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## RESEARCH ARTICLE

### INDIA'S SWACCH GRID: AN OPTIMIZED ENGINEERING SOLUTION TO INDIA'S GARBAGE AND POLLUTION MENACE

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#### ABSTRACT

21<sup>st</sup> Century is proving to be a huge paradox. While prosperity is getting relatively democratized globally, however it is also creating a new huge, huge problem never witnessed by mankind before. The Garbage Crisis is hitting all the cities, towns, rivers, lakes, seas, roads all around the globe threatening the basic well being and health across all species of living beings. Developing Countries are finding it more and more difficult to cope with the crisis. In India it has taken the top politicians and intellectuals to make us realize the gargantuan level of problem. This paper will attempt to give ideas to solve the problem by highlighting upon the gradual successes of automobile industry, in aligning and in compliance with increasingly stringent Emission norms, and then discussing the ideas of making India clean by launching massive amounts of Engineering resources and ideas to create pan India Swacch Bharat Green and Clean.

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#### INTRODUCTION

On 26 December 2004, India along with a large number of countries washed by Indian Ocean faced a historic tsunami after a huge earthquake which emanated from near Sumatra region of Indonesia. The world was ill prepared to face the consequences of damage due to no active mechanism of early warning system. Things have much changed now. But it happened only after loss of thousands of lives and damage to property. Equally serious loss and destruction of "silent kind" is now hitting us. The Garbage crisis in our cities, towns, villages, roads, shopping markets, educational institutions, office complexes is clear and present danger. The same is required to be solved urgently because this crisis is of different type. Tsunami like disasters have only one time impact. However, Garbage crisis will impact the genes of all species. The impact will be felt across numerous generations. There is a present and clear danger of Garbage Crisis looming over human existence as well as survival of our planet in its present form. Mankind took centuries to get the present prosperity. But it may not be able to enjoy the sustained fruit of prosperity due to the polluted and dirty world. The following paragraphs are an attempt to find the viable technical and other solutions to this mighty and ugly crisis. Success Story from Automobile Industry illustrates that Engineers always rise to the challenges posed by problems.

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One successful transformation which comes to one's mind is the relative success of reducing pollution in the environment by enumerating the norms to be followed in Emissions by automobiles. Previously automobile manufacturers had become villains of all due to emissions of gases from the exhausts and catalytic convertors. However, their commitment and adherence to Emission Norms has been credible and tangible with enforcing ecosystem also playing the due role. In this context, the switchover to Electric vehicle ecosystem e.g. Tesla is also praiseworthy. The same is illustrated below in graphical form:-

The gradual climb from Euro 1 through Euro 6 norms (or equivalent norms in different countries) has yielded to increasingly less and less pollution from vehicles on roads. The same has translated to cleaner air. A case in point is India's capital New Delhi. The air now on roads is a sea change than in the 1990s when fumes from vehicles would choke one and all leading to health issues. Of course, the Supreme Court intervention also helped. A chart from SIAM, India below illustrates the increasing reduction trends in pollution. We need to further strengthen, consolidate and build up on this paradigm to other industries. The best part of enforcing pollution norms on Automobiles is that things are measurable and enforceable. But it is still a "low hanging fruit" of Pollution and Garbage crisis. At present there are many heavy pollutants who are escaping the "Pollutant Tags/Labels" due to non awareness among general population about the pollution they are causing. Some of these industries are as follows:-

- a) Food Industry
- b) Fast Moving Consumer Goods(FMCG) Industry
- c) Leather/Tannery Industry
- d) Textile Industry
- e) Oil Industry
- f) Paper Industry
- g) Construction Industry
- h) Packaging industry
- i) Electronics/Computer Industry
- j) Railway Industry
- k) Courier Industry
- l) Paint industry
- m) Cement Industry
- n) Mining Industry
- o) Hospital industry

**Concept of Unified One India (UOI) Swachh Grid:** - The Block Diagram at Fig 4 below outlines the concept.

Having seen that pollution agencies and industries are quite diversified in nature and category, it is proposed to implement the concept of One India Swach Grid. This will cover the geography from Kashmir to Kanyakumari and Gujarat to Arunachal Pradesh. This will be very much akin to the recent successful transformation to One India One Tax system of GST Implementation. Despite several tolls on highways, India is still a free travel country. For the same Geographical distances in Europe one may have to cross many check points with several visas and formalities required. The free movement is good but it also brings along with it the attendant evils of spread and proliferation of pollution across all states by

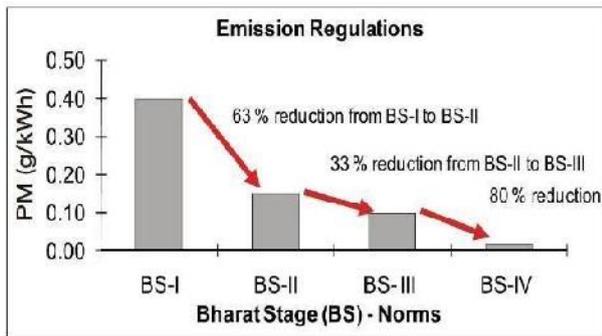


Fig.1. Increase in stringency of norms

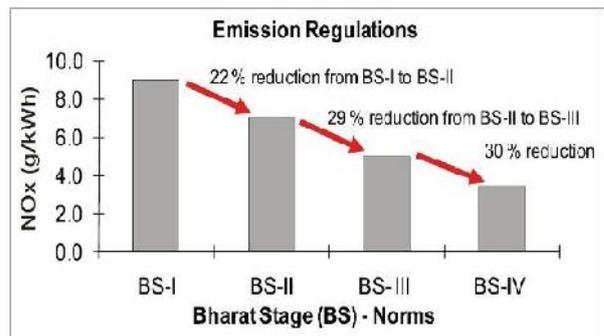


Fig.2. Increase in stringency of norms

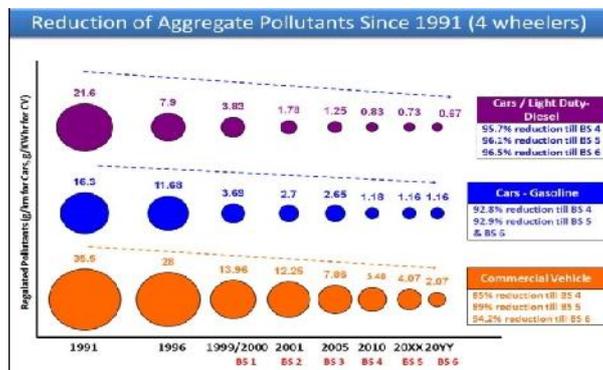


Fig.3. Reduction of Aggregate Pollutant since 1991 (4 wheelers)

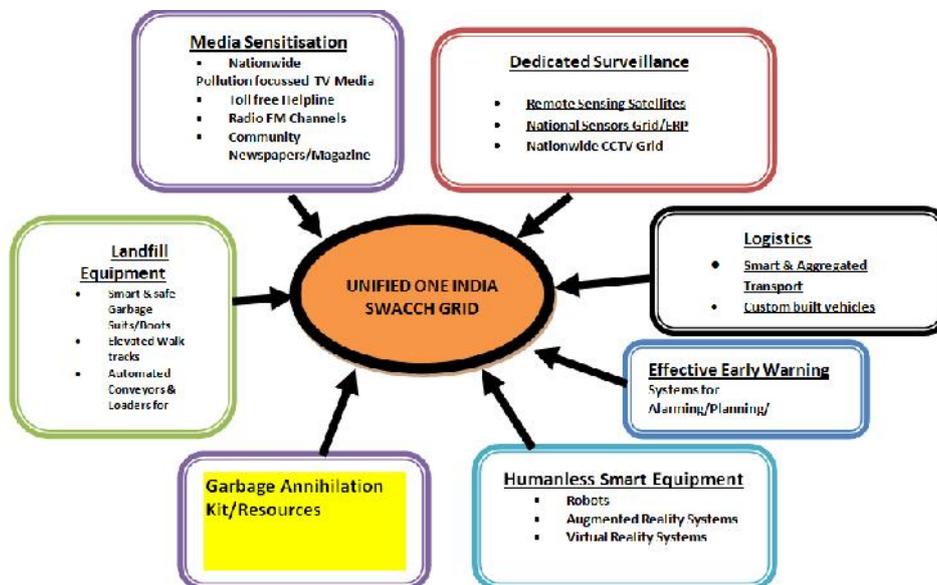


Fig.4. Unified One India Swacch Grid

truckers, rail travelers and car drivers, without any, penalty or disincentive. In order to have a pan Indian Garbage free environment, befitting a unified proud Nation, it is felt essential to have the following facilities/resources:-

**Dedicated Satellite Imagery System:** - It targeted to carry 24X7x365 surveillance and watch on all Landfills/Dumping grounds pan India. Similarly other Pollution Generating Centers will also be targeted. These include Subzi Mandis, Malls, Railway Stations, Bus Stations, Airports, warehouses. Access to these images will be provided to a new agency named as Swachh Bharat Grid of India (SBGI). The agency will be responsible to collate, analyse, interpret, advise, red flag and alarm authorities on the volume of garbage generation. Any above par and below par reports will also be generated by SBGI. Further, local area drones and Building Top CCTV cameras can also be very useful for such surveillance. Other resources will be:-

- a) **Dedicated ERP** will need to be developed for implementation of Clean and Green Bharat. Pan India ERP will be made ab initio. Future expansion of cities will also be kept in mind while developing this ERP. TCS, Infosys or any other IT company may be approached for this task.
- b) **Smart Garbage Logistics** will need to be in place to ensure speedy upstream, midstream and downstream collection and disposal of garbage/trash.
- c) **Array of sensors:** Array of sensors will be like watchdogs and alerting system of Garbage related defaults, work not done, overflow etc. The sensors will be of various types including olfactory type, moisture catchers, heat sensors etc.
- d) **Garbage Robots:** These will be leveraged to go to the places where human beings will be facing health hazard and challenging duty with nauseating smell emanating all around. Further, similar to the kit provided for Fire personnel, Garbage workers must be provided a Garbage suit/kit with adequate breathers and oxygen cylinders/ventilators.
- e) **Garbage Police:** This will be necessary to ensure that people follow the laws/guidelines related to maintenance of Clean and Green India at all times. These Police persons will be keeping eye on potential "culprits" "who show no respect for Cleanliness related laws/instructions. They will also send various reports to District authorities on daily basis.
- f) **Garbage Annihilation Kit:** The vast mounds of garbage in the landfills will require intervention not from ground only. Aerial benign solutions will also be necessary. The usage of Drones and other such equipment like custom built helicopters with capability to activate previously located incinerators on ground can be very helpful kit to annihilate Garbage at difficult- to- reach locations and identified locations. A new device called laser incinerator for burning the garbage can be made by researchers/scientist/engineers.
- g) **Pollution "Honkers":** These will be the devices which will broadcast the true alarming and dirty picture of pollution at all crossings/intersections in the cities. Pollution hooters will get activated on the lines of Ambulance hooters to create a feeling of urgency of attending problem at allocation based on its pollution permissibility crossing parameters. Year on Year and Month on Month comparisons need to be given as is done by the Business Industry on Business channels.
- h) **Dedicated Pollution TV Channel:** We have lot of Trash and meaningless channels on TV ranging from brainless comedy shows to soap operas to religion channels. There is an urgent necessity to have a channel called SWACCH BHARAT CHANNEL now. This will be dedicated to Pollution related matters. It will not be glamorous in the beginning. But with endorsements from leading icons like Amitabh Bachchan, Mahesh Babu, Virat Kohli it will become a hit. Advertisements will not be a problem as the topic is getting increased traction day by day. Start can be made by opening a **Doordarshan Swachh Channel:** Then the private sector can also pitch in to fulfill the responsibility in this field. The channel can use a diversified portfolio of raising awareness on pollution matters by using Animations, role plays, dazzle videos followed by a serious message dedicated to curb pollution and garbage, street plays, on site visits, nostalgia of living in pristine and green places to "Pollution reducing happening places and case studies".
- i) **Dedicated Pollution Helpline/whistleblower website:** A dedicated All India Toll Free number of Garbage/pollution/trash related complaints/issues will be useful to the general public who face issues in their locality.
- j) **Dedicated Pollution FM Channel:** On similar lines as above, a dedicated All India FM Channel can be started to focus on the Swachh matters. Similarly regional FM channels can also be started.
- k) **Leveraging Cricket/ Bollywood Economy:** Since Cricket and Bollywood complex is very important and visible in India, the same must be leveraged. Slogan of "Neat is Glamorous" will help raise the awareness of pollution matters & pollution mitigation. Formal policies must be aligned towards this slogan. IPL and Bollywood Awards must have first slogan related to reducing Pollution.
- l) **Special Transport & Processing Methodology Equipment:** - Though a serious matter, however the garbage crisis is a good opportunity for Engineers to develop the new type of equipment or transport. Garbage volume is increasingly mounting so much that trucks will not be sufficient. Mass garbage trains will be required to transport garbage on dedicated "Garbage Corridors" in cities & towns. After reaching the landfills in cities/towns, the trains will get attached/mated to a complex system of equipment which will have equipment starting with suction equipment, segregator tunnels for segregating, type of Garbage, Processor equipment including Biodigester, Laser or Hypergolic ignited pulverisor and green exhaust system/chimney.

## Policy Formulations/Implementations

The automobile industry led the way of reducing the emissions as the guidelines of adherence and compliance were clearly defined. The same template now needs to be replicated to the entire gamut of Pollution ecosystem. Pollution Generation and Dissipation norms need to be strengthened on the similar lines as done for Automobile Industry. Certain examples are as follows:

**(a) Food Industry:** - The biggest behemoth of pollution, this Industry has so far escaped the pollution tag totally. There need to be guidelines and norms of Acceptable Garbage Footprint(AGF) for the hotels, restaurants, eateries, dhabas, corner shops, sweet shops, milk shops, bakeries, pizzerias, coffee shops etc. Food Industry must strive to Institute Best Practices like Lean Management from Manufacturing Industry. The success of low cost air carriers is another good example of optimizing processes. 21<sup>st</sup> Century denizens will have to learn to be frugal and without frills. Recently for a small burger taken by us at a restaurant, I got loads of tissues, paper, more sauce than required etc. The same is an indulgence which will not be environmentally sustainable any more. Some of the parameters could be:-

- Permissible level of Volume of Paper Generated in a Day(PPGD)
- Permissible level of Volume of Food waste Generated in a Day(PFWGD)
- Permissible level of Chimney Gases Generated in a Day(PCGD)
- Permissible level of Waste water Generated in a Day(PWWD)

**(b) Leveraging Aadhar enabled Linking:** The Aadhar card can be very fruitfully leveraged for encouraging people to be more cleanliness-minded with good Clean India citizen behavior an example of implementation can be like this. Govt can issue a promulgation that all Aadhar Card holders will automatically be members of their respective geolocation Garbage Grid ecosystem Postal PIN Code style unique Garbage Pin no will be allotted to the grid. This office will have a database of all potential "customers" in that geography. A customer, based on his Aadhar card address, in default, will be registered for Garbage services with local zone/colony authorities to get the access to Garbage Clearance services on daily basis. Activation of registration can be through OTP/SMS/E Mail enabled methodology. Failure to register will imply that customer is a "potential cleanliness offender". Therefore, he/she will get a chain of SMS or emails from SBGI Authorities (akin to Income Tax style caveats/notices). Further in the morning and evening Garbage Clearance will be done by nominated authorities (or outsourced contractors) after they ascertain, authenticate and confirm the Aadhar card of customer. Regular recording of this data will lead to data of compliances and non compliances by the customer. Record of Compliances and non Compliances of the customers can be kept as History. More than 5-10 non compliances in a quarter will invoke automatic deduction of approved penal fine from linked Aadhar

bank account of the customer. 10-15 non compliances will invoke doubling up the penal fine. Any non compliance above 10 will be treated as civil offence under Indian Penal Code.

- c) CCTVisation:** CCTVs grid is increasingly getting expanded day by day in various cities of India. But it is primarily targeted for Security related purpose. It will be a good idea to have the CCTVs grid also duplicated for the purpose of Pollution watch and checking Pollution related deviances of people. These CCTVs must be put across India on a structured plan after proper coordination at higher level. These CCTVs may be programmed for special check of Pollution defaults/deviances.
- d) Adopt Japanese Clean culture** Japanese are known as the people obsessed with quality and cleanliness. Best Practices from them must be immediately adopted in households, factories, public areas, hospitals, schools, colleges, Housing societies etc. 5S methods must be encouraged at all levels.
- e) Clean Atonement methodology** It will be a good methodology to have a system of "Clean Atonement". Any non compliance to Pollution laws by defaulters must have a bearing on the persons or organizations. Default in their respective areas must be compensated by Atonement/Penance. This will not be in the same area but at a different location in the city. The concerned defaulters would have to make up for the equivalent default in other area by own efforts. A record of such atonements will be kept with authorities. This will act as a good deterrent.
- f) Flying Pollution squads** These Pollution squads will be on the move in the complete city to watch for Pollution defaults/potential defaults. They will be fast and dynamic. An example of one type of such squads is in Bangalore where the Traffic Police outsourced Vehicles and hefty looking persons act fast on the wrongly parked vehicles on the streets. These are rightly towed away without any mercy or discrimination.
- g) Garbage Sniffers:** Man's best friends, Dogs, can be trained to detect the pollution centers from a distance by smell sense. This will be a deterrent to the people who muck up the streets and bylanes of our towns and cities. This training will be a special training.
- h) Pollution Proliferation from Festivals:** -- Indians celebrates an excessive number of festivals throughout the year ranging from Holi, Dussehra, Eid, Diwali, Ganesh Puja, Onam etc. While one must respect the sentiments of all, but there is increasingly need to sensitize people on the need to take a fresh perspective and relook and readjustment of celebrations which will yield minimum pollution footprint. In this, policies on the lines of Emission norms in automobiles may be taken as a template to progressively reduce pollution footprint year on year. Year on Year or festival to festival reduction in pollution targets must be given to each and every Housing Society, mohalla, block, street, office, retail shops, and malls and so on. Self

Compliance Inspection documents/forms before the festival and after the festival must be filled up accurately by responsible office bearers of the locality.

- i) **Leverage Clubs/Place of worship ecosystem:** The clubs, Resident Welfare Committees, religious gathering do always have substantial number of people available. These gatherings can be leveraged to carry the message of need to be clean. Green and environmentally sustainable. Formal pledges can be part of this exercise.
- j) **Spur to Garbage mitigation Technologies:** While the Garbage is a menace, no doubt, but humans have always been one up in Survival battle since the dawn of civilization. The Garbage crisis resolution has to be in the centrstage, the best brains and research must get a spur towards this field. University curriculum should focus on courses on these subjects. Masters and PhD programmes with focus on this field must be started. These professionals will get good market opening in the current context. Several knock off and new technology solutions will definitely result. These will be useful in future for space colonization at Mars and Moon.

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