Combating air pollution
Clear solutions

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Particulate emissions are tangible, and would appear easy to deal with. In the 1950's, several techniques already existed, which are still used today. One simple cleaning device, is a cyclone. In this model you can see how it works. A dusty airstream is spun into a cone, the particles are separated by being flung against its wall, sliding down into a hopper. Another solution is a wet collector. Here a dusty airstream is cleaned, by being passed through a turbulent curtain of water. These simple gas cleaning systems, are often inadequate on their own to cope with the strict limits of present-day legislation. But, other solutions are at hand. Increased efficiency can be obtained, by using electrostatic forces to separate dust from air. The dusty stream is passed through a vast chamber containing charged plates and wires. In this demonstration model, water vapour is used to simulate dust particles. The voltage is switch on, and particles are attracted to the mesh, taking them out of the airstream, which emerges clean. Yet another technique which grew rapidly in importance, works like an inside out vacuum cleaner. Dusty air is filtered by a fabric. The dust collects on the outside of the bag, and is periodically shaken off into a hopper. Large installations like this power station in Dusseldorf, must have sophisticated multiple stage cleaning. This removes gaseous pollutants, as well as particulate matter from flue gases. But however efficient, these systems are not an end to the pollution problem. They're all known as, end of pipe techniques. Everything is put into stopping pollutants, which have already been produced from escaping. There are several possible short comings. Faults like a shorting wire on an electrostatic precipitator, can have a devastating effect on performance. A small drop in efficiency, say from ninety nine point nine percent, to ninety nine point eight percent might seem unimportant. But it represents a doubling of emissions. A potentially more powerful approach, is to deal with the problem at source. Power generation using renewable energy like the wind, avoids producing gaseous pollutants, and addresses potentially more serious problems of global warming. For cars, an end of pipe solution, might involve an exhaust catalyst. A solution at source, would be the use of an alternative fuel. But this raises another issue. Whatever strategy is adopted for controlling pollution, the pollutants have to be known, and often, what was regarded as a safe waste product, turns out to be harmful. In effect, we're faced with a moving target, which prevents even the problems from being cut and dried, let alone the solutions. One example, is the acute problem in cities with sunny climates and heavy traffic, of photochemical smogs involving ozone. This problem of low level ozone, has uncovered a new target for legislation in the 1990's. A group of previous unrestricted substances called volatile organic compounds or VOCs for short. The problem with VOCs, is that they interact with other pollutants, to make photochemical smog. Nitrogen dioxide largely coming from car exhausts, reacts under sunlight with oxygen in the air, to produce nitrogen oxide and ozone. Paradoxically, although ozone is vital in the upper atmosphere, it's also poisonous and so a pollutant at lower levels. Normally the amount of ozone in the air is limited, because this reaction is reversible. During the day, the forward reaction predominates, and levels of ozone can rise. But during the night, the reverse reaction is favoured, and ozone levels fall. So, a degree of equilibrium is maintained. But when VOCs are present, which may also come from car exhausts, or from industries using solvents or paints, the equilibrium breaks down. VOCs will now react with some of the nitrogen oxide, completing the loop, and leaving an excess of ozone which can build up.