

Carbon Negative Power Plants

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Global Thermostat LLC (GT) (www.globalthermostat.com) was formed in 2006 to develop and commercialize a unique technology for the direct capture of carbon dioxide from the atmosphere and other sources. The GT process “co-generates” carbon capture with other industrial processes—such as power production—by using the process heat from those processes to drive its carbon capture technology. By combining CO₂ capture from air along with capture from the flue gas of an electrical power plant, and using the power plant’s low cost process heat to provide the energy needed for the air capture process, GT technology has the capability of transforming power plants into net carbon sinks. Global Thermostat technology also can work with renewable power plants, because it captures carbon directly from air using the plant’s process heat. For example, heat from a Concentrated Solar Plant (CSP) can be used by Global Thermostat to drive its capture process.

CO₂ capture from air is different from other forms of carbon capture in that it extracts CO₂ directly from the atmosphere at low temperatures and at a concentration of about 400 parts per million (ppm). Other carbon capture technologies typically extract CO₂ only from flue gases at higher temperatures and ppm. Global Thermostat technology also can work very economically in conjunction with standard capture technology by combining air and the flue as its sources of carbon.

The US Department of Energy recently announced \$2.3 billion in funding in carbon capture technologies. Additionally, China has built into its Twelfth Five Year plan a 17 percent reduction of CO₂ per unit of GDP output and is funding a number of its own initiatives to accomplish this goal.

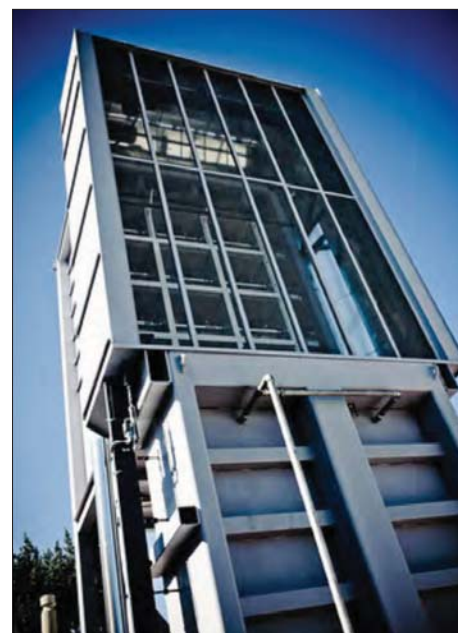
GT’s technology has multiple advantages. The most important are: (i) GT’s plant location flexibility allows CO₂ capture where CO₂ can be used as a product, thereby reducing transportation and distribution costs, (ii) GT technology has the ability to make a power plant carbon negative, and (iii) GT technology uses low cost process heat to provide the energy needed for the air capture process.

CO₂ air capture has gained momentum on the policy front and in the business community as a viable and economic solution for reducing carbon emissions and is now being introduced commercially with pilot demonstration plants. The first GT pilot plant erected at SRI International in Menlo Park, CA, captures 1,000 tpy (tons per year) of CO₂ and was co-developed with Corning and BASF. The CO₂ captured at plants like this is available for use in applications such as enhanced oil recovery, greenhouses, production of industrial grade formic acid, producing bio-fuels from algae, and, when combined with hydrogen, for producing hydrocarbons such as high octane gasoline.

According to the International Energy Agency, over 41 percent of all human based emissions of CO₂ are generated by power plants and 89 percent of electricity production around the world is powered by fossil fuels. This represents an energy infrastructure valued in excess of \$55 trillion dollars. As this cannot easily be replaced, CO₂ emissions will be around for some time to come. However, with CO₂ air capture, much of this emitted CO₂ can be recovered and molecularly tied up, thereby lowering the CO₂ loading in the atmosphere. With GT’s technology, the more electricity one produces, the more CO₂ one can reduce from the atmosphere. This reverses the paradigm that links fossil fuel based power production with carbon emissions. A GT plant utilizing process heat in its process can capture up to twice the CO₂ that a coal power plant emits, leading to carbon negative electrical power production.

Here is a snapshot of how GT’s technology works. Air and/or the flue gas mixture are moved by fans over a wall of Corning’s honeycomb monoliths, which are coated with a proprietary ‘sorber’ (amine based chemical) produced by BASF. The coated monoliths adsorb the CO₂. Process steam is then used to desorb the CO₂ from the wall. High purity CO₂ is recovered and the process heat that the plant does not use drives the GT process, making it more cost effective. A CSP plant can be used to drive the process.

The purity level of the CO₂ gas recovered



by GT’s process can be as high as 98–99 percent, and the stream can be further purified and/or liquefied using standard “compression” techniques.

Transportation costs for large volume gaseous CO₂ is significant and can run as high as \$1.5 million per mile for a pipeline, plus compression. With the GT process, these costs are drastically reduced or eliminated; a CO₂ air capture plant can be located anywhere, needing only air and heat to operate. A GT plant can be built next to an oil field or a food processor, eliminating the need to pipe the CO₂ over a long distance.

Global Thermostat technology can reduce emitted CO₂ by 200 percent (it is carbon negative) and also can operate alongside other conventional methods of CO₂ capture. GT’s technology enhances the efficiency, capture rates, and CO₂ purity levels generated by conventional processes, which typically only reduce 90 percent of the emitted CO₂. Global Thermostat has a number of commercialization discussions underway in the US and China and believes that its process holds significant value in reducing environmentally damaging CO₂ emitted by the two countries, while creating economic value for its CO₂ consuming industries. ■

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