The Myth of Smog Towers

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Under stressful times, there is often a strong desire, both social and political, to search for solutions driven by public perception instead of good science. Covid-19 times have seen quite a few examples of such ineffective prescriptions. Smog Towers being advertised as a vaccination for ambient or outdoor air pollution at the scale of a city or a community are no different. Anti-Smog Towers or Smog Free Towers work on the principle of HEPA filtration or air ionization technology to remove PM2.5 particles. That is, air flowing through a smog tower passes through a filter to provide clean air coming out of the top or bottom. These methods of cleaning air are scientifically well established and used widely for cleaning indoor air where the air exchange with the outdoors is minimal. However, to extrapolate the same principle to the scale of a whole city is absurd and has no scientific evidence behind it. Following simple back of the envelope calculations can throw some light on it. For a city like Delhi with an area of about 1500 KM^2, the volume of ambient air in a well-mixed boundary layer of 1000 m is about 10^{12} m^3. State of the art smog towers claim to clean air to the tune of a million m^3 per day. One would still need to install about a million smog towers to clean a city like Delhi with air of about 10^{12} m^3. Making matters worse is the fact that the ambient air is not trapped here as in a closed room and is continuously being replaced. The air of the entire city of Delhi gets replenished from the neighboring states about twice a day. The latest smog tower being planned for Connaught place, based on news articles, has a budget of about 20 crores. Based on this unit cost, a million smog towers in the city are going to cost about a couple of trillion dollars, approximately equal to India's current GDP! The above order of magnitude analysis is only for the system's capital cost, maintenance and operation costs are extra.

In summary, cleaning of ambient air is impossible at the scale of a city or any open-air community due to the air pollution being very dilute with continuous replenishment of polluted air from the boundary layer and neighboring regions, that is, from both vertical and lateral directions. Developing and implementing different technologies to clean air at the source of emissions is lot more realistic. This is because there are a finite number of large sources accounting for much of the pollutant load and the pollutants being well characterized at the source. Standard Catalytic Converters for reducing NOx to nitrogen and particulate filters for PM2.5 removal for automobiles, removal of sulfur from diesel fuel, emission control devices at coal power plant chimneys etc. are technologies well developed and implemented successfully at a number of places in the world. The challenge is to implement and regulate these solutions in India. We do have scattered sources of pollution at the scale of a household where biomass is widely used as a fuel. Implementing technologies to regulate emissions at these sources is challenging. However, waiting for these pollutants to be set loose in the ambient air and then hoping for a technology like Smog Towers to clean that air is not realistic. Air pollution is not just a problem of Delhi or Indo-Gangetic plains or India. It is not just a problem of this winters or next winters. According to WHO, about seven million deaths are caused by air pollution worldwide per year, lot more than what Covid-19 pandemic is estimated to cause. Certain pollutants in air not only have health hazards but also have serious consequences to the problem of climate change. The problem of air pollution requires a long-term strategy for a permanent solution instead of short-term ineffective solutions. We, the public, needs to realize and accept it before hoping the policy makers to frame the right policies.