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Swachh Bharat Abhiyaan: Why cleaning up India is serious business

Hari Pulakkat, ET Bureau Mar 3, 2015, 06.55AM IST

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Tags: Swachh Bharat | pollution | Modi Government | Clean Water | Budget 2015 | Arun Jaitley

Swachh Bharat may have started on a high note, but cleaning up the country is serious business. Apart from investment, it calls for behavioural changes, expertise and scientific knowledge.



If Finance Minister Arun Jaitley chooses to, he could remind citizens about the need to keep the country clean every time they pay for any service. In his Budget proposals, he has taken a provision that will enable him to levy a 2% cess on service tax towards financing and promoting and financing Swachh Bharat initiatives. But a truly clean India is a lot deeper than merely sweeping our streets clean.

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This is a good time to look at the magnitude of the problem and possible ways to clean up the country. A good place to start is an area far away from the country, a patch of garbage in the middle of the ocean near Hawaii. This swirling mass of plastic is about a 1,000 miles across and growing rapidly, with smaller and growing patches in the Atlantic and the Indian Ocean. A research paper published in the journal 'Science' last month says plastic in the oceans will increase 10 times in the next decade if nothing is done about it.

What is the link between Swachh Bharat and plastic in the oceans? Ocean plastics disintegrate into smaller pieces and are eaten by fish, and its toxic constituents work their way back to human beings when they eat fish. When pollution so far away has such profound implications for human health, what about what is so near? What about the garbage dump 100 miles away from your city? It comes back immediately, through water and air that travel long distances these days.

Anything we throw away will come back quickly, disguised as food, water or air. Swachh Bharat primarily looks at sanitation and solid waste. Cleaning India takes far more than that, as unseen pollutants work their way into ecosystems and into the food chain.

All the environmental scientists and engineers ET spoke to are unanimous about one aspect: cleaning up the country is serious business, and takes major behavioural changes as well as deep expertise and scientific knowledge about biology and ecosystems, not to speak of high investment in technology and R&D. Among the world's major problems, waste management is one of the hardest, with no silver bullets in sight in the near future or even the distant future.

Air pollution is hard too, as fossil fuels continue to stay with us and pollution control costs money. As water shortages increase, providing clean water is becoming harder and harder.

ET gives you an overview of the problems and some possible solutions. Problems as diverse as these require a large variety of solutions, and so this is just a snapshot of some ideas. ET will look at this problem more deeply over the year, through indepth stories about specific problems and solutions.

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CLEAN WATER

On the surface, Kerala has some of the cleanest towns and villages in the country. And yet about 80% of the ground water in the state is supposedly contaminated, mostly with sewage. Kerala has small residential plots with toilets and wells in each one of them, and sewage water from septic tanks does not go enough distance for it to be cleaned up through soil filtration. What does this mean for Swachh Bharat?

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Poor sanitation is not the only reason for poor water quality in Kerala, but it is an important reason. The septic tank is not a good solution for places where wells are too close to each other, or where the ground water table is high. To clean up Kerala water, the state has to come up with a completely different solution for sanitation. The state has to redesign all of its septic tanks or install a large number of sewage treatment plants.

Clean water

Some facts

Urban population in India now **400 million**

Urban population in 2030 **600 million**

Clean water requirement for urban India **135-150 litres** per person per day, according to current usage patterns

WATER IS CONTAMINATED:

- Less than 20% of waste water in the country treated
- Untreated waste water flows freely into rivers
- 60% of the country dependent on septic tanks that can pollute ground water
- Major cities do not have enough sewage treatment, with the partial exception of Mumbai and Delhi
- India has the capacity to treat only 30% of urban sewage

GOOD TECHNOLOGY CAN SOLVE THE PROBLEM

The Moving Bed Membrane Bioreactor (MBBR): Gaining popularity as an advanced water treatment technology, MBBR uses biological techniques to treat waste water. It consists of a tank with a submerged plastic plate where bacteria grows and cleans up the waste water. It is supposed to be a durable and low-cost option, and is spurring further research into biological techniques

TOILETS

One-third of the world population does not have access to toilets.

Constructing toilets for everybody in India is not an easy problem to solve, as the technology has to be affordable, aligned to local culture and work well for long periods. Many technologies exist and several others are emerging, and here are a few low-tech and high tech options

Biodegradable bags: Known as Peepoo bags, these are among the simplest options imaginable. This single-use bag contains urea that will sanitise waste in four weeks. The degrading bag then releases the waste into the soil. Popular in developing countries but not in India, probably due to cultural reasons

Pit latrines and septic tanks: A good choice in remote areas where the water table is very low. Not a good

option when the water table is high or keeps fluctuating. Three-fourths of wells in Kerala – considered a state with high standards of hygiene – are contaminated because of proximity to septic tanks

Zero discharge toilet: Developed by IIT Kanpur some time ago, and being used in some places including the railways, this separates and reuses the solids and liquid parts of the waste. Requires no power or sewerage lines and can be used as standalone facility

Off-grid treatment: IIT Madras is developing an off-grid sewage treatment plant that uses solar power when available. This is in pilot trials

Centralised sewage treatment: A good option in large apartment complexes or congested areas. Many new technologies are emerging, some of them high tech but expensive

According to experts in the field, large plants in big cities, made with the best technology and high investment, work very well and produce high quality treated water. Smaller plants around the country rarely work well; some say 90% have some sort of problem.

"Most of the smaller plants in India have control and maintenance issues," says Absar Ahmad Kazmi, professor at the Indian Institute of Technology in Roorkee. Among the major tasks of Swachh Bharat, sewage treatment is one of the easiest to solve. The technology is adequate, not too expensive, and one can get reasonably good quality of water fit to be discharged into the environment. There are three widely-used technologies: the Membrane Bioreactor, the Moving Bed Biofilm Reactor and the Sequencing Batch Reactor.

The major problems are in the expense, design and management of sewage treatment plants. There are problems in the choice of appropriate technology, as the Kerala example shows. When the population is thin and the water table low, even pit latrines are good choices. Large centralised plants work well in cities, but at a cost. Modern sewage treatment plants work only on electricity; finding enough power is an additional problem.

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R&D institutions in India are busy developing technology for some uniquely Indian conditions. The zero discharge toilets from IIT Kanpur are being tried in some places around the country; this does not require power, motors or sewerage lines, as it separates the liquid in the sewage for reuse in flushing. It is simple enough to be used in villages and small communities. IIT Madras is developing a small sewage treatment plant that can be run off the grid. Water from the system, instead of seeping to the ground, will be pumped up for flushing again.

"If you replace the septic tank with this system," says Ligy Philip, IIT Madras professor of civil engineering, "contamination of ground water can be avoided."

AIR POLLUTION

Delhi tops the charts in the world in terms of air pollution, but the city has good company. Out of the 20 most polluted cities in the world, 13 are in North India, many of them not far from Delhi. Vehicular traffic is considered the main reason behind air pollution in Delhi, but are there other equally important factors as well? Look at a completely different set of data: Cancer rates in Punjab. At 90 patients for every 1 lakh people, this state has higher cancer rates than the national average.

Pesticide exposure is often blamed as the primary cause, but there are other hidden factors as well. For example, in the past few decades, Punjab farmers have been burning crop residue like never before. This increases the amount of particles and carcinogens in the

atmosphere, and they travel long distances.

"We have found high concentrations of carcinogens like benzene," says Vinayak Sinha, assistant professor of earth sciences at the Indian Institute of Science Education and Research in Mohali. Vehicular pollution is high enough in Indian cities, but burning of waste — crop residue as well as municipal solid waste — is another important factor behind the high levels of pollution in Delhi and other nearby cities. And neither shows any signs of abating. Emission norms for vehicles are improving rapidly, and Bharat V norms are quite stringent even by developed country standards. And yet, they would do little to reduce pollution unless other factors improve simultaneously: phasing out of old vehicles, improving traffic flow, and stopping of burning waste.

Burning of waste is a national problem. As the accompanying article shows, there are no easy solutions to solid waste accumulation. Poor traffic flow contributes to pollution in cities. In a study at the Indian Institute of Technology in Guwahati, professor of Civil Engineering Sharad Gokhale found significant improvements in pollution during free flowing traffic, and also significant differences depending on the proportion of petrol and

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Air pollution

Some facts

13 of the world's most 20 polluted world cities are in India

Delhi is the world's most polluted city

Every Indian loses at least 3 years due to pollution

Air pollution is the fifth leading cause of death in India

Pollution cuts crop yields by 50% in some places

TECHNOLOGY NOT THE KEY FACTOR

Reducing diesel vehicles can cut particulate matter emissions

Phasing out older vehicles can reduce emissions significantly

Bharat V emission norms mandate particulate matter filters that will cut pollution further

Burning of plant and plastic waste can have an immediate benefit

Sources: Government of India, World Bank, IIT Guwahati, a study in Economic and Political Weekly, Ranjith Annepu

diesel vehicles.

"We can reduce 15-20% of pollution in cities by mere traffic flow management," says Gokhale. As far as emissions from cars are concerned, improving fuel and vehicle emission standards will reduce pollution significantly. There is a big leap technologically from Bharat IV to Bharat V, and vehicles are improving their performance not just through engine improvements. It may take some time for Bharat V norms to be implemented, but they are a considerable advance over Bharat IV, which itself has not been implemented throughout the country.

For example, Bharat V norms demand the use of diesel particulate matter filters and require the use of direct injection of diesel. Cars are in any case becoming lighter and thus more fuel efficient. The current Budget has some measures encouraging electric vehicles, but the country's electric grid may not be able to handle a large population of electric cars. Fuel cell cars might come one day, but not in the foreseeable future.

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"Unless there is a breakthrough soon, the internal combustion engine will be predominant for another 15 years," says CV Raman, executive director of engineering and R&D for Maruti Suzuki.

SOLID WASTE

A large metropolis is a good place to study the magnitude of the problems of solid waste management in Indian cities. In Bengaluru, now often called the garbage city, lorries collect and carry solid waste far out from the city and dump or bury them in open grounds. These malodorous landfills and dump yards emit toxic gases and pollute the ground water. The city is still looking for good places to dump wastes.

Sometimes, for no apparent reason, garbage dumps sprout by the side of the streets. Experts cite many reasons why Bengaluru has such a crisis of waste accumulation. For example, lorry owners have process contracts but are just transporting the waste. Sound regulations and management could reduce the crisis in the city a bit, but the big problem would remain and not go away: there is no technology that can handle such a heterogeneous collection of wastes.

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"India needs extensive R&D with high investment to solve the solid waste problem," says Absar Ahmad Kazmi, professor of civil engineering at the Indian Institute of Technology in Roorkee. Kazmi has been researching on solid waste management, and is convinced that it is a most difficult problem to solve. Indian waste differs in composition from place to place, and no one in the world has found a technology appropriate to handle any kind of waste. No expert considers landfills a solution. Recycling is hard, as sorting is not done at source and mechanised sorting is inadequate and expensive.

"The only way out is decentralised handling of waste with segregation at source," says Kumar Suba Rao, founder of Aruna Green Ventures, a company that makes products to recycle organic waste. Kumar, who had worked in the waste management industry in Canada for over two decades, feels segregation at source has to be implemented through legislation.

Some facts:	70 million tonnes per year Solid waste generated in urban India	920 tonnes Waste generation in the next ten years
COMPOSITION OF INDIA'S SOLID WASTE: 51% organic matter (food waste, vegetable and fruits) 17.5% recyclables (plastic, paper, metal) 31% inert (stone, dirt, ash)	CONVERTING RESOURCE INTO POISON: Landfills generate toxic fumes and carbon dioxide Composting of mixed waste introduces toxic metals into the food chain Burning plastics and other waste exposes people directly to dioxins and furans, among toxic compounds on earth Burning also produces particulate matter and other pollutants Millions of tonnes of plastic enter the oceans and degrade, coming back to human food chain through fish	TECHNOLOGY STILL IMPERFECT BUT IMPI Landfills can be mined and metals and minerals recovered Gas from landfills can be burned for energy Sorting technology improving with optical recognition Waste-to-energy plants can tackle non-recyclable term, but require good pollution control devices In the future, engineered microorganisms will take over

About half of Indian waste is organic, and hence can be used for composting and as manure. Plastics, although a small part of the waste, do present a problem as they do not degrade. Scientists have found bacteria that can degrade plastics, but no such plant exists even on a small scale.

One day, synthetic biologists could engineer an organism capable of converting plastic into harmless constituents, but at the moment there are only two ways to handle them: recycling or incineration. In recent times, incineration in a Waste to Energy (WTE) plant is being touted around the world as a solution to handling waste. Many environmentalists criticise this procedure; that it creates too many nanoparticles or that it gives an incentive to produce more waste. However, WTE has its champions too, who say that good pollution control measures can reduce the nanoparticle levels to well below that of coal plants.

"Waste-to-energy plants can be considered a good medium-term solution," says Ranjith Annepu, a solid waste management consultant. "Its main goal is to destroy waste and not to sell power." In the Indian context, however, the process is not easy to implement. Pollution control devices are expensive. The plant may not recover enough money through selling power as Indian waste does burn well and produce high amounts of energy.

And yet, since there is no good alternative at the moment, large cities have no option but to use them at a high cost. Reduce the waste we generate, and the plant becomes more expensive to run. Increase the amount of waste, and we spend more money on pollution control. No wonder solid waste is a hard problem to

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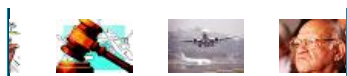
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