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Rock Bottom View

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Hello again, via another edition of “The View from Rock Bottom”. TVRB originally took its name from my old writing porch along the shore of the Pedernales River at The Rock Bottom Ranch in Central Texas, USA. Since we were last together, I have permanently relocated to central Mexico along the northern shore of Lake Chapala, just south of Guadalajara, Mexico’s second largest city. The area has BOTH the elevation of Denver, Colorado, and the latitude of Honolulu, Hawaii. Daytime temperatures are moderate, and evenings are borderline chilly.

After twelve blistering Texas summers at RBR, and ever-rising, oppressive summer heat levels between 2011-2023, the region’s temperatures have become most unpleasant during the summer. Actually, for those who do not have refuge from the heat, the situation is downright harmful to human health. Hence during summers, we found ourselves housebound, “protected” only by central air conditioning. However, this modern miracle also proved to be a worrisome single source of failure, if the unit were to malfunction during the summer’s intense strain on the unit. The other option was to clear out and simply travel away during the worst of the weather. While many would view the “remedy” as a normal extended vacation for retirees, in actuality, we became climate refugees. In reality, we were held captive by worsening atmospheric conditions on Planet Earth, driven by global warming.

An unrelenting stretch of blistering days amid the ongoing heat wave has put this summer on track to be one of Texas’ (and much of the south and southwest parts of the US, plus globally along these same latitudes) most extreme, weather data shows. Although June was only Texas’ 16th warmest on record by average temperature, according to the state

climatologist, a long period of very hot days between mid-June and mid-July has made this summer one of the most intense in terms of extended high temperatures.

In June, a sample of 38 weather stations across the state recorded a temperature at or above 100 degrees F (38C) 250 times — the fifth-greatest monthly total for that month in the past three decades, according to a Texas Tribune analysis of National Weather Service data. The average temperature for June was 82.2F (28C) degrees, which was 2.6 degrees above the 20th century average, according to data provided by the state climatologist.

You might say, “so what”, or “I don’t understand the connection”, or “meh, it’s simply a normal cycle that Earth moves through over time”. Whatever your view on the issue, and/or probable causes for global warming, it matters little vs. the reality of hesitation and the critical dilemma for human health. Man-made chemical constituents can and are causing problems for the Earth’s atmosphere, contributing to various worsening environmental issues.

MAJOR PROBLEMATIC SUBSTANCES INCLUDE:

1. “Greenhouse Gases (GHGs)”: Greenhouse gases, such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and fluorinated gases, trap heat in the Earth’s atmosphere and cause the greenhouse effect. Increased concentrations of these gases, primarily due to human activities, lead to global warming and climate change.

2. “Ozone-Depleting Substances (ODS)”: Chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), and halons are

examples of ODS that contribute to the depletion of the ozone layer in the stratosphere. This depletion allows more harmful ultraviolet (UV) radiation from the sun to reach the Earth's surface, posing health risks and impacting ecosystems.

3. "Particulate Matter (PM)": Particulate matter consists of tiny particles suspended in the air, including dust, soot, and aerosols. PM can cause respiratory and cardiovascular health problems when inhaled and affects air quality and visibility.

4. "Volatile Organic Compounds (VOCs)": VOCs are emitted from various sources, including industrial processes, vehicle emissions, ranching, and certain consumer products. They can contribute to the formation of ground-level ozone (a component of smog) and have adverse health effects.

5. "Nitrogen Oxides (NOx)": NOx, primarily from vehicle exhaust and industrial sources, contributes to the formation of ground-level ozone and particulate matter. It also plays a role in acid rain, which can harm ecosystems and aquatic life.

6. Sulfur Dioxide (SO₂): SO₂ is produced by burning fossil fuels containing sulfur, such as coal and oil. It contributes to the formation of acid rain, which can damage forests, soil, and bodies of water.

7. Mercury (Hg): Mercury emissions, mainly from coal-fired power plants and industrial processes, can lead to the accumulation of mercury in the environment. Mercury becomes methyl mercury in water bodies, accumulating in fish and posing health risks to humans and wildlife.

8. Ammonia (NH₃): Ammonia is released from agricultural activities and other sources. It can contribute to air pollution and ecological problems, such as eutrophication in water bodies.

9. Chlorine and Bromine Compounds: In addition to ODS like CFCs, certain chlorine and bromine compounds can contribute to ozone depletion in the stratosphere.

Addressing these problematic chemical constituents is crucial to protect the Earth's atmosphere and mitigate the adverse impacts on climate, human health, and ecosystems. Efforts to reduce emissions, adopt cleaner technologies, and promote sustainable practices are essential steps in safeguarding the environment.

Releasing CO₂ (carbon dioxide) into the atmosphere is a problem due to its significant role in contributing to climate change and its associated impacts on the environment and human well-being.

KEY REASONS WHY ESPECIALLY CO₂ EMISSIONS ARE A CONCERN:

Greenhouse Gas Effect: CO₂ is a greenhouse gas, which means it traps heat in the Earth's atmosphere. While greenhouse gases are essential for maintaining a habitable climate by retaining some of the sun's heat, human activities have led to an excessive increase in CO₂ levels. This enhanced greenhouse effect is causing the Earth's temperature to rise, resulting in global warming and climate change.

2. Global Warming: As CO₂ concentrations in the atmosphere increase, they enhance the greenhouse effect, leading to a rise in global temperatures. This warming contributes to various adverse impacts, such as more frequent and intense heatwaves, melting polar ice caps and glaciers, rising sea levels, and shifts in weather patterns.

3. Ocean Acidification: A significant portion of the excess CO₂ released into the atmosphere is absorbed by the world's oceans. When CO₂ dissolves in seawater, it forms carbonic acid, leading to a decrease in ocean pH. This process is known as ocean acidification, which has detrimental effects on marine life, especially on organisms with calcium carbonate shells and skeletons like corals, mollusks, and certain plankton species.

4. Disruption of Ecosystems: Climate change driven by CO₂ emissions can disrupt ecosystems and biodiversity. Some species may struggle to adapt to changing conditions, leading to shifts in habitats and potential extinction risks. Additionally, altered weather patterns can impact agriculture and food production, threatening food security in some regions.

5. Extreme Weather Events: Rising global temperatures due to CO₂ emissions can intensify extreme weather events such as hurricanes, droughts, floods, and wildfires. These events can cause significant damage to infrastructure, agriculture, and human communities. By now, we are very familiar with tragic global weather-event catastrophes almost daily, covered by the evening news channels.



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6. Health Impacts: Climate change caused by CO₂ emissions can have indirect effects on human health, such as increased heat-related illnesses, worsening air quality, and the spread of certain diseases as the range of disease-carrying vectors expands.

ACTION NEEDED NOW.....

Addressing the issue of excess CO₂ emissions is crucial to mitigate the impacts of climate change and protect the planet's ecosystems and human societies. Implementing measures to reduce emissions, transitioning to cleaner energy sources, and fostering sustainable practices are essential steps to combat this global challenge.

SO WHAT MUST WE DO?????.....

Most critical and familiar to our industry's practices is carbon capture for petrochemicals and refining. Carbon capture refers to the process of capturing and storing carbon dioxide (CO₂) emissions that are generated during petrochemical and refined fuels/lubes production or other related industrial processes. Petrochemicals and fuels are chemicals derived from petroleum or natural gas, and their production can contribute to greenhouse gas emissions and climate change.

Carbon capture technologies aim to mitigate these emissions by capturing CO₂ before it is released into the atmosphere and storing it underground or utilizing it for other purposes. The process typically involves the following steps:

Capture: CO₂ is captured from the flue gases or exhaust streams of petrochemical plants and refineries using various methods such as absorption, adsorption, or membrane separation.

Compression: The captured CO₂ is compressed to a higher pressure, making it suitable for transportation and storage.

Transportation: The compressed CO₂ is transported via pipelines, ships, or trucks to the storage site or utilization facility.

Storage: The CO₂ is either stored deep underground in geological formations, such as depleted oil and gas fields or saline aquifers or utilized in processes like enhanced oil recovery (EOR) where CO₂ is injected into oil reservoirs to increase oil production while simultaneously storing the CO₂ underground.

Hence carbon capture for petrochemicals and fuels can help reduce the environmental impact of the industry by mitigating CO₂ emissions. It is part of a broader strategy to transition to more sustainable and low-carbon practices in the petrochemical/fuels sector. It's worth noting that while carbon capture can play a role in reducing emissions, it is not a standalone solution for addressing climate change. Other strategies such as energy efficiency, renewable energy adoption, and sustainable product design should also be considered to achieve substantial emissions reductions in the long term.

INDUSTRIAL EFFORTS UNDERWAY....

Occidental Petroleum (Oxy) is an international energy company that operates in the oil and gas industry. Oxy is a leader in capturing and handling carbon before its harmful effects harm the atmosphere. Below is a general overview of carbon capture for petrochemicals/fuels and its potential application within the industry.

Along with Oxy, several other major energy companies are involved in carbon capture efforts to reduce greenhouse gas emissions. Companies like ExxonMobil, Shell, BP, Chevron, and Total were among those investing in research and development of carbon capture technologies.

These companies explored various methods, such as direct air capture, carbon capture and storage (CCS) from industrial facilities and utilizing carbon capture to enhance oil recovery. Some are also involved in joint projects and collaborations with governments and other companies to accelerate the deployment of these, as well as upcoming technologies.

Carbon capture can help reduce the environmental impact of the industry by mitigating CO₂ emissions. It is part of a broader strategy to transition to more sustainable and low-carbon practices in the sector. These major firms are analyzing and designing innovation in sustainable project design including critical elements.....

Energy Efficiency: plays a crucial role in addressing climate change by reducing greenhouse gas emissions and mitigating the impact of energy consumption on the environment. It involves using less energy to achieve the same or improved level of output or services. Here are some key points highlighting the importance of energy efficiency for climate change:

Emissions Reduction: Improving energy efficiency across sectors such as buildings, industry, transportation, and appliances reduces the overall energy demand. This leads to a decrease in the burning of fossil fuels, the primary source of greenhouse gas emissions. By reducing emissions, energy efficiency helps mitigate climate change.

Cost Savings: Energy-efficient practices and technologies can result in significant cost savings for individuals, businesses, and governments. By using energy more efficiently, less energy is wasted, leading to lower energy bills and operational costs. These savings can then be invested in further energy efficiency measures or other sustainable initiatives.

Renewable Energy Integration: Energy efficiency complements the adoption of renewable energy sources. By reducing energy demand through efficiency measures, the need for energy generation from fossil fuels is decreased. This allows renewable energy sources such as solar and wind to provide a higher percentage of the energy mix, further reducing greenhouse gas emissions.

Sustainable Development: Energy efficiency supports sustainable development goals by promoting responsible and efficient use of resources. It helps to reduce energy poverty, improve energy access, and enhance energy security, making communities more resilient and less reliant on fossil fuels.

Job Creation and Economic Growth: The implementation of energy efficiency measures creates job opportunities in various sectors, including construction, manufacturing, and renewable energy industries. Additionally, energy efficiency initiatives stimulate economic growth by driving innovation, promoting technological advancements, and attracting investment in clean energy technologies.

Co-benefits: Energy efficiency offers co-benefits beyond climate change mitigation. It improves air quality by reducing pollutants emitted during energy production and consumption, leading to better public health outcomes. Energy-efficient buildings also provide enhanced comfort, indoor air quality, and productivity for occupants.

FUELING THE FUTURE....

Delegates from most of the world's largest economies met in Goa, India, in late July to discuss the energy transition as extreme heat takes hold in many areas across the globe. The G20 Energy Transitions Working Group Meeting was intended to set tone and strategy, and while there were some points of agreement, the summit ended without any consensus on phasing out fossil fuels. Investors in energy and renewables are especially taking note ahead of a gathering of G20 leaders in September and the COP28 forum in December.

Snapshot: Greenhouse gases like carbon dioxide, methane and nitrous oxide continue to reach new record highs, while increasing temperatures, a loss of biodiversity and extreme weather events are said to be growing in intensity. It doesn't help that much fossil fuel manufacturing usage is being outsourced to developing nations, where deregulation of environmental protections has been used to advance their economies. This can even be seen among countries that are powering the green revolution, like nickel smelting for EV batteries, with further criticism being leveled at the sustainable commitments of some of the world's most profitable companies.

Many nations are also attempting to shore up their domestic fuel stockpiles as Russia's war in Ukraine and geopolitical tensions elsewhere threaten to weaponize energy supplies. The U.S. Senate last week voted to block China from purchasing oil from the Strategic Petroleum Reserve, while U.S. Energy Secretary Jennifer Granholm reiterated calls for additional supplies as "it gets dangerous when the prices are so high." At the same time, the American government has plowed billions of dollars in subsidies and tax breaks into businesses involved in electric vehicle technology and the energy transition, but other countries may not be able to finance such initiatives or those priorities, and that makes finding a consensus quite complicated.

Outcome statement: "Given that fossil fuels currently continue to play a significant role in the global energy mix, eradication of energy poverty, and in meeting the growing energy demand, the importance of making efforts towards phase down of unabated fossil fuels, in line with different national circumstances

was emphasized by some members." The gathering also failed to set a specific global goal for renewable energy development, and there was also disagreement about the effectiveness of carbon capture technologies. To note, G20 countries account for more than three-quarters of global emissions and world's gross domestic product.

WE ALL MUST LEND A HAND...

To maximize the potential of energy efficiency, governments, businesses, and individuals can adopt various measures. These include implementing energy-efficient building codes, promoting energy-efficient appliances and equipment, conducting energy audits, adopting sustainable transportation options, and raising awareness about energy conservation practices.

As always, Engineering Practice Magazine (EPM) and the International Association of Certified Practicing Engineers (IACPE), directly supports and actively promotes resourcing necessary, to encourage upcoming STEM and engineering talent to train, graduate, and apprentice in evolving vocations which will positively affect this burgeoning field of expertise.

Until September, please stay cool (or warm if in the southern hemisphere), prosperous, and content. We greatly appreciate our readership's continued interest in and support for our work. If we may better cover subjects of interest and benefit to our mutual Earth, please let us know.

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