, Hawaii, Nevada, Northern Marianas, Samoa

10
Alaska, Idaho, Oregon, Washington



1
Maine, Connecticut, Massachusetts, New Hampshire, Rhode Island, Vermont

2
New York, New Jersey, Puerto Rico, US Virgin Islands

3
Maryland, Delaware, District of Columbia, Pennsylvania, Virginia, West Virginia

4
North Carolina, Alabama, Florida, Georgia, Kentucky, Mississippi, South Carolina, Tennessee

5
Michigan, Illinois, Indiana, Minnesota, Ohio, Wisconsin

EFCN MEMBERS

- **New England EFC at the University of Southern Maine** *neefc.org*
- **Syracuse University EFC** *efc.syr.edu*
- **EFC at the University of Maryland** *efc.umd.edu*
- **EFC at the University of North Carolina at Chapel Hill** *efc.sog.unc.edu*
- **EFC at the University of Louisville** *cepm.louisville.edu*
- **Great Lakes EFC at the Michigan Institute of Technology** *gleic.org*
- **Southwest EFC at the University of New Mexico** *southwestefc.unm.edu*
- **EFC at Wichita State University** *wichita.edu/thisis/home*
- **National Rural Water Association** *nrwa.org*
- **EFC West at Earth Island Insitute** *efcwest.net*
- **EFC at Sacramento State** *efc.csus.edu*
- **EFC at RCAC** *rcac.org*

ENVIRONMENTAL FINANCE CENTER **NETWORK**

Creating innovative solutions to the difficult challenges of environmental infrastructure and public health through sustainable utility management.

efcnetwork.org

WHO WE ARE

The Environmental Finance Center Network (EFCN) is a university-based organization creating innovative solutions to the difficult challenges of environmental infrastructure and public health through sustainable utility management. The EFCN works with the public and private sectors to promote sustainable environmental solutions while bolstering efforts to manage costs.

OUR FOCUS AREAS (Drinking Water, Wastewater, Stormwater, Solid Waste)

- **Asset Management**
- **Materials Management**
- **Leadership & Governance**
- **Finance & Rate Setting**
- **Capacity Development**
- **Community Engagement**
- **Water Loss Reduction**
- **Planning**
- **Resiliency**
- **Stormwater**

WHO WE SERVE

- Local Governments
- Federal Government Facilities
- Businesses
- Tribal Governments
- State Government Agencies
- Mobile Home Parks
- Public and Private Utilities
- Schools
- Homeowner Associations

WHAT WE OFFER

In-Person Training **Technical Assistance** **Webinars** **Publications** **Process Facilitation**

efcnetwork.org

CONTACT US

EFCN President:
Khris Dodson
Associate Director
Syracuse University EFC
kadodson@syr.edu

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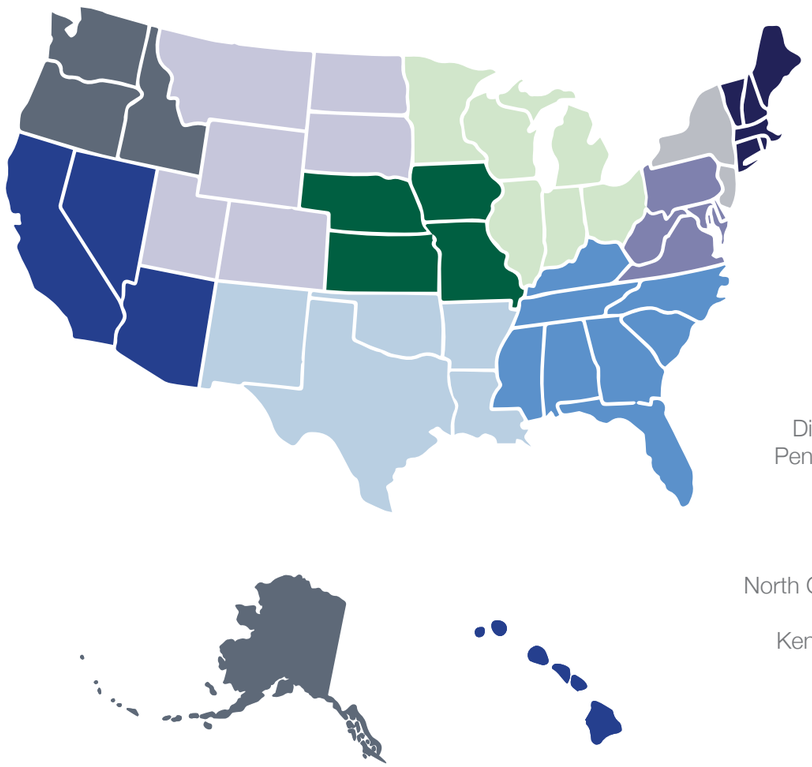

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- **EFC at the University of North Carolina at Chapel Hill** *efc.sog.unc.edu*
- **EFC at the University of Louisville** *cepm.louisville.edu*
- **Great Lakes EFC at the Michigan Institute of Technology** *gleic.org*
- **Southwest EFC at the University of New Mexico** *southwestefc.unm.edu*
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Find us online at
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ENVIRONMENTAL FINANCE CENTER NETWORK

JEN COTTING, UNIVERSITY OF MARYLAND EFC

MARTHA SHEILS, NEW ENGLAND EFC

KHRIS DODSON, SYRACUSE UNIVERSITY EFC

TONYA BRONLEEWE, WICHITA STATE UNIVERSITY EFC

APRIL 21, 2021

THE EFC NETWORK

- Ten centers across the country
- Covering each EPA Region
- Regional expertise leveraged through collaboration

New England Environmental Finance Center

Environmental Finance Center Syracuse University

University of Maryland 1856 ENVIRONMENTAL FINANCE CENTER

Great Lakes Environmental Infrastructure Center
Environmental Finance Center for EPA Region 5

NEW MEXICO ENVIRONMENTAL FINANCE CENTER
http://nmefc.nmt.edu

UNC ENVIRONMENTAL FINANCE CENTER

ENVIRONMENTAL FINANCE CENTER AT SACRAMENTO STATE

EFCN environmental finance center network

WSU Wichita State University Hugo Wall School of Public Affairs
Environmental Finance Center

EFCWest Environmental Finance Center West

Environmental Finance Center EPA REGION 10

OUR AUDIENCES & PARTNERS

- Local governments
- State and federal agencies
- Tribes
- Nonprofits
- Academic institutions
- Private sector

EFCN
environmental finance center network

WHAT WE DO

- Direct technical assistance
- Capacity building
- Outreach, education and training
- Support to state and federal agencies
- Development and distribution of tools and resources
- Community engagement
- Network facilitation
- Program and policy analysis
- Systems analysis, modeling and GIS

EFCN
environmental finance center network

SECTORS WE WORK IN

- Climate & Resilience
- Water
- Green Infrastructure
- Sustainability
- Energy
- Air
- Agriculture
- Food systems
- Waste

With an equity lens applied to all

EFCN
environmental finance center network

EXAMPLES OF OUR WORK

- **Resilience work across the EFC Network**
- **Southeast New England Program Network**
- **Work in Water**

SNEP NETWORK

WORK in WATER
advancing water careers in Iowa, Kansas, Missouri & Nebraska

EFCN
environmental finance center network

WORKING ON CLIMATE & RESILIENCE

Tools and Resources

- CLASIC – Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (Maryland)
- Resiliency Planning: Tools and Resources for Communities (Sacramento State)
- Natural Capital Resilience Financing Toolkit (Maryland)
- Sustainability Tool (Wichita)

Local Support

- Urban Waters Ambassadors (Wichita)
- Community-based technical assistance

WORKING ON CLIMATE & RESILIENCE

Water Systems

- Interdependency of systems in the face of a changing climate (SW EFC)
- Water Equity Roadmap (Wichita)
- Water Loss (Wichita)

Food Systems

- Food Waste Summits (Wichita)
- Food Sovereignty (EFC West)

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SOUTHEAST NEW ENGLAND NETWORK

A collaborative network of partners with expertise in stormwater management, financing, water quality and habitat restoration, green infrastructure, low impact development, and watershed-scale conservation and restoration.

Empowering communities to achieve healthy watersheds, sustainable financing and long-term climate resilience through management of stormwater and restoration projects

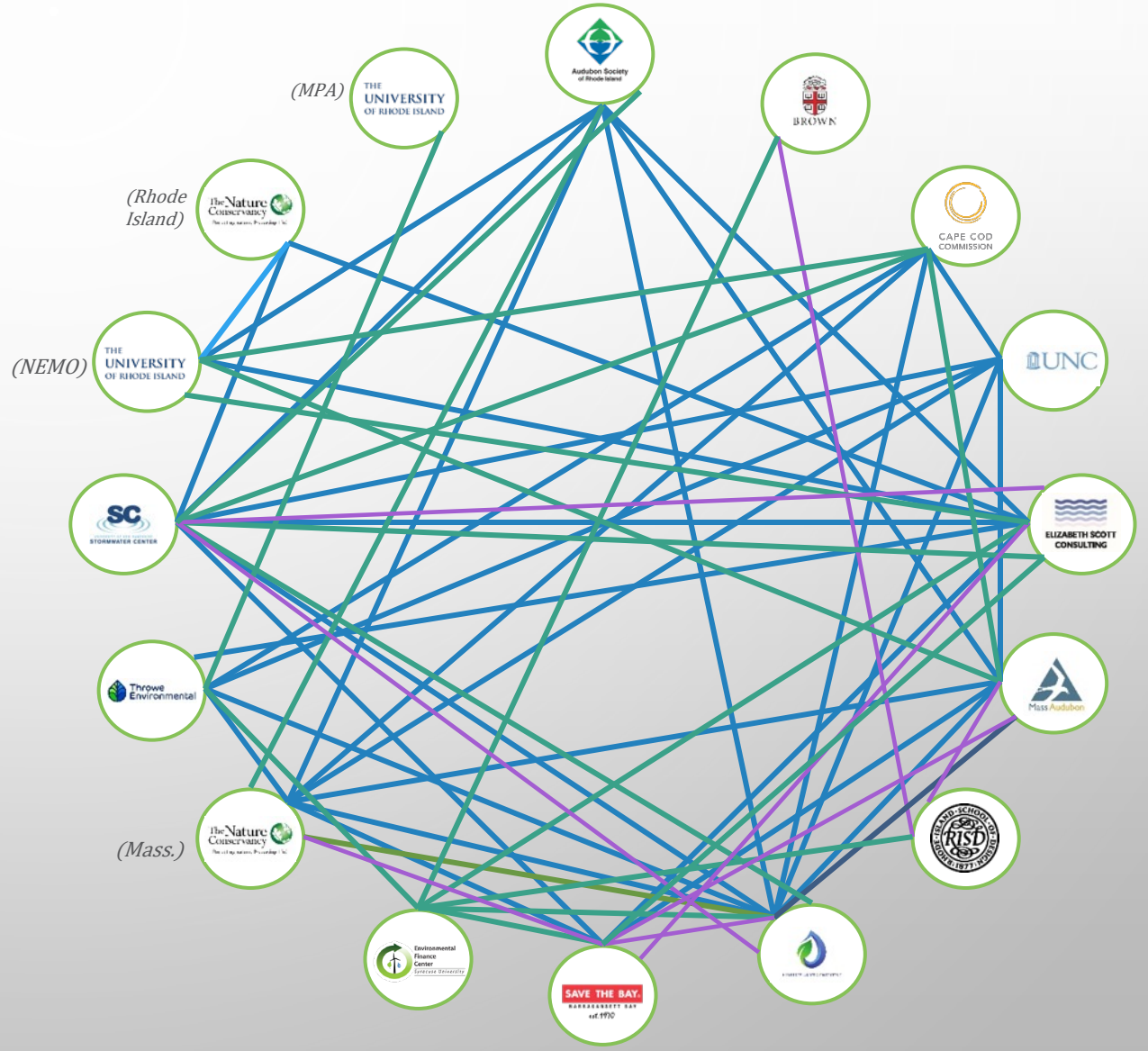
Services are offered free of charge to municipalities, tribes and organizations across the Southeast New England Program area

EFCN
environmental finance center network

SNEP NETWORK PARTNERS

The SNEP Network is a partnership of **16 environmental organizations, academic institutions, and consultants** who work collaboratively to **advance sustainable financing and long-term climate resilience** within Southeastern Massachusetts and Rhode Island

- CFP Projects
- Regional initiatives (cross-cutting topics)
- Pilot Projects and Network Products



SNEP NETWORK ACCOMPLISHMENTS

Network Projects — Working with **12 communities** through the SNEP Call for Participants Process to provide free technical assistance; 2 regional watershed projects (Maidford and Taunton Watersheds)

Funding support— Over 80% of the budget to direct technical assistance to communities through Partners sub-awards and the Network consultant pool

Community Reach — Reached **127 communities** through various SNEP Trainings/webinars

Sustainable Climate Financing —Unique and innovative approach to helping communities achieve sustainable climate financing (Bourne, MA & Wareham, MA)

SNEP Regional Tools — Stormwater Retrofit Manual, StewMap, and LID and Model Ordinance Checklist

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WORK in WATER

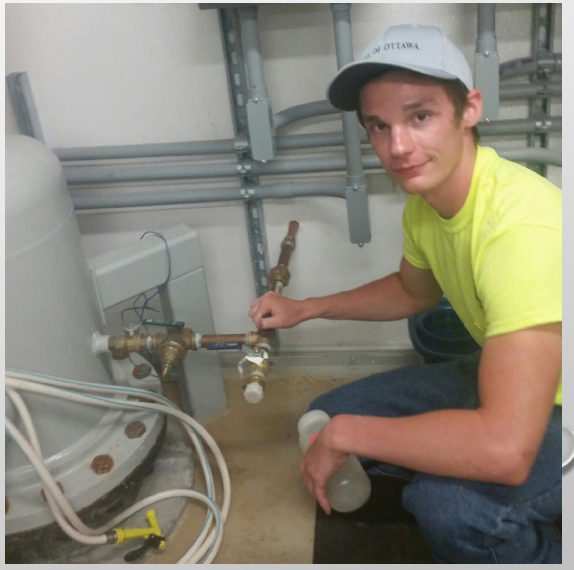
advancing water careers in Iowa, Kansas, Missouri & Nebraska

WORK in WATER

advancing water careers in New York & Puerto Rico

Classroom Workshop

Plant Tours



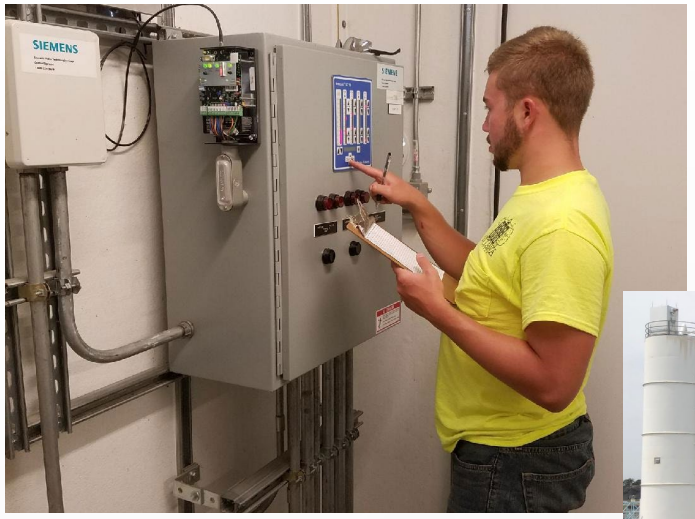
Internship

EFCN environmental finance center network

www.wichita.edu/workinwater

WORK in WATER

Advancing water careers



ENGAGE US!

The EFCN includes:

- New England Environmental Finance Center at the University of Southern Maine
- Environmental Finance Center at Syracuse University
- Environmental Finance Center at the University of Maryland
- Environmental Finance Center at University of North Carolina, Chapel Hill
- Great Lakes Environmental Infrastructure Center at the Michigan Institute of Technology
- Southwest Environmental Finance Center at the University of New Mexico
- Wichita State University Environmental Finance Center
- National Rural Water Association Environmental Finance Center
- Environmental Finance Center at Sacramento State
- Environmental Finance Center at the Rural Community Assistance Corporation

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Environmental Finance Center Network

Links Provided During April 21, 2021 EFAB Meeting

About the Environmental Finance Center Network: https://efcnetwork.org/about-the-network/

The Water Research Foundation - Community-enabled Lifecycle Analysis of Stormwater Infrastructure Costs (CLASIC): https://www.waterrf.org/community-enabled-lifecycle-analysis-stormwater-infrastructure-costs-clasic

Environmental Finance Center at Sacramento State – Resiliency: https://www.efc.csus.edu/resiliency/

University of Maryland – Resilience Financing for Maryland Local Governments: https://arch.umd.edu/research-creative-practice/centers/environmental-finance-center/project-areas/resilience-financing-maryland-local-governments

Wichita State University – Community Sustainability Tool for Water/Wastewater Infrastructure Investments: https://www.wichita.edu/academics/fairmount_college_of_liberal_arts_and_sciences/hugowall/efc/community-sustainability-tool.php

Wichita State University – Local Food Waste Summits - Learn More and Register: https://www.wichita.edu/academics/fairmount_college_of_liberal_arts_and_sciences/hugowall/efc/Event-Pages/food-waste-summit-learn-more-regsiter.php

Southeast New England Program Network: https://snepnetwork.org/

New England Environmental Finance Center: https://neefc.org/

Wichita State University – The Work in Water Experience: www.wichita.edu/workinwater

April 20, 2021-
USEPA EFAB – VIII. Environmental Risk and Cost of Capital Workgroup

Co-Chairs: Jan Beecher – Michigan State University
Ted Chapman – S&PGlobal
Chris Meister – Illinois Finance Authority

Chris:

Colleagues –it is an understatement to say that this – Environmental Risk and the Cost of Capital - is a developing topic. Despite our desire to stay ahead of developments – it is clear that developments are outpacing our volunteer efforts. This speaks to both the urgency of the topic and the priority that federal policy makers – the Administration and Congress – as well as the private sector – have placed on the topic.

First – we want to thank Joanne and Ed for their patience – thank our co-chair – Jan – who first put this idea for a charge on EFAB's agenda - and thank our volunteer colleagues on this working group for your participation in the March 30, 2021 virtual meeting.

Before we begin – we want to read two quotes that highlight the challenge of this topic:

> "Secretary Yellen discussed the importance of using all the tools at our disposal, including the tax code, to drive toward net-zero emissions." READOUT: *Secretary Yellen and Deputy Secretary Adeyemo's Meeting with Environmental Organizations on Corporate Tax Reform*, April 16, 2021, US Treasury

> **". . .** I believe we are on the edge of a fundamental reshaping of finance. . . . In the near future – and sooner than most anticipate – there will be a significant reallocation of capital." *Larry Fink, Chair and CEO, Blackrock*, January 2020

The science and the reality is clear. Climate change is causing more extreme weather events more often. The investor community, including the insurance industry and rating agencies, have already clearly recognized this. The relationship among mitigation, adaptation, environmental justice, sustainability and good, inclusive jobs need to be integral under a national climate finance strategy and policy.

And to these quotes – we can add the yellow highlighted quote from Lek Kadeli, Senior Advisor to the USEPA Office of the Chief Financial Officer, presented earlier today:

> "What are the key forces or developments that you think might affect environmental finance over the next 20 years?"

At the moment – this work group has neither a formal charge nor a formal client within USEPA. But we do have the support of Joanne and Ed, the interest of the Members, as well as the urgency of the topic and the moment. Ed has generously offered to connect the working group in touch with career economists within USEPA to help develop this broad topic into a charge. But before we do so – we turn to the EFAB mandate:

> "The Environmental Financial Advisory Board (EFAB) provides ideas and advice to EPA's Administrator and program offices on ways to lower the costs of and increase investments in environmental and public health protection."

The three of us, with our professional backgrounds, represent just two the necessary sectors – state-based regulation and capital markets - that will be necessary to further develop both a full charge – and more importantly - into ideas that the USEPA Administrator – and other federal policy makers can use to lower the costs and increase investments in environmental protection – specifically what federal policy makers and financial leaders have identified as the challenge of our time – how to effectively use finance to combat – or mitigate – or adapt to – climate change. All of you – the EFAB members – have much greater depth and breadth of experience and perspectives.

One of the challenges of this topic is the volume of information so we have distributed three very short documents that we hope that you have had the chance to read:

1. The US Treasury Press Release Announcing a "coordinated climate policy strategy," the creation of a US Treasury Climate Hub, and the appointment of the Climate Counselor" –dated – yesterday – April 19, 2021 along with a Bloomberg article discussing the same; and
2. An article from EE News (shared by Ed) – "Biden poised to sign executive order on climate finance," dated 4/9/21 – last week – this article gives a short overview of the anticipated announcements of federal policy this week – which the US Treasury Department and others have declared as Climate Week; and
3. National Intelligence Council's Global Trends 2040 (released April 2021) https://www.dni.gov/index.php/global-trends-home

So these are big – broad ideas – so it is our challenge as EFAB Members to reduce these ideas to something clear, brief, relevant and solid. Something that will aid the Administrator and his colleagues in the execution of their policy directives.

But some history is in order. Leadership on climate (or environmental) finance is in the DNA of this agency. In connection with our past EFAB work, we have had the opportunity to review past EFAB reports – even going back to its creation decades ago. We have too little time to go into all of this history – our USEPA colleagues can help the Members do so if you are interested. But this is what is clear –

1. USEPA has a decades old record of achievement and leadership in the realm of using climate finance - from the State Revolving Funds to the WIFIA programs. These successful climate finance tools – were at the time that they were implemented innovative and ground breaking. Importantly – thru the State Revolving Fund – USEPA is already in the business of counting things – it is one of the reasons why State Revolving Funds so easily translate into green bonds.
2. We believe that USEPA's record, resources and culture of innovation with respect to climate finance position USEPA – with the help of the EFAB Members – to rapidly meet the challenge of the policy makers to develop – and advise on the

implementation of climate finance tools that can "lower the costs of and increase investments in environmental and public health protection." With the help of all of you – the members of the working group – and the entire EFAB membership.

3. In doing so – we want to build on the leadership of the private sector, the not-for-profit sector as well as USEPA's federal partners – US Treasury, the Securities and Exchange Commission, Commodity Futures Trading Commission or CFTC, the Federal Reserve, and the White House. The CFTC example is relevant because last year, the CFTC used as FACA structure (just like EFAB) to develop and publish as very lengthy document that has helped set the terms of the national conversation on climate finance.

So what we would like to do is put these big ideas out to all of you for what we hope to be a vibrant and constructive discussion as to interest and next steps. I will turn it over to Ted.

Ted:

- You just heard Chris refer to Blackrock. You heard Lek speak to how previous EPA strategic plans assumed, rightly, that right there among future risks and opportunities was climate change, sea level rise, storm surges and water scarcity
- This isn't just a trend. It's embedded in what the financial community does and has been doing for more than a decade
- If you were to tally all the assets under management among mutual funds and ETFs, in 2020 sustainable-related investments exceeded $1 trillion for the first time. Green bonds have nearly doubled in issuance every year for each of the last five years.
- As George pointed out this morning, it's not a fad. BNP Paribas did a survey last year that showed 78% of asset managers globally said ESG as a strategy is becoming integral to what they do
- Demand for green bonds is still far outstripping supply. The Climate Bonds Initiative in March 2021 did a look-back of already issued fixed income investments and those bonds on average were more than 4 times oversubscribed, leading to a greenium with those bonds ending up with a higher price and lower yield compared with "vanilla" bonds
- If you access the credit markets, the rating agencies have all revised their respective analytical approaches to incorporate environmental, social and governance risks and opportunities. The key foresight questions slide from this morning asked "what could go wrong or get worse?" I can tell you from my observations, it's mostly risks, not opportunities. Unaddressed risks.
- So as I pass it off to Jan, think about this: other than maybe the Corps, EPA is one of the biggest investors in infrastructure in local communities.
- Even if you don't agree with the current administration's emphasis on climate risk management and EJ, at the very least look at it from EFAB's marching orders of helping communities find a way to implement EPA's rules in an affordable, low-cost way. If you could lower the cost of capital for those communities, why wouldn't you?

Jan: Will close - And now we want to hear your comments – colleagues.

US Treasury PRESS RELEASE
Treasury Announces Coordinated Climate Policy Strategy with New Treasury Climate Hub and Climate Counselor - April 19, 2021

WASHINGTON — Today, the U.S. Department of the Treasury announced a coordinated climate policy strategy that will:

Bring to bear the full force of the Treasury Department on domestic and international policymaking, leveraging finance and financial risk mitigation to confront the threat of climate change. These actions will position the economy for strong and sustainable growth consistent with a net-zero emissions future.

To implement this strategy, Treasury will focus on the broad range of its climate-related policy work connected to 1) climate transition finance, 2) climate-related economic and tax policy, and 3) climate-related financial risks. As part of this strategy, Treasury is also creating a new Climate Hub and appointing a Climate Counselor to coordinate and lead many of its efforts to address climate change.

Treasury's unique responsibilities to lead on a range of programs related to climate change – including economic, financial sector, and government policies – will be reflected in the expanded climate strategy work program. The Treasury Climate Hub will coordinate and enhance existing climate-related activities by harnessing the tools, capabilities, and expertise from across the Department – including from Domestic Finance, Economic Policy, International Affairs, and Tax Policy. With a view of all Treasury climate initiatives, the Hub will enable Treasury to move nimbly and efficiently in prioritizing climate action.

Treasury's first Climate Counselor is John E. Morton, a recognized leader in the field of climate finance. Mr. Morton brings to Treasury more than 25 years of experience in emerging markets, investment finance, and economic and environmental policy. As Climate Counselor, he will lead the Climate Hub, report directly to and advise the Secretary on a broad range of climate matters, and focus in particular on Treasury's efforts to facilitate and unlock the financing needed for investments to achieve a net-zero economy at home and abroad.

"Climate change presents new challenges and opportunities for the U.S. economy. The steep consequences of our actions demand that the Treasury Department make climate change a top priority," said Secretary Janet L. Yellen. "Climate change requires economy-wide investments by industry and government as well as actions to measure and mitigate climate-related risks to households, businesses, and our financial sector. Finance and financial incentives will play a crucial role in addressing the climate crisis at home and abroad and in providing capital for opportunities to transform the economy. I look forward to working with John and our team to leverage their expertise and ensure that Treasury is doing everything it can to respond to climate change while creating opportunities that strengthen our economy."

Treasury's climate policy strategy will support the Biden-Harris Administration's critical climate-related goals by:

- Mobilizing financial resources for climate-friendly investments at home and abroad, and prioritizing the expedited transition of high-emitting sectors and industries;
- Leveraging economic and tax policies to support building climate-resilient infrastructure and ensuring the transition to a net-zero decarbonized economy;
- Ensuring that environmental justice considerations feature centrally in programs, policies, and activities given the disproportionate impacts that climate change has on disadvantaged communities;
- Ensuring that policies designed and implemented to assist with the transition to a lower-carbon economy are broadly just and equitable and support well-paying jobs;
- Helping household, businesses, workers, and investors analyze, stay informed about, and adapt to the economic and financial risks and opportunities associated with climate change;
- Promoting globally consistent approaches to climate-related financial risks; and
- Understanding and mitigating the risks that climate change poses to the stability of the U.S. and global financial system and economy.

Consistent with President Biden's whole-of-government approach to climate change, Treasury will work with other stakeholders, including the National Climate Task Force and other agencies and regulators. The efforts across the Department will support engagement by the Secretary, senior officials, and staff in related independent processes, including at the Financial Stability Oversight Council.

ABOUT JOHN E. MORTON, CLIMATE COUNSELOR
John E. Morton was most recently a Partner at Pollination, a specialist climate change advisory and investment firm. Morton was a Presidential Appointee in the Obama Administration and served as White House Senior Director for Energy and Climate Change at the National Security Council. In this role, he had overall responsibility for coordinating the Obama Administration's policies and strategies on international energy and climate change issues. Earlier in the Administration, he served for six years as Vice President for Investment Policy, Chief of Staff, and Chief Operating Officer of the Overseas Private Investment Corporation (OPIC). Before his Government service, Morton was Managing Director of Economic Policy at The Pew Charitable Trusts and a private equity investor with Global Environment Fund. He began his career as a strategy consultant with Mercer and managing World Bank projects in environmental infrastructure sectors in the former Soviet Union.

Politics-Bloomberg
Yellen Names Ex-Obama Aide John Morton to Lead Climate Policy
By Christopher Condon and Jennifer A Dlouhy-April 19, 2021, 12:00 PM CDT
Investment-firm partner to head Treasury's climate efforts- Treasury seeks to adjust economy, mitigate climate risks

Treasury Secretary Janet Yellen named John E. Morton to head the department's new office devoted to addressing climate change, picking a former Obama White House official with private-sector experience to coordinate efforts across the agency.

Morton, 50, who as climate counselor will report directly to Yellen, was most recently a partner at Pollination, an investment and consulting firm focused on climate-change opportunities.

He is expected to take a central role in President Joe Biden's "whole-of-government" approach to tackling the issue, with a particular focus on aligning public and private investments with international goals on emissions and global warming, the Treasury said in a statement Monday.

Activists are pushing U.S. financial regulators to move aggressively in forcing Wall Street to reckon with the risks and curtail investments in fossil fuels that drive climate change. They're urging Yellen to use her power as head of the Financial Stability Oversight Council to trigger tighter scrutiny of investments in oil and gas assets.

"Climate change requires economy-wide investments by industry and government as well as actions to measure and mitigate climate-related risks to households, businesses, and our financial sector," Yellen said in the statement.

The new "Climate Hub" illustrates the Treasury Department's commitment to addressing the financial risks posed by a warming planet and comes as the Biden administration steps up work to confront climate change across the federal government. Biden has established an interagency task force dedicated to coordinating climate-policy moves across the executive branch, from Treasury to Transportation.

According to Monday's statement, the new office will be tasked with:

- "Mobilizing financial resources for climate-friendly investments"
- Using economic and tax policy to build resilient infrastructure and "transition to a net-zero decarbonized economy"
- Ensuring climate policies consider "environmental justice"
- Helping make information on economic and financial risks associated with climate change available to companies, workers and investors
- Understanding and mitigating risks posed by climate change to global financial stability

Morton was senior director for energy and climate change at the National Security Council under former President Barack Obama. He's also served in multiple senior positions at the Overseas Private Investment Corp.

In a December interview, Morton said the Treasury should find ways to use Covid-related stimulus to invest in green programs. He also said that Treasury will have the most power to address climate change through its work with the banking sector and how the industry assesses environmental risks.

The announcement is part of a rush of actions this week as the administration seeks to prove to the world that the U.S. is back in the global fight against climate change. Biden is convening the leaders of up to 40 nations in a climate summit Thursday and Friday.

And beforehand, the president is set to announce a new U.S. pledge to slash greenhouse-gas emissions that is expected to require a 50% reduction from 2005 levels by the end of the decade.

The Treasury Department is also readying a plan for distributing potentially billions of dollars more in aid to help developing nations adapt to global warming and propel clean energy. Biden ordered the spending blueprint in January.

— With assistance by Saleha Mohsin

WHITE HOUSE

Biden poised to sign executive order on climate finance

Avery Ellfeldt, E&E News reporterPublished: 4/9/21

President Biden is expected to soon issue an executive order on climate finance. CNP/AdMedia/Newscom

The Biden administration is preparing to throw its weight behind international efforts to alleviate climate risks that threaten the stability of the global financial system.

The move, which is expected to come soon in the form of an executive order, is the latest sign that the administration will seek to mitigate climate-related financial risks as a pillar of its carbon policies.

"The directive from the top is clear," said Rachel Kyte, a former vice president and special climate envoy at the World Bank Group. "There's no plausible deniability [anymore]. You can't be a financial actor out there and say that you're not really clear where the administration stands on these things."

Details about the structure, scope and timing of the executive order are still emerging.

But White House climate envoy John Kerry said on Wednesday that President Biden is "poised to issue an executive order" that will require companies to be more transparent about the threats they face from climate change.

"It's going to change allocation of capital," Kerry said. "Suddenly people are going to be making evaluations considering long-term risk to the investment based on the climate crisis."

That's not all. The president also reportedly plans to direct top administration officials to develop a governmentwide strategy to mitigate climate-related financial risks to public and private financial assets, according to a draft of the executive order reviewed by Bloomberg.

That plan — which would be crafted by National Economic Council Director Brian Deese, national climate adviser Gina McCarthy, Treasury Secretary Janet Yellen, and the Office of Management and Budget — would be due within 120 days.

The president is expected to direct Yellen to collaborate with top financial regulators to issue a separate report within six months that outlines the regulatory community's efforts to assess — and address — climate risks. According to Bloomberg, she would do so as chair of the Financial Stability Oversight Council, or FSOC, a body created in the aftermath of the financial crisis of 2008.

Yellen held her initial meeting with FSOC just last week. Climate change was on the agenda for the first time in the council's decadelong history (***Climatewire***, April 1).

The White House and State Department did not respond to questions about the timing or scope of the executive order.

But sources say the move has been in the works for weeks and will likely be rolled out before or alongside the administration's climate summit on April 22 and 23.

The White House has invited 40 world leaders to attend the virtual event, where it is expected to unveil a range of new climate goals, potentially including halving U.S. emissions by 2030.

Financial regulatory expert Gregg Gelzinis, of the left-leaning Center for American Progress, said the administration's move on financial risk is an "extremely valuable signaling exercise."

"The fact that this issue is going to get its own executive order really elevates the topic, emphasizes the administration's priorities here and creates some wind at the sales for action both at the Financial Stability Oversight Council but also at the primary regulators," Gelzinis said.

Kyte, who is currently dean of the Fletcher School at Tufts University, agreed. She said the executive order would signal "to every corner of the financial marketplace" that the U.S. is serious about addressing the relationship between rising temperatures and economic stability.

"There's no ideological dispute as to the fact that we need to protect the financial system so it can operate in a world where carbon is no longer powering the economy," she said.

The expected move by the White House follows financial agencies in the U.S. and elsewhere that have already taken steps to address the issue.

The Commodity Futures Trading Commission and the Federal Reserve have both launched internal initiatives to zero in on the ways that rising temperatures — and environmental regulation — could impact the firms and markets they oversee.

The Securities and Exchange Commission has gone even further. Under the leadership of acting Chair Allison Herren Lee, the regulator has made a flurry of moves to begin pushing securities markets to more accurately account for global warming. That includes kick-starting a review of the rules that dictate what climate-related information companies are required to disclose to investors and the public.

Sustainable finance proponents have welcomed those efforts. But they've also called on the administration — with Yellen at the helm — to do everything it can to streamline, coordinate and accelerate the efforts of independent regulators, which don't take direct orders from the president.

Gelzinis is among them. "The White House has such an important bully pulpit, that setting a path here can really have a broader impact" beyond immediate steps outlined in the expected executive order, he said.

Multiple sources interviewed for this story emphasized that it's still early in the process. The executive order and subsequent reports from top officials will be far more revealing of the government's trajectory on the issue that, until recently, was largely ignored by the U.S. financial regulatory system.

"We're in the first half of the first inning," said Tyler Gellasch, a former SEC aide and current fellow at Duke University's Global Financial Markets Center.

Even so, he said, Biden has been clear from the beginning that curbing climate change would require "moving private market forces to doing more, and more quickly."

That could be done in a slew of ways, from requiring finance firms to be more transparent about their exposure to climate risks, to regulating what risks they do or don't carry on their balance sheets, to overseeing what types of business activities they finance and how.

Ultimately, Gellasch said, "the financial regulators are the ones who set the terms for capitalism. And if we think we are going to have to address climate change, then capitalism has to be working in the favor of addressing climate change."

Climate advocates, meanwhile, have urged the administration to ensure it addresses the financial system's contributions to global warming — not just its vulnerabilities.

"Any climate finance approach from the Biden administration must actively drive decarbonization of the financial system, not leave capital allocation up to the market," said Moira Birss, a finance campaigner at Amazon Watch.

For Reference & Script Review Only - Article 2 -

5 ways Biden wove climate action into his budget

Adam Aton and Scott Waldman, E&E News reportersPublished: Monday, April 12, 2021

President Biden waves as he leaves church Saturday. Biden's first budget would fund climate initiatives in a broad range of areas, from prisons to transportation. Alex Edelman/CNP/Polaris/Newscom

President Biden's first budget proposal sketches a vision for greening the entire federal government, and it includes areas that have been traditional afterthoughts to climate policy, such as prisons.

His $1.4 billion environmental justice plan, for example, calls for $39 million to repair Bureau of Prisons buildings, the preliminary budget says, "in a manner that improves conditions of confinement and enhances environmental sustainability."

That's far from the only instance. Biden has promised a whole-of-government approach to climate, and his budget is full of initiatives — both expected and unexpected — that underscore that ambition.

To be sure, much of Biden's proposal remains in flux. Some of the specifics await the administration's full budget proposal later this spring, including details for the agencies directly responsible for executing Biden's climate agenda. And all spending ultimately is decided by Congress. But in the limited terms available, Biden's so-called skinny budget outlines a sprawling process of decarbonization.

Biden is asking Congress for a $14 billion increase to climate programs. That's more than he's proposing to boost programs on immigration and asylum (about $1.4 billion), the opioid epidemic ($3.9 billion) or tribal health and housing ($3.1 billion).

Biden's climate bump is also greater than the increase he proposed for the Pentagon, though his total national security budget would rise by almost the same amount, about $13 billion.

His plan suggests the administration is juggling several pressing priorities. Climate comes second to education in Biden's plan, which calls for a $20 billion increase to grants for high-poverty schools.

Coupled with Biden's $2 trillion infrastructure plan, his budget could kick-start climate policy across the country. It remains to be seen, though, if Congress will give him what he wants — as well as if any future agreement would be enough to cut emissions in half by 2030, the deadline scientists have set for averting catastrophic warming.

Clean electricity standard

Biden's budget would invest in one of his most ambitious climate policies — the clean electricity standard — which aims to move the nation's electrical grid toward carbon-free power in the next decade.

The White House proposal includes a $2 billion plan to build a clean energy projects and workforce initiative at the Department of Energy, which would put to work "welders, electricians and other skilled labor" building the transmission lines, solar arrays, wind turbines, electric vehicle charging stations and elements of the new grid.

A senior administration official on Friday acknowledged that the outline was more symbolic and called it a "complementary but separate proposal" to Biden's infrastructure plans.

"This is the beginning of a long appropriations process that the president's budget will influence. I think it will set a tone," the official said.

In Biden's $2.3 trillion infrastructure proposal, he laid out the framework of a plan to get to a carbon-free grid by 2035. If passed by Congress, the clean electricity standard would require utilities to shift the nation's power

grid toward more renewables in an unprecedentedly tight time frame. More than a dozen states have either adapted or committed to a standard.

Even with an initial round of funding behind it, a clean electricity standard faces a steep hurdle to get through Congress, where Democrats only can lose a handful of votes and where some moderates have been resistant to policy that curtails the use of fossil fuels. If the standard doesn't survive Congress, it would be more of an aspirational goal than a government mandate.

Transportation

Transportation is the single largest source of U.S. emissions, and Biden's budget builds on the electric vehicle and mass transit plans he proposed in his infrastructure package.

Biden aims to use federal procurement to jump-start the electric vehicle supply chain. Only about half a percent of the federal fleet is electric — 3,200 of 645,000 vehicles — according to General Services Administration data on fiscal 2019, the most recent available.

The budget proposes $600 million to purchase electric vehicles and charging stations for the federal government's own fleet, with half dedicated to the GSA and half to other agencies.

Transit grants would get a 23% bump, reaching $2.5 billion. The budget also calls for $250 million to help transit agencies buy low- and no-emissions buses.

Amtrak would see a 35% increase to its budget, reaching $2.7 billion, and a further $625 million would be set aside for a new passenger rail grant program.

Environmental justice

This issue cuts across two of Biden's core promises — halting climate change and addressing racial inequity.

He's proposed a framework of ensuring 40% of climate benefits reach disadvantaged communities. The budget identifies EPA as leading that initiative, with a proposed $936 million program called Accelerating Environmental and Economic Justice. That would include air quality monitoring and enforcement, along with non-climate programs such as Superfund cleanups.

The Justice Department would see a $5 million bump for its Environmental and Natural Resources Division to take on environmental justice cases, along with the $39 million boost for prisons.

The budget calls for creating new funding streams and grant programs for historically Black colleges and universities.

It also calls for starting up climate and environmental justice research in new corners of the government. For instance, Biden is proposing to create an Office of Climate Change and Health Equity under the Department of Health and Human Services, aimed at decreasing climate impacts among vulnerable populations.

Coal towns and other fossil fuel-dependent communities also would get funding boosts, including a $50 million increase for the Assistance to Coal Communities program.

Climate impacts

Biden's budget would boost funding to harden communities and federal buildings against wildfires, floods and other climate-fueled hazards.

Tribes would see a $450 million increase in resiliency projects. Farmers could expect $161 million more in conservation and environmental services programs, as well as expanded programs to forecast drought and other climate impacts.

Base resiliency seems to be the main climate focus in Biden's defense budget.

Other departments would see new funding to prepare for climate impacts. Not all of the focus is on physical infrastructure, either.

Health and social programs would direct more attention to climate's impacts on health. The Centers for Disease Control and Prevention's climate and health program, for instance, would see its funding jump to $110 million from $10 million.

Climate science

Biden's plan heavily invests in climate science across multiple agencies, with a plan to increase not just U.S. understanding of climate impacts, but also strategies for adaptation and mitigation. It offers a $4 billion research portfolio that expands climate science at NASA, NOAA, EPA, the Interior Department and the National Science Foundation.

The plan uses $1 billion to create an Advanced Research Projects Agency for Climate and to invest in the existing Advanced Research Projects Agency-Energy. Both are intended to advance riskier but potentially groundbreaking research that private industry and foundations often are hesitant to support.

NOAA would receive almost $7 billion in funding, including an additional $1.4 billion to expand its climate observation and forecasting work, and to provide better data and information to policymakers. It also would receive money for resilience programs that protect coastal communities from the economic and environmental effects of climate change.

"This increase includes $800 million to expand investments in climate research, support regional and local decision-making with climate data and tools, and improve community resilience to climate change," the document states.

NASA's Earth science budget would receive a boost of $250 million, to $2.3 billion. That increase would be focused on improving the agency's understanding of how the planet is responding to climate change, and it would support new research tools to understand how the planet is changing.

The money is intended to "initiate the next generation of Earth-observing satellites to study pressing climate science questions," the document states.

The National Science Foundation would receive $10.2 billion — a significant bump of $1.7 billion, or 20%, over current levels.

Included in that funding is $1.2 billion for climate- and clean energy-related research, a $500 million increase from current levels. The money would help study "climate science and clean energy, including research on atmospheric composition, water and carbon cycles, modeling climate systems, renewable energy technologies, materials sciences, and social, behavioral, and economic research on human responses to climate change," according to the White House.

A number of agencies would receive money for research on strategies to mitigate and adapt to climate change.

In the Interior Department, wildfire research would be boosted to $1.7 billion, an increase of $476 million over the 2021 enacted level, to study and mitigate the forces that drive worsening fire seasons.

Research would be conducted on forest management, droughts and ecosystems. The budget would devote an increase of $161 million to the Department of Agriculture to better incorporate science into conservation planning. In particular, it would focus on carbon sequestration, greenhouse gas reduction and wildlife stewardship.

National Intelligence Council's Global Trends 2040 (released April 2021)
https://www.dni.gov/index.php/global-trends-home

Every four years since 1997, the National Intelligence Council, which reports to the Director of National Intelligence, updates its Global Trends report, which is intended to provide a consensus opinion of the entire intelligence community, in the form of a 20-year look ahead "provide an analytical framework for policymakers early in each administration as they craft national security strategy and navigate an uncertain future."

Right up in the executive summary, the report notes:

"In the environment, the physical effects of climate change are likely to intensify during the next two decades, especially in the 2030s. More extreme storms, droughts, and floods; melting glaciers and ice caps; and rising sea levels will accompany rising temperatures. The impact will … create new vulnerabilities and exacerbate existing risks to economic prosperity, food, water, health, and energy security. Governments, societies, and the private sector are likely to expand adaptation and resilience measures to manage existing threats, but these measures are unlikely to be evenly distributed, leaving some populations behind. Debates will grow over how and how quickly to reach net zero green - house gas emissions."

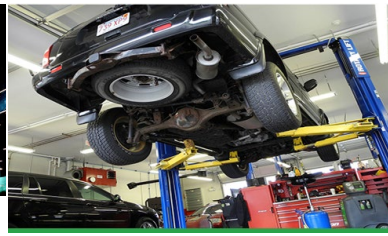
Pollution Prevention: P2

Facilitating Access to Capital for Pollution Prevention in Small Manufacturing Facilities: *Exploring a Role for EPA*

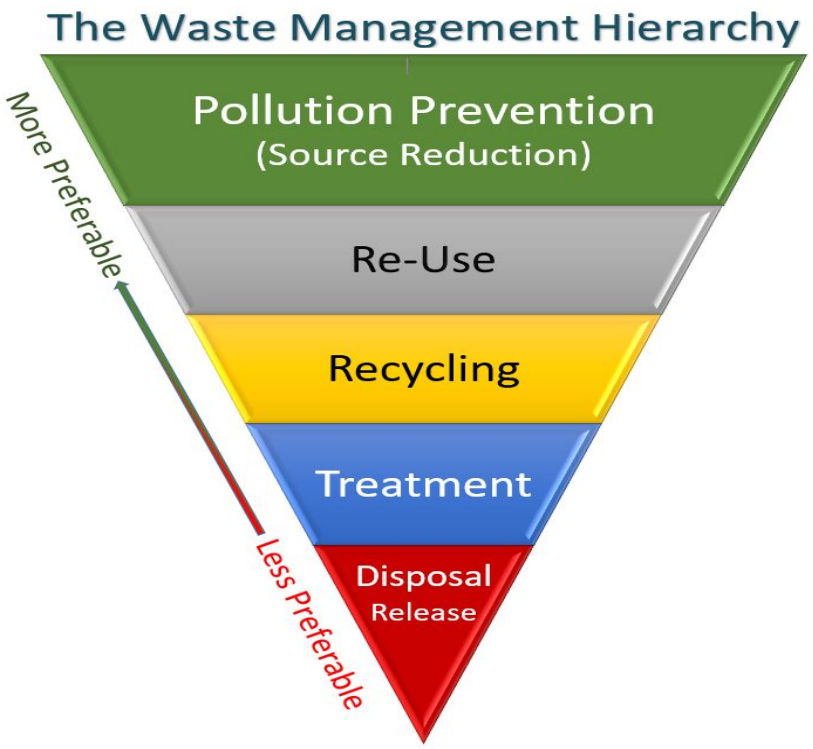
Office of Pollution Prevention & Toxics







“An ounce of prevention is worth a pound of cure!”

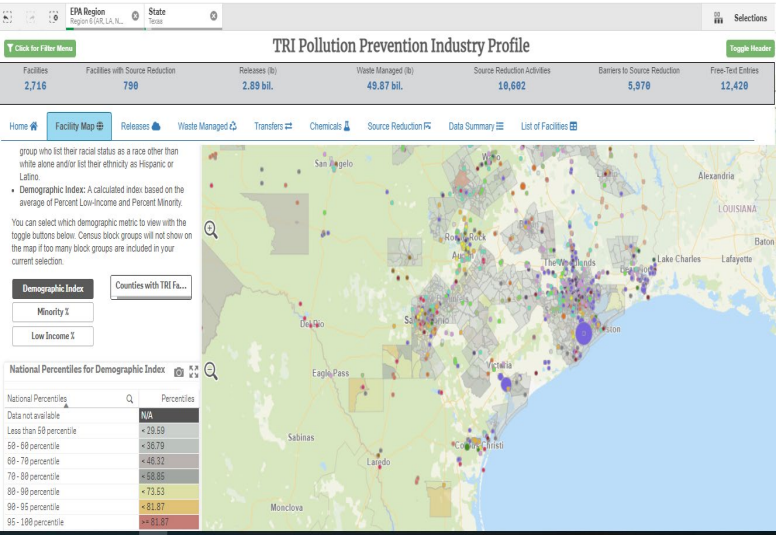


- It’s often cheaper to prevent the creation of pollution than to clean it up afterwards or pay for control, treatment, and disposal of waste products.
- For businesses, all forms of waste represent inefficient expenditures.
- If a business can reduce or eliminate operating, regulatory, liability and other expenditures, that immediately translates to the bottom-line by increasing net revenue.

EPA's Pollution Prevention (P2) Program

- Technical assistance to advance P2 in National Emphasis Areas:
  - Food/Beverage, Auto, Aerospace, Fabricated metals, Chemicals
- Highlight best practices– spotlights, case studies
- Drive sustainable change through voluntary programs, like Safer Choice and Environmentally Preferable Purchasing

Toxics Release Inventory National P2 Analysis



www.epa.gov/trinationalanalysis

- EPA can leverage reported TRI P2 data to aid in identifying
  - example P2 capital investment projects;
  - possible information sources - facilities that have implemented select technologies and could potentially inform on benefits and associated costs with the investment;
  - candidate facilities that could benefit from a P2 finance project - those facilities that have reported barriers to implementing source reduction and could be approached for a targeted P2 campaign.
- EPA can also enhance and promote use of TRI analytic public-facing tools with demographic mapping to help with identification of vulnerable communities.

Example Small Business P2 Interventions

- **Good housekeeping:** including efficient operation of machinery, monitoring of raw material flows, segregating waste, and training staff;
- **Materials substitution:** such as phasing out chlorofluorocarbons (CFCs), and switching from solvent-based paints to water-based alternatives;
- **Manufacturing modifications:** including cutting the number of processes or switching from chemical to mechanical, and introducing closed-loop processing;
- **Resource recovery:** for example, reusing pollutants in the same process, and selling waste by-product as raw materials in other industries.

Metal Finishing Technical Assistance: P2 Results

Metal finishers are one of the leading sectors for Superfund and Corrective Action sites R1, R5, R9 developed assistance programs and materials to help metal finishers reduce toxics use, improve production processes, and significantly reduce potential for land contamination

Results (EPA R9 project alone):

- 14 Facilities in CA and AZ received technical assistance
- 34 Workshops in CA and AZ
- 2,000 copies of Materials Distributed

Raw Materials/Waste Reductions:

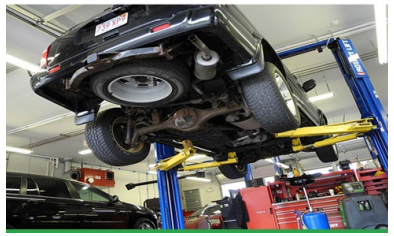
- Water/Wastewater 12.4 M gallons
- Process Chemicals 6,450 gal. + 7,980 lbs.
- Hazardous Waste 200,000 lbs.
- Metals in Wastewater 56 lbs.
- VOCs 5,790 lbs.

Average Cost Savings to Companies = $12,741/year
Average Simple Payback = 1.7 years

Ripe for Financing?
Pollution Prevention Intervention examples

- *Solvent distillation.* In some industries, distilling solvents can present an alternative to directly disposing of hazardous waste.
  - ~$40,000 for new distillation equipment
  - Has reduced waste generation by 90%
  - Has achieved an ROI of 0.6 years

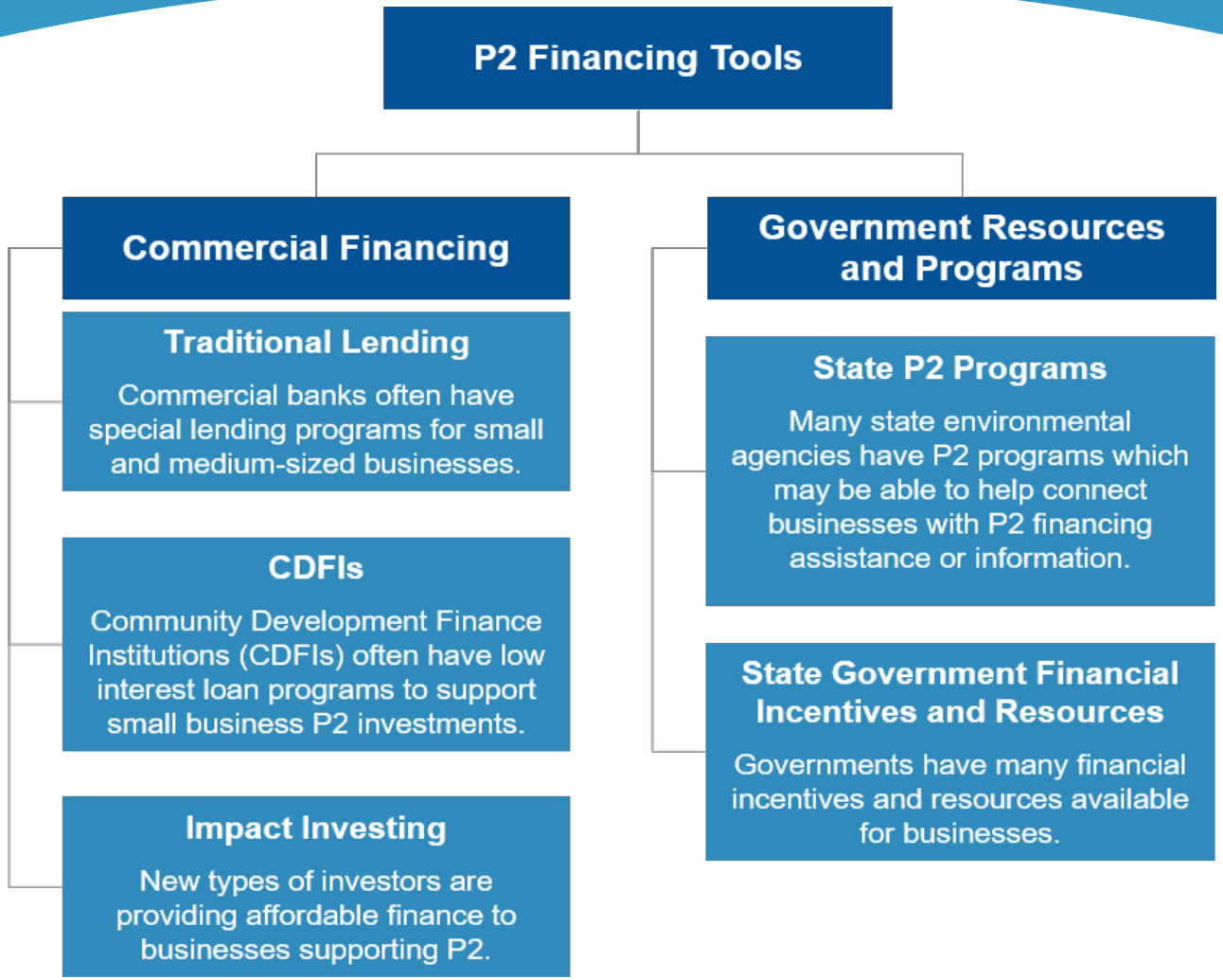
- *Plural component spray paint.* Businesses like those in aerospace and automotive industries use spray guns to apply premixed paint for client's specific color requests. Premixing paint normally leads to large volumes of unused paint that ultimately gets disposed of. By switching to a plural component system, which mixes the paint directly at the tip of the spray gun, companies can eliminate overmixing and drastically reduce the use of solvents for equipment cleaning.
  - Could be upwards of $500,000 to convert a system
  - ROI of 1.5 years has been achieved due to reduced labor, product purchases, and waste generation and disposal costs.



Challenges

- P2 projects (e.g., new equipment, contractor services) often require cash disbursements upfront, with potential savings (avoided costs) accruing over time.
- These projects must often overcome an “if it’s not broken, don’t fix it” mentality and must often compete for limited resources with other internal business priorities that are essential for revenue generation.
- Small business often have not quantified inefficiencies or loss of revenue from continuing with current approaches.
- Small businesses may not be used to borrowing money from external sources or they may not think that they are able to do so at affordable terms.

Landscape of Current P2 Financing Options



Commercial Financing for P2

- Techniques that can make small business loans more attractive to lenders
  - **Loan bundling:** Banks sell several loans together as a single combined unit, often for a lower price and with less risk than they would charge investors to buy each item separately.
  - **Securitization:** Banks merge or pool loans into a group which is repackaged and sold to investors.
  - **Insurance:** Loan protection insurance covers debt payments on certain covered loans if the insured loses their ability to pay due to a covered event.
  - **Tax-harvesting:** The selling of securities at a loss to offset a capital gains tax liability. This strategy is typically employed to limit the recognition of short-term capital gains.
  - **Loan loss reserve:** An expense set aside as an allowance for uncollected loans and loan payments. This somewhat reduces the risk for investors, making them more likely to invest.

Federal P2 Financing Programs and Resources

The federal government does very little direct funding of small businesses on P2 projects.

- The **Department of Commerce's CDFI Fund** invest federal dollars alongside private capital for Community Development Finance Institutions (CDFIs)
- The **U.S. Small Business Administration**:
  - Provides economic injury loans to small businesses impacted by COVID-19.
  - Offers "Pollution Control loans" to aid businesses in reducing their environmental impact. ***Currently this program is not available due to lack of appropriations.***
- The National Institute of Standards & Technology (NIST) **Manufacturing Extension Partnership** is a federally-funded resource for providing technical assistance; NIST does not provide loans.

Evolving finance questions from the P2 Program:

- How would a sector-based or intervention-based approach inform economies of scale in financing?
- How might an energy service company (ESCO) type model be used to bundle P2 projects for multiple small manufacturers within a sector?
- What could EPA's role be in facilitating such an approach?
- Are there other financing models/approaches that we should consider?
- Are there any calculators or tips to enhance or reinforce the small manufacturers' financial strength to lenders?

As a start, EPA has begun to profile select P2 technologies/ approaches, typical returns/benefits, and the scope of the potential market. (EPA could provide this research to the EFAB.)

EFAB Recommendations and EPA Responses

Compiled April 13, 2021

Table of Contents

EFAB Recommendations and EPA Responses

Prepared April 12, 2021

Consultation on Financing and Governance Options for the Backhaul Alaska Program

April 13, 2020

https://www.epa.gov/sites/production/files/2020-04/documents/efab_backhaul_alaska_consultation_letter-package.pdf

Overarching EPA Response	• Acknowledgement Letter (signed by Region 10 Regional Administrator, April 30, 2020)
	  ○ Commits to continue to work with the Solid Waste Alaska Taskforce and its Backhaul Alaska Advisory Committee to advance the program
	  ▪ Commits to reviewing EFAB's recommendations with the Taskforce and Committee for incorporation into the Backhaul Alaska implementation plan
	  ○ Agrees to use EFAB's recommendations in future discussions with the State of Alaska and other Federal agencies on sustainable financing strategies for Backhaul Alaska
	  ▪ Caveats pandemic currently straining economic resources in Alaska
	  ▪ Agrees to explore how EPA funds can continue to support program development as Backhaul Alaska transitions from pilot phase to full implementation
	  ○ Expects to work with EPA partners to develop long-term sustained funding for the program

EFAB Recommendation	***EPA Response***
EFAB strongly recommends that EPA and the State of Alaska identify additional grant funds to support the start-up of Backhaul Alaska over the first few years of operations until another long-term sustainable funding source is developed	In response to EFAB's recommendation, EPA dedicated $3,000,000 to fund the first three years of rural Alaska backhaul service operations. Under an EPA and Denali Commission Interagency Agreement, the Denali Commission is competing a $3,000,000 grant, with EPA funding, to fund the delivery of household hazardous waste backhaul services for rural Alaska communities and to establish program administrative and operational capacity.

	The competition is expected result in one award of $1,000,000 per year for three years. Eligible entities include tribes and intertribal consortia. The application period closes on April 16, 2021. The award decision is expected in May 2021. Grant competition information is available on the Denali Commission's website: https://www.denali.gov/programs/backhaul-services/
The Board recommends that the EPA work with other federal partners and the State of Alaska to identify grant funds that could serve as seed money for such an endowment or other sustainable, long-term solution	The above-mentioned grant competition solicits from applicants their plan for long-term program growth and sustained funding. EPA intends to work with the newly awarded grantee, federal partners, and the State of Alaska, as well as other backhaul stakeholders, to identify seed money for an endowment or another sustainable, long-term funding solution.

EFAB Recommendations and EPA Responses

Prepared April 12, 2021

Evaluating Stormwater Infrastructure Funding and Financing

March 30, 2020

https://www.epa.gov/sites/production/files/2020-04/documents/efab-evaluating_stormwater_infrastructure_funding_and_financing.pdf

Overarching EPA Response	• Acknowledgement Letter (signed by OWM Director, July 16, 2020)
	  ○ Acknowledges satisfaction of AWIA Section 4101 requirement of Stormwater Infrastructure Funding Task Force
	  ○ Commits to providing copy of EPA Report to Congress as required under AWIA Section 4101
	• EPA Report to Congress
	  ○ In development as of March 2021

EFAB Recommendation	***EPA Response***
Develop a new and enhanced construction grant program specifically for stormwater projects, similar to the federal Municipal Construction Grants Program that funded the construction of wastewater treatment plants.	EPA is finalizing the Sewer Overflow and Stormwater Municipal Grant program. This new grant program will provide funding for critical stormwater infrastructure projects in communities including combined sewer overflows (CSO) and sanitary sewer overflows (SSO). Grants will be awarded to states, which will then provide sub-awards to eligible entities for projects that address infrastructure needs for CSOs, SSOs, and stormwater management. States are required to prioritize funding projects for communities that are financially distressed, have a long-term municipal CSO or SSO control plan, or for projects that have requested a grant on their Clean Water State Revolving Fund (CWSRF) Intended Use Plan. The program received a $28 million appropriation in fiscal year 2020 and a $40 million appropriation in fiscal year 2021.
Increase annual funding allocation for and modify the Clean Water Act section 319(h) grant program to allow and encourage local capacity building, utility fee study and implementation and asset management, and remove restrictions on use of grant funds for MS4 permit compliance.	While many of the revisions listed would require congressional action, EPA is working to promote the use of 319 programs in partnership with traditionally funded SRF projects and vice versa. The CWSRF and NPS Programs are partnering to produce a Best Practices Guide for using CWSRF to address NPS needs. Several technical assistance pilots will happen over the next year to promote this integrated funding approach.
Provide additional funds for the CWSRF and Water Infrastructure Finance and Innovation Act (WIFIA) programs specifically for stormwater. The CWSRF and WIFIA programs are integral tools among the many infrastructure financing options available to communities.	EPA is evaluating options responsive to this recommendation, in addition to highlighting the case studies and current uses of CWSRF and WIFIA for stormwater.

Whether stormwater receives consideration of its own through a new SRF program or receives less restrictive eligibility considerations and larger appropriations within the existing CWSRF, it is the view of the Task Force that stormwater would benefit from a separate, additive, recurring financial commitment from EPA. This would provide communities an incentive to create dedicated funding sources to demonstrate financial capacity and capabilities, while still retaining the flexibility and local control as to the actual method for repayment. This could be achieved by the implementation of one or more of the following, each of which has associated risks and opportunities: I. Create a specific stormwater set-aside in the existing CWSRF framework and increase awareness/guidance on the CWSRF for stormwater projects, including the Green Project Reserve program. II. Create a "One Water" SRF with amounts allocated to drinking water, clean water and stormwater. III. Create a new SRF program exclusive to stormwater programs and projects. IV. Expand the existing WIFIA program (e.g., explicit references to stormwater project eligibility, priority points for stormwater projects, lower project minimums for bundled stormwater projects) to allow funding for more stormwater projects or fund the Army Corps of Engineers (USACE) Corps Water Infrastructure Financing Program (CWIFP), also established in 2014.	
Create a federal funding program (similar to the Low Income Home Energy Assistance Program [LIHEAP]) to help address household affordability issues for customers who are economically challenged in paying their water related charges, including stormwater.	The federal Low Income Housing Water Assistance Program has been funded in two separate Acts for a total of $1.186B. The program is being administered by HHS with assistance from EPA in a similar approach and program eligibilities to LIHEAP.
Provide funding to educate elected officials, professional administrative leaders and the public on the benefit and need for sustainable local stormwater funding and organizational capacity through, for example, the creation of stormwater utilities or the expansion of existing utilities into the stormwater sector. Sustainable funding for stormwater infrastructure builds long-term financial capacity, improves operational performance and over time produces results for citizens and residents. For over two hundred years, this has been the experience with drinking water and wastewater utilities in this country. The educational goals for these three audiences are to demonstrate that stormwater management investment directly benefits the health, safety and economic opportunity for citizens and residents through the overall improvement of water quality and resiliency of communities.	EPA is producing an interactive learning module geared towards educating city officials and watershed managers about innovative stormwater financing options. These will include pay-for-performance, in lieu fees, and generating private sector funding. The learning module will include sections focused on the importance of dedicated revenue streams and long-term funding strategies.

Provide technical assistance and funding to help communities create and maintain sustainable and legally defensible funding sources and increase operational efficiency. This could include assistance with funding need assessments, organization analysis, grant applications, affordability assessments, integrated planning and/or establishing revenue instruments.	EPA has partnered with the Environmental Finance Centers (EFCs) at the University of Maryland and University of North Carolina to provide states and municipalities free technical assistance for integrated planning. The free technical assistance is available until August 31, 2021. For state permitting authorities, free technical assistance is available to review integrated plans submitted to states in accordance with EPA's 2012 Integrated Municipal Stormwater and Wastewater Planning Framework. For municipalities, technical assistance is targeted to developing components of Element 4 (alternatives analysis) of EPA's 2012 Integrated Municipal Stormwater and Wastewater Planning Framework.
Provide for a common application for different federal grants applicable to stormwater across all federal agencies.	EPA is working with the Environmental Finance Centers to evaluate and streamline federal reporting requirements for grants and loans. The EFC will produce a public tool to help under-resourced communities more efficiently apply for and meet grant and loan requirements and streamline the administrative burden they face.
Provide funding to build and maintain a compendium of case studies and other resources to assist users to identify successful stormwater funding and financing approaches.	EPA is building on the case studies developed by the EFAB workgroup. These case studies will all be presented on a new, interactive website that will allow users to search based on geographic area, community size and funding source type.
Promote innovative financing, such as pay-for-performance or nutrient trading, to help reduce costs and create efficiencies. *(included in the EFAB report cover letter, not in the full report)*	

EFAB Recommendations and EPA Responses

Prepared April 12, 2021

Revenue Options for a Waste Backhaul Service Program in Rural Alaska

August 19, 2019

https://www.epa.gov/sites/production/files/2019-12/documents/revenue_options_for_a_waste_backhaul_service_program_in_rural_alaska.pdf

Overarching EPA Response	• Acknowledgement Letter (signed by Region 10 Regional Administrator, January 6, 2020)
	  ○ Says EPA staff have taken steps to explore EFAB's recommendations and in doing so, have made progress towards strengthening the backhaul service program
	  ○ Acknowledges EFAB will continue to work with the EPA Region 10 to further develop recommendations for backhaul financing during the February 2020 EFAB meeting

EFAB Recommendation	***EPA Response***
Identify the full scope of potential benefits and cost savings related to health and environment engendered by Backhaul Alaska, including a quantitative range where possible, and use the information to promote the value of the Backhaul Alaska program.	EPA worked with rural Alaska backhaul stakeholders on some of EFAB's 2019 report recommendations (see highlighted text), including: • Evaluated the possibility of a co-op model with the University of Alaska Cooperative Development Center and the Backhaul Alaska Advisory Committee. As of now, a co-op model does not appear to be prudent. (EFAB members may recall that Andrew Crow, Executive Director of the Cooperative Development Center attended the February 2020 EFAB backhaul consultation) • Developed an Extended Producer Responsibility Program proposed framework paper that, if enacted, would generate funding for backhauling waste electronics. The framework document can be found here: https://907swat.org/product-stewardship/ • Made contact with GSA Disposition services to identify potential opportunities for program support. • Used EFAB's report to engage with backhaul stakeholders.
Evaluate seriously and in greater detail the possibility of a co-op model and how that might work in Alaska. The Workgroup strongly encourages contacting the U.S. Department of Agriculture Rural Development Office in the state of Alaska or the National Cooperative Business Association to connect with someone familiar with establishing cooperatives in the area. Also contacting the Secretary of State to procure literature on the state laws affecting co-ops is a helpful resource.	
Although some of the financing will come from fees and other as yet unidentified mechanisms, Backhaul Alaska may be able to procure funding from financial institutions that work specifically with co-ops. Contact the local Rural Development Office or the National Cooperative Business Association to start off in the right direction.	
FUTURE: If the feasibility analysis, and the sociocultural, political, and infrastructure implementation considerations, indicate a co-op model is best, incorporate the co-op and develop the necessary paperwork for membership. The contract should detail when and	

how much money is due, when products need to be picked up and the notice required for opting out of the co-op.	EPA intends to work closely with the forthcoming Denali Commission Rural Alaska Household Hazardous Waste Backhaul Service Program grantee to assess the remaining recommendations and support their implementation. (Grant competition information is available on the Denali Commission's website: https://www.denali.gov/programs/backhaul-services/)
Assess whether there are opportunities to partner and potentially receive funding from the Bill and Melinda Gates Foundation, Google.org, or other foundation which focuses on economic opportunity, provides tools, and financial assistance. Assess becoming a World Bank member to gain support and awareness of the needs for backhaul in Alaska.	
Develop a stakeholder stewardship council for environmental and economic strategic planning that would evaluate and develop a workable Extended Producer Responsibility program.	
Consider adopting enabling state and tribal legislation that mirrors EPR policies in force in New York City. Even those that might increase up-front costs by way of deposits would still be refundable and cost-neutral to the consumer. If collection sites are available at or near existing retailers, it would nearly eliminate any inconvenience to the consumer who would be bringing their business to the retailer anyway.	
The Backhaul Alaska program should reach out to computer manufacturers to inquire if they would be interested in the e-waste that needs to be removed. This could be done on an in-kind basis if the benefits outweigh cost.	
While the Workgroup highly encourages extended producer responsibility (EPR) programs, it comes with a caveat. If such a program results in significant cost increase to the consumer/communities, some other mechanism must be created to counteract that increase so that the net effect on communities is neutral or negligible.	
Identify the detailed procedures and potential of how the use of GSA disposition services could result in cost savings specific to the infrastructural needs of Backhaul Alaska.	
Seek out and partner with various interested veteran councils. They may provide skilled voluntarism for a variety of roles.	
Communicate with the appropriate military points of contact for Backhaul Alaska leveraging opportunities and assess the potential and scope of military assistance in practice.	
Consult with the Alaska Department of Homeland Security and Emergency Management to see what opportunities there may be to partner or obtain financial resources.	
Delve further into the potential for, and tradeoffs of, backhaul/solid waste fee districts.	
The EFAB recommends that the EPA, particularly the EPA Region 10, utilize this report to engage with partners in Alaska regarding the removal of backhaul from remote rural Alaskan communities.	

EFAB Recommendations and EPA Responses

Prepared April 1, 2021

A Decision-Maker's Guide to Alternative Service Delivery Options for Public Utility Projects

June 4, 2019

https://www.epa.gov/sites/production/files/2019-12/documents/a_decision-makers_guide_to_alternative_service_delivery_options_for_public_utility_projects_june_4_2019.pdf

Overarching EPA Response	• Acknowledgement Letter (signed by OWM Director, February 14, 2020)
	  ○ Agrees with finding regarding need for local officials to identify and consider financing alternatives at earliest possible time thoughtfully and efficiently
	  ○ Expresses appreciation for recommendation that EPA Water Infrastructure and Resiliency Finance Center (WIRFC) continues to work with all interested parties in improving access to the entire range of available information
	  ○ Commits to using this guide to inform the forthcoming "Alternative Project Delivery Learning Module" being developed by WIRFC
	  ▪ The learning module will be available through the Water Finance Clearinghouse once complete

EFAB Recommendation	***EPA Response***
The guide has been designed to harmonize with, and be used in coordination with, more lengthy and detailed informational materials being developed by EPA's Water Infrastructure and Resiliency Finance Center.	The content for the Alternative Service Delivery learning module has gone through the initial review process within Office of Wastewater Management. Once a contracting vehicle is in place, the learning module will be put into Captivate (the software program used to create all learning modules) and be routed for Office of Water and Office of Public Affairs review.
We encourage the Agency's Water Infrastructure and Resiliency Finance Center to work with all interested parties in improving access to information on the plethora of detailed resources available to communities on this subject.	During initial development of the learning module content, WIRFC consulted with a handful of interested parties. Before deployment, these stakeholders will be provided a draft copy of the content for review as well.

EFAB Recommendations and EPA Responses

Prepared April 13, 2021

Financing Strategies to Promote System Regionalization

April 25, 2019

https://www.epa.gov/sites/production/files/2019-12/documents/funding_strategies_to_promote_system_regionalization_april_25_2019.pdf

Overarching EPA Response	• Acknowledgement Letter (signed by Office of Wastewater Management Director, February 14, 2020) ○ Outlines several EPA actions underway in response to the report (captured below)
EFAB Recommendation	***EPA Response***

Promote and incentivize consideration of regionalization and consolidation alternatives through the Safe Drinking Water Act (SDWA) and Clean Water Act (CWA) permitting processes, and through EPA-controlled funding programs including the state revolving funds (SRF), Water Infrastructure Finance and Innovation Act (WIFIA) and other grant programs. Facilitate funding for projects that address new or expanded drinking water and wastewater management needs through regionalization or consolidation alternatives.	• EPA will continue to make information available to assist drinking water and wastewater systems in making informed decisions.
	  ○ EPA's guide "Water System Partnerships: State Programs and Policies Supporting Cooperative Approaches for Drinking Water Systems" contains information about programs, statutes, and policies implemented in each state that encourage partnerships between drinking water systems.
	  ○ For drinking water systems, EPA is planning to develop in-depth case studies of state programs that include regionalization activities within their Capacity Development programs. These case studies will explore best practices for integrating regionalization into state policies and programs.
	  ○ For both drinking water systems and wastewater systems, EPA will identify state programs that are incentivizing regionalization activities through their use of the Clean Water State Revolving Fund (CWSRF), Drinking Water State Revolving Fund (DWSRF), or other state grants or loans.

Promote the use of “Safe Harbor” provisions to protect systems that absorb troubled systems from regulatory penalties for a reasonable period of time, consistent with existing statutes and regulations.	• EPA will also continue to communicate the use of "Safe Harbor" (also referred to as Consolidation Incentive) provisions as recommended in the EFAB's report. ○ As Congress directed EPA through the America's Water Infrastructure Act (AWIA), EPA intends to make changes to Consolidation Incentive provisions. Section 2010 of the AWIA requires states to have the authority to require public water systems to assess options for consolidation, or transfer or

	ownership of the system, or other actions expected to achieve compliance with National Primary Drinking Water Regulations (NPDWRs). ○ EPA has begun development of the Water System Restructuring Rule (WSRR) which will outline a general sequence for water systems and primacy agencies to follow and establish requirements for, as well as limitations on, the (h)(S) liability protection provision. ▪ The WSRR will codify the 1414(h)(2) statutory requirement that primacy agencies provide up to two years enforcement relief for a public water system under an approved restructuring plan. ▪ In addition, the WSRR will codify requirements of, and limitations on, enforcement relief. ▪ The WSRR will codify the 1414(h)(4) provisions stating that water systems are eligible for DWSRF loans to implement out restructuring activities identified in a mandatory restructuring assessment.
Examine the impact EPA's Public Water System Supervision (PWSS) grant allocation formula has on creating disincentives for state governments that actively promote beneficial consolidation of water systems to determine if the formula should be changed.	
Review capacity development policies and programs at the state level to ensure consideration of beneficial regionalization and consolidation options.	
Enhance the scope and structure of EPA's guidance and support for objective, well-informed evaluation of regionalization options through EPA's information tools (e.g. Water System Partnership website) and active engagement of key stakeholders.	• EPA has been in the process of developing the "How to Support Water Systems Partnerships" tool which will serve as a resource for states and their drinking water programs to identify potential water system partnerships. This interactive tool will lead states through a series of steps by identifying public water systems with technical, managerial, and financial (TMF) challenges that could benefit from a partnership. • EPA has been developing the "Water System Partnership Training Toolbox". This Toolbox is intended to provide tools for state representatives, technical assistance providers, and other interested stakeholders to develop and run workshops for small drinking water systems. These workshops provide the tools needed at the local level to help systems and communities determine the extent to which they already engage in partnerships with other systems, and to help them determine which new types of partnerships could be established in the future. • In 2020, EPA launched the Water System Partnership Handbook is an interactive tool to assist state drinking water programs in identifying, assessing, and implementing

	water system partnerships. Technical assistance providers may also find this tool useful. Additionally, it is intended to provide states and their drinking water programs, including tribal systems, an opportunity to identify potential water system partnerships, by walking states through a series of interactive steps. The document is an update to the EPA's 1991 Restructuring Manual, Chapter 4: Role of the Drinking Water Regulator (EPA 570-9-91-035). • EPA launched an interactive storymap to allow stakeholders to explore partnership types and relevant case studies in 2017.
EPA should facilitate informed decision-making by providing states and local officials, as well as other stakeholders, with objective information about legislative and regulatory initiatives and policy tools related to potentially beneficial regionalization or consolidation of water and wastewater systems.	• EPA will continue to utilize its websites and the Water Finance Clearinghouse to disseminate information about regionalization.

Comments Received for the Environmental Financial Advisory Board April 2021 Meeting

Written Comments Provided with Registration

1. Ronald Chick
   SUASCO River Stewardship Council
   COMMENT: PFAS & PFOS concerns

2. Heidi Siegelbaum
   Washington State University, Washington Stormwater Center
   COMMENT: Can you please address green bonds and public-private partnerships? Also does the new Administration offer any support via infrastructure funding?

3. Kali Bronson
   Natural Resource Services
   COMMENT: I did not request to have the ability to comment, so I would like to pass along a comment regarding the off-site stormwater discussion:
   MS4 permits require treatment of the stormwater quality volume onsite or within the MS4. Much of the runoff comes from large impervious areas, biggest being parking lots and roads. Most MS4s do not have a charge for treating stormwater quality and struggle with funding addressing stormwater quality, including green stormwater infrastructure implementation and maintenance. I would like to understand better how this board defines "off-site Stormwater" and would like to be part of these discussions. I am with Bernalillo County in New Mexico. We do not have primacy and our permits come from EPA Region 6. EPA in 2014 gave us a watershed-based permit. Given the cooperative elements of this permit, this area would be well suited to explore this idea of trading and finding sources of funding for stormwater quality and green stormwater infrastructure.

Written Comments Submitted

4. Tracy Brown
   Save the Sound
   COMMENT: (attached)

5. Chuck Job
   National Ground Water Association
   COMMENT: (attached)

6. John Peairs
   XiO Water System
   COMMENT: (attached)

Registered to Provide Comments During Meeting

7. Dylan Bakley
   ACUA

8. Pedro Modesto
   EPA Region 2 CEPD

9. Sanjiv Sinha
   ECT

10. Sacoby Wilson
    University of Maryland, College Park
    (Comments made on Tuesday, April 20th)

11. Jerry Lee Bogard
    Grand Prairie Farming and water
    (Comments made on Tuesday, April 20th)
    ADDITIONAL WRITTEN COMMENT: I found the EFAB Zoom meeting to be beneficial and encourage more of these types of opportunities.
    As co-owner and Managing Partner of Grand Prairie Farming and Water Company LLC, our focus is to continue to look for ways to lower our costs of Groundwater Preservation / Nutrient Reduction Offsets through Public Private Partnerships.
    We need each other if we are going to take on these large scale projects.

12. Sylvia Orduño
    Michigan Welfare Rights Organization
    (Comments made on Wednesday, April 21st)
    ADDITIONAL WRITTEN COMMENT: (attached)

13. Josif Brifman
    Universal Research and Development Enterprise LLC
    (Comments made on Wednesday, April 21st)
    ADDITIONAL WRITTEN COMMENT: (attached)

From: Tracy Brown
To: EFAB; Johnson, Tara
Subject: RE: Comments at EPA"s Environmental Financial Advisory Board Meeting April 20-21, 2021
Date: Wednesday, March 24, 2021 10:28:49 AM

Thank you for offering this meeting.

I'm interested in the approach that EPA takes to conducting cost benefit analysis for conservation investments. Specifically, how do you do ecosystem services valuations and are there other best practices?

I'm also interested in hearing how EPA conducts cost benefit analysis when projects are proposed for an environmental justice community. For example, projects that will help save property from the impacts of climate change such as flooding. If EPA only assesses benefits based on replacement cost of real estate, then higher value real estate and communities get protected and low income communities do not. Do you have a method for assessing value outside of property replacement costs (i.e. valuing other characteristics such as scarce low income housing stock, older neighborhoods, avoidance of displacing communities with low mobility, etc.)?

Tracy

Tracy Brown
Regional Director, Water Protection
Save the Sound
545 Tompkins Ave, 3rd Floor | Mamaroneck, NY 10543
[redacted]
www.savethesound.org

Make a gift today to protect the land, air, and water of the Long Island Sound region!

From: EFAB [mailto:EFAB@epa.gov]
Sent: Tuesday, March 23, 2021 6:03 PM
To: Johnson, Tara <Johnson.Tara@epa.gov>
Subject: Comments at EPA's Environmental Financial Advisory Board Meeting April 20-21, 2021

Hello,

Thank you for registering for the upcoming Environmental Financial Advisory Board meeting.

You've indicated on your registration that you would like to provide comments during the meeting.

Please be aware that oral comments are limited to three minutes per speaker. If you anticipate that your full comments may be longer than the alloted three minutes or you would like to provide your comments to the Board in advance, you are encouraged to submit your comments in writing by April 12.

You can deliver oral comments during the meeting and provide written comments as well. Written comments will be included in the meeting materials and will be posted to the EFAB website in advance of the meeting. Please be aware that any personal contact information, if included in your written comments, may be posted to the EFAB website. Copyrighted material will not be posted without explicit permission of the copyright holder.

Please reply to this email with any written comments you would like to provide to the Board and your preferred day to provide oral comments (Tuesday, April 20 or Wednesday, April 21).

If you have any additional questions, please let me know.

Tara Johnson (she/her)
Water Infrastructure & Resiliency Finance Center
Mail Code 4204M
Office: 202-564-6186
Cell: 202-809-7368
Fax: 202-501-2346

Office of Wastewater Management: Solutions for Clean Water

From:	Chuck Job
To:	EFAB
Cc:	Sawyers, Andrew; Miller, Wynne; Brubaker, Sonia; Deane, Michael; Kloss, Christopher
Subject:	Written Statements for April 20-21, 2021 EFAB Meeting
Date:	Monday, April 12, 2021 3:32:56 PM
Attachments:	Response to EPA EFAB GW Protective Stormwater Control Financing-Guidance Needed 2021 04 12.docx

To the Environmental Financial Advisory Board

I am submitting the attached statement on behalf of Brian Snelten, Chair, Government Affairs Committee, National Ground Water Association, regarding stormwater infrastructure financing.

The National Ground Water Association is available to respond to questions and provide further input regarding this statement.

Thank you for the opportunity to comment on this significant EFAB priority.

Chuck Job | Regulatory Affairs Manager

National Ground Water Association

[redacted]

NGWA — Better Together
601 Dempsey Road | Westerville, Ohio 43081| USA
(800) 551-7379 | (614) 898-7791 | x 1561 | fax (614) 898-7786
NGWA.org | WellOwner.org

Private Well Owner Hotline: (855) H20-WELL | (855) 420-9355

National Ground Water Association
Response to
Environmental Protection Agency Environmental Financial Advisory Board
Regarding Steps Beyond Its Report
"Evaluating Stormwater Infrastructure Funding and Financing"

Submitted: April 12, 2021

Support for Stormwater Infrastructure Financing But Concerns for Groundwater-Protective Design

The National Ground Water Association commends the Environmental Financial Advisory Board for completing its report "Evaluating Stormwater Infrastructure Funding and Financing" one-year ago (March 2020) highlighting the need for financial, technical and educational assistance to communities to deal with the challenges of stormwater, particularly with climate-changed conditions. NGWA supports financial assistance for stormwater infrastructure, including infiltration, that adequately incorporates protection of groundwater quality, where applicable. Addressing this concern offers the potential to lower future groundwater supply treatment costs to communities that infiltrate stormwater. At this time, EPA has utilized the report recommendations to establish a state grants program to address stormwater needs but without a basis for grant costs protective of groundwater quality. In the face of communities beginning to submit applications for this financial assistance, NGWA asks that EFAB take a further step and work with the engineering community to establish the conditions and their costs that affect the financial assistance needed by these communities responding to EPA's policy promoting stormwater infiltration that may impact future groundwater quality and increase remedial costs. Stormwater runoff can contain chemicals, pesticides, sewage overflow, road salt, oil and grease, animal waste, disease-causing bacteria and viruses, used motor oil, fertilizers, paint, construction debris, industrial waste, PAHs (polycyclic aromatic hydrocarbons) and PFAS (perfluoroalkyl and polyfluoroalkyl substances).[1]

Stormwater Infiltration Infrastructure Needs Critical Features

If groundwater-supplied communities, which are primarily smaller communities, do not fully consider potential groundwater-quality impacts of stormwater infiltration, they may not incorporate critical features affecting stormwater infiltration including: stormwater pretreatment, design and placement of stormwater infiltration sites to mitigate future groundwater contamination, representative monitoring of groundwater to provide feedback and confidence in their stormwater-groundwater management decisions, and future treatment needs, even for water systems drawing surface water receiving groundwater discharge. Such an approach uses the "one-water" concept as central to analytical and management processes.

Many MS4 Communities Rely on Groundwater Potentially Impacted by Stormwater Infiltration

As a precursor to the educational, technical and financial process for drawing on the financial capacity that EFAB analyzed, the NGWA conducted a "coincident location" analysis of the Clean Water Act National Pollutant Discharge Elimination System (NPDES) stormwater program (municipal separate storm sewer systems (MS4s)) community permittees with the groundwater-supplied public community water systems under the Safe Drinking Water Act.[2] NGWA reported the results of this analysis to EPA with the Ground Water Protection Council on October 19, 2020, in responding to the Proposed 2020 Financial Capability Assessment for Clean Water Act (CWA) Obligations that included stormwater infrastructure.

At least an estimated 1,525 MS4 permittees may be coincident with groundwater-supplied public community water systems (CWS) that collectively serve 36.4 million people, based on matching place names between the two databases. These MS4 permittees equal 22 percent of the MS4s that EPA identified in 2009 which may not include many small MS4s identified since that time. Communities relying on groundwater supply adjacent to MS4 communities using stormwater infiltration to protect surface water quality may also be affected. At least 254 additional groundwater-supplied CWS (and perhaps more not identified in this place name analysis) serving an additional 6 million people may be adjacent to many of these MS4 permittees. These counts do not include industrial stormwater dischargers that are separately permitted, nor do they count larger surface-water supplied systems that have groundwater wells for peak demand, backup or emergency water supply purposes. Nearly 70 percent of the coincident groundwater-supplied community water systems are medium-size to small communities serving 20,000 or fewer people. This count does not include the many private well owners relying on groundwater adjacent to these towns. Two-thirds of these community groundwater systems serve 10,000 or fewer people. These small communities have fewer resources and technical capability to address future groundwater quality problems. Thirty states have from 20 up to 100 percent of their MS4 permittees that are coincident with groundwater-supplied community water systems. These percentages and populations may increase if surface-water supplied CWS with backup groundwater wells can be identified.

Guidance Needed for Project Financing to Minimize Future Stormwater Infiltration Impacts and Costs

In the view of the NGWA, the coincident location analysis was critical to provide a perspective on financial assistance capacity that is needed to support design and construction of stormwater infiltration measures adequately protective of groundwater quality while supporting groundwater recharge. Factors to be considered in educational, technical and financial assistance to minimize future costs, including potential remediation, are:

- 4 survey reports of research on or related to stormwater infiltration[3] indicating that (1) highly variable quality of stormwater requires caution for use as groundwater recharge, (2) groundwater is vulnerable to contamination from stormwater, (3) pretreatment maybe needed, (4) representative monitoring at the base vadose zone should be considered for management, and (5) generally insufficient research has been conducted to support infiltration as a method of stormwater management, with needed research for a range of stormwater control measures, in a range of geologic conditions that exist across the nation, over extended timeframes reflecting underground water movement and covering spatial conditions reflecting municipal infiltration regions.

- A fifth research report on stormwater infiltration completed in 2020 at two sites over 3 years was inconclusive regarding representative results because of limited time and geologic conditions and recommended more research.[4]
- Forty-eight groundwater settings have been identified in the United States[5] reflecting the complexity of subsurface conditions and groundwater flow potential in municipal environments.
- Fifteen percent of the continental United States has karst topography – 40 percent east of the Mississippi River[6] – that is very vulnerable to infiltration of potential stormwater contaminants[7].
- If any infiltration site becomes a hazardous waste site because of contaminated stormwater that leads to contaminated groundwater, cleanup costs (excluding "mega-waste" sites) could reach $10 to 25 million[8] ($12-30 million in 2020$US), based on previous chemical waste disposal cases.
- Guidance is needed to align financing to address stormwater infiltration infrastructure factors protective of groundwater quality[9] to minimize future small community treatment and remedial costs. The guidance should be focused and targeted to assist contractors for small MS4 communities in implementing groundwater-protective technology.

In evaluating financial capacity, NGWA considers affordability as a significant factor. The financial capacity assessment's recommended educational aspects should now consider the expected costs of "in the ground" stormwater control measures that would be implemented in the range of conditions that are projected to exist that adequately protect the groundwater quality of small communities potentially applying the technology that will be reliable for and maintainable by them with the resources expected to be available.

NGWA appreciates the opportunity to provide this perspective to EPA and its Environmental Financial Advisory Board. NGWA is available to provide further consultation on this matter.

For further information, please contact:

Charles Job
Regulatory Affairs Manager
202-660-0060
cjob@ngwa.org

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[1] U.S. Environmental Protection Agency. 2020. Featured Story: Stormwater Runoff Prevent Chemicals, Garbage and Other Debris from Winding Up on the Local Beach. Featured Story: Stormwater Runoff, NPDES - Water | Pacific Southwest | US EPA; Deeb, Rula; Jennifer Arblaster; Adam Questad; and Brandon Steets. 2020. PFAS in Surface Water; The state of the practice. Published online in Stormwater. PFAS in Stormwater: The State of the Practice | Stormwater Online (stormh2o.com); and U.S. Environmental Protection Agency. 2020. New Interim Strategy Will Address PFAS Through Certain EPA-Issued Wastewater Permits; Press Release of Nov 30, 2020.

[2] U.S. Environmental Protection Agency, Stormwater Branch, communication of August 26, 2020. Nationwide inventory of MS4 permittees in 2009. The inventory of permittees does not include any small Phase II communities that were brought into the program as part of the 2010 census; U.S. Environmental Protection Agency. 2020. Government Performance Results Act Drinking Water Tool. GPRA [Drinking Water] Inventory Report.

[3] National Research Council. 1994. Ground Water Recharge Using Waters of Impaired Quality; National Research Council. 2007. Prospects for Managed Underground Storage of Recoverable Water; Environmental Protection Agency. 2018. The Influence of Green Infrastructure Practices on Groundwater Quality: The State of the Science. EPA/600/R-18/227; National Academies of Science. 2019. Improving the EPA Multi-Sector General Permit for Industrial Stormwater Discharges.

[4] U.S. Environmental Protection Agency. 2020. The Influence of Stormwater Management Practices and Wastewater Infiltration on Groundwater Quality: Case Studies. EPA/600/R-20/143.

https://cfpub.epa.gov/si/si_public_record_Report.cfm?dirEntryId=350152&Lab=CESER

[5] U.S. Environmental Protection Agency. 1987. DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings. Kerr Research Laboratory, Ada, Oklahoma. EPA/600/2-87/035.

[6] U.S. Geological Survey. 2017. Karst Hydrology Initiative & Fractured-Rock Aquifer Studies. https://water.usgs.gov/ogw/gwrp/activities/karst_hydro.html#:~:text=Karst%20topography%20occurs%20over%20nearly%2015%20percent%20of,land%20area%20located%20east%20of%20the%20Mississippi%20River

[7] Herman, J. S., D. J. Vesper, and E. K. Herman. 2016. Groundwater contamination in karst regions affects human health. Eos, 97, https://doi.org/10.1029/2016EO056011.

[8] U.S. Government Accountability Office. 2010. EPA's Estimated Costs to Remediate Existing Sites Exceed Current Funding Levels, and More Sites Are Expected to Be Added to the National Priorities List.

[9] National Academies of Science. 2019. Improving the EPA Multi-Sector General Permit for Industrial Stormwater Discharges.

From:	John Peairs
To:	EFAB
Subject:	Re: XiO - request to comment at Virtual EFAB meeting April 20-21
Date:	Friday, April 9, 2021 5:27:41 PM
Attachments:	ATT00001.txt

Thanks for the opportunity to add context.

For the last 200+ years, every community in American has had to build, operate and upgrade their water systems individually.

By giving thousands of small water agencies the technology to share Cloud computing platforms for water system control, XiO can free up billions of dollars to spend on water treatment plants, new pipes, solar arrays, etc. The money XiO can save cities across the US can be spent on water quality and energy efficiency projects instead of on building computer rooms, buying new computers, hiring expensive programmers to write custom software, and trying to protect individual water IT systems from hackers.

I spoke with a major water agency yesterday. They have 15 programmers on staff to support thousands of pages of custom software. They have over 500 control system sites that use technology which is 35+ years old. XiO's Cloud SCADA system does not require any local computers, any custom software or expensive technical personnel. We have completely reinvented water control systems. We also dramatically improve the cyber security of water control systems. The recent hack in Florida of a water system could not have happened to XiO's Cloud Platform.

In addition to freeing up money for many new environmental projects, XiO can consolidate the operational data from thousands of water systems enabling advanced software to uncover critical impacts that water and wastewater agencies are having on surrounding ecosystems. Watersheds and groundwater basins that extend thousands of miles can be monitored in completely new ways by consolidating the data generated by wells, reservoirs, sanitary lift stations and treatment plants. By collecting daily water system data from across vast geographic areas, XiO is able to inform environmental decisions and help prioritize remediation projects.

As the government is preparing to spend 100 billion dollars on water system improvements, we should be careful not to throw money into technology solutions that are nearly 50 years old. XiO has brought Cloud computing platforms to the water industry. Our technology is the first of a new generation that can enable vast efficiencies, insights and ecosystem improvements. We have proven our technology in over 1000 locations in California. We are a California manufacturer and have solved one of the most entrenched problems in our society.

Thanks again for the opportunity to bring our technology to your attention.

Best Regards,

John Peairs | [redacted] | www.xiowatersystems.com

On Fri, Apr 9, 2021 at 1:49 PM EFAB <EFAB@epa.gov> wrote:

> Thank you for providing this information.
>
> Could you provide additional context to your comments, specifically how it connects to the Environmental Financial Advisory Board's work?
>
> Thank you!
>
> ---
>
> **From:** John Peairs <[redacted]>
> **Sent:** Friday, April 9, 2021 2:06 PM
> **To:** EFAB <EFAB@epa.gov>
> **Subject:** XiO - request to comment at Virtual EFAB meeting April 20-21
>
> Hello:
>
> The US water industry is highly fragmented with over 40,000 community water systems. The power industry is highly consolidated. Over the coming years, there will be massive consolidation of water systems and a parallel launch of thousands of micro power grids.
>
> In 2012, XiO became the 1st company to replace traditional SCADA servers with hosted computers to control water and wastewater systems. Our Cloud SCADA® platform can enable a national water grid which would save tens of thousands of communities from having to duplicate the effort and expense of automating their water systems by themselves. Cloud SCADA® technology can help save US water agencies tens of billions of dollars over the next 30 years.
>
> Would it be possible for me to make a few comments outlining a new vision for the future of the community water systems.

Regards,

John Peairs | [redacted] | www.xiowatersystems.com

April 21, 2021

EPA EFAB Public Comments by Sylvia Orduño

SUBMITTED VIA EMAIL

Dear EPA Environmental Financial Advisory Board:

I am honored to share my comments with you on the work you provide insights and recommendations to the EPA on the enormous challenge of attending to the nation's infrastructure needs. I too share these concerns as a 25 year community organizer with the Michigan Welfare Rights Organization based in Detroit whereI have worked for most of the last two decades on the issues of unaffordable water and wastewater, energy utilities, and housing for low-income and poor residents.

The issues and charges before you in these EFAB meetings are of considerable concern among environmental justice (EJ) and low-income communities (aka impacted communities). I appreciate the thoughtful discussions you have engaged in with one another and EPA staff.

As you provided feedback to the Mr. Kadeli, Senior Advisor to the EPA's Chief Financial Officer, on the 'Foresight: Strategic Discussion and EFAB,' a number of issues came to mind that I hope the EFAB will take into consideration:

- **Promote federal grants vs. loans to EJ communities**: As federal water and wastewater infrastructure investment in the form of grants vs. loans to states have decreased significantly in recent decades, the burden of loan (and bond) debt upon EJ and low-income communities has had a significant toll. My organization and community have been reporting on the problems of low-income affordability, particularity in majority-minority communities, since the turn of the century. Many of you are aware of the growing problem of unaffordable water and wastewater utility bills and rates -- along with longstanding inadequate access and contamination -- across the country and into territories and First Nations. While the issue has finally made its way into national dialogue and legislation it has been stifled by the promotion of community assistance programs (CAPs) that promote assistance programs for temporary hardship over long-term affordability for chronically poor and financially burdened households. CAP's cannot address the challenge of impacted communities to manage the growing costs of water utility infrastructure repairs and replacement -- further complicated in consent agreements -- while residential customers must also carry the debt to repay loans and bonds. Pre-COVID-19 pandemic, EJ and low-income customers were subject to regular and on-going cycles of disconnected water service that impacted public health and led to greatly declined quality of life among impacted households. We hear the Biden

Administration's national call for addressing environmental justice to include addressing disparate social, environmental, *and* economic impacts.

- *We call upon the EFAB to promote more grants (including principal forgiveness) vs. loans (and bonds) in infrastructure projects within impacted communities.*

- **Encourage multi-agency approaches to address infrastructure equity and public health:** The social, economic, environmental, technological, and political concerns that you raised on key forces over the next 20 years have every reason for us to worry as they are likely to get worse. Many experiences behind these problems to address issues of scarce, compromised or inaccessible water and sanitation, in particular, -- while mitigating the effects of climate change (including impacts of food and utility access and costs), industrial pollution and contamination, and workforce opportunities and sustainability -- have been standard fare for environmental justice communities for decades. Several of your discussions suggested that an ideal way to address infrastructure and finance issues would be to leverage private capital by promoting less EPA control and execution over its programs and operations, and transfer opportunities for that work to a process that encourages the EPA to buy performance-based outcomes. As other members of your Board indicated, measures of success and justice won't be captured in cost-benefit analyses nor do they reflect how systemic inequality and racial inequity are behind the reasons for disparate impacts and legacy pollutants in EJ communities. The private sector has not effectively demonstrated or proven that it shares the objectives of EJ communities unless there are profit motivated incentives. For instance, Opportunity Zones in some communities are often referred to by those residents as "Opportunist Zones" for their failure to incorporate local resident priorities and objectives. Approaches for addressing these crises are not the EPA's alone and must be part of integrative approaches and solutions across federal agencies in the "whole of government approach," including the Departments of Justice, Transportation, Labor, Energy, Defense, Health and Human Services, Agriculture, Commerce and more, plus the White House.
    - *We call upon the EFAB to consider how its recommendations to the EPA to purchase performance-based outcomes may have unintended consequences; and to reflect on how its recommendations to improve equity and public health could be improved or enhanced by the incorporation of other federal agencies.*

- **Involve NEJAC AND OEJ in EFAB working groups**: Several EFAB members with support of the Chair indicated an interest to learn more about environmental justice, "impacted communities," and how the Board may better be able to incorporate the Administration's priorities in its working group reports and recommendations. We appreciate their interest in this and believe this is an opportune time for the EFAB to consider working alongside NEJAC in many shared concerns and objectives. Additionally, please know the staff of the Office of Environmental Justice to be a tremendous resource at the EPA both in their technical expertise and their conviction to receive and respond to the public's questions and feedback on environmental justice issues.

- *We call upon the EFAB to consider invitations to NEJAC members for participation in its working groups that could be aided by participants who have environmental justice awareness or expertise.*

- **Review NEJAC's Water Infrastructure Charge Report, 2019**: As EFAB assesses the complexity of water and wastewater system challenges in its work, we encourage the Board to review NEJAC's May 2019 report, "EPA's Role in Addressing the Urgent Water Infrastructure Needs of Environmental Justice Communities." We spent considerable time on this charge issued in October 2016. First among the recommendations you will find is encouraging "Governments Treat Water As a Human Right." The Council believes this is fundamental to understanding and addressing the real and significant human needs disparities and public health problems that are playing out in EJ and low-income communities. Rather than respond with the frequent response that the U.S. constitution nor our systems of laws and policies don't allow for the recognition of human rights, we ask you to reflect on the enormous consequences that have resulted from social and economic deprivation that has resulted from this lack of recognition and enforcement. Prioritizing the right of impacted communities to live without dire consequences is an enormous first step to ensure that our local, state and federal communities, territories and First Nations are prioritized; and that successful measures and outcomes can be achieved in environmental justice initiatives. Additional recommendations that prioritize and increase funding for water infrastructure and public health protections, and other timely objectives in EJ communities (including meaningful participation,) are important to NEJAC members and also reflect many public comments over the years.
    - *We call upon the EFAB to review NEJAC's water infrastructure report and consider its recommendations and priorities in the Board's analyses and recommendations to the EPA within the Administration's priorities and objectives.*

I thank you for your time and consideration of these recommendations and appreciate your on-going work to provide timely and important advice to the Environmental Protection Agency.

Sincerely,

Sylvia Orduño
On behalf of Michigan Welfare Rights Organization

smorduno@gmail.com
(313) 964-2500 MWRO office

From:	JOSEPH BRIFMAN
To:	EFAB
Subject:	Re: Public Comment for Today"s EPA Environmental Financial Advisory Board (EFAB) Meeting
Date:	Wednesday, April 21, 2021 10:28:23 AM
Attachments:	New Wastless Civilization on letterhead 8-18-2020.docx

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It is certainly unfortunate that I had no chance to deliver the information about technology what pretty much for sure will decidably change the way how humanity takes care about the environment.
Please, see the attachment.
Thank you
Joseph Brifman
President and CEO URDE

On Tuesday, April 20, 2021, 02:07:01 PM EDT, EFAB <efab@epa.gov> wrote:

Thank you again for signing up to provide public comment at today's EPA Environmental Financial Advisory Board (EFAB) Meeting.

Please be aware that due to changes in the meeting agenda, today's public comment time has been moved to approximately **2:25 PM Eastern**. You will receive a link to join the Zoom platform shortly.

Thank you and we look forward to hearing from you!

Best regards,

EPA's Water Finance Center

URDE
UNIVERSAL RESEARCH & DEVELOPMENT ENTERPRISE

Approved and Registered Federal Contractor
DUNS: 009767111
CAGE Code: 7XH54

PRESENT

WASTELESS CIVILIZATION
Developing the concept of zero-discharge economy.

WORKING TOGETHER
FOR WASTELESS TOMORROW

The ideal economy should self-sustaining and resilient. An ability to adjust to changes in population, economic growth, natural hazards and variability in production and demand requires a level of sophistication at all stages of production, processing and waste management.

A major limitation is likely to be the use and re-use of water and the optimization of all systems using best available technology to approach the concept of zero waste. The PLAZER technology is an example of a disruptive technology that can not only assist with the processing of liquid wastes it can assist with treatment of

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

many mining and industrial wastes, some air pollutants and solid biological wastes.

The technology is based on a major scientific and technological breakthrough - Micro-pulse Micro-arc processing (MIPMAP) in rotating electromagnetic fields. This technology enables the conversion of organic and inorganic sludges, mine tailing accumulations, sewage from all sources, industrial waste including many types of hazardous waste (organic and non-organic) and even construction waste, into raw materials for reuse with minimal processing.
For example, organic wastes are quickly converted into fertilizer as high quality organic fertilizer, removing chemical impurities elements to low levels. Similarly, non-organic waste into metal oxides or stable chemical components, materials for use as high quality construction materials (silica, alumina, mixed oxides etc.). The separation method using settling or floatation provides a low-cost high purity product.

MIPMAP can potentially enable us to reprocess most types of waste into major sources of key materials, while minimizing wastes from many existing industries thereby preventing new accumulations.
The need to conserve and recycle our water reserves is critical to the industrial and socioeconomic economies. With cost effective and technological efficacy for capture and recycling of pollutants this will preventing them from reaching streams, rivers and lakes. It also enables water re-use.

The incorporation of MIPMAP type technologies into existing systems will allow us to approach the ideal of zero discharge and total re-use.

Economic and Financial Benefits

This technology has the following financial advantages when compared with the BAT for comparable processes:

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

1. The initial capital costs are reduced by up to 80% and are typically 50% lower;
2. The footprint is similarly reduced by an equivalent amount with reductions in building sizes, land acquisitions and buffer zones;
3. Land requirement for associated buildings and external infrastructure can also be reduced by up to 80% as holding ponds and secondary processing equipment is removed;
4. Associated process equipment such as motors, compressors, pumps is reduced by up to 60%;
5. Personnel based operation and maintenance (O&M) costs are reduced due to the simplified processes, the self-contained equipment and less hazardous processes;
6. Electric power costs will be reduced by up to 70%;
7. No extra biosolids are produced in this process. Organic and inorganic based solids are separated out for reuse and reprocessing. This can be an additional income stream depending on the waste composition.

The actual benefits will depend on the site and treatment need characteristics. The figures quoted here are for typical comparable plants that are biological or biological/chemical treatment systems for advanced secondary or tertiary treatment.

Environmental Benefits

The systems are fully enclosed treatment processes that require no major oxygen inputs as with biological processes and no biological inputs. They are not a reservoir for antibiotic resistance, and after the initial(conventional) solids screening there is no exposure to the atmosphere and no production of odors or development of nuisance organisms such as midges. The biological fraction of solids residues is suitable for direct use as fertilizers and are stable.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

The technology provides the first opportunity for zero discharge processing of domestic and industrial wastes with on-site or local re-use. Alternatively discharge of the water into the environment permits the release of low nutrient water without the risk of eutrophic waterbodies or the need for significant flushing or dilution flows.

PLAZER-RF - a novel technology for processing of air, water and solid waste materials.

1 Introduction

Most 'new' technologies that are presented for dealing with environmental contaminants are either specific to the target, incremental improvements to existing technology or need supplementary technology to deal with by-products or concentrates. The aim of zero waste with zero discharges accompanied by lowered energy, smaller footprint and flexible – fast start up and shut down to and from full operation, has been met in very few instances and then only for a limited number of applications. Accordingly, industry - and regulators, is stuck with traditional technologies that have well known limitations. There have been incrementally improvements over time or novel treatment technologies have added to the process trains but the goal of zero discharges is missing. There are also very few (if any) technologies that can be used for the treatment of gases, liquids and solids using the same physicochemical or biological principles.

In chemical treatment processes, impurities are removed as particles from the water as precipitates or colloids. These are accumulated in settling tanks prior to discharge in permitted areas or for delivery to shore based waste units. The shortcomings of existing systems using physical and chemical principles of purification include high construction and operating costs; the need for cleaning of units; complexity of the control and monitoring systems, large bulk and mass, and the need for specialized ventilation and additional safety measures for confined spaces.

These are often combined with membrane or other types of filtration systems to remove residual solids or microorganisms.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

A further disadvantage of chemical treatment systems is that the treatment products prepared by these methods can contain residues of chemically active substances that are harmful to the aquatic and marine biosphere so that further treatments are required.

Biological treatment of wastewater uses bacteria that process impurities into a substance that can be removed overboard. Biological treatment systems require creation and maintenance of optimal conditions for the existence and multiplication of bacteria, with considerable time required to put the plant into operation after prolonged interruptions to operation. While marine based biological systems with brackish or saltwater are now relatively common, they are sensitive to changes in feed water composition. Biochemical treatment units need to be continuously fed to avoid incomplete treatment or prolonged start up times. When the delivery of wastewater to the unit is reduced or stopped, the sludge(biomass) activity reduces with corresponding reductions in treatment efficacy sometimes for extended periods.

Widely used technologies and equipment for disposal of wastewater use multistage cleaning methods: reagent treatment, coagulation, aeration, sedimentation, filtration, neutralization of slimes, clarification and more. An important factor that degrades the technical and economic efficiency is the low process intensity in the operating zones due to relatively low concentrations of the active components. Processes are correspondingly slow so that the size of the equipment is large, with low material and energy efficiency.

The Plazer technology uses a completely different method of generation of multiple forces and reactive agents to treat materials. Details of the technology are in Appendix A but the principles are outlined here.
The technology provides for the passage of material – gas, solid or liquid, through a tubular reactor in which an inductor generates a rotating electromagnetic field. Ferromagnetic elements(indenters) that are needle shaped are placed in the working cylindrical zone of the inductor/reactor. The working elements oscillate, reaching several thousand periods per second. For a short time, electric circuits are formed in which strong currents arise to form temporary circuits. When these circuits break, a large number of micro-arcs arise. When moving, the working bodies continuously emit powerful local micro-impulses and micro-arcs –

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

MIPMAP. This facilitates intensive mixing of the media being treated and the dispersal of materials. The high-powered local shock impulse action from the chain breaks acts on the material being treated.

Several effects are generated that combine with the local thermal and mechanical phenomena that occur when the working bodies interact with a substance. The power of these effects is so great that, acting simultaneously on any particles of a substance, they provide structural and energy changes at the molecular and atomic level. The combined effect of all factors creates a very high level of activation of all components of the substance involved in the process. The reactions are no longer diffusion controlled but become a function of the discharge phenomena with associated increases in the rates of change or reaction kinetics. This process enables a rate increase in the treatment process by many orders of magnitude thereby reducing energy use and achieving processes previously considered unattainable.
The following examples illustrate the range of capabilities of the technology. Further examples are provided as separate attachments. Neither is comprehensive as the range of potential applications is so large that is it presently beyond the capacity of the existing inventors and researchers. Nevertheless, the potential uses for just the demonstrated technology applications justifies not only immediate adoption but also a comprehensive research program to explore the potential uses.

2 Gas Processing

At present, attempts to use CO_2 from emissions of Thermal Power Plants (TPP) and other fossil fuel-based generators have not found a useful application. Attempts to underground storage are possibly the best technical option but have a number of drawbacks.
The main sources of CO_2 growth in the atmosphere are:

1. Energy complexes (TPP)
2. Food and beverage production, including fermentation processes
3. Metallurgical industry
4. Internal combustion engines of all types.
5. Household fuel combustion.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

The first three are the major emitters of CO_2. There are no major uses for the CO2 that permit sequestration of the gases or allow for recycling or replacement existing emissions.
Technogenic sources of emissions of bound nitrogen, including ammonia, are much more modest, but there are also a lot of them. They include all the processes of decay. In metallurgy, the source of ammonia water is coke quenching and some others.
At present, the production of ammonium carbamate with the subsequent conversion to urea is commonly deployed. These processes are based on the reaction
$NH_3 + CO_2 \rightarrow NH_4[CO_2 \cdot NH_2] \rightarrow CO(NH_2)_2$
Ammonium carbamate after heating to above 115^0C is converted to urea.

The carbamide industry is based mainly on technologies using a stripping process as an improvement to the full liquid recycle. In all processes CO_2 and ammonia are directly fed to the synthesis stage, where the process conditions are maintained at a pressure of about 140 bar and a temperature of 180 ° C.
The described method has significant drawbacks:
1. The synthesis is carried out at a temperature of up to 180^0C at a pressure of about 140 bar.
2. Multi-stage schemes are required for the carbamate production.
3. The process is complex with expensive equipment.
4. There are potentially technological and environmental hazards during operation although present technology has reduced these risks.
5. The process is inhibited components containing impurities, such as biogas or smoke.

The Plazer-RF technology eliminates these drawbacks and uses raw CO_2 as the feedstock material, directly from flue gases, biogas, or similar sources.
The working area of Plazer-RF, the interaction mechanism mainly does not coincide with the traditional views. Thus, the saturation of the zone with needles creates a continuous and continuously replenishing background of energy. This means that there is no need for consumption and time to transfer the energy pulse to any point - the energy at this point is always available. The medium (NH_3, CO_2 and water in this case transform into ionized state throughout the entire volume (OH-, H +, CO-), which instantaneously arises and is continuously

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

maintained also throughout the entire volume. Therefore, the delivery of ions to the reaction zone is not required, that is, the diffusion transfer of matter and energy takes place at the reaction or discharge site.

Consider the application of the technology to a simple standard aqueous NH_3 solution and pure gaseous CO_2. The CO_2 component of flue gases from conventional thermal power plants is also a potential source. In traditional systems, to obtain an acceptable rate of interaction of the simple components NH_3 and CO_2 they operate at a temperature of 180-200^{0}C, and at pressures up to 140-200 atm. These reaction conditions are now regarded as optimal for the process. If a contamination component is introduced into the working mixture - for example, flue gases that contain approximately 20% of CO_2, but also N_2, SO_2, etc., then the reaction efficiency between NH_3 and CO_2 will deteriorate by about 5 times with multiple side reactions.

Plazer-RF equipment provides a focused mixing and reaction zone at room temperature irrespective of the phase state and concentration. By activating each component, the reactivity is increased with the synthesis of carbamate proceeding quickly and to completion. Depending on the process conditions and the component ratio, several compounds containing ammonia at various concentrations may be formed. Pure carbamate can be obtained by reacting pure gaseous NH_3 and CO_2.

If using flue gases as the CO_2 source, it is desirable to pre-purify them from several components, mainly SO_2, a major contaminant from coal and other fossil fuels.

The technological process of flue gas cleaning includes the following operations: after passing into a heat exchanger they are cooled to a temperature of approximately 300-350 ° C. prior to feeding to Plazer-RF simultaneously with a water input. At a temperature 300-320°C, water does not react with the CO_2, but first reacts with SO_2 to form sulfurous acid, and then sulfuric acid. At the same time, other components of the flue gas, for example, V_2O_5 and other solid particles, are retained.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

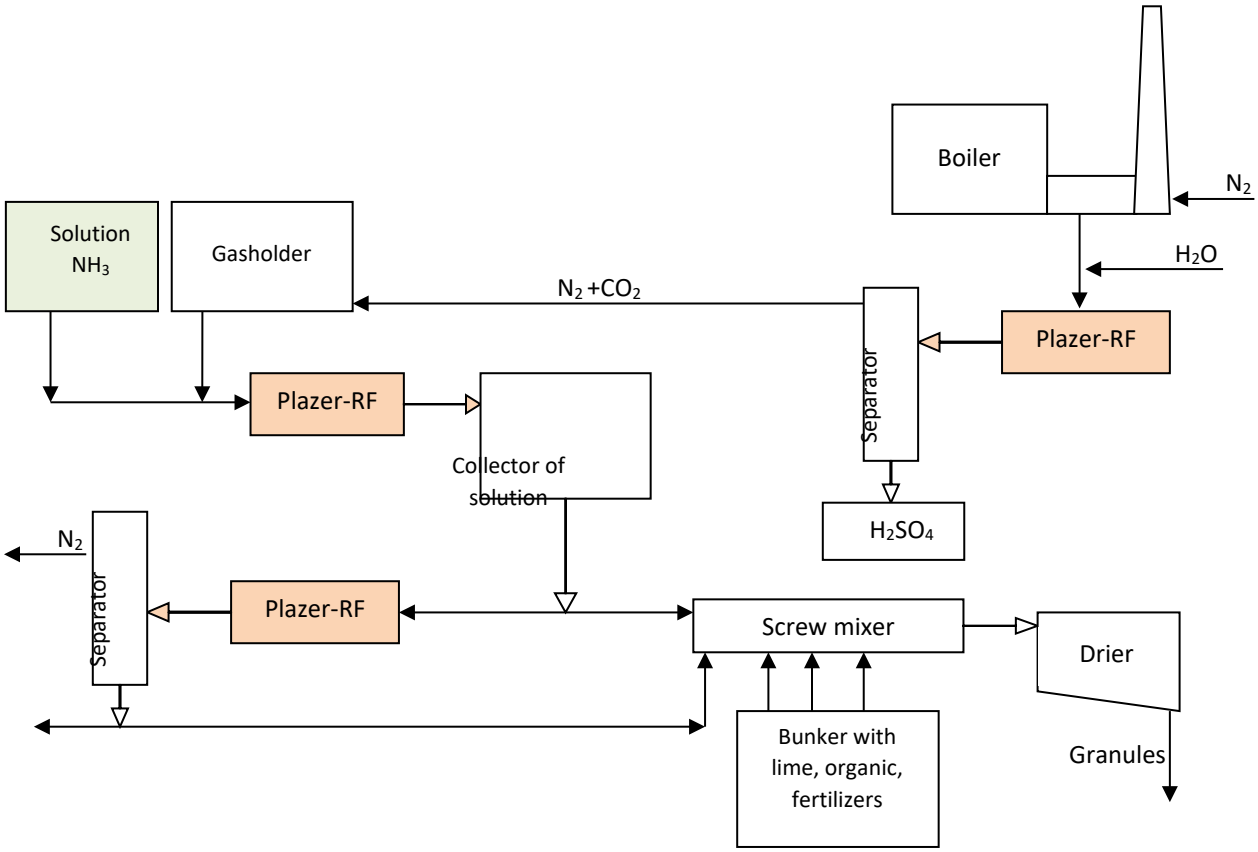

Fig. 1. Schematic of use of Plazer with CO_2 and NH_3 for production of urea and organomineral fertilizers containing nitrogen.

The production of granulated organomineral fertilizers provides several technological lines:

- Lines of ammonium carbamate synthesis;
- Lines of formation of urea or other products;
- Lines for the production of granulated organomineral fertilizers containing nitrogen;
- Lines for cleaning flue from sulfur and solid particles.

This technological line operates as follows:

From the tank, an aqueous solution NH_3 and gas mixture of CO_2 + N_2 from the gasholder are pumped through a mixer into the Plazer-RF installation in which synthesis reactions take place. The mixture is useful to heat before entering to the Plazer-RF. If pure CO_2 is used, for example, from cylinders, then the gasholder

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

is switched off. The resulting carbamate can be used as an additive for the production of organomineral fertilizers containing nitrogen. To this, the carbaminate solution is pumped to the collector with a pump in which a solution is accumulated and the molecular nitrogen from the gasholder is separated therefrom. Part of the molecular nitrogen from the flue gases in Plazer-RF interacts with water from the carrier solution NH_3, thereby increasing the yield of carbamate. Ammonium carbamate enters to the screw, into which powdered lime, mineral fertilizers and organic materials, for example, manure, peat, etc., are fed from the bunkers. In the screw, the mixture is mixed and in the form of a viscous mass is forced through the holes in the granulating head.

Granules enter into the dryer, where they quickly solidify without the use of thermal action, although the introduction of hot flue gases into the dryer is useful, but not necessary.
Depending on the needs, part of the carbamate is processed into urea. For this, a part of the flow is directed to the Plazer-RF with the system for heating the mass to a temperature above 115 ° C. Further, the urea solution enters to the separator, from which the solution is sent to the production of organo-mineral fertilizers containing nitrogen. From the separator, gaseous molecular nitrogen is sent to a pipe or just dropped into the atmosphere.
Most probably that in the future, the main supplier of CO_2 will be flue gases from TPP, and the fuel they consume almost always contains a lot of sulfur - a source of "acidic" rains. From the boiler, hot flue gases at a closed gate valve enter to economizer, where the gases are cooled to a temperature of approximately 300 ° C. The smoke exhaust directs the flow of gases to the Plazer-RF. At the same time, the water is supplied into Plazer-RF. At a temperature of 300° C, CO_2 does not react with water, and SO_2 forms sulphurous acid with water first, and then sulfuric acid. Simultaneously, solid components are almost completely trapped in Plazer-RF, for example, vanadium pentoxide, which is almost always present in coals, in oil or fuel oil. In the separator, the gas phase (CO_2 and N_2) is separated from the liquid (H_2SO_4 solution and its salts). Gases enter to the gasholder, and the liquid phase enters to the collector.

As a result of work, depending on the type of flue gas or other gaseous waste or emissions, the following products are formed in the described production line.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

1. Urea;
2. Ammonium carbamate (or mixture of compounds of nitrogen based on NH_3);
3. Granulated organomineral fertilizers containing nitrogen;
4. Technically pure nitrogen;
5. Sulfuric acid (its salts).

Therefore, separation from the flue of CO_2 and SO_2 is a technically solvable task. SO_2 can be separated, but CO_2 remains almost unchanged in the gas composition. Flue gases become environmentally friendly raw materials for the production of products containing bound nitrogen. Moreover, a very important fact was discovered: in the working zone of Plazer-RF at elevated temperatures (50-80^0), the interaction of molecular N_2 with water was observed with formation of NH_4OH and more complex compounds containing ammonia and carbon.
It was found that when solution contains 25% of NH_3 and 75% of water, there is no water in the resulting product, but a jelly mass is formed and there is no liquid-containing component, which we consider a solution.

These facts have a great importance, since reserves of N_2 in the atmosphere are unlimited, and the amount of discharged CO_2 is estimated at many billions of tons. Therefore, the production of nitrogen-containing compounds such as ammonium carbamate and urea from free waste can solve many problems facing humanity.

Created Plazer-RF industrial installations, which have a large capacity but small dimensions, mass and energy capacity, can be installed at any TPP, in factories dealing with fermentation processes at any metallurgical enterprise.

3 Organics Processing

Developments of biological treatment processes have made major advances in aerobic and anaerobic treatment to overcome the inherent problems the processes have in treating wastewaters. The inherent disadvantages remain particularly for food processing waste systems, so that use of additional physico-

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

chemical technologies is required post biological treatment to meet discharge criteria.

The next generation of technologies will involve only advanced physico-chemical processes that will provide full treatment in one operation, lead to major reductions in the materials produced and consumed, with lower energy use, smaller footprint and rapid start up time. The PLAZER-RF technology is the first technology that offers the broadest treatment capability covering a multiple of integrated treatment mechanisms to provide a novel advanced technical solution to meet all the requirements of lower cost of installation, operation and maintenance.

This technology - also called micro arc processing with rotating magnetic field, combines the advantages of the physico-chemical process with other novel aspects. This overcomes the disadvantages of all existing processes and particularly the biological processes. Each unit has a capacity of up to 60 000 gals/day. It requires very little start up time(minutes), removes all contaminants to very low levels in a single pass, can be tuned for specific wastewaters, deals with trace organics and metals and can take solids up to 5mm without changes in operation efficacy. There is no biological component, so the solids removed are only those in the water – usually at ppm levels. These solids settle quickly and easily - unlike biological sludges, and a small high-rate settling tank is all that is required post treatment. Use of multiple units provides flexible treatment capacity.

The outcomes from these reactions are that complex solids are formed that are stable and can incorporated into recycling systems. The solids are compact low water content materials that settle quickly and can be further easily dewatered. The resultant process water is free of living microbial organisms, trace organics and heavy metals and suitable for most forms of re-use. Prior treatment for removal of gross solids and gross fats is typically less than that required in normal pre-process terms. Typical retention times in the settling tanks are 30 min to 2 hours for maximum settling and clarification, much shorter that conventional systems.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

The technology can be applied to almost all forms of wastewater generated in the food processing applications areas – viz wash-down water, processing wastewater, cleaning and by-product wastewaters, fatty, oily and greasy wastewaters and similar. The resultant water and solid materials are suitable for discharge or reuse.

3.1 Wastewater Treatment Technology for Small Country Towns

Changes in population and regulations on discharge requirements have imposed a major burden on small towns for wastewater treatment. Existing technologies based on biological wastewater treatment are expensive, have a long lead-time and require expert operation to meet optimum operational performance. Physico- chemical processes are expensive with high ongoing operational costs and just as much sludge.

Incremental upgrading using biological systems is usually in the form of an additional digestion tank, upgrade to the inlet works and a new clarifier as well as pumps, blowers and sludge handling facilities. These restrictions not only inhibit servicing growth in population, they are disincentives for industry location as well as creating a potential liability for the towns in cases of non-compliance. In addition, the byproducts such as sludge require additional treatment for handling and disposal there are additional costs in energy supply upgrades.

3.2 Options for Upgrading or New Centralized or Decentralized Systems.

The ideal system should have a small footprint require no major infrastructure upgrades, be quick to commission, not require chemicals and have a lower energy consumption as well as a better effluent quality for discharge or ideally for re-use.

There have been no systems being offered commercially to date in the US that can meet these requirements.

A new system that offers all these advantages is now available through Plazer-RF LLC. It overcomes all the disadvantages of existing systems and provides additional benefits at no extra cost.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

The prototype has a capacity of 60 000 gals/day per unit. It requires very little start up time (hours), removes all contaminants to very low levels in a single pass, can be tuned for specific wastewaters, deals with trace organics and metals and can take solids up to 5mm without changes in operation efficacy. There is no biological component, so the solids removed are only those in the water – usually at ppm levels. These solids settle quickly and easily - unlike biological sludge. A small high rate settling tank is all that is required post treatment. Use of multiple units is used to provide increased capacity.

The core operating principle of the technology is the passage of wastewater through an inductor that generates a rotating electromagnetic field in the presence of cylindrical shaped ferromagnetic elements (indenters). These working elements oscillate, reaching several thousand periods per second. Brief electric circuits are formed with strong currents that lead to production of a large number of micro-arcs.

Under the influence of the rotating magnetic field the ferromagnetic elements rotate with an accompanying change in polarity. With this magnetization reversal there is a very rapid change in the discharge positions. This combination of the discharges in a rotating magnetic field provides a novel take on treatment providing a series of complex reactions.

In operation these working elements appear as local micro-impulses or micro-arcs. This action facilitates intensive mixing of the treated medium as well as dispersion of any materials. The powerful local impulses or shock actions are of sufficient power that almost all materials can be treated. This unique combination of processes leads to accelerated chemical and physical interactions with rapid kinetics for the treatment processes. These are of both macro-duration and micro-duration.

The outcomes from these multiple reactions are that complex solids are formed with oxidation of heavy metals and removal of organic materials either through polymerization, breakdown or adsorption. The solids are compact low water content materials that settle quickly and can be further easily dewatered. The resultant process water is free of living microbial organisms, trace organics and heavy metals and suitable for most forms of re-use.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

The technology can be applied to almost all forms of wastewater generated in town systems. Prior treatment for removal of gross solids and gross fats – less than 2mm is all that is required in process terms. Design of the settling tanks post treatment is assessed after the raw water is tested. Typical retention times in the settling tanks are 30 min to 2 hours for maximum settling and clarification.

Typical PLAZER-RF Performance
Maximum flow per unit: 2500 gal/hr per unit
COD – from 10,000 mg/L to less than 2mg/L in a single pass
BOD – to <1 mg/L ;SS – 5000mg/L to less than 1 mg/L
Metals 100mg/L to less than 1mg/L total metals Phosphate as P - 50 to <0.05 mg/L
Nitrogen – 500 mg/L total nitrogen to less than 1 mg/L; FOGs – less than 1 mg/L

A single unit's footprint is smaller than a shipping container with greatly reduced maintenance, replacement or operating costs. Environmental compliance becomes easier with less visible infrastructure, improved quality of treated water and less solids to treat. It also provides the potential for complete water re-use.

Energy requirements are about 40 to 50% of conventional biological systems with the footprint about 30% or less for an equivalent biological based flow treatment.

Water can be directly re-used as technical grade water or treated further for some re-use applications. Capital cost is typically 50% of comparable conventional systems or it can be leased.

3.3 Marine Waste Treatment Challenges

During the operation of ships and other marine infrastructure, polluted wastewater is formed. If discharged untreated into the marine ecosystems this causes significant ecological short- and long-term damage. Discharge of untreated wastewater is prohibited in the territorial or controlled waters of many countries with strict international standards to be complied with for signatories to IMO (International Maritime Organization). The appropriate treatment of wastewater

before discharge on marine vessels presently requires special chemical and/or biological treatment systems.

On ships where space is at a premium the treatment facilities of ships occupy significant areas. More importantly, unless they are specific or limited range of biological organisms they do not provide the required level of purification to achieve the numbers in water below the maximum permissible concentration of hazardous elements and compounds (MPC) and are not able to capture and dispose of, for example, heavy metals.

In the design of special purpose sea going vessels such as used by the military with specific performance requirements including maneuverability and combat serviceability, an important requirement is to reduce the weight, material consumption and energy consumption of auxiliary equipment – that includes ship's treatment facilities.

Ship operations including service and repair of marine vessels results in the following types of contamination:

- Water contaminated with oil products as well as exotic marine organisms (bilge and oily water). This can include pollution from accidental spillage of oil products during bunkering of vessels and as a result of various emergency situations. Cleaning large volumes of ballast water directly on-board ships while under way is further issue to reduce down time in port.
- Water contaminated with by-products after welding, cutting, cleaning the hull of the vessel from deposits, old paint, chemical solvents, etc. These toxic substances get into the water during repair work. Other liquid wastes are formed during the repair work, including washing water, oily water from washing holds and tanks, motor fluids such as oil, hydraulic fluids, lubricants and antifreeze. They mix with pulverized metal fractions, slag, shot, particles of old paint, chemicals, forming suspensions, and complicating the purification.

Purification technology and equipment is required that will provide for both on shore and offshore facilities. Ideally that equipment will also provide for reductions in materials, energy consumption and energy intensity; provide versatility to treat a wide range of pollutants, as well as providing treatment of

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

sewage for potential re-use of water for technical purposes after meeting sanitary and bacteriological quality requirements.

4 Solids processing – Inorganic and Organic

4.1 Organic

The traditional digestion process begins with bacterial hydrolysis of the input materials. Low solubility organic polymers, such as carbohydrates, are broken down to soluble derivatives that become available for other bacteria. Acidogenic bacteria then convert the sugars and amino acids into carbon dioxide, hydrogen, ammonia, and organic acids. These bacteria convert these resulting organic acids into acetic acid, along with additional ammonia, hydrogen, and carbon dioxide. Finally, methanogens convert these products to methane and carbon dioxide. The methanogenic archaea populations play an indispensable role in anaerobic wastewater treatments.

The four key stages of anaerobic digestion involve hydrolysis, acidogenesis, acetogenesis and methanogenesis. The overall process can be described by the chemical reaction, where organic material such as glucose is biochemically digested into carbon dioxide (CO_2) and methane (CH_4) by the anaerobic microorganisms viz: $C_6H_{12}O_6 \rightarrow 3CO_2 + 3CH_4$

Under typical circumstances, hydrolysis, acetogenesis, and acidogenesis occur within the first reaction vessel. The organic material is then heated to the required operational temperature (either mesophilic or thermophilic) prior to being pumped into a methanogenic reactor. The initial hydrolysis or acidogenesis tanks prior to the methanogenic reactor can provide a buffer to the rate at which feedstock is added.
The anaerobic digestion process can be inhibited by several compounds, by affecting one or more of the bacterial groups responsible for the different organic matter degradation steps. The degree of the inhibition depends, among other factors, on the concentration of the inhibitor in the digester. Potential inhibitors are ammonia, sulfide, light metal ions (Na, K, Mg, Ca, Al), heavy metals, some organics such as biocides including chlorophenols, halogenated aliphatics, N-substituted aromatics, and long chain fatty acids. These do not occur in significant concentrations in normal wastes only in some industrial wastes.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

The most important initial issue when considering the application of anaerobic digestion systems is the feedstock to the process. Almost any organic material can be processed with anaerobic digestion. If biogas production is the aim, the level of putrescibility is the key factor in its successful application.[47] The more putrescible (digestible) the material, the higher the gas yields possible from the system.

PLAZER RF Interventions Advantages and Optimization

The actions of PLAZER-RF should be as part of the inflow process into a digester:

- Break up solids containing bioavailable materials including microbial cells;
- Remove inhibitor compounds such as long chain fatty acids and
- Commence hydrolysis reactions or reduce large MW compounds to smaller easily digestible materials;
- Reduce the HRT
- Increase the methane recovery
- Ensure color and odor removal
- Leave a solids residual that is easy to manage.

The microbial populations of the digesters are dynamic and respond to the inputs sources over time depending on the substrate compositions. Even with a constant input the final equilibrium microbial population may be completely different from the starting composition without any change in gas composition or residual biosolid dewaterability.

However, the critical factors that need to be optimized for an operator are:

- Gas compositions – ideally in excess of 70% methane, low sulfur and the balance of carbon dioxide.
- Retention time in the digester – the longer each individual step takes the larger the hydraulic retention time (HRT). This is typically 15 to 30 days - some plants have achieved a 5-day HRT for easily digested materials.
- Nature and mass of the residual Biosolids. – These are dependent on the microbiome of the digester and the input materials. The critical factor is the ease of dewatering and resultant dry solids and composition of the leachate.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

Process	Moisture %	Fractional composition. %						Note
		3 mm	2 mm	1 mm	0.5 mm	0.25 mm	< 0.25 mm	
Source untreated	93.27	7.38	5.78	18.59	4.76	4.89	58.6	
After processing	95.03	0.29	0.21	12.59	5.94	6.06	76.91	Flow rate 4.5 m^3/h.

Table The influence of PLAZER-RF processing on particle size of livestock wastes

The impact of the particle size on gas production is significant as well as on the HRT.

Table The influence of additives and PLAZER-RF processing on bacteria in livestock wastes (*E-coli and Staphylococcus aureus).* Processing Time 3-10 sec.

Material	Additive		E-coli	S. aureus	Check Time (days)
	View	Quantity			
Source - untreated	–	–	10^6	10^6	1
After processing	Kon	1 L/t	10^2	10^2	1
After processing	Kon	3 L/t	10 °	10 °	1
After processing	Kon	5 L/t	0	0	1
After processing	Ammonia	30 L/t	0	0	3
After processing	Ammonia	5 L/t	0	0	3
After processing	Formaldehyde	10 L/t	10	10	1
After processing	Formaldehyde	25 L/t	0	0	1

Similarly, the disinfection achieved after processing indicates a high level of removal of indicator bacteria.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

Post Digestion Treatment
Residual COD/BOD of the decant liquor. This is typically 2000 to 5000mgC/L that requires a second pass treatment using an aerobic treatment. In STPs this is usually passed back to the headworks of a STP but could be PLAZER treated. Preliminary studies have shown that polymerization of the complex organics left occurs with greatly lowered COD after treatment.

A post AD treatment that could reduce the COD of the residue to less than 2 mg/L in a single pass may be able to be provided by PLAZER as well as biologically inactive outputs – so called disinfection, without any adverse compounds such as NDMA and chlorinated organics such as THMs. Removal of P and N would be advantageous as part of the settling process would add benefits.
These are not controllable in the usual sense but will depend on the multiple factors outlined above.

4.2 Inorganic Wastes, Metal processing byproducts and tailings wastes.
This document will provide perspectives on the application of micro-pulse micro-arc processing (MIPMAP) in rotating electromagnetic fields known as PLAZER for disintegrating minerals, processing mineral waste dumps tailings and metal processing waste sludges to capture valuable components from virgin and depleted ores. The process provides lower capital and operating costs and higher rates of recovery. The process design and operations can be incorporated into existing plant or be used as a separate processing feed.

The wide variety of ores used in the mineral processing industry does not allow a simple prediction of the possible results from processing with the PLAZER system. Therefore, it is essential to undertake a full study of the composition of the ore (mineralogy and physicochemical properties, composition) to select the optimum size for target mineral recovery. This is no different to the development of the usual mineral processing practice.

Traditional technologies such as initial grinding, milling, floatation, solvent chelating or acid leaching followed by precipitation are multi-stage processes with intensive use of chemicals, energy and other materials such as water. An

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

additional issue is the treatment of wastewater and disposal of the treated water and byproducts. All traditional operations requiring direct contact of the ore with a solution are also relatively slow and of low efficiency.

Plazer-RF and **Plazer-RC** equipment can be used to accelerate the dissolution and leaching processes and to increase the level of extraction of the target components from the ore without increasing the residues. The effectiveness of this process with this non-traditional technology and processing also enables profitable recovery of target elements from low grade ores, tailings dumps and mine waters.

Traditional processes for grinding of ores and concentrates in ball and rod mills are time consuming and energy intensive. The grind output size is limited to several hundred microns unless multiple passes are used to fully expose finely disseminated ores. With the **Plazer-RC + Plazer-RF** complex, most minerals can be milled to several microns in a single pass. This opens up new possibilities for a more complete extraction of minerals. The time for production is lowered with lowered use of energy, water and reduced noise. For example, **Plazer-RF** is capable of producing powders from 500 microns particles to fractions of 44 microns or less within 20-50 seconds as shown in the table below with iron ore.

Powder size Fe_2O_3 after milling 500-micron material with Plazer-RF (% composition of resultant powder).

	Fractions, microns													
	30-100	**20-30**	**14-20**	**10-14**	**8-10**	**6-8**	**4,3-6**	**3-4,3**	**2-3**	**1,4-2,0**	**1-1,4**	**0,43-1**	**0,04-0,43**	**Σ ≤ 1**
Single pass from 500 µm	**27,91**	**1,58**	**0,79**	**1,57**	**1,05**	**2,35**	**2,62**	**2,59**	**3,36**	**2,83**	**24,41**	**20,3**	**8,64**	**28,94**
After Plazer 3 min.	**Not detected**			**8,13**	**4,38**	**3,92**	**3,47**	**3,0**	**2,96**	**12,08**	**12,44**	**16,17**	**33,45**	**59,62**

The above data indicate that **Plazer** equipment can provide uniform fine powders of less than 1 micron in short time frames.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
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Plazer-RF also enhances metal recovery particularly at very low levels using hydrometallurgical cementation processes. Experimental evidence – shown below, has established that in the presence of iron, ores processed with PLAZER-RF provide for high levels of recovery of nickel copper, gold, silver, arsenic, platinum and other metals from solution at a rapid rate.

There is a noticeable speed up of chemical reactions, a reduction in the consumption of additives, the consumption of electricity, and reduction in associated labor costs.

1. Significant acceleration of settling/precipitation of the solid phase (95% drops in the first 5-8 minutes) The sediment and solution above it have a clear interface.
2. Increased output of valuable components.
3. Collection (separation) of valuable components from dumps using the same equipment.
4. Obtaining finely ground quartzite suitable for use as foundry sands – 'Marshallit', as valuable by-product.
5. There is no need to use high toxic regents for extraction of precious metals, including mercury and cyanide.
6. Decrease in the volume of sedimentation tanks (by a factor of about 10), as well as the number of mixers, filters, auxiliary tanks.
7. Suitable for deployment as mobile treatment sites, greatly reducing the time for development of the whole production.
8. Areas are self-contained with zero discharge production that prevents discharges, the loss of potentially valuable components and complies with environmental regulations.

Performance capacity of one set of the basic equipment (**Plazer-RF** reactor and grinder **Plazer-RC**) reaches 35 t/day for ore or 200 m^3/day of pulp slurry. Increased production is achieved with multiple units.

The equipment based on this innovative technology is very suitable for processing of small deposits of valuable elements such as tungsten. In the absence of supporting infrastructure such as roads, major plant, power and equipment these mobile equipment sites with **Plazer-RF & Plazer-RC** can be easily delivered to site and removed when it is finished with little environmental impact.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

5. Discussion

5.1 Advances in Treatment Processes

The range of traditional physico-chemical treatment options is large ranging from simple physical separation through to advanced oxidation and cold plasma technologies.

The limitations of each of these methods are that each technology by itself generally provides only partial treatment for any wastewater and with changes in input composition they can result in incomplete treatment of the water. Such failure leads to either restrictions in the potential use of the water or non–compliance with discharge criteria or permitting conditions.

With a few exceptions the poor level of development of these technologies for large-scale domestic and industrial wastewater treatment has made the development of aerobic and more recently anaerobic biological methods the method of choice for most systems. The investment in research and development led to advances in treatment that resulted in biological processes and their developments becoming the technology of choice for most small and large-scale treatment systems.

There are limitations to these systems. More stringent discharge criteria have led to the need for complex post primary or secondary reactor systems usually involving a physico-chemical process. This has led to a re-evaluation of physico-chemical systems as options for large treatment facilities. The use of these for post biological treatment example as disinfecting agents including UV, chemical precipitation of nutrients, ozone/UV for trace organics and catalytic technologies to remove pathogens and trace metals has led to a new awareness of their capabilities.

Emerging issues such as non–removal of some pathogenic organisms, excess sludge production and lack of removal of trace organics and inorganics and increased investment in capital works to meet increasingly stringent water quality criteria have accentuated this re-evaluation of the fundamentals of biological systems.

Various technical solutions have been successfully developed for additional or add-on processes to deal with some of these issues. For example for sludge treatment – CAMBI (https://www.cambi.com/) or use of granular sludges (http://www.aquanereda.com/) , increased use of anaerobic treatments for a

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

broader range of carbon loadings and the inclusion of membranes for both separation of solids and retention of biological biomass[2] have led to improvements in processing to overcome some of these issues. Capture of more valuable minor components such a nutrient such as in the form of struvite or nitrogen removal by processes such as Anammox have led to a resurgence of interest in the biological processes and their use for water and wastewater treatment.

Despite all these advances the biological processes have major inherent disadvantages including:

- Capital intensity
- Process intensification is difficult
- Long and complex construction times
- Difficulties with operation and automation/instrumentation is expensive
- Large footprints
- Odor and nuisance organisms – midges for example
- Sensitivity to inflow variations
- Long lead times for commissioning and start-up
- Variable output quality
- Inability to deal with metals or and the increased range of trace organics of low biological reactivity
- Slow overall processing rates
- Requirements for physico-chemical post biological treatments for best quality effluents
- Disrupted easily by biocides, foreign materials and dilution of food sources
- Energy intensity with low energy efficiency
- Difficulty to upgrade in terms of capacity or treatment levels.

5.2 Advances in physico-chemical treatments.

The use of physico-chemical treatment in the post biological processes has led to a new acceptance of the efficacy of these methods. There have been big increases in efficiency in for example ozone production and its safe use, and UV ozone methods are a method of choice for trace organics in many cases. Scaling of these systems to cope with flows of up to 100 million gallons/day has proven the fundamentals of the processes and their design.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

Use of newer membranes including ceramic materials rather than chemical precipitation has allowed a greater use of technologies that don't cope will with suspended solids. Their energy requirements are still relatively large and capital investment for large systems compared with biological systems is not shown to be widely accepted except for specific applications. Even then regulatory approval can be restrictive if there are not proven examples for the specific application.

The use of physico-chemical systems is regarded as the next 'holy grail' of water and wastewater treatment by a number of major industry groups with significant resources being devoted to a range of technologies. These include UV/ozone, chlorine and its derivatives, electrochemical methods using novel electrodes and linking these with ceramic membranes. Cold plasma and related technologies appear to be the next generation of treatment technologies.

Of the newer technologies for full treatment – as distinct from post or tertiary treatment, the cold plasma technology is one of the most interesting with some key aspects for its uses. These include rapid settling of solids post treatment, removal of trace organics and high levels of disinfection. There are no off gases produced and the waste is only that of the material in the solution, there is no additional sludge or biomass involved. The technology has been used in the food processing industry for pathogen removal with a high level of success. Scaling of this technology to give large treatment capacity at low energy consumption has not been demonstrated so far.

A recent emerging technology called micro arc processing with rotating magnetic field [7] combines the advantages of the physico-chemical process with some other novel aspects. This overcomes the disadvantages of existing physico-chemical processes and particularly the biological processes. It is a major advance over cold plasma technologies while appearing to have all the advantages of that technology.

It has gone beyond piloting stage to pre-production prototype with a capacity of $10m^3$ per hour (60 000 gals/day). It requires very little start up time(minutes), removes all contaminants to very low levels in a single pass, can be tuned for specific wastewaters, deals with trace organics and metals and can take solids up to 2mm without changes in operation efficacy. There is no biological component, so the solids removed are only those in the water – usually at ppm levels. These

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

solids settle quickly and easily - unlike biological sludges, and a small high-rate settling tank is all that is required post treatment.

At present scaling up beyond the existing throughput is not possible but models for development and design purposes are being developed and proposed. Use of multiple units is feasible to provide increased capacity.

The core operating principle of the technology is the passage of wastewater through an inductor that generates a rotating electromagnetic field in the presence of cylindrical shaped ferromagnetic elements (indenters). These working elements oscillate, reaching several thousand periods per second. Brief electric circuits are formed with strong currents that lead to production of a large number of micro-arcs.

Under the influence of the rotating magnetic field the ferromagnetic elements rotate with an accompanying change in polarity. With this magnetization reversal there is a very rapid change in the discharge positions.

This combination of the discharges in a rotating magnetic field provides a novel take on treatment providing a series of reactions that combine:

a. Particle Dispersion;
b. Water ionization with separation of H+ and Hydroxyl Group OH-;
c. Weakening of intermolecular and interatomic bonds;
d. Oxidation/Reduction reactions (redox) by free radicals;
e. Magnetic field sustaining processes with highly ionized entities;
f. Magneto Hydrodynamic shocks comparable to cavitation processes or hydro-acoustic effects,
g. Intensive mixing of liquid phase
h. Localized thermal effects.

In operation these working elements appear as local micro-impulses and micro-arcs. This action facilitates intensive mixing of the treated medium as well as dispersion of any solid materials. The powerful local impulses or shock actions are of sufficient power that almost all materials can be treated.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

This unique combination of processes leads to accelerated chemical and physical interactions with rapid kinetics for the treatment processes. These are of both macro-duration and micro-duration.

The outcomes from these complex reactions are that complex solids are formed with oxidation of heavy metals and removal of organic materials either through polymerization, breakdown or adsorption. The solids are compact low water content materials that settle quickly and can be further easily dewatered. The resultant process water is free of living microbial organisms, trace organics and heavy metals and suitable for most forms of re-use.

The technology can be applied to almost all forms of wastewater generated in the marine applications areas – viz bilge water, on board wastewater, cleaning and dry dock wastewaters, oily wastes and similar. Prior treatment for removal of gross solids – less than 5mm is all that is required in process terms. Design of the settling tanks post treatment will be assessed after the raw water is tested. Typical retention times are 30 min to 2 hours for maximum settling and clarification.

This technology is described in a brief technical bulletin provided by PLAZER – RF (attachment 1).

While developments of biological treatment processes have made major advances in aerobic and anaerobic treatment to overcome the problems the processes have raised in treating wastewaters, the inherent disadvantages remain particularly for marine based systems.

The next generation of technologies will involve advanced physico-chemical processes that will provide full treatment in one operation, lead to major reductions in the materials produced and consumed, lower energy, smaller footprint and rapid start up time. Of these the PLAZER-RF technology offers the best and a novel technical solution in this area of technology.

6. Conclusion

The Plazer technology uses a completely different method of generation of multiple forces and reactive agents to treat materials. This is disruptive technology unlike any presently in use for this purpose.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

The technology provides for the passage of material – gas, solid or liquid, through a tubular reactor in which an inductor generates a rotating electromagnetic field. Ferromagnetic elements(indenters) that are needle shaped are placed in the working cylindrical zone of the inductor/reactor. The working elements oscillate, reaching several thousand periods per second. For a short time, electric circuits are formed in which strong currents arise to form temporary circuits. When these circuits break, a large number of micro-arcs arise. When moving, the working bodies continuously emit powerful local micro-impulses and micro-arcs – MIPMAP. This facilitates intensive mixing of the media being treated and the dispersal of materials. The high-powered local shock impulse action from the chain breaks acts on the material being treated.

A number of effects are generated that combine with the local thermal and mechanical phenomena that occur when the working bodies interact with a substance. The power of these effects is so great that, acting simultaneously on any particles of a substance, they provide structural and energy changes at the molecular and atomic level. The combined effect of all factors creates a very high level of activation of all components of the substance involved in the process. The reactions are no longer diffusion controlled but become a function of the discharge phenomena with associated increases in the rates of change or reaction kinetics. This process enables a rate increase in the treatment process by many orders of magnitude thereby reducing energy use and achieving processes previously considered unattainable.

A number of examples are provided in treatment of gases, liquids – fresh and saline, solid organics and solid and liquid wastes in inorganic material processing. This range of potential applications is so large that is it presently beyond the capacity of the existing inventors and researchers to investigate all applications. Nevertheless, the potential uses for just the demonstrated technology applications justifies not only immediate adoption but also a comprehensive research program to explore the potential uses.

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

TECHNICAL SUPPLEMENT: PLAZER RF TECHNOLOGY

SUMMARY

The purpose of this is to document the performance of a novel advanced technology for treatment of wastewater, water and other solids for reuse and groundwater injection without the production of disinfection by-products.

The advantages of this technology include low capital and operating costs compared with any alternative process, low by-product production, treated water that is suitable for direct re-use and by-products that are suitable for easy re-processing for nutrient and other resource recovery.

THE EQUIPMENT AND TREATMENT PROCESS

The equipment provides a continuous flow through treatment of up to $10m^3$/hr for each unit. Pretreatment requires grinding or settling to remove gross solids (solids to less than 2mm and preferably around 500 microns) and post treatment with settling/filtration to remove solids. Further treatment for re-use may be required to meet local re-use criteria.

The core operating principle of the technology is the passage of wastewater through an inductor that generates a rotating electromagnetic field in the presence of cylindrical shaped ferromagnetic elements (indenters). These working elements oscillate, reaching several thousand periods per second. Brief electric circuits are formed with strong currents that lead to production of a large number of micro-arcs.

Under the influence of the rotating magnetic field the ferromagnetic elements rotate with an accompanying change in polarity. With this magnetization reversal there is a very rapid change in the discharge positions. As a result of these almost continuously emitted power impulses, a large force is applied to the environment (15 to 20 tons/mm^2), acting over a small distance. In water the extent (or range) of interaction of these pulses is several times larger than in solid phase operations.

In operation these working elements appear as local micro-impulses and micro-arcs. This action facilitates intensive mixing of the treated medium as well as

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

dispersion of any solid materials. The powerful local impulses or shock actions are of sufficient power that almost all materials can be treated.

As a result of these interactions the wastewater to be treated is exposed to the following effects:

a. Particle Dispersion;
b. Water ionization with separation of H+ and Hydroxyl Group OH-;
c. Weakening of intermolecular and interatomic bonds;
d. Oxidation/Reduction reactions (redox) by free radicals;
e. Magnetic field sustaining processes with highly ionized entities;
f. Magneto Hydrodynamic shocks comparable to cavitation processes or hydro-acoustic effects,
g. Intensive mixing of liquid phase
h. Localized thermal effects.

This unique combination of processes leads to accelerated chemical and physical interactions with rapid kinetics for the treatment processes. These are of both macro-duration and micro-duration.

The outcomes from these complex reactions are that complex solids are formed with oxidation of heavy metals and removal of organic materials either through polymerization, breakdown or adsorption. The resultant water is free of living microbial organisms, trace organics and heavy metals and suitable for most forms of re-use.

The separated solid waste stream can be further treated for beneficial reuse or resource recovery especially nutrients. Note that the solids removed are only that in the original wastewater – there are no added chemicals or biological by-products or sludges. (In some PLAZER-RF systems treating very high loads of metals, pH adjustment may be required).

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

Pretreatment:
Solids to be less than 2mm or preferably 500 microns
Gross solids to be removed .

A single unit's footprint is smaller than a shipping container with greatly reduced maintenance, replacement or operating costs.
Environmental compliance becomes easier with less visible infrastructure, improved quality of treated water and less solids to treat. It also provides the potential for complete water re-use.

Joseph Brifman
President and CEO URDE
Dr. David Garman -Partner
(Science and Technology)

1 Farraday Lane, Suite 2D, Palm Coast Florida 32137 Phone# (386)445-4144; cell# (386)793-6471
E-mail: brifmans@bellsouth.net

FIRST NAME	LAST NAME	ORGANIZATION
Joseph	Abramson	Morgan Stanley
Andra	Ahrens	City of Pueblo Wastewater
Ashley	Allen Jones	i2 Capital
Brent	Anderson	RESIGHT
Jeffrey	Andrilenas	The TBLS Group
Steven	Anspach	PENNVEST
Eduardo	Antunez	Biola Community Services District
Amadou	Ba	CDFA
Joseph	Baietti	HUD
Dylan	Bakley	ACUA
Chrisna	Baptista	US EPA/OECA
Glenn	Barnes	Water Finance Assistance
Catharine	Bartone	VTDEC
Nizanna	Bathersfield	US EPA
Stacia	Bax	Missouri Department of Natural Resources
Lara	Beaven	Inside EPA
Lisa	Bechini	Northbridge
Janice	Beecher	Michigan State University - Institute of Public Utilities
Stacey Isaac	Berahzer	IB Environmental
Laura	Betts	CLEO
Shabir	Bhegani	NSBE/TDOT
Jody	Bickel	Creekbank Associates
Jenny	Bielanski	US EPA R5
Courtney	Black	King County
Joel	Blanco-Gonzalez	USEPA
Jerry Lee	Bogard	Grand Prairie Farming and water
Steven	Bonafonte	The Metropolitan District of Hartford
Sergio	Bosques	USEPA R2
Michelle	Boyd	US EPA
Angela	Bricmont	Denver Water
Josif	Brifman	Universal Research and Development Enterprise LLC
Tonya	Bronleewe	Wichita.Edu
Kali	Bronson	Bernalillo County, New Mexico
Erica	Brown	AMWA
Jasmine	Brown	GNO, Inc.
Jennifer	Brown	CT Consultants
Stacy	Brown	Freberg Environmental, Inc.
Tracy	Brown	Save the Sound
Sonia	Brubaker	USEPA
Sarah	Buck	RCAP, Inc.
Enriqueta	Caballero	Texas Water Development Board
Bruce	Cain	Ahtna, Inc.
Adriana	Caldarelli	WEF
Neil	Campbell	Florida Department of Environmental Protection

Joan	Card	Culp & Kelly, LLP
Curtis	Castle	City of Santa Monica
Brian	Chalfant	Pennsylvania Department of Environmental Protection
Theodore	Chapman	S&P Global Ratings
Addison	Chau	USEPA
Can	Chen	FIU
Ronald	Chick	SUASCO River Stewardship Council
Jeanne	Christie	Christie Consulting Services
Ed	Chu	USEPA
Ernest	Chung	Nixon Peabody LLP
Allison	Clark	FitchRatings
Kimberly	Cluney	Anne Arundel County
Melissa	Collier	MS Department of Environmental Quality
Tim	Colling	Michigan Tech Universtiy
Kathleen	Compton	US EPA
Alexandra	Corcoran-Shannon	M&I, PLLC
Arthine	Cossey van Duyne	WaterFunder, LLC
Jennifer	Cotting	UMD
John	Covington	US EPA
Phillip	Cravatt	Chickasaw Nation
Zachary	Davidson	Ecosystem Investment Partners
Michael	Deane	U.S. Environmental Protection Agency
Jeff	Diehl	Rhode Island Infrastructure Bank
Hanna	Dodd	Dudek
Kris	Dodson	SYR.EDU
Jessica	Dominguez	EPA - Region 1
David	Doyle	USEPA
John	Doyle	Little Big Horn College
Robert	Dunlevy	USEPA Region 7
Robert	Dunlevy	USEPA
Steve	Dye	Water Environment Federation
A.	Edwards	Office of Water
Rosemary	Enobakhare	US EPA
Sonja	Favors	Alabama Department of Environmental Management
Angela	Fentress	Ohio Environmental Protection Agency
Philip	Fine	USEPA
Alison	Flenniken	US EPA
Felecia	Fort	US EPA
Jon	Freedman	SUEZ Water Technologies & Solutions
Dale	Galvin	Deliberate Capital, LLC
Phyllis	Garcia	San Antonio Water System
John	Garnsey	J Garnsey Environmental Group
Todd	Gartner	World Resources Institute
Ryan	Gierhart	Ohio EPA
Susan	Gilson	NAFSMA

Yvonne	Gonzalez	US EPA
Yvonne	Gonzalez	USEPA
Mary	Grant	Food & Water Watch
Kelly	Green	EGLE - Michigan
Gerald	Greene	CWE
Yolanda	Grinstead	Sewerage and Water Board of New Orleans
Jon	Grosshans	USEPA
Leo	Gueriguian	U.S. EPA, Office of Water
Carla	Hagerman	US EPA
Roy	Heald	Security Water and Sanitation Districts
Ted	Henifin	Hampton Roads Sanitation District
Mark	Hoffman	Chesapeake Bay Commission
Craig	Holland	The Nature Conservancy
Chris	Hornback	NACWA
Craig	Hrinkevich	New Jersey Robert W. Baird & Company Inc.
Ernesto	Huaracha	Lake County
Hannah	Humphrey	Missouri DNR
Elena	Humphreys	Library of Congress
Lee	Huntoon	Texas Water Development Board
Dennis	Jackson	Jacobs
Lavonda	Jackson	GLWA
Lavonda	Jackson	Great Lakes Water Authority
Tara	Johnson	USEPA
John	Jones	New Mexico Rural Water Association
David	Kane	Portland Water District
Margot	Kane	Spring Point Partners LLC
Mark	Kellett	Northbridge
George	Kelly	Earth & Water Strategies
Maureen	Kerner	OWP EFC at Sacramento State
Alison	Kinn	USEPA
Alison	Kinn Bennett	US Environmental Protection Agency
Alanna	Kinnebrew	IB Environmental
Lloyd	Kirk	Oklahoma DEQ
Liz	Kirkwood	For Love of Water (FLOW)
Robert	Kisilywicz	Rainplan
Matt	Klasen	US EPA
Karen	Klocke	Washington State Dept of Health
Angela	Knecht	FL DEP
Katya	Kniazeva	Washington State Department of Ecology
Cynthia	Koehler	WaterNow Alliance
Ellen	Kohler	University of Maryland Environmental Finance Center
Colleen	Kokas	Environmental Liability Transfer, Inc.
Adrienne	Kotula	Chesapeake Bay Commission
Megan	Kung	Los Angeles Regional Water Quality Control Board
Joanne	Landau	Kurtsam Realty Corp

Timothy	Larson	Ross Strategic
Pamela	Lemoine	Black and Veatch Management Consulting, LLC
Eric	Letsinger	Quantified Ventures
Linda	Lindsay	King County, WA Wastewater Treatment Division
William	Lipps	Shimadzu Scientific Instruments
Pia	Lolster	Environmental Finance Center - Univ of MD
Jim	Long	Arrow
Alexander	Loucopoulos	Sciens water
Dana	Lynn	Indiana Utility Regulatory Commission
Michelle	Madeley	EPA Office of Community Revitalization
Michael	Maker	NewGen
Valarie	Mann	DOJ ENRD
Barbara	Martin	AWWA
Mike	Matichich	Jacobs
Megan	Matson	Table Rock Infrastructure
Kerner	Maureen	OWP at Sac State R9 EFC
Issa	McDaniel	TWDB
Al	McGartland	USEPA
James	McGoff	Indiana Finance Authority
Daniel	McGregor	Bernalillo County Public Works
Christopher	Meister	Illinois Finance Authority
Alfredo	Mendoza	GMEDCA
Michelle	Metteer	Town of Minturn
Cathy	Milbourn	US EPA
Pedro	Modesto	EPA-2-CEPD
Laura	Montoya	US EPA
Bernadette	Mora	Pinoleville Pomo Nation
James	Moran	City of Hollywood - Public Utility
Scott	Mueller	RCAP Solutions
Kassandra	Myers	City of Hollywood Department of Public Utilities
Jack	Neil	JNA Annapolis
RosAnna	Noval	Rural Community Assistance Corporation
Kerry	O'Neill	Inclusive Prosperity Capital, Inc.
Shaun	O'Rourke	Rhode Island Infrastructure Bank
Sharon	OBannon	USDA/Rural Development
Fatima	Ochante	Alaska Dept of Environmental Conservation
Ana	Olay	CK Blueshift, LLC
Jim	Olson	For Love of Water FLOW
Sylvia	OrduÃ±o	Michigan Welfare Rights Organization
Jennifer	Palmiotto	NRWA
James	Parrott	Metropolitan Sewer District of Louisville
James A. "Tony"	Parrott	Louisville Metropolitan Sewer District (MSD)
Eric	Patterson	Kiewit
Eric	Patterson	Kiewit
Ben	Pauli	Kettering University

Ted	Payseur	V&K Engineers
MaryAnna	Peavey	Idaho Department of Environmental Quality
Burton	Pflueger	Nebraska Department of Environment and Energy
Jamie	Piziali	USEPA
Steve	Polacek	USDA RD RUS Water Programs
Sushama	Pradhan	Onsite Water Portection Branch, NC DHHS
Dennis	Randolph	City of Grandview
Bradley	Raszewski	DWSRF/EPA
Corey	Reeves	City of South Fulton
Jessica	Reimer	Western States Water Council
Emily	Remmel	NACWA
Rachel	Renteria	Colorado Water Resources & Power Development Authority
Lori	Reynolds	Global Water Alliance
Michael	Roberts	Maryland Department of the Environment
Tom	Roberts	UNC-EFC
Karen	Rogers	Seattle Public Utilities
David	Roman	SpiritVen
Eric	Rothstein	Galardi Rothstein Group
Barry	Rubin	People's Water Board Coalition-Detroit
Howard	Rubin	USEPA
Barry	Rubin	Water Board Coalition-Detroit
Desi	Santerre	DOLA
Eric	Sapirstein	Ens Resources
Paul	Sayan	WSP
Robert	Seeley	Entech Engineering
Joanna	Seto	Hawaii DOH Environmental Management Division
Jerome	Shabazz	Overbrook Environmental Eduction Center
Phyllis	Shaw	city of Hollywoodfl.org
Martha	Sheils	New England Environmental Finance Center
Chloe	Shields	New England Environmental Finance Center
Heidi	Siegelbaum	Washington State University
Thomas	Sinclair	City of Modesto
Gracie	Singh	City of Turlock
Sanjiv	Sinha	ECT
Bre	Slaughter	USDA, Rural Development
Robert	Sloan	Bio DAF USA
Aaron	Smith	Iowa Finance Authority
Sejal	Soni	EPA
Sejal	Soni	US EPA
Alison	Souders	EPA
William	Stannard	Raftelis
Raffael	Stein	USEPA
Sean	Stephenson	Ohio EPA
Francine	Stinziano	Southwest Environmental Finance Center
John	Sullivan	Michigan Tech

Kristina	Surfus	NACWA
Ken	Susilo	Geosyntec
Taling	Taitano	Guam Waterworks Authority
Ying	Tan	US EPA
David	Tancabel	US EPA
David	Tancabel	USEPA
Joseph	Tapp	USEPA
Ellen	Tarquinio	EPA
Ali	Tasdighi	Michael Baker International
Victoria	Taylor	Project Finance Advisory, Ltd
Andrew	Terminiello	NC State
Laura	Tessier	Woodard and Curran
Carl	Thompson	Infiltrator Water Technologies
Joanne	Throwe	Throwe Environmental LLC
Mary	Tiger	Orange Water and Sewer Authority
Hala	Titus	CDM Smith
John	Towe	USEPA
Patrick	Travers	ADEQ
Bev	Vazquez	USEPA
Amanda	Vincent	Louisiana Department of Environmental Quality
Brett	Walton	Circle of Blue
Tim	Warren	Jones & Henry Engineers, Ltd.
Jean	Waters	PPRC
David	Wegner	NAS-WSTB
Michael	Weiss	EPA Region 9
William	Wheeler	US EPA
David	Widawsky	USEPA
Darryl	Williams	USEPA Region 4
Sandi	Williams	USEPA
Sacoby	Wilson	University of Maryland, College Park
Jeff	Winner	City of Portland
Andrew	Wynne	USEPA
Erich	Yost	U.S. Department of Housing and Urban Development
Harry	Zhang	WRF
David	Zimmer	New Jersey Infrastructure Bank