Extended Abstract | Electrical & Electronic Systems | 2021 | Vol.10 No.3

# Uplift CO2 Production up to 100% and enhanced Sustainability by resolving major CO2 design & operating problems

**Muhammad Farooq**

## Abstract

Carbon dioxide (CO2) is the byproduct generated and emitted from Ethylene Glycol (EG) plant by catalytic oxidation of ethylene to produce Ethylene oxide and CO2. CO2 is known feedstock in production of urea & methanol and it is also greenhouse gas (GHG) that contributor to climate change. Annual worldwide emission of the GHG now exceeds 30billiontones, which is exceeding gradually .With this regards, UNITED initiated the practical solution & implementation to convert the huge raw CO2 emission into useful, valuable and high-grade/food-grade product. Leading to remarkable improvement and contribution towards environmental aspects and sustainability

This is first prototype plant, where EG raw CO2 by-product convert to food grade CO2. For such a great novelty, the numbers of challenges were faced from concept until sustainable operation. The innovative concept, reliable & valuable engineering with the safe, effective & productive construction and startup with sustainable operation were challenges of this plant. The raw CO2 from the vent gas is captured and purified to required purity level (per European Industrial Gases Association specification) exceeding the highest food grade requirement.

The plant is design to compress and purify around 1,500 tons per day of raw carbon dioxide. Plant is capable to produce both gaseous and liquid food grade CO2.The CO2 production positive contribution is ultimately improve the Sustainability of UNITED, SABIC and KSA. Those figures are in GHG reduction more than 19.7%, energy reduction more than 11%, water reduction more than 10.6% and material effectiveness more than59.1%. This is the major carbon capture and utilization (CCU) plant, where such huge amount of CO2 can captureandproduceinvaluable&profitableproduct.Thereductio nofCO2emissionsisanimportant aim of SABIC's sustainability strategy. In summary, an estimated more than 500,000 tons/year of CO2 emissions will be saved with more than 10 million of earning per year to sell CO2 as valuable product. Industry faces a significant challenge to reduce current levels of greenhouse gas (GHG) emissions in order to comply with upcoming legislation. Public pressure for reduced GHG emissions from industry has intensified in recent years, and industrial plant owners are now accelerating their efforts to minimize these emissions from their facilities. Scientists believe that anthropogenic (man-made) carbon dioxide (CO2) makes a larger contribution to global warming than other industrial gases. Refinery and petrochemical facilities are now seeking cost-effective methods of capturing this gas and sequestering it in geologic formations.

Since the market for use of CO2 is very small, there is a need for storage of this gas. In order to bring a significant benefit to the environment, large quantities of CO2 need to be captured and stored. Accordingly, CO2 capture and transport will require the construction of large diameter, dedicated pipelines. As an example, a 400 MW coal-fired plant can produce up to 8000 tons/day of CO2. With several thousand of these plants worldwide, the opportunity exists to capture and transport substantial amounts of CO2, should these plants install capture facilities. Since CO2 has been used in beverages for many years, the public's perception is that this gas is relatively safe to transport. This belief leads to the perception that CO2 can be processed and pipelined with no risk to people. In fact, because of this perception and because of the large quantities of this gas in transport, the consequences of potential CO2 pipeline accidents are of significant concern. There is a need for more strict regulations governing CO2 pipelines than those for natural gas pipelines.

CO2 can be fatal to humans and animals, partly due to suffocation. It also produces dangerous physiological effects when present in high levels in the blood stream. Either one of these factors, or both, can cause fatalities. The permissible exposure limit (PEL) for this gas is 5000 ppm per OSHA guidelines, and 40 000 ppm (4%) is considered to be immediately dangerous to life and health (IDLH).

A volcanic lake, Lake Nyos, in Cameroon presented recent proof of the danger created by CO2 release when gas from the bottom of this ancient lake travelled down a valley, killing approximately 1800 people and many animals in a very short period. Naturally occurring CO2 in mountainous regions can also be dangerous to hikers and skiers in these areas. Some incidents related to the food and beverage industry have been reported that were a consequence of exposure to high levels of CO2. Therefore, this gas needs to be handled and transported with a full understanding of the danger it poses, and the public needs to be adequately informed of its potential dangers.

There appears to be no recorded fatalities directly attributable to the failure of CO2 pipelines. Acid gas injection (CO2 and H2S) has been practiced in Western Canada for a number of years and no major safety issues have been reported for these small pipelines, due to good design and operating practices being implemented by the owners. However, if future CO2 pipelines become as common and extensive as natural gas pipelines, similar failure statistics as for natural gas pipelines would be expected and applicable. The consequences of failure would be much more severe due to the large inventory transport without adequate dispersion mechanisms for the escaped gas. Natural gas pipeline ruptures lead to escape of the gas upwards, due to its lower than air density, and may ignite on rupture, thereby burning the released gas. However, CO2 cannot be burned and it will disperse quickly and collect in nearby depressions, which may store this gas for extended periods until wind disperses it or vegetation absorbs it.