

Pollution Control Review

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ABSTRACT: *Air pollution control technologies is relatively new to the world. There are many ways in which air pollution can be prevented or cleaned up. Respective to industry, each has their own way of attempting to control the emissions they release into the atmosphere. There is a very intriguing history of when we became concerned with air pollution and what made the world decide to begin cleaning up the air we breathe. As technology has advanced so have the ways in which we control emissions. The construction of electric vehicles, using concentrated solar power, the method of carbon capture and storage, or using electrostatic precipitators to remove particles from the atmosphere are examples of a few currently in use.*

Air pollution control is crucial to the health of all species and the planet. There are many ways that we have learned to do so. The world history of polluting the air is quite colorful, however; we have just recently in the last 130 years or so become aware of the detriment to human health and the environment because of so much polluted air. The air we breathe can be controlled in a variety of ways through the building of electrified vehicles, utilizing solar panels on a concentrated level, continuing to use carbon capture and storage, or using electrostatic precipitators to help prevent or rid the air of these pollutants. The pursuit of air pollution control technologies requires understanding the history of air pollution.

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I. BACKGROUND: AIR POLLUTION HISTORY

The discovery of fire by man, polluted the air with smoke, ash, and particles. As humanity devolved population increased, as did the number of fires that were burning. What was in those fires changed dramatically over the years. It started out with brush, sticks, and wood logs. According to the Center for Chemical Process Safety (CCPS) in 2006 around the 1300s or so, low-grade coal burning replaced wood and the like for cooking and heating. The air quality got so bad in England that King Edward I banned the use of sea coal to help cut down on the air pollution. The fires with coal burned very hot helping to smelt metals of all kind through the years and with no technological advances to understand, metal particulates were then added to the atmosphere. Fast forward to the Industrial Revolution, the world became very dark and labor was overworked in poor air quality conditions. The Industrial Revolution “resulted in increasingly larger scale manufacturing and industrial operations that significantly increased the air pollution levels. These operations required increasingly larger sources of energy, usually from the burning of fossil fuels. They released gases, vapors, and particulates to the atmosphere.” (CCPS, 2006) By 1928, it had been reported that New York City sunlight was reduced by some 20 to 50 percent. It wasn’t until 1967 that the U.S. Congress passed a law requiring a national emission standard. As technology improved, Congress passed the Clean Air Act of 1990 which gave the Environmental Protection Agency (EPA), introduced in the Clean Air Act of 1970, more needed regulatory control. This is where the technologies for air pollution control started to bloom, with the new technologies emerging daily like alternative fuels and electrified vehicles.

II. LITERATURE REVIEW

Electrified vehicle popularity has a history of highs and lows like the silhouette of the Colorado Rockies. Electrified vehicles emerged in the early 1800s, before the gasoline powered automobile, however interest in them was lost by 1935. The gasoline shortage 30 years later, quickly boosted popularity again only to fall abruptly. By the 1990 scuriosity had peaked again and technological advances began to take flight,

continuing to steadily gain ground. (Matulka, 2014) The term electrified vehicle, as defined by Carnegie Mellon University, refers to a range of technologies that use electricity to propel a vehicle. The technologies include:

- Hybrid Electric Vehicles (HEV) that get all propulsion from a gasoline engine but is regulated by an electrical system that improves the fuel efficiency.
- Plug-in Hybrid Electric Vehicles (PHEV) that use a combination of gasoline and an electric battery.
- Battery Electric Vehicles (BEV) run solely on battery power, eliminating carbon emissions.

Electrified vehicles are just one example of air pollution control that reduces or eliminates carbon emissions. If the U.S. and China alone would adopt a goal of 45 percent or more by the year 2030, the oil imports and CO₂ emissions would fall drastically. (McKinsey Quarterly, 2009) Electrified vehicle manufacturers may also incorporate solar panels as a form of pollution control.

III. RESEARCH ANALYSIS

The expense of concentrated solar power technology is high because of the rarity of its use. Right now, the cost of a kilowatt of power is 15 cents, however, in a decade it is predicted to decrease to around 5 cents as the industry improves. The reduced emissions alone would more than pay for itself in a healthier population and environment. This would reduce the cost of almost everything, i.e. healthcare, food, and electricity. Concentrated solar power is exactly as it sounds; the sun's rays are concentrated using mirrors pointed at a chamber of oil that is then heated to over 400 degrees Celsius. That hot oil is used to generate steam and provide power. Nine CSP plants in the Mojave Desert supply power to over 350,000 people. Just like solar panels, this technology was slow to get off the ground due to a lack of funding from banks and investors. Now it seems, there is a push to reduce and/or eliminate harmful emissions into the air we breathe. CSP plants have the best potential for this because a recent study has shown that just 39,000 square kilometers of them could provide half of the U.S. power needs. (Giles, 2007) If the U.S. and China would follow McKinsey's advice and push for concentrated solar power (CSP) by the year 2030, it could supply about 22 percent of the electricity in China and the United States. (McKinsey Quarterly, 2009) As we continue to pursue new technology in air pollution control, there is one method that was born in the late 70s and has improved greatly since, carbon capture and storage technology. (ieaghg, n.d.)

Carbon Capture and Storage.

In the early 70s, Texas oil fields captured CO₂ for Enhanced Oil Recovery (EOR). This was an early form of CO₂ capture that was pumped into the oil fields to boost oil recovery. Later, in that same decade, it was suggested to use the same technology to prevent CO₂ emissions from entering the atmosphere. The oil field continued to capture and inject CO₂ to yield more oil; however, the CO₂ is now captured with the oil to be used again and again until the oil is depleted. It is then sealed in the depleted oil field keeping it from the atmosphere. Another way that CO₂ capturing is being used is in power plants by capturing CO₂ before it reaches the atmosphere. The CO₂ provides no value as it is not being used to produce electricity and is strictly captured to control pollution in the atmosphere. Finally, facilities that process and sell natural gas must first clean it of CO₂ before it is sold. (ieaghg, n.d.) An important part of air pollution control technologies is the elimination of harmful particles from entering the atmosphere.

Electrostatic Precipitator.

Patented in 1907, the first electrostatic precipitator was later used in northern California to pull sulfuric acid and lead oxide fumes from the air to prevent further damage of vineyards. The concept of the electrostatic precipitator is to electrostatically charge the air and collect the charged particles, this forces them to attach to plates. The technology is used both in industrial and residential applications, however residential is not recommended because of the ozone gas produced in the process. The industrial application of the electrostatic precipitator is used to eliminate the particles that make up smoke and prevent them from entering the atmosphere. These charged particles attach to plates that are then shaken, scraped off, or washed off. Then they are disposed of in an eco-friendly manner. There are a few types of electrostatic precipitators, the plate precipitator, that was explained briefly above, and the wet precipitator. This type of precipitator pulls liquid particulates, especially sulfuric acid mist, from industry production. (Oransi, n.d.) These precipitators are just one piece of the puzzle in ensuring that the world has a fresher, cleaner air today and for the future of all things.

IV. CONCLUSION

As technology continues to progress, so will the need for a cleaner atmosphere. These technologies for air pollution control are just a few of the many that exist today and that will be invented in the future. The constant that exists is the need for a cleaner environment that will give future generations what we lack. After the electrified vehicles rule the road, the U.S. is receiving the majority or all its power from concentrated solar panels, carbon capture and storage has improved to somehow become a usable energy without entering the

atmosphere, and electrostatic precipitator technology has improved for in home use without ozone production; there will be even more technology that has come along to help improve the air quality both indoor and outdoor.

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