

# Carbon Dioxide – A friend in industry and an environmental foe

## – Merchant CO<sub>2</sub> opportunities and emissions control

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### CO<sub>2</sub> sources can represent excellent long term money making opportunities

The merchant CO<sub>2</sub> market is about 20million tons of annual consumption, when taking into consideration all forms of this merchant product. This is from the common liquid product used in industry, i.e. soft drink bottling, specialty food freezing, meat and vegetable processing and the ever present MAP (modified atmosphere packaging) applications for this most versatile product – plus endless industrial applications. The so-called developed markets such as the European Zone, Japan and the U.S. consume the majority of this product, which is refined and liquefied (or compressed into dry ice); however, in developing markets, places with lots of high atmospheric temperatures, and requirements for refrigeration, CO<sub>2</sub> is an excellent means of achieving this end.

Today, some markets in Asia, Africa, and Latin America 'make' carbon dioxide on site v. using a concentrated by-product from sources such as hydrogen reformers in the refining industry, off gas from chemical plants such as ethylene oxide and titanium dioxide, natural gas processing, fermentation; and sometimes concentrated high pressure underground wells. If the CO<sub>2</sub> source is the initial form suggested as the smaller CO<sub>2</sub> made for this purpose only, and not a by-product of the chemical industry as described, then fuels such as diesel, coal, coke, oil, etc. are used, and then the CO<sub>2</sub> is concentrated; then the CO<sub>2</sub> is purified and liquefied to meet often primarily beverage grade standards. These markets can often be expanded dramatically when studying applications for the CO<sub>2</sub>, and perhaps utilizing larger chemical and energy sources such as reformer and fermentation plants; thus skipping the step which is concentrating the CO<sub>2</sub>. In this respect the flue gas from combustion is perhaps 8 – 12% (v), compared to a concentrated by-product source such as ammonia, fermentation and reformer being up to and beyond 99%. The economics then lend themselves very well to the larger scale, chemical and energy by-product sourced facilities v. often small flue gas sources from fossil fuels.

The applications for CO<sub>2</sub> in many developing and developed markets continue to expand, and offer endless money making opportunities in the application for food chilling and freezing, Ph reduction (in lieu of sulfuric or hydrochloric acids), blast cleaning via small dry ice pellets, agricultural applications in grain storage, growth enrichment in greenhouses; and the utilization of CO<sub>2</sub> in algae and other forms of crops which then can be converted to oils used in biodiesel, for example. Beyond this, would be many applications in the steel industry, the chemical industry, using dry ice for chilling food in carts, trucks, railcars, and many food stands found in the world's cities. The applications are almost limitless – however, it is essential to understand the markets, evaluate the applications, and understand the cost of converting an otherwise environmentally unfriendly CO<sub>2</sub> by-product into a food, beverage, and industrial product for healthy, environmentally

friendly, and economically sound applications in industry. Of course, in very large sums, CO<sub>2</sub> is used to enhance oil recovery (EOR), stimulate gas wells, and enhance the removal of methane from coal seams (CBM) – these last few examples are specific to markets, sensitive to the value of these fossil fuels, and are usually pipeline delivered, unlike the merchant end of the business, where CO<sub>2</sub> is transported as ice or as a liquid in trailers or railcars – or on a small scale in cylinders and ISO tanks. So a full understanding of the CO<sub>2</sub> sources, their costs for production of the refined product for merchant use, and a full understanding of markets and applications is fully essential to make money from these by-product or natural CO<sub>2</sub> sources – this can provide revenues as well as cure some emissions output problems, the advantages can be twofold.

### Climate change and the catastrophic potential

Carbon dioxide (CO<sub>2</sub>) in today's world is perhaps the most popular gas of all when it comes to the media; largely due to claims and often proof of increased levels of this gas in the atmosphere, the product of combustion, decomposition of organic matter; and ultimately feared as leading to global catastrophic results – should global warming, and the lack of CO<sub>2</sub> containment, abatement, or management not take place. When considering one opinion, that being a world voice for global temperature increases, the Intergovernmental Panel on Climate Change, a U.N. arm, confirms a global atmospheric temperature in excess of 2 degrees C, compared with pre-industrial levels will be absolutely catastrophic. The greatest offender in terms of CO<sub>2</sub> venting to the atmosphere would be the electric power sector, at least 40% of the 75million tons daily let to the atmosphere. Of this 75 million tons per day vented, maybe 25million tons are taken in by natural oceanic activity, the saving grace and highly significant natural carbon sink – now overwhelmed by CO<sub>2</sub> content, and often approaching a state of acidification. Next, would be the world's rainforests, which are shrinking every day, due to crop conversion, and harvesting of lumber; thus making room for mankind to expand his ever – presence.

When considering a greater extreme in global temperature increases, a rise from 6 to 9 degrees F would result in between 40 and 70% of all species becoming extinct. Further, Southern Europe, The Middle East, and Northern Africa would become uninhabitable for humans. Also, Permafrost in Siberia would melt, releasing huge sums of methane, a powerful greenhouse gas – making things much worse, and this goes on and on.

A full understanding of the consequences behind endless CO<sub>2</sub> emissions, the technologies possible for abatement of this product; and destinations for this CO<sub>2</sub> are all essential in order to ultimately tame this beast. Advanced Cryogenics provides such full expertise. It is fully achievable; however, all of us and all of industry must participate in order to retain an environmentally safe world. Once again, for the merchant CO<sub>2</sub> market, a full evaluation and understanding is also essential.

#### About the author:

Sam A. Rushing, president of Advanced Cryogenics, Ltd., a major CO<sub>2</sub> consulting firm with over 30 years of expertise provides a full menu of consulting services primarily to CO<sub>2</sub>, and cryogenic gases. As a CO<sub>2</sub> consultant, all merchant options can be evaluated and developed; as well as expertise on the greenhouse gas reduction end of the CO<sub>2</sub> business.

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