

**CIBO Virtual
Environmental, Energy, and Sustainability (SWG)
Committee Meetings
September 14 – 15, 2021
MINUTES**

Environmental Committee – Kristine Davies, Chair, Trinity Consultants, Inc.

Kevin Boudreaux, ChemTreat, Inc., reported on water resource management and sustainability. Key drivers include water availability and costs, environmental limitations, and air permits. Corporate sustainability is a business approach that creates long term shareholder value by addressing opportunities and mitigating risks. Water sustainability involves the supply, demand, and quality of water resources. Water and sewer costs are increasing, along with environmental compliance costs. Further, corporate image is also important.

Water and drought moves. Currently, the western US is suffering from drought, while the Gulf Coast is being overwhelmed with water. Water costs range from \$3 - \$25/thousand gallons. Aging infrastructure is one of the key drivers of cost increases. The repair, maintenance, and replacement costs have been increasing, adding to the cost of water. Discharge regulations are also adding to costs. In particular, phosphates and nitrogen compounds are attracting significant attention. Toxic discharges have been reasonably controlled. The key problem is the impact on the plants and animals that are living in the water resource.

For water management, the keys are reduce, reuse, and recycle. Costs increase in going from reduce through reuse and then recycle. Reduce is typically the low hanging fruit. These activities include reduced blow down, improved efficiency, and elimination of leaks. A closed loop is no longer closed if 5% of the flow is lost in a month. Steam traps are a source of losses. Water treatment to reduce the level of total dissolved solids (TDS) can reduce the need for blow down. Eliminating leaks conserves water.

Cooling tower optimization is a source of improved water reuse. Increasing the number of cycles can cut down the blow down requirement. However, after about 7 cycles, the gains are minimal. However, if the cooling tower is working at 2 cycles, the blow down can be reduced by a factor of 5 in going from 2 cycles to 7 cycles. This increases the concentration of TDS, so materials of construction need to be considered for corrosion issues. Also, the drift from the cooling tower can lead to PM2.5 issues, as liquid water can drift from the tower, which carries the dissolved solids. The calculations for drift need to be understood. The drift rate is very hard to measure. The calculations depend on drop size, particle size, and air flow rate. Good control can reduce both the blow down and the makeup rate.

Water reuse is another means of reducing the need for water. Reuse can involve higher risk, as nothing is done to the water. Condensate from air handlers can be captured and reused. Reject water can sometimes be sent to the cooling tower for make-up. It will be important to determine the chemistry, quality, and quantity of water that is available and whether it is compatible with the materials in the plant that will reuse the water.

Grey water comes from municipal effluent, industrial processes, and industrial effluent. Organics, phosphates, and air borne pathogens are the major concerns. Ammonia can be another issue. Recycle is the highest cost solution, but the lowest risk. This involves taking the water stream and processing it to clean up the water before using it again. Clarification, filtration, and chemical treatment can produce a good quality water. Of course, the processing is expensive. Zero liquid discharge (ZLD) is generally the most expensive. Costs run up to \$40/thousand gallons. Initial solids concentration sets the start of the process. Typically, make-up water can be concentrated 3 – 10 times. Scale forming minerals are the major concern. Front end softening is usually the most economical. Some softening systems can remove both hardness and silica. Intermediate concentration can use reverse osmosis (RO) to concentrate TDS in the effluent and produce a good quality water that can be recycled. Final concentration takes the more concentrated water and essentially boils the water. The water vapor can be condensed, producing a very pure water. The brine that results can be 150,000 ppm or more. This brine can then be further concentrated to something like 65% solids. Further evaporation produces a damp solid, which can be pressed or centrifuged to produce a final solid that goes for disposal. The evaluation depends upon what can be allowed for discharge. In some cases, a modest concentration can be discharged. In other situations, full treatment may be required. Successful management starts with a good water balance for the plant. Managing the solids is the key driver to proper handling of the water.

Lisa Jaeger, Bracewell, LLC, reported on some recent EPA enforcement developments.

Environmental Justice (EJ) and climate issues are being rolled into all aspects of enforcement, particularly with respect of EPA. **David Uhlmann** has been appointed head of the EPA Office of Enforcement and Compliance Assurance. He has a history of pushing environmental and EJ enforcement. His appointment hearing in Congress is this week. The administration is committed to greater environmental review. The Clean Air Act Risk Management Rule, 112(r), was expanded during the Obama administration. The rule was challenged and is still in court. The Trump administration pulled back on some of the more egregious requirements. The current administration will likely pull many of those requirements back in. A revised rule will likely be forthcoming in about a year. EPA and OSHA are working together on coordination for this rule.

OECA has issued a criminal enforcement memo and a superfund memo. The goal is more transparency and enforcement on criminal environmental actions relative to EJ in such impacted communities. Penalties should be commensurate with the facility profile. With EJ built into these rules, environmental groups can challenge permits on additional grounds. Civil rights claims will increase. A calcining plant in an EJ community in Texas had a permit issued that is being challenged via a Title VI civil rights investigation carried out by EPA.

On the air side, there will likely be more EPA scrutiny of state Title V permit decisions. EPA had been following a policy of deference to the States. This is being challenged by environmental groups and may be rescinded by EPA. Another conflict issue has been the VW case where VW pleaded guilty to installing devices that violated the emissions tests and standards on automobiles. Now states are jumping on board to sue for additional damages. In one case, Ohio has sued for \$1 trillion. This may go to the Supreme Court.

SEC enforcement on ESG requirements are now a concern. One question is whether climate disclosures must be filed or just furnished. A rule is expected by the end of the year. Another concern is “attribution science”. After the heat wave in the EU ins 2003, studies were done that tried to claim that weather events can be connected to climate change, and, in particular, can be attributed to specific emissions. There is an NAS judicial workshop that is training federal judges on the use of “attribution

science” relative to weather events.

Skip Kropp, Steptoe & Johnson PLLC, provided a MOG update. MOG has been pretty busy since the last CIBO meeting. There are 7 key activities in particular. The CSAPR revision was issued in April. MOG filed an appeal. There has been no appeal by others. However, several intervenors have filed for comment. The appeal covered no photochemical modeling for 2021, no comment on the 1% significance test, no comment on maintenance monitor flexibility, and not allowing adequate comment period.

The EPA failed to address MOG cost assessments. EPA has set a schedule for final briefs this year, but have since requested final briefs by the end of March 2022. MANE-VU commented on the Ohio 2nd Period Regional Haze SIP. Ohio rejected the MANE-VU requests for low sulfur fuel use and additional controls. MANE-VU also commented on Michigan's SIP. Michigan had rejected all of MANE-VU's requests.

LADCO noted that the 2019 ambient PM_{2.5} observed values were all below the required standard and did not require additional controls. EPA issued a Regional Haze memo that required a 4 factor analysis that now must be included in the state SIPs. In this memo, EPA stated that even though some progress has been made, additional controls may still be required. EPA is also expecting much more input from the Federal Land Managers. EPA will also be reviewing standards for mobile sources relative to GHG emissions.

Transportation is the largest contributor to GHG emissions in the US. EPA intends to develop future rules (post 2026) to reduce GHGs and criteria pollutants from mobile sources. The New York 126 petition remand is still ongoing. EPA indicated that the gross number of sources was too high. EPA had indicated that another response was coming out this August, although none has been forthcoming. The Maryland and Delaware petitions were also denied. These were more targeted. The court remanded the case back to EPA to consider 4 EGUs that did not have SCRs. EPA still has to respond. New York proposed a plan to allow some simple cycle gas turbines to avoid controls until 2025, although NY is in non-attainment and having a 126 petition. MOG opposed approval. However, EPA ignored MOG and approved. The appeal date is in October. EPA has options for addressing “Good Neighbor SIP Obligations”, including issuing a FIP for the 8 states that do not have their SIPs approved.

The revised CSAPR update only applies to the 2015 ozone situation. EPA is using an “interpolation technique” in estimating ozone status for 2021, using 2018 data and estimated 2023 data and interpolating back to 2021. A final revised CSAPR rule was due in March. EPA had requested February 2022, but was denied. Alpine Geophysics has done some modeling that indicates that a reduction of the ambient PM_{2.5} standard from 12 micrograms/m³ down to 10 would put a number of states in the mid-West and East Coast in non-attainment. Mobile sources are the major contributor to PM_{2.5}.

Ann McIver, Citizens Thermal, introduced **Nathaniel Berg** and **Nathan Wright** who presented “Wildnote”, an app platform for field inspection. Inspections have to be done for erosion control and storm water management any time it rained more than 1/2 inch or every week. These inspections required substantial time and effort. A 3 page report along with photos was required for 23 locations. The “Wildnote” software can operate on a cell phone. The information is captured by the software that eliminates paper records. The turnaround time is much faster. The site surveys and reports are searchable. The software can generate the report automatically. The site location is confirmed in the

software. That means that correct forms are always used. Photos are automatically labeled and captured and are directly embedded into the report. Searching can be done by site or by issue. Tracking of unresolved issues is now much easier. The location is recorded from the cell phone.

For industrial pre-treatment inspections, the software can also be used. The information can be readily uploaded to the server. With remote working, site scheduling can be revised to accommodate the location relative to the inspector's home. There is a lot of flexibility in the software. There is an editor function with the software to allow modifications to the forms, if necessary. Work is planned to become CROM-ERR reporting, as requested by EPA. Additional inspection programs are also anticipated. Wildnote has been very responsive to any requests for help or support.

Courtney Briggs and David Chung of the Waters Advocacy Coalition gave an update on “Waters of the US” (WOTUS). The Water Advocacy Coalition represents 45 associations that are impacted by water issues. The coalition began when some members of Congress tried to eliminate the word “navigable” from the definition of waters of the US in the Clean Water Act. Congress was not very specific in their definition, as this was left to rule making to clarify. This, in turn, impacts requirements and obligations for both facilities and ruling agencies. The prior administration limited the definition to avoid ephemeral streams, isolated ponds, isolated wet lands, ground water, and other questionable water sources.

The pre-2015 situation involved 3 Supreme Court decisions, which generated more questions. The Clean Water Rule was introduced in 2015, but was enjoined and never became effective. The Clean Water Rule was repealed and replaced by the Navigable Waters Protection Rule. Arizona vacated the rule. The current administration announced that they would review the rule and probably pull back the NWPR. The EPA asked the states to remand the rule without vacatur. Agencies have announced that they have “halted” NWPR implementation and gone back to the pre-2015 definition. The expectation is that the NWPR will be repealed. Regional round tables were planned, but Covid intervened. There will be a replacement definition rule making. This will take some time. Whatever is proposed will likely end up in litigation.

The Coalition is trying to work with Congress to get a more reasonable result in the new definition. In particular, relating some of these issues to infrastructure is seen as a means to gather support. There is a list of 333 projects that were cited as having potential negative environmental impacts. However, there are a number of beneficial projects (solar, schools, wet land restoration, etc.) that were included in that list.

Energy Committee – Mike Zebell, Chair, Environmental Resources Management

Anthony Reed, Archer Daniel Midland (ADM) and Neil Naraine, International Paper (IP), provided an update on government relations regarding key energy and sustainability issues. Anthony led off by noting that ADM has set up their own sustainability goals. All of their activities are directed towards what is achievable, rather than what is aspirational. Emissions, wastes, water use, etc. are all targeted for reductions by 2035. They are working with farmers and suppliers on the front end and processing at their facilities, as well as packaging and downstream activities. Renewable fuels have been a key part of their activities. The CAFE standards and Renewable Fuel Standards (RFS) are key issues going forward. Energy use and energy standards play into clean power production. The replacement of the ACE rule and its prior rule, CPP, is expected.

On the legislative side, there has been a lot of activity due to the budget reconciliation bill. DOE funding of key reduction projects and new technologies for the industrial sector is needed. This is an important role for CIBO, as the industrial sector will be the hardest to decarbonize. Demonstration and commercialization of new technologies is needed. Carbon capture and sequestration is another area that needs support. The 45Q tax credits are particularly important. ADM is asking for \$85/ton rather than \$50/ton for the industrial sector. Anthony noted that CIBO support for 45Q would be very helpful. The House is pre-conferencing with the Senate on many of these packages.

Neil reported on the 3 big issues for IP. These include biomass/carbon neutrality, PFAS, and PM2.5. IP uses a lot of biomass in their mills. The “leave it in place” mentality with respect to trees is detrimental to the forest products industry. The EU and Asia recognize the carbon neutrality of biomass. They would like some certainty for the treatment of biomass.

There was an EPA statement that biomass residuals were carbon neutral, but it was pulled back with the new administration. CIBO can help by endorsing scientific papers and reports that support the carbon neutrality of biomass. CCS can have a major play in industry. CIBO can help support CCS deployment and continued energy improvements. The PFAS issue is important since it is used extensively in packaging and food products. Paper recycling can bring PFAS back into the production of paper. CIBO can help by helping to educate EPA on the best modeling approach and working with industry on the best destruction technologies. PM2.5 is important as many areas could go into non-attainment. CIBO could help educate EPA on scientific uncertainties, modeling differences, and study quality.

Neal Elliott, ACEEE, reported on industrial decarbonization programs and provisions relative to Capitol Hill. Currently, there is a bipartisan infrastructure bill, fiscal 2022 appropriations, new initiatives, the partisan reconciliation, and the bipartisan China bill. A true Clean Energy Standard is unlikely. The Clean Electricity Payment Program is being considered in the reconciliation package. Utilities would be paid for adding clean energy capacity. There would also be fines. The target level is 0.1 lb/Mwhr GHG emissions, which would require CCS on natural gas combined cycle plants. The prospects are uncertain. There are a number of concerns, including gas prices. There are more concerns about resiliency and reliability. There have been claims that natural gas reliability was better than electric reliability. This has been questioned with the Texas experience and, to a lesser extent, to the recent hurricane season.

Opportunities for industrial decarbonization include CCS/CCUS, hydrogen production, and increased RD&D. There have been proposals to increase the budgets for the Advanced Manufacturing Office (AMO). There are some provisions for increased RD&D, demonstration, energy efficiency, and deployment in the infrastructure bill. Industrial investment proposals include co-funding of the “first three” commercial applications of transformative technologies. Investment in strategic facilities is being considered. Industrial clusters are being looked at. Grants and funding programs are all parts of various programs. The AMO has done an Industrial Decarbonization Roadmap that should be of interest.

The supply chains are also important. There is more and more pressure to reduce carbon footprint for companies in both the regulatory area and the investment area. Full carbon accounting will be needed to demonstrate compliance. Much of the contributions to carbon accounting come from supply chains. Relative to the difference between reporting and filing, the Justice Department is considering the voluntary reporting of climate related information as being material business information. When that happens, Sarbanes-Oxley regulations could imply civil and criminal penalties for mis-stating

information. The Scope 3 emissions are the more difficult ones to assess, particularly for tier 2 and tier 3 suppliers. The hope is that the Justice Department and the SEC can come up with a requirement that is “good enough” without being too burdensome.

Corrina Ricker, DOE EIA, provided the supply and demand outlook for natural gas. The rig count has remained somewhat muted. WTI price is expected to remain above \$60/bbl. US lower gas production is expected to remain relatively flat for 2021. Current gas prices are expected to drive some increased production in 2022. The Haynesville, Permian, and Appalachian regions continue to be the growth regions. In the Permian basin, most of the production is associated gas, with oil being the main driver. The Appalachian region has plateaued recently, but is expected to show growth as more pipelines become available. The Haynesville will show growth due to the nearness to export terminals. Consumption of gas is expected to decline slightly in 2021 and 2022 from 2020.

Higher prices will bring in competition from existing coal and new renewable electric generation. Most of the growth in exports will come from LNG. Elevated spot prices in Asia and Europe make US LNG attractive in those regions. Gas storage is expected to be in the lower range of the 5 year average (about 5% below normal). The cold winter and the high June temperatures have caused greater draw down and lower injection to storage this year. Longer term, gas prices are expected to be in the range of \$3.20 - \$3.60/MMBTU. Gas consumption is expected to increase in the industrial sector. LNG exports are expected to grow through 2030 and then level off.

Lori Aniti, DOE EIA, reported on the electric market short and long term outlooks. Utility generation has been shifting to natural gas and renewables, with natural gas now showing nearly 39% of generation. Industrial generation has also shifted to natural gas. The forecast shows continued retirements of coal and some nuclear plants.

Natural gas and renewables will continue to increase, but the share of natural gas will decline to 36%. Renewables expect to increase to 42%. Coal and nuclear continue to decline. Renewables will also increase for industrial generators. Electricity generation is expected to increase by over 30% by 2050.

In the high oil and gas supply case (meaning low prices), natural gas continues to grow and actually increases its share. Projected coal, gas, and renewable generation varies greatly by region. SERC, MISO, PJM, and Florida will continue to be dominated by gas. California, SPP, the West, and the Northeast will see more renewables. ERCOT will see both. The agency calculates the levelized cost of electricity (LCOE) using the levelized capital costs, variable O&M costs, and hook up costs, as well as an estimate of the capacity factors for the various fuels. The levelized avoided cost (LACE) accounts for differences in grid services for a particular technology.

Sustainability – Sharon Nolen, Chair, Eastman Chemical Company

Charles Crain, National Association of Manufacturers, provided an update on the SEC and ESG Regulatory Disclosure. Charles noted that there has been a spike in interest in this topic, especially with the new administration. There is no real definition of ESG, but we are approaching a regulatory regime that will impact all of industry. The basic question is whether or not there is enough disclosure to be satisfactory to all stakeholders. In particular, the president issued an executive order announcing a “whole of government approach” to climate related financial risk on May 20.

The SEC published a request for public information on climate change disclosures. ESG initiatives

have included both reporting and risk management requirements. The RFI has a list of 15 questions asking about the types of information and the use of information by investors. The NAM submitted comments on the request. In particular, clarity on some of the types of information requirements would be helpful. The NAM also suggested that financial material information should be all that is required. It should not be that an investor wants to make his portfolio more green and therefore the information is material. Policy goals outside of the SEC's purview should be avoided.

The SEC has issued its regulatory agenda for 2021 and 2022. Climate change disclosures and human capital management are at the top of the list. Chairman Gensler highlighted his priorities. Consistent and comparable disclosures should be mandatory. Qualitative and quantitative disclosures will be identified. He has asked how to make Scope 1 and Scope 2 happen and whether or not Scope 3 should be required. Scenario risks should be for local issues. The problem will be the broadness of the types of scenarios that become required. Legal liability questions are also involved. For example, Form 10-K has liability risks. General reporting typically does not.

Human capital management efforts will probably require more key metrics, including demographics, health and safety, turnover, employee satisfaction, and others. Board diversity is also a potential requirement. Public companies can comment on this request. Business community engagement is critical. Specific experiences can be shared with the SEC staff. Comments and positions can be funneled through NAM and other organizations.

Carl Bozzuto, CIBO Consultant, provided a presentation on why batteries do not solve the problem of intermittent generation for base load power. The US load duration curve indicates that 40% of generation requires base load power, i.e. 24/7 and 365 days/yr constant generation. Typically this load has been supplied by nuclear and coal based power plants, with nuclear at 20% of generation and coal still at 19%. Presuming the nuclear plants remain in service, the goal of decarbonizing the electric grid by 2035 would mean shutting down all of the fossil based power plants. That means figuring out how to generate that extra 20% of base load with intermittent renewables. Many proponents of renewables state that batteries can be used to store power and then use it when needed. This analysis takes a “sanity check” look at the costs for such a system. Solar PV was used to provide a basis for the system.

A solar PV system can be purchased for \$5,000/peak kilowatt, all in cost. The panel cost is only 10 – 15% of the total cost, so further reductions in panel prices will not change the overall analysis. The peak is produced at solar noon. The average for a sunny day is 0.5 Kw. Thus, to get 1 Kw on average, 2 Kw need to be purchased. The battery cost is \$2,500/Kw that lasts for 4 hours. In order to work through the night, at least 3 batteries have to be purchased. These batteries need to be charged up during the day. It takes about 1.2 Kw to charge the battery to get the 1 Kw output. Thus, 7.2 Kw worth of panels are needed during the day to charge up the batteries. However, during the early morning and later evening, the output is not sufficient, so another battery is needed. That needs another 2.4 Kw of panels. Altogether about 10 panels are needed to charge up the 4 batteries, not accounting for cloudy, rainy, or snowy days. The total for 12 panels and 4 batteries is \$70,000. In theory, this setup could produce 1 Kw on a 24/7, 365 days/yr basis, assuming the sun comes out every day, which is not the case.

For simplification, utility financing was used to convert capital cost into annual operating cost. The typical capital charge rate for utility financing is 20%. This one significant figure number includes all of the costs associated with the capital cost of the plant including, interest rates, return on investment, depreciation, working capital, inflation, risk, property tax, and insurance. The capital charge rate is then applied to the capital cost to get an annual operating cost, in this case, \$14,000/yr. The base

assumption was 8760 hours/yr, which gives an operating cost of \$1.60/Kwhr for generation cost. This cost compares to 7 – 8 cents/Kwhr in New England for generation, which is a high cost region. The average generation cost is closer to 5 cents/Kwhr. This analysis did not look at the additional costs that would be needed to get through inclement weather and other interruptions. This analysis demonstrates one of the reasons why the “last 20%” is considered the most difficult to decarbonize. It also supports the case for CCS, or CCUS, to allow some use of fossil fuels with CO2 capture for decarbonization.

CCS is not cheap, but American Electric Power has indicated that it can be deployed at power plants for a 50 – 80% increase in generation costs. That would put their average generation cost at around 9 cents/Kwhr, which is a far cry from \$1.60/Kwhr. It should be recognized that this analysis is rough, in the sense that it is more of an “order of magnitude” check rather than a hard price to be used for investment. Even so, it does illustrate the difficulty faced with trying to decarbonize that last 20%. It also demonstrates that, right now, fuel storage is the lowest cost of energy storage, as it is practiced all over the world at today's price levels.

David Jaber, Climate Positive Consulting, reported on Industrial Energy Opportunities in a Net Zero World. There are now many activities regarding climate goals and targets. There are science based target initiatives, net zero goals, and related programs. There is an organization called science based targets. The basic theme is that, “If the science based targets indicate that a certain level of reduction is required to meet climate goals, then companies should be striving to do at least as well.” Offsets are not allowed, according to this group. To be aligned with the Paris based goals, a 42% reduction in GHG emissions would be needed by 2030. Net zero goals allow for different offsets in that the goal is to take out enough emissions to balance what is actually emitted. Typically, 2050 is the target year. The Paris goal is net zero by 2050. There are other programs calling for similar actions, some with goals of 2030. Companies can sign up with these organizations and adopt these targets.

The implications for industrial heat include CCS, biomass, waste heat, methane capture, waste organics, and hydrogen. Electrification is another way to lower facility emissions. The assumption is that the grid will make a lot of progress toward renewable energy use.

CCS can be used to allow the use of fossil fuels while capturing the CO2 and either using it or sequestering it. Cost is an issue as it takes energy to capture the CO2, compress it, and move it to sequestration. There are some industrial processes that produce relatively concentrated CO2, which reduces costs. Sequestration needs to be available, which is a problem at the moment. There is no point in capturing CO2 if there is no place to put it. Waste organics and biomass are used today. Methane capture directly reduces GHG emissions.

Hydrogen can be considered an energy storage product, which can be generated when there is excess renewable generation and used when needed. Electric boilers can be considered, but there are cost issues. There could also be an emissions concern if the grid is not decarbonized. Concentrating solar energy can be used (mirrors that reflect solar energy).