Applied Recent Technologies to Reduce Air Pollution

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Human activities have an impact on almost every major ecosystem of our world today, and this impact is not always positive. Pollution is one factor that has been badly affecting our planet for decades. However, global awareness and the fear for our planet have caused governments, and scientists to focus their efforts on using technology to solve the hurdle of pollution. Tremendous efforts in science and technology have been made to develop technologies to remediate the effects of pollution during the last three decades. Throughout this article we will focus on the recent advances in technology for reducing air pollution. Carbon monoxide, lead, nitrogen oxides, ground-level ozone, particle pollution (often referred to as particulate matter), and sulfur oxides are among air pollutants that affect the environment and human health. One of the latest findings to tackle some of these pollutants is titanium oxide. It is one of several technologies that curb the emission of pollutants during combustion. In electrical power generation plants, selective catalytic reduction, utilizing ultrafine titanium dioxide (TiO2) as a De-NOx catalyst, has been demonstrated to remove over 90 percent of the NOx generated by the combustion of coal, gas or other fossil fuels to produce electricity. TiO2 acts as a catalyst to convert the harmful gases into harmless nitrogen and water vapor. This technology has been available for up to 30 years and has been demonstrated to be very effective. The technology is beginning to be used more widely to reduce the level of pollutants generated when producing electricity.

Systems are now available for use to reduce NOx and diesel particulate matter from tailpipe emissions. In these systems, we utilize the technology of ultrafine titanium dioxide in a similar fashion to the power plants, but engineer the materials to perform under the conditions found in vehicle emission systems. Ultrafine TiO2 is an essential ingredient in many catalytic systems that allow emissions from diesel sources to meet increasingly strict environmental regulations, such as Euro IV, Euro V and Euro VI. These products are now widely used in the automotive industry. Ultrafine TiO2 is found in many of the world's most recognizable brands of truck.

In the above cases, the products are specifically designed to perform in the conditions found in the particular combustion process, with an efficiency of 90-95 percent. More still needs to be done to deal with pollutants that have either escaped from cars or power plants, or are formed in the atmosphere. A second line of defense is needed.

Using similar TiO2 catalyst technology, scientists are also able to introduce the material into a wide range of construction materials, including concrete, pavement, roofing tiles, membranes, paints, coatings and glass – thereby becoming part of a local smart solution. The photocatalytic TiO2 uses the sun's energy to break down pollutants. In this way, all of us could play a role in improving air quality. Through broad implementation of this technology a city could, in theory, clean itself of a significant percentage of its pollution, as the surface exposed to the atmosphere removes the pollution out of the air.

Generating energy is one of the most polluting processes that were used and produces high levels of the pollutants mentioned above. Nowadays, using renewable energy

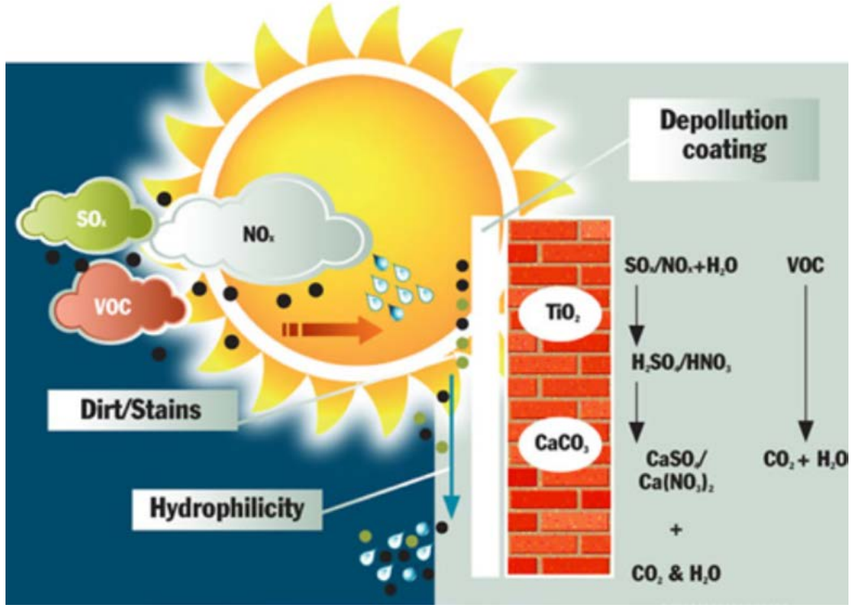

Figure 1: TiO2 used in the construction industry to help minimize air pollution.

sources like solar, wind, hydroelectric power and geothermal energy has become more widespread, greener and even cheaper.

Earth produces heat and hot water underground, known as geothermal energy. There are two ways to capture geothermal power that allows us to use our planet's natural heat for energy purposes. Geothermal heat pumps are used in a process that allows the users to capture this heat through underground pipes, where it gets transferred into homes and buildings to be used as heating. This process can also be reversed in times when temperature needs to be minimized. Another method is the use of geothermal power plants which makes electricity through steam that gets generated from the heat deep inside the Earth. More than 70 % of Iceland's electricity is generated by geothermal power.

Siharbor from Siemens is a new technology applied nowadays in Hamburg, Germany. This city is one of the most attractive spots in the world for cruise ships, an industry which is set to continue booming. When in port, ships need to keep their engines running to maintain power using diesel generators. This process produces pollutants such as NOx, CO2 and others in vast amounts. In order to control and maintain a clean air in the port and the city, a collaboration between Siemens and Hamburg officials yielded Siharbor. It is a shore connection system where the ships can safely and efficiently draw the power they need from the mainland and turn off the generators while in port.

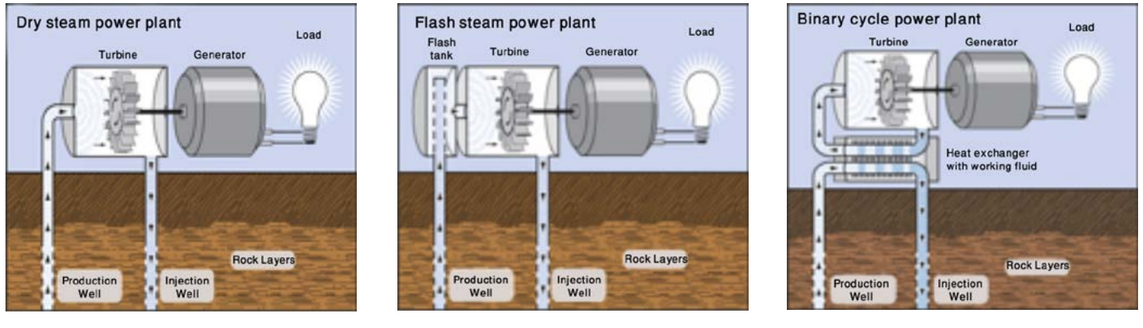

Figure 2: The differences between dry steam, flash steam, and binary cycle power plants.