"WHAT WORKS"

Leading Practices Catalogue from Municipalities and Municipal Corporations of Gujarat

For Performance Assessment System Project

June 2011

Prepared for
CEPT University, Ahmedabad

Compiled By
Urban Management Centre

URBAN MANAGEMENT CENTRE
in collaboration with ICMA

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UMC: The Urban Management Centre is a not-for-profit organization based in Ahmedabad, Gujarat, working towards professionalizing urban management in India and South Asia. UMC provides technical assistance and support to Indian state local government associations and implements programs that work towards improvement in cities by partnering with city governments. UMC builds and enhances the capacity of city governments by providing much-needed expertise and ready access to innovations on good governance implemented in India and abroad. UMC is a legacy organization of International City/County Management Association (ICMA) and hence is also known as ICMA-South Asia. More details are available on www.umcasia.org

PAS, a five-year action research project, has been initiated by CEPT University with funding support from Bill and Melinda Gates Foundation. PAS aims to develop better information on water and sanitation performance at the local level to be used to improve the financial viability, quality and reliability of services. It will use performance indicators and benchmarks on water and sanitation services in all the 400-plus urban areas of Gujarat and Maharashtra. UMC and All India Institute of Local Self Government are CEPT's project partners in Gujarat and Maharashtra respectively. More details are available on www.pas.org.in

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Introduction to the PAS Program

Access to water and sanitation services in Urban India is widespread, but little is known about the quality and level of service, and coverage of the poor households. For new investments in the sector to be effective, it is important to assess the performance of the existing system and ensure its sustainability and reach for the poor and unserved.

CEPT University and Urban Management Centre (UMC/ICMA-SA) have undertaken the PAS program with the aim to develop better information on water and sanitation performance at the local level. This in turn will be used by the state and local governments for extending services to all, strive for financial viability and improve reliability and quality of services. The research will focus on the use of performance indicators and benchmarks to facilitate consistent reporting, monitoring, planning, budgeting, and investing in water and sanitation services in all urban areas of Gujarat. Lessons from the project will be disseminated to other states and at the national level.

The PAS envisaged in this project includes: **Performance Measurement, Performance Monitoring, and Performance Improvement**.

The key project objectives of the **five year project** are**:**

- **Objective 1:** To develop and implement **a performance measurement system** for regular and reliable UWSS information
- **Objective 2:** To design and share results with ULBs, state government agencies, other stakeholders and media through **performance monitoring and dissemination system** for use in decision making, providing incentives and influencing demand
- **Objective 3:** To facilitate development of **performance improvement plans** by urban local bodies with support from state government, NGOs and the private sector

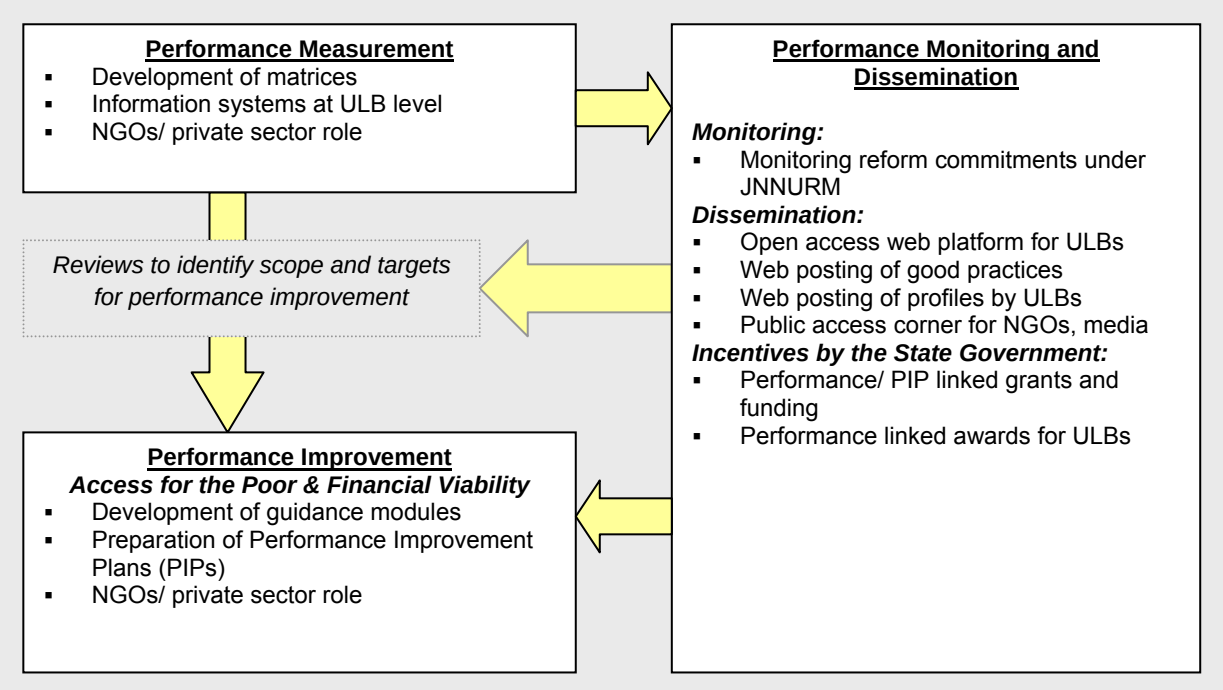
The performance measurement refers to development and implementation of measurement metrics. According to official information, 90% of households in urban India have “access” to water and 70% households have “access” to sanitation.[1] However, there is no reliable information on quality and level of services. It is also not known whether the urban poor households have adequate WSS coverage. Some studies[2] suggest that in slum settlements both the access and quality of service are very low, especially for sanitation. Information on intra-city distribution of services, quality of water, non-revenue water, costs of service provision, service level and functionality of metering, etc. is also not available on a regular basis. Such information is critical for allocation of public resources, improving efficiency of service delivery and increasing access for the urban poor communities.

The indicators for performance measurement will be developed through studies and stakeholder consultations at state level. Indicators for access and coverage, quality of services, efficiency, financial viability, customer orientation, and equity have been developed. Unlike previous attempts that have been one-off studies in a few cities, this project intends to cover all urban areas in the two states. It will develop a system of measurement that is more frequent and ‘in-sync’ with other data collection processes at local and state level. It also focuses on a process that will have active participation of all stakeholders to generate ‘ownership’ and ‘buy-in’ at the state and local level. Pilot studies will be done in selected cities before finalizing the indicators and data checklists. Over the five year period, the project will enable direct self-assessment by urban local bodies through training support.

The performance monitoring will include setting up appropriate systems at state level, where annual and real-time information will be available, and detailed analysis of indicators, developing benchmarks, and documenting good practices will be done. A dedicated web platform will be set up in each state to host this information with access by Urban Local Bodies (ULBs) and other stakeholders.

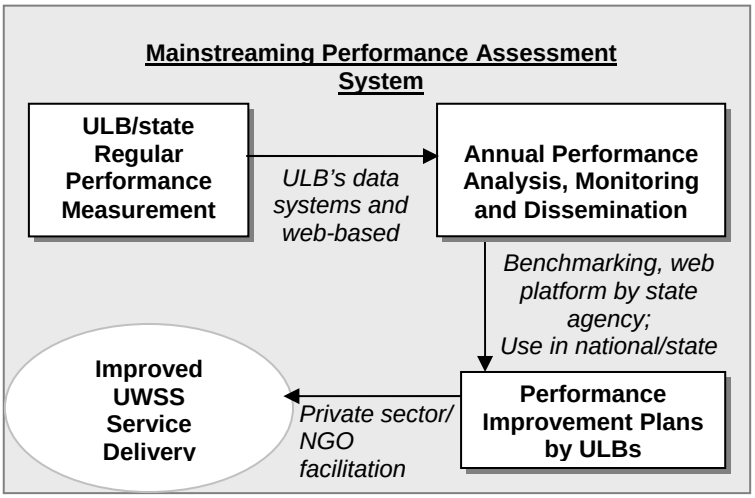
[1] WHO/UNICEF Joint Monitoring Programme, 2004. “Meeting the MDG drinking water and sanitation target: a mid-term assessment of progress.” WHO and United Nations Children’s Fund.
[2] See for example analysis using information from the Census of India and NSS in Mehta S 2008 “Poverty in Urban Slums of Gujarat.”. Presentation at CEPT. Mimeo.

Comparative analysis will be made available to all ULBs to enable them to track their performance with peers. The performance monitoring will be also linked to the performance linked grants, monitoring performance on reform commitments under the JNNURM and possible rewards for better performing local governments.



The performance improvement relates to the use of performance indicators to improve service levels. The project will provide support to local governments to develop performance improvement plans for reaching the poor and unserved, and increasing financial viability (from reduction of costs, tariff reforms and increased collection of dues).

The PAS will be mainstreamed in state and local government administration by aligning the information collection, analysis and use in the ULB and state government systems, and through 'self-assessment' of performance measurement in later years of the project. Use of PAS by private sector and civil society groups will be encouraged. The impact of PAS on improved service delivery will be measured in terms of improved equity (e.g. better coverage for urban poor), efficiency (e.g. reduced costs) and financial sustainability (e.g. better operating ratio).



Results and learning from the project will also be disseminated nationally and internationally. The information can be potentially integrated within international utility benchmarking frameworks (e.g. IB-NET), to raise the quality of urban utility benchmarking, particularly related to service delivery for the poor.

Introduction to "What Works", Leading Practices Catalogue

It is realized that due to the rapidly changing urban environment, information exchange and communication amongst urban managers and continuing education are critically important tools for improving urban governance. Our experience of working with urban local bodies have shown that best practices documentation and its transfer between peers is an effective mechanism for sharing innovations and lauding the efforts made by city managers to improve the quality of life in their communities.

As part of the efforts to improve water-sanitation services in cities of Gujarat, there is an immense need for building the capacity of urban local bodies and support the development of skilled, professional city managers.

Urban Management Centre (UMC/ICMA-SA) teams have been visiting all 166 urban local bodies for data collection, pertaining to the water supply, sanitation (toilets and sewerage), solid waste management (SWM) and storm water drainage services.

After the first round of data collection in year 2009-10 (data for year 2008-09 was collected), UMC team has compiled the data and summarized the indicator values in tabulation form for each class of urban local bodies. During interaction with staff of ULBs, the teams came across leading practices and innovations that cities have undertaken. All these practices have been documented in a standard format and have been brought to the reader as a catalogue of ideas.
The objective is to promote such ideas, processes and practices through a wider readership for knowledge up-gradation and learning. Hopingly, this would develop insights, and encourage replication of such strategies that lead to improved performance indicators in water and sanitation sector in ULBs.

UMC/ICMA-SA has worked with the basic understanding of the criteria for categorizing a practice as a 'Leading Practice'. We are not trying to sit in judgment, but we hope this kind of compilation would provide a ready reference for any City Manager to undertake innovations in his/her community. That is why we call it a catalogue. It is an album to choose from.

The catalogue deals with leading practices in water and sanitation sector as discussed above, and in a detailed format, friendly enough for busy city practioners on the field.

Documentation of urban innovation should be and is a continuous process. Also any initiative is a dynamic process and it is constantly evolving. What we are presenting in a catalogue is "dated". One would be required to re-visit them and understand how differences are brought about in the community. Also one needs to discuss with the community whether they have perceived those innovations and are appropriate or acceptable to them time to time.

This is the fourth catalogue being compiled by UMC/ICMA-SA since UMC's inception. UMC has been documenting Best, Good, Leading Practices since 1999. Such practices are then supported for its transfer to other cities which are ready for change.

Acknowledgements

We at Urban Management Centre/ICMA-SA experience a deep sense of satisfaction in bringing out this volume on leading practices in water and sanitation sector in urban local bodies of Gujarat. The publication is part of the ongoing Performance Assessment System (PAS) program Gujarat with support from CEPT University, Ahmedabad.

The entire effort is an outcome of field visits during the year 2009-10 and 2010-11, and interaction with service related heads of various departments such as Water Supply, Sewerage/Drainage, SWM, Taxation and that of Accounts.

It is obvious that publication of this volume would not have been possible without the excellent cooperation and unstinted support from the Urban Development Department, Govt. of Gujarat, Gujarat Municipal Finance Board, Directorate of Municipalities, Gujarat Urban Development Company, Municipal Commissioners, Chief Officers, Departmental Heads and Technical staff of all ULBs visited by us.

We therefore, take this opportunity to express our gratitude to all concerned, with the hope that this volume will promote its objective of creating awareness, peer-to-peer learning and replication wherever possible.

We also would like to thank the Bill and Melinda Gates Foundation for supporting the PAS Program.

Manvita Baradi,
Director,
Urban Management Centre/ ICMA South Asia

Meghna Malhotra,
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Urban Management Centre/ ICMA South Asia

Table of Contents

ABBREVIATIONS

APFC: Automatic Power Factor Correction
BOO: Build, Own, Operate
CASP: Conventional Activated Sludge Process
CBO: Community Based Organization
CCC: City Civic Center
CDM: Clean Development Mechanism
CER: Certified Emission Reduction
CFL: Compact Fluorescent Lamp
CISF: Central Industrial Security Force
CPCB: Central Pollution Control Board
GEB: Gujarat Electricity Board
GIDC: Gujarat Industrial Development Corporation
GoI: Government of India
GSFC: Gujarat State Financial Corporation
GUDC: Gujarat Urban Development Corporation
HBEPL: Hanjer Biotech Energies Pvt. Ltd.
HGV: Heavy Goods Vehicle
HRD: Human Resource Development
ICT: Information Communication Technology
IEC: Information Education Communication
kWh/ML: kilowatt hour per mega litre
kWh: kilowatt hour
LDP: Low Density Polypropylene
LGV: Large Goods Vehicle
LIC: Life Insurance Corporation
MGD: Million gallons per day
MGV: Medium Goods Vehicle
MIS: Management Information System
MLD: Million litres per day
MNES: Ministry of Non-Conventional Energy Sources
MSL: Mean Sea Level

MSW: Municipal Solid Waste

MWe: Megawatt electrical

NGO: Non Government Organisation

NOC: No Objection Certificate

NRV: Non-Return Valves

O&M: Operation and Maintenance

OWC: Organic Waste Convertor

PAC: Poly Aluminum Chloride

PPP: Public Private Partnership

RDF: Refuse Derived Fuel

SCADA: Supervisory Control and Data Acquisition system

STP: Sewerage treatment plant

SWM: Solid waste management

TDS: Total Dissolved Solids

TOC: Total Organic Carbon

TPD: Tons per day

TPM: Time, Place and Movement

UASB: Up-Flow Anaerobic Sludge Blanket Reactor

ULB: Urban Local Body

UNFCC: United Nations Framework Convention on Climate Change

WDS: Water distribution system

WTP: Water Treatment Plant

Leading Practices

Rajkot Municipal Corporation

Improved solid waste management

Rajkot City Profile

Rajkot city, covering an area of 94 sq km, is the fourth largest city in the state of Gujarat. It ranks as the 28th largest urban agglomeration in India. Rajkot is also the administrative headquarters of Rajkot District, situated on the banks of the Aji River and the Nyari River. Rajkot was the capital of erstwhile Saurashtra state from April 1948 to October 1956 before getting merged in bilingual Bombay State on November 1, 1956. It was merged into Gujarat State from bilingual Bombay state on May 1, 1960.

The city contributes to the economy of the state with heavy and small scale industries under the patronage of Gujarat Industrial Development Corporation (GIDC) and Gujarat State Financial Corporation (GSFC).

Rajkot city is famous for its jewellery market and hosts several small scale manufacturing industries. It has one of the largest gold markets in India. Some of the industrial products for which Rajkot is known include bearings, diesel engines, kitchen knives and other cutting appliances, watch parts (cases & bracelets), automotive parts, forging industry, casting industry, machine tools, share market and software development.

Over the last few years, it has started to play an increasingly important role in the complex supply chains of many global engineering companies that make products such as electric motors, automobiles, machine tools, bearings, etc. There are about 500 foundry units in Rajkot. It is also growing in software industries and ITeS sectors[3].

Geographical location and connectivity

Rajkot is located about 200 km west of Ahmedabad. It is well connected by air, road and rail to all major cities of the country.

Profile of Rajkot Municipal Corporation

Rajkot Municipal Corporation (RMC) was established in 1973. The city has 23 administrative wards supporting a current, estimated population of 14,36,700 (Provisional data of Census 2011). There are 72 elected municipal corporators.

Rajkot has been one of the most progressive cities and has been undertaking innovations and incorporating newer management approaches to improve its service delivery. It was one of the first ULBs in India to initiate PPP in various sectors.

[3] Excerpted from Rajkot, Wikipedia, 2010

Population (Census 2011, Provisional)	14,36,700
Population (Census 2001)	10,03,315
Number of households	2,64,400
% of slum population (Census 2011)	na
% of slum population (Census 2001)	17%
Number of wards	23
Area (sq.km)	104.86 sq km
Annual budget (2009-10) Rs million	3905.22 (actual)
Contact details of municipal corporation	Municipal Commissioner, Rajkot Municipal Corporation Dhebharbhai Road, Rajkot Tel: +91-281-2239973 Fax:+91-281-2224258, e-mail : mc_rmc@rmc.gov.in www: www.rmc.gov.in

1 IMPROVED SOLID WASTE MANAGEMENT

Category: *Solid Waste Management*

Information provided by: *NR Parmar (Executive Environment Engineer), Maulik Ganatra (Assistant Environment Engineer), Digvijaysinh Tuvar (Deputy Environment Engineer), RMC*

Abstract

Previously, Rajkot was challenged by litter strewn across the city. By 2010, it had secured the ninth rank in a national sanitation survey conducted by the Ministry of Urban Development (MoUD), Government of India, under the National Urban Sanitation Policy.

The approach towards making the city clean has been an integrated one—including improving efficiencies in waste collection, transportation, treatment and disposal and imposing administrative charges as penalty.

While ensuring that no stone is left unturned to make the city clean, RMC has also focused on upliftment of the lower strata of the society. The corporation roped rag pickers into its door-to-door waste collection service. This not only provided them a life of dignity, but also improved their livelihood. RMC too has benefitted from this initiative as it reduced its expenses towards the service.

To adhere to the MSW Rules 2000 and the guidelines therein, RMC established the MSW processing plant on a Build, Own, Operate (BOO) basis. It leased out its land to a private sector company that was given the responsibility to establish the plant and operate it. The company is also responsible for marketing and sale of recovered products, by-products and co-products. The company produces and sells Refuse Derived Fuel (RDF), segregated recyclable material and eco-bricks made out of crushed sand and flyash. The revenue so generated goes to the company.

It was due to these integrated initiatives by RMC that it was ranked second among municipal corporations and Class A cities in Gujarat and ninth in India under the national sanitation survey conducted by MoUD.

Situation before the Initiative

RMC collects a total of 370 TPD of MSW from all wards of the city. Door-to-door waste collection in Rajkot was started in 2002. However, the service delivery was not up to the mark. It was carried out by RMC's staff until 2008. At that time, the door-to-door collection coverage was 65 percent. The establishment expense incurred by RMC for the year 2007-08 was Rs 210 million. Bio-medical waste was being disposed along with MSW. Waste generated by construction activities was not being disposed properly. Roads were littered with garbage.

The MSW was transported to an open dumpsite at Manda Dungar, 8 km away from the city. The site was not designed as a scientifically engineered, sanitary landfill as per MSW Rules 2000. It was a mixed waste collection — not segregated into recyclables, bio-degradable and inert residual material. Some additional drawbacks of any such practice are foul odour, increasing number of fire incidents, and ground water contamination due to the open dumping.

Implementing MSW Rules 2000 would also mean establishing waste treatment and processing

plant, apart from the required landfill. This requires heavy capital investment; moreover, the experience of such plants across India is not encouraging — high initial investment, high operating and maintenance cost, and difficulties in establishing a market for the by-products such as compost manure, pellets, etc. towards revenue generation.

Initiative

For improving door-to-door collection of waste, rag pickers were organized into *sakhi mandals*. Night sweeping was introduced as an additional shift. A mobile squad was formed to ensure that there is no littering on the roads; fines were introduced. Both, construction debris collection and biomedical waste collection have been taken care of.

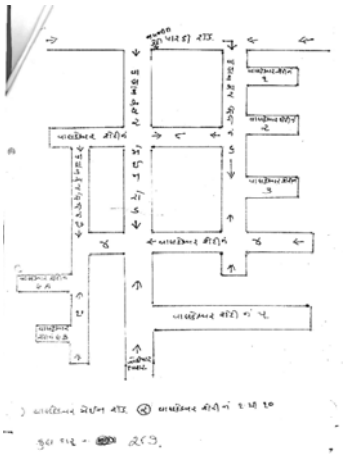
Sakhi collecting waste

RMC established the MSW processing plant on a BOO basis. It leased out its land to a private sector company that was given the responsibility to establish and operate the plant. The company is also responsible for marketing and sale of recovered products, by-products and co-products.

Implementation Strategies

<u>Door-to-door waste collection</u>

The idea of involving rag pickers for garbage collection came in the year 2008. RMC approached rag pickers in the city. These women were asked to form self-help groups. They were registered as *sakhi mandals* with the corporation and were given training in door-to-door waste collection. The *sakhi mandals* were operationalized in March 2008.



A route map for one of the sakhi mandals

Each *sakhi mandal* comprises nine *sakhis* and a leader. Currently, there are 94 such *sakhi mandals*, of which 86 have been allotted the work of door-to-door garbage collection. As per the rules laid down, each *sakhi* can collect garbage from a maximum of 300 houses or shops. Thus, each *sakhi mandal* can collect garbage from a maximum of 2,700 houses/shops. Almost 0.207 million households have been covered under the door-to-door collection, indicating 98 percent coverage. This coverage does not include vacant or closed properties. According to RMC authorities, the rest of the areas are not easily accessible for door-to-door garbage collection.

RMC provides wheel-barrows to the *sakhis*, while the apron, whistle, I-card, etc. are provided by the *sakhi mandals*. Route maps have been prepared by the ward supervisors. The beats have been charted out, and *sakhi mandals* operate accordingly.

The sakhis collect waste between 7 am and 11 am every morning. While collecting waste, they segregate the recyclable matter such as plastic and paper, and later sell it. This way, while they earn extra money, the quantum of waste eventually going to the processing plant is reduced.

Road sweeping

Rajkot wakes up to a clean city. This has been made possible by the night sweeping carried out on 48 major roads i.e. total 80 km of length. The corporation's SWM staff that have been relieved of the task of door-to-door waste collection have been given the task of sweeping.
Roads are also swept in the mornings and afternoons. Vegetable markets are also cleaned up at night through scraping and brushing.

Checking of littering on roads

The mobile squad was formed in June 2008 to ensure that there is no littering on the roads. The team comprises two sanitary sub inspectors, a driver and 5 labourers per shift. They move around the city in a jeep with a tipper, and are accompanied by a lifter that lifts garbage dumped on the streets.
Administrative charges are collected from the defaulters. By the end of April 2011, 18,585 cases had been registered and Rs 5.056 million had been collected as administrative charges. The charge is levied based on the expense incurred by RMC in collecting the waste from that point.
6,000 dustbins have been distributed to shopkeepers in commercial areas so that they would not throw the waste on the streets. Three mobile garbage collection vans, one for each zone, have been pushed into action to collect waste from problem areas. The person or group responsible for littering the area has to pay the applicable administrative charges.

Approximately 4,500 waste bins have been installed till date at public places at regular intervals. 10,000 more have been planned to cover approximately 150 streets.

Construction debris collection

The debris squad was formed in June 2008 to move about the city and collect construction waste from sites. The team comprises one sanitary sub inspector, two drivers and two labourers per shift. This team has one loader (JCB) and one tipper. It takes administrative charges from the responsible person at the site. The construction waste in turn is used to fill up low lying and water-logged areas. Till April 2011, administrative charges amounting to Rs 0.216 million have been levied against lifting of construction waste.

Bio-medical waste disposal

License for scientific disposal of bio-medical waste has been given to a private agency. This agency arranges for waste to be collected from hospitals and clinics. RMC conducts regular drives to check if the hospitals and clinics are properly disposing of the waste. If any institution or individual is found guilty of mixing bio-medical waste with municipal solid waste, administrative charge of Rs 5,000 is slapped on the offender. So far, Rs 0.54 million has been collected as administrative charges for improper disposal of bio-medical waste.

Integrated MSW Processing in PPP Mode

To adhere to the MSW Rules 2000 and the guidelines therein, RMC placed an advertisement in local newspaper inviting interested parties to install an integrated solid waste management plant. After scrutinizing all proposals received, Hanjer Biotech Energies Pvt. Ltd. (HBEPL) was

short-listed for further discussions. After a series of detailed technical discussions and presentations, the suitability of HBEPL- was ascertained.
The Standing Committee of RMC passed a resolution in June 2003 to confirm the contract for the establishment of the waste processing plant. It was decided that RMC and HBEPL would establish the plant on the BOO basis. The plant became fully operational in April 2006.
RMC acquired 100 acres of land for the purpose of development of a sanitary landfill and waste processing plant on lease of 200 years. Being a wasteland, it could be utilized for construction of a landfill site.
Of the 100 acres, 30 acres was given to HBEPL for establishing the waste processing plant on a lease of Rs 1 per sq m per year. In other words, the land was leased to HBEPL for Rs. 4048 per acre per year. The construction work for plant started on 7th June, 2005.

Salient features of BOO Agreement

Role of HBEPL

- Lease rental for land at the rate at Rs 1 per sq m
- Installation and commissioning of waste conversion and processing plant
- Penalty of Rs 1 million in case of failure to set up plant
- Liability of the equipment involved in waste conversion/processing to be with HBEPL
- All products as output of the waste conversion and processing to be the assets of HBEPL
- HBEPL would be responsible for marketing and sale of recovered products, by-products, co-products and all the revenue generated would go to HBEPL.

Role of RMC

- To lease 30 acres of land for setting up the processing plant and warehouse facilities for an initial period of seven years
- No financial assistance from RMC to HBEPL
- To deliver 300 metric tons of MSW per day to the plant
- To provide utilities like access road up to entrance of premises of plant, water supply of up to 0.2 million litres per day, electricity power line (user charges for such utilities to be borne by HBEPL)
- Proper disposal of mixed, heterogeneous rejected waste not required by the waste processing plant.

The Process

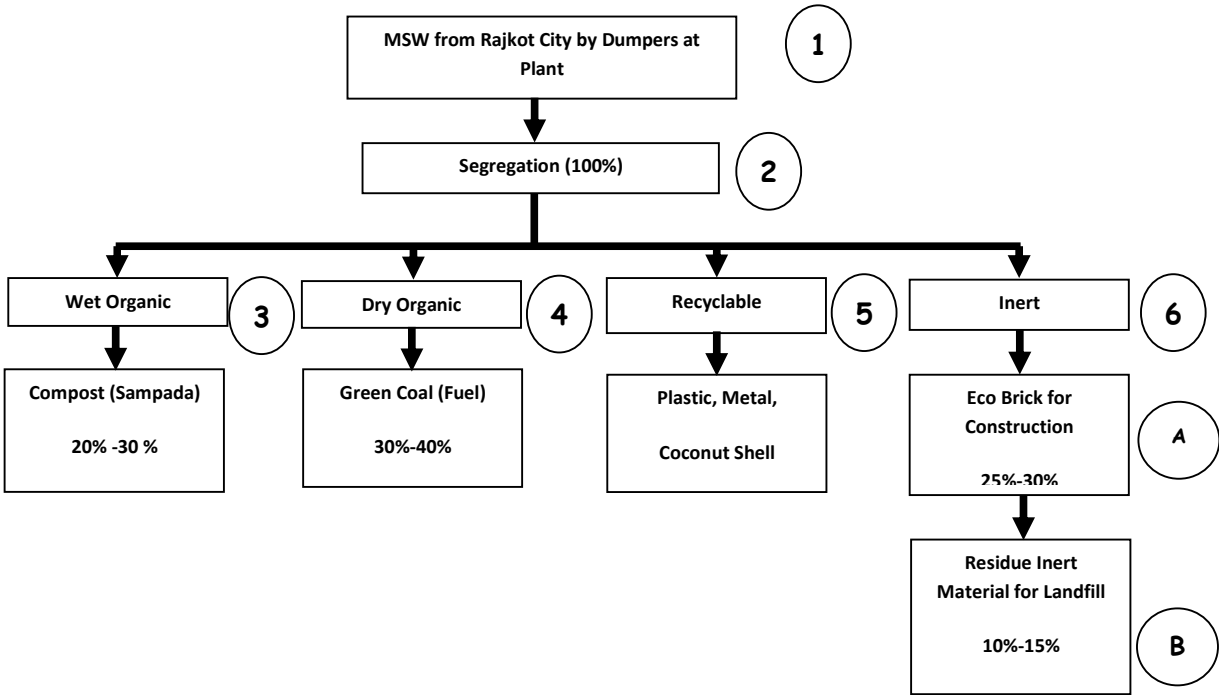
Collection and Transportation: Waste from the city is brought in dumpers and taken to the waste processing plant where it is weighed and taken for stages of processing as shown in the diagram.
Segregation: The waste is then segregated into wet organic waste, dry organic waste, recyclable waste (plastic, metal, etc.) and inert materials.

Wet Organic Waste: Gets treated and is transformed into organic compost

Dry Organic Waste: Utilized for making green coal or fluff as it is commercially called and is used as a fuel for industrial processes.

Recyclable Waste: Fifth stage of entire process is segregation of recyclable waste like rubber, metal, plastic which has economic importance in the recyclable junk market.

Inert Materials**:** HBEPL utilizes fine grit and inert material (almost 20-35 percent of total inert material) for making briquettes by mixing it with fly ash. 10-15 percent of total waste goes to sanitary landfill site.



Results and Impact

- Prior to the *sakhi mandal* intiative, rag-pickers were an unorganized group. They did not have any fixed monthly income. Post formation of *sakhi mandals*, the women have got employment and get regular income every month. They can avail of government schemes aimed at social upliftment. This has given them financial as well as social security. The initiative has facilitated employment for 860 women. Each member gets Rs 10 per house per month. So if she covers 300 houses, she earns Rs 3,000. Besides, the women sell the recyclable waste from the waste collected and earn approximately Rs 1,500 from this exercise.
- Hiring *sakhi mandal*s has been the most cost-effective solution for RMC. The corporation currently spends Rs 2.07 million per month on *sakhi mandal* as compared to Rs 11.9 million that it would have spent had it hired its own staff to the work. Even the option of outsourcing the task to private contractors would have entailed expenditure of Rs 2.9 million.
- The RMC staff members who used to collect garbage earlier were handed the task of extended street sweeping and night sweeping. This increased the sweeping efficiency.
- Littering has been reduced as waste is collected from the doorstep every day.
- Requirement of closed containers has been reduced as there is daily collection and transportation of waste from secondary points to the processing plant.
- With the *sakhis* segregating plastic waste, stray cattle are prevented from eating it.

"Earlier, our income was not fixed. However, now that we have fixed jobs, we can rest assured of fixed income at the end of the month. Even if we are to deduct the amount spent on commutation to our place of work, we can have a decent saving."

- *a sakhi*

- As recyclable waste is removed from the total waste, it reduces the tonnage to be transported to compost facilities.
- Because of the integrated municipal solid waste processing plant, the quantity of inert residue that has to be sent to the landfill site is only about 20 percent. A number of products are manufactured at the processing site, including manure, eco bricks, plastic products, etc. RMC also saves on the capital and operational expenditure on processing of waste.
- Mobile squad presence has given a message to citizens that RMC is serious about the task of maintaining a clean city.

The Integrated Waste Processing Plant of RMC, operated on BOO basis, is the first of its kind which utilizes nearly 85-90 percent of bio-degradable waste and leaves behind only 10-15 percent of total waste as rejects that go to landfill. This way the landfill has a longer life.

The results have been very encouraging. The entire waste of 300 MT of MSW is processed into:

- ✓ Bio Fertilizer : 40 MT/day
- ✓ Fluff (Green Coal) : 70 MT
- ✓ Eco – bricks : 15,000 nos.
- ✓ Recyclable : plastic metals and others

The production costs of by-products are compatible with their conventional counterparts. Initial results are very encouraging and there are many takers for the by-products of the plant.

Bio Fertilizer

A sample container of 18,000 kg of bio-fertilizer was exported to Oman in October 2005. Now, the entire compost is being sold to corporate clients including Reliance Industries at Jamnagar (Gujarat) and Reliance Energy at Dahanu (Maharashtra). Compost is also being used as appropriate mix with chemical fertilizers. This application has been approved by the Gujarat State Fertilizer Corporation as having advantages of reducing the costs and increasing the crop output. It has been reported that the crop yield increases by approximately 1.5 times.

Fluff (Green Coal)

The dry organic waste is compressed into fuel fluff. Its calorific value is very high compared to other sources of fuel. The production cost of the fluff is also economical. It is just Rs 1.40 per kg and hence is a much cheaper option than other conventional fuels like coal or wood. The table below shows a comparative analysis between calorific values and costs of fluff and various conventional sources of fuel.

Source	**Calorific value kcal/kg**	**Cost per kg**
Coal	3600 – 4080	Rs 9
Wood	4060 – 6960	Rs 7 to Rs 10
Fluff (Green Coal)	**3700 – 4200**	**Rs 1.4**

The fluff has high demand in paper and cement industry due to its high calorific value and economical costing. The fluff could also be used in combination of other sources of fuel like coal, wood, natural gas etc. Presently, the fluff is being sold to a cement factory at Kodinar, paper mills at Vapi and at Kuwadwa.

Eco Bricks

The eco bricks are utilized by HBEPL for construction work in their plant itself. The production cost of eco brick is Rs 1.10 per unit, while the cost for normal burnt brick is Rs 1.40 per unit.

RDF Processing Plant

The Integrated Waste Processing Plant has created a ripple in the region. It is reported by HBEPL that other municipal corporations like Bhavnagar Municipal Corporation and Jamnagar Municipal Corporation have also evinced keen interest in constructing the Integrated Waste Processing Plant in a manner similar to RMC.

Production of Eco-bricks

Lessons Learnt

Often in large cities, macro level institutional and management interventions are required, not only to improve services but to make the services environmentally, socially and financially viable.

SWM projects with private sector participation not only facilitate the inflow of private capital into civic services but also ensure sharing of risks. The ULB also benefits from the technical expertise of the private sector. The entry of a private sector player in the area of waste management category aptly demonstrates the power and potency of public-private collaborations to transform the ULB's civic services.

Sustainability

The door-to door collection initiative is a win-win situation for all the stakeholders—the *sakhi mandals*, RMC and the residents. The cost-effectiveness of the system makes this initiative sustainable. Other practices by RMC, including collection of waste and construction debris by mobile squad and debris squad respectively, privatization and scientific disposal of bio-medical waste are environmentally and financially sustainable.

The contract between RMC and the private sector player is for a period of seven years. Till now, most of the solid waste treatment plants had not met with success owing to non-availability of a market. The private sector company, HPEBL, has successfully developed a market for its end-products and hence this initiative is financially sustainable.

Treatment and processing of organic/wet garbage and production of alternative fuels from the inert substances left over after processing of MSW is an environmentally sustainable activity.

Transferability

Rajkot's initiatives are unique as well as replicable. A certain basic investment has to be made, in terms of time, money and energy, for bringing together and training workers from unorganized sector. Finding such manpower may also not be very difficult. Once the system is in place, the work will be much easier, efficient and satisfying for the ULB.

Forming separate squads may not be feasible for all the ULBs, most of which are already reeling under severe staff crunch. The least a ULB can do is to tighten its ropes and decide on action against offenders.

While RMC is a larger body and can initiate a number of practices simultaneously, the smaller ones can replicate some of the processes or customize them according to their resources and requirements.

Bhavnagar Municipal Corporation

Converting organic waste to manure

Promoting energy efficiency in water pumping

Leakage control methods for water conservation

Bhavnagar City Profile

Bhavnagar city is the administrative headquarters of Bhavnagar district. It is the fifth largest city of Gujarat and second largest in Saurashtra region. Bhavnagar is considered a city of education and culture, and is known as the cultural capital of Saurashtra.
The area of Bhavnagar city is 53.8 sq km, however with the present-day growth it is now around 90 sq km. About 20,000 persons comprise the floating population visiting the city daily.
Bhavnagar was one of the princely states with modern infrastructure facilities like water and sewer treatment plant (slow sand filter was constructed in 1920, sewer network in 1952, and the treatment plant in 1955). It also had model town planning schemes executed during the early period of 1945-55.

Bhavnagar is an important centre for the diamond cutting and polishing industry in Gujarat as well as India. Bhavnagar's commercial importance is enhanced by its proximity with the Gulf of Cambay and the Arabian Sea. It is the largest producer of salt, with 34,500 tons being produced annually in the district. Alang ship breaking yard is the biggest in the world, recycling about 50 percent of salvaged ships of the world. This has also helped developing ancillary industries. Certain sections of the society depend upon agriculture for their livelihood. The city is a prominent trading post for cotton products. There are 112 medium and large scale industries located in Bhavnagar district.

Geographical Location and Connectivity

Bhavnagar is situated 228 km south of the state capital Gandhinagar, and to the west of Gulf of (Cambay) Khambhat. It is located in the south eastern corner of the Saurashtra peninsula. Bhavnagar is one of the coastal towns falling under the category of intermediate port. It is situated on the Gulf of Cambay. The city is 210 km away from Ahmedabad and is well linked by state and national highway to the other areas of the country. It is a terminus railway station on western railway's meter-gauge line. The city is also connected through airport, seaport and a coastal highway. It is 15 m above mean sea level (MSL) and excess humid and saline condition is not experienced here. This situation has helped the flourishing of steel and other industries.

Profile of Bhavnagar Municipal Corporation

Bhavnagar Municipal Corporation (BMC) was formed in 1982. As per the provisional data available in 2011, the city has a current, estimated population of 28,77,961 spread across 21 wards. There are 66 elected municipal corporators.

The bulk of water supply for Bhavnagar city, 10 MLD, is procured from its own surface water sources viz. Gaurishanker and Khodiyar lakes. The city also draws ground water, although in meager quantities, from bores and wells located in different parts. People draw from these sources to meet with their increased demand, particularly those who do not have water connection facilities.

At present, BMC has three WTPs, at Takhteshwar, Chitra and Nilambaug. Together, the total treatment capacity is 105 MLD. The treatment process includes sedimentation, filtration, and

pre- and post-chlorination processes. The fourth WTP, at Tarsamiya, Bharatnagar Housing Board Colony, has been constructed and is currently under trial. With enhanced treatment capacity, BMC will now able to supply almost the entire water quantity with due treatment.

There are four Water Distribution Systems that supply drinking water to 82,111 water connections; the number includes 81,670 residential households, 120 industrial units and 200 public taps/stand posts (2008-09 data).

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Population (Census 2011 Provisional)	28,77,961
Population (Census 2001)	5,17,708
Number of households	98,396
% of slum population (Census 2011)	4.39
% of slum population (Census 2001)	15.81
Number of wards	21
Area (sq.kms)	53.30
Annual Budget (2009-10), million	1519.5
Contact details of municipal corporation	Municipal Commissioner Bhavnagar Municipal Corporation Sir Mangalsinh ji Road, Kalanala, Bhavnagar Tel: +91-278-2510532 Fax: +91-278-24228628 Email: info@bmc.gujarat.gov.in Website: www.bmc.gujarat.gov.in

2 CONVERTING ORGANIC WASTE TO MANURE

Category: *Solid Waste Management*
Information provided by: *Vikramsinh Gohil (Executive Engineer-Solid Waste Management), BMC*

Abstract

In 2009-10, Bhavnagar Municipal Corporation (BMC) installed an organic waste converter along with necessary infrastructure to convert organic waste into bio-manure and fuel pellets. The converter has been installed behind the vegetable market near Gangajaliya Talav. As a result of this initiative, not only are the surroundings cleaner but the ULB is also saving on transportation cost of the waste to the dumping site. The converter has given an eco-friendly solution to the city's organic waste problem and presents a win-win situation for both BMC and the external agency which is in charge of the compost shed. About 24 tons of organic waste is recycled everyday at this shed.

Situation before the initiative

The Gangajaliya Talav market, which is the main vegetable market in Bhavnagar, generates 11 tonnes of organic waste every day. Earlier, this waste was crudely dumped at a site in Kumbharwada, nearly 7 km from the city. It would get mixed with other municipal solid waste. The corporation incurred a lot of expenditure in collecting the waste and transporting it to the site. The waste posed health hazard to people. It also threatened to clog the sewerage network. The market was rapidly turning into a breeding ground for unhygienic conditions.

Initiative

The manufacturers of organic waste convertors (OWC), Excel Industries, are Bhavnagar-based. A proposal was made for installation of a unit free of charge as a gesture of goodwill towards BMC and the city of Bhavnagar. The machine was gifted by the company in 2008-09. BMC set up the infrastructure, including a shed to house the machine, behind the vegetable market near Gangajaliya Talav.

An organic waste converter

The converter can process organic waste between 25 kg and 125 kg per batch of 10-15 minutes, depending on the capacity of the model. The product is packed in bags of 50 kg.
Initially, BMC operated the OWC. It then hired *Sakhi Mandals* for some time. Currently, the work has been outsourced to Mahatma Gandhi Khadi Gram Udhyog Trust. The trust pays Rs 10,000 to BMC every month. The 'soil enricher', as the final product is called, is sold by the trust for Rs 2 per kg. Mostly, farmers purchase it.

The corporation has hired three sweepers to sweep the market, collect waste from shops and dump it at the OWC shed. Traders who have godowns on the market premises make private arrangement for the waste to be sent to the shed.

The Process:

Organic waste goes into converter → Homogenized odour-free output → Manure (soil enricher) ready in 21 days

The converter has a batch period of 10-15 minutes. Dry waste is shredded beforehand. Then, it is added to the machine. After two to three minutes, wet waste is introduced, followed by a microorganism culture. The output, a homogenous mixture, is odour-free. This mixture is then sprayed with slurry of microorganisms and kept aside in windrows for 21 days. The product at the end of this period can be used as soil enricher or converted into fuel pellets. The residue which is approximately 350 kg is sent to the processing plant.
The fuel pellets take 2-3 days of drying. The pH level of the product is 7, which is near neutral, and it has a bacterial count of $3x10^9$. The soil enricher can be used for kitchen gardening, landscaping and crop cultivation. Farmers are the major buyers of this product.

A vendor brings a basket of organic waste to dump at the OWC shed

The compost windrow that is left to dry for 21 days before it is packed

Results

Earlier, BMC had to transport the waste from the market to its designated dumping site nearly 7 km away. This would require total of 8-10 trips by two tractor trailers and one refuse compactor. At the rate of Rs 400 per trip, BMC incurred an expenditure of Rs 0.12 million per month for the transportation. With the installation of the OWC right behind the vegetable market, this cost was reduced. The agency sells the soil-enricher to farmers and pays BMC Rs 10,000 monthly. These benefits are besides a cleaner market area in Bhavnagar.

Lessons learnt

Spot-mechanization of composting process is a financially and environmentally viable proposition. It makes more sense to dispose of the organic waste at the spot of generation itself. BMC was able to save a lot on the cost of transportation after setting up the OWC shed at the market place.

Sustainability

The set-up does not entail major operation and maintenance costs. It is environmentally sustainable. Requirement of manpower is also less. The earnings from the sale of manure are nearly 50 percent higher than the expenditure involved, thus indicating that it is a profitable venture for the agency. BMC earns Rs 10,000 per month (Rs 0.12 million per annum) without being directly involved in the work. Outsourcing also means reduced burden on the local body.

Transferability

The success of BMC's initiative can provide inspiration to other cities.

- The organic waste converter is not very expensive. It costs approximately Rs 0.8 million to Rs 1 million.
- The process requires minimum labour attention. Not more than eight persons, including two-three operators depending on the number of shifts (one operator per shift), are required for the entire task.
- Very less space, i.e. 3m x 4m, is required to install the machine.

Put together, these factors make the initiative easy to replicate.

3 PROMOTING ENERGY EFFICIENCY IN WATER PUMPING

Category: *Energy Efficiency, Water Supply*
Information provided by: *MC Mehta (retd. City Engineer)*

Abstract

The pumps at various water works in Bhavnagar were low in efficiency, high on energy consumption and prone to frequent break downs. This led to high O & M costs. Any attempt at repairs would mean disruption of city's water supply. In this background, BMC managed to increase the pumping capacity so as to make available the desired quantum of water on time, and simultaneously reduce energy consumption, remove avoidable costs even while ensuring uninterrupted water supply to the citizens of Bhavnagar. Following a carefully planned strategy with strict adherence to the time table, BMC completed the project in just over three months and recovered the investment in about eight months.

Situation before the Initiative

Located about 55 km south-west of Bhavnagar city is an irrigation dam, the Shetrunji Dam, which is also a major source of the city's water supply. A pipeline of 1000 mm diameter brings around 60 MLD of water to the city through a two-stage pumping — one at the dam site and the other at Sarkadia, 10 km downstream of the dam. This 60 MLD of water was being pumped against pumping head of 100 m for 17 km before gravity flow occurs. A total of around 1200 HP of pumping machinery was deployed at each of the two pumping stations to carry out the pumping operation.[4]

The pumps at dam site and Sarkadia were of submersible type, which are low in efficiency and high on energy consumption. They were also prone to frequent break downs leading to heavy maintenance and repairs, and consequent high O & M costs. Breakdowns also caused uncertainty and sometimes, total disruption of city's water supply. The city lacked adequate storage facilities which could compensate such frequent disruption thus causing enormous inconvenience to the people at large. Local sources were just not adequate to substitute the water received from the Shetrunji dam, nor was the water received from other sources sufficient to fulfill the demand.

Initiative

In late 2004, BMC decided to take action and set the following objectives for itself:

- Increase the efficiency, i.e. the pumping capacity so as to make available the desired quantum of water on time
- Reduce energy consumption, reduce avoidable costs
- Ensure uninterrupted water supply to the citizens of Bhavnagar

[4] Based on PAS Visit Notes

Additionally, the required foundation work, non-return valves (NRV), Flange, Bends, Suction line, and related works constituted other essential components. The entire project was completed in just over three months in February 2005.

Implementation Strategies

In order to achieve the stated objectives, BMC decided to replace the existing inefficient and dilapidated submersible pumps at Sarkadia with better, efficient centrifugal pumps, and related components as detailed under:

- 325-HP Jyoti make Centrifugal Pumps and motor sets (3 nos)
- 325-HP ATS fully automatic panels (3 nos)
- 300 sq mm armored aluminum cable
- 700 mm dia. main MS Header line

Process

As implementation was to be carried out while the pumping operation was underway, it called for stringent planning with least disruption in the existing water supply. Old pumps were gradually taken out and replaced by the new ones along with the accessories. Concomitantly, suitable civil, mechanical, and electrical works/ and alterations were undertaken for the new technology to dovetail with the existing infrastructure.

A strict time schedule spanning just over three months was meticulously worked out and adhered to (keeping the critical path as short as possible by ensuring simultaneous/parallel implementation to the extent feasible). The project got implemented on time and the start of the new technical set-up on February 14, 2005 coincided with the 25th Foundation Day of BMC.

Challenges faced

The biggest challenge was to bring about the switch-over, that is, to ensure replacement of the new pumping machinery without causing any disruption to the water supply of the city. This was resolved by carefully planning the strategy in such a way that the replacement was brought about one by one to obviate any disruption in pumping operation.

Sarkadia Pumping Station

Results and Impact

1. For the pumping system, four inefficient submersible pumps were replaced by three centrifugal pumps, resulting in total pumping capacity of 85 percent efficiency, higher by 35 percent compared to old pumps.

Sr.No	Details	Old pumps	New pumps	Difference
1	Average pumping hrs	78 hrs	71 hrs	7 hrs
2	Average energy conservation	16410 units	16260 units	150 units
3	Average qty of water lifted	51 MLD	61 MLD	10 MLD
4	Average energy conserved per ML	321 units	266 units	55 units

   Daily energy savings based on 55 units saved per ML of water pumped led to a saving of 3,355 units. This meant a daily saving in energy consumption of Rs 14,258 at the rate of Rs. 4.25 per unit. With an annual saving of Rs 5.2 million, the pay-back period of the initiative was only eight months 12 days.

2. The citizens, including the industrial customers, were ensured sufficient quantity of water on a daily, but importantly, steady basis

Lessons Learnt

It requires a little effort by a ULB to bring about energy efficiency in a cost-effective manner.
The existing water supply need not suffer because of any engineering intervention. However, this requires careful planning and strategizing and disciplined adherence to the action plan.

Sustainability

Against the project cost of Rs 3.6 million, there is a daily saving, on an average, of 3,355 units translating into a daily saving of Rs 14,258 as per the earlier tariff and an annual saving of nearly Rs 5.2 million.
With the project cost recovered in less than a year of operation, the entire exercise has turned out to be highly sustainable, and in tune with the needs of urban management in contemporary times when energy audit, optimum utilization of power, augmentation of efficiency/output and strengthening of operation are being emphasized upon for sustaining higher revenues for urban local bodies.

Transferability

Once committed, it requires a little effort by a ULB to carefully plan and strategize action plan to bring about energy efficiency in water supply sector in a cost-effective manner.

LEAKAGE CONTROL MEASURES FOR WATER CONSERVATION

Category: *Water*
Information provided by: *MC Mehta (retd. City Engineer, BMC)*

Abstract

The water storage tanks at a water treatment plant (WTP) at Bhavnagar were worn out and in a dilapidated condition. More importantly, the authorities realized the real cost of water that includes cost for its procurement and transmission. In-situ engineering solution was implemented by the engineers, a formidable task when viewed against the need for maintaining simultaneous continuity of water supply to the city.

Bhavnagar Municipal Corporation (BMC) adopted technical measures to optimize and conserve the precious water, and contribute to sustainability of environment even as preventing considerable revenue losses in supplying the expensive, Narmada sourced water.

Situation before the Initiative

Takhteshwar WTP of BMC has been upgraded from 2.0 to 3.5 MGD (9-15 MLD) prior to independence, upgraded again around 1963-65 to 7.5 MGD (35 MLD), and further upgraded to 8.8 MGD (40 MLD) through a World Bank-funded Water Supply Scheme during 1985-87. The WTP has total storage capacity of 27 MLD, out of which 20 MLD storage space consists of old rubble masonry walls covered with RCC slabs.

Takhteshwar filter plant

At the WTP, there are seven clear water storage facilities, each comprising plastered rubble masonry walls inside, and lime mortar joints outside. Each facility is 100 ft x 100 ft x 12 ft volume. The storage tanks had got worn out over the passage of time, and were in a dilapidated condition, aggravated further by minor earthquakes in recent years.

As a result, they were rendered weak and were profusely leaking. Repairing the facilities was considered to be a formidable task by the engineers as the continuity of water supply to the city was of utmost concern, more so as Bhavnagar faces frequent incidences of water scarcity. However, they also realized the real cost of water that includes the cost of its procurement and transmission, and that of Narmada-based water supply project. Leakage on a large scale was unaffordable, and something needed to be done about it urgently.

Initiative

In 2004-05, BMC authorities were compelled to adopt measures to optimize and conserve water, and accept the challenge of repairs and restoration the first three of the seven storage facilities at the WTP.

Storage Tank at the Filter Plant

Implementation Strategy

The Planning Process

The political wing was taken into confidence about the need and the strategy adopted for undertaking the work.

The initial efforts were concentrated on actual loss evaluation. Water level, after the water supply and pumping came to complete closure, was marked. Subsequently, the levels were recorded on hourly basis and the fall in water level was noted. This enabled computation of water loss occurring during the observation period. From the data, the loss for a 24-hour day was derived.

The technology options to be adopted for repairs were selected after weighing the pros and cons of each. The options that were finally considered are:

Dilapidated state of water storage tank

- Providing an inner RCC wall and base concrete — estimated at Rs 3.683 million
- Guniting of the inner masonry wall, followed by plastering and the base concrete - Rs 3.76 million
- Fixing of the chicken mesh, followed by Ferro-cement plaster, using special chemicals that prevent leakages and have rapid hardening characteristics
- Outside grouting and making up of the construction joints with rich cement mortar in 1:2 proportion of cement mortar
- Special chemicals that were considered were:
  - Conbex GP-1 with Cebex 100 in grouting
  - Complast-421 JC in inside plaster and Conplast-211 in floor concrete
  - Rust preventing zinc-based primer with bonding and Nitro-Based SBR for roof plastering

The Technical Process

1. People were duly informed about the work being undertaken by BMC, and were requested to cooperate.
2. The work was allocated to experienced and qualified contractor after due procedure of tender invitation with pre-qualification criteria.
3. Tanks that are interconnected were isolated by fixing plugs on the incoming/outgoing pipes.

4. Pumps in concerned tanks were shifted to other tanks, changing the suction delivery alignments, and also shifting the associated electrical cabling.
5. The work was supervised by competent supervisory staff and the site was visited on day-to-day basis by a senior officer.
6. Progress of the work was reviewed and monitored on daily basis, and impediments, if any, were immediately sorted out.
7. Pre- and post-leakage observations were made; the contractor had assured complete leak prevention; 10 percent of the contract amount was kept as security deposit, released only after the leakage prevention was found to be complete and satisfactory.

Repair work in progress

Wire meshing as Reinforcement

Results and Impact

- The project for the first three water storage tanks was completed within the estimated amount of Rs 2.111 million; in fact, there was saving of approximately Rs 0.065 million. This is unlike most projects which usually exceed the estimated costs.
- Based on this successful experience, the remaining four storage tanks were taken up for repairs and restoration with an estimated cost of Rs 6.5 million; once again, as against the project estimate, BMC saved approximately Rs 0.15 million.
- Overall, for all the seven tanks restored, the results obtained were very encouraging, enabling BMC to prevent daily losses of almost 3 MLD of water. This means that BMC saved Rs 18000 daily and Rs 6.57 million annually (considering the cost of procurement of Narmada water).
- Besides financial gains, the restoration work of the otherwise dilapidated structures prolonged its life by at least another 15 years.
- Stoppage of massive leakages meant that the surrounding residential dwellings which experienced persistent dampness in their structures as well as damages, did not suffer any longer.

Lessons Learnt

- Although challenging, the task of repairing important intermediate infrastructure within a water supply route is possible without much disruption in service delivery.
- Most of the ULBs have very old water supply network with leaking installations. If assessed for water leakages, such installations could also be taken up for repairs and restoration measures that would help in reducing water losses.
- The savings would not be just in terms of quantity of water, but also in revenue that is lost through such severe leakages.

Sustainability

Repairs and restoration of a major storage tank at Takhteshwar WTP of BMC, and replicating the process for four other such tanks is a step towards sustainability of environment. The consequent cash savings contributes to the financial sustainability of the initiative.

Repairing and cleaning of the Water Tank 1

Transferability

Most of the ULBs have very old water supply network with leaking installations. If assessed for leakages, such installations could also be taken up for repairs and restoration measures that would help in reducing water losses.

Surat Municipal Corporation

Towards ensuring quality water supply, reforming O&M and energy efficiency

Outsourced door-to-door garbage collection

Green energy generation from sewerage

Surat City Profile

Surat[5] is the 9th largest city of India and second largest in Gujarat. It is known for its textile trade, diamond cutting and polishing industries. The city of Surat is located midway on the 500-km-long Ahmedabad-Mumbai western corridor, having direct linkages with the industrial urban centers of Vadodara, Ankleshwar and Vapi. National Highway No.8 passes within 16 km of the Surat Municipal Corporation boundary and is one of the busiest inter-state trunk routes in the country.

An overview of Surat at the banks of Tapi

The city is located on the River Tapi and has about 6 km long coastal belt along the Arabian Sea. Due to these reasons, the city emerged as an important trade centre and enjoyed prosperity through sea trade in the 16th, 17th and 18th centuries. Surat became the most important trade link between India and many other countries and was at the height of prosperity till the rise of Mumbai port in the 17th and 18th centuries. Surat was also a flourishing centre for ship building activities. The entire stretch of Tapi from Athwalines to Dumas was specially meant for ship builders. After the rise of the port at Mumbai, Surat faced a severe blow and its ship building industry also declined. During the post-independence period, Surat has experienced considerable growth in industrial activities (especially textiles) along with other trading activities. Concentration of these activities combined with residential developments has resulted in considerable expansion of the city limits.

The city is largely recognized for its textile and diamond businesses. It is also known as the diamond capital of the world and the textile capital of India. 92 percent of the world's diamonds are cut and polished in Surat. It has one of the highest GDP growth rates in India, at 11.5 percent as of 2008.

Profile of Surat Municipal Corporation

Surat Municipal Corporation (SMC) came into existence under the provisions of the Bombay Provincial Municipal Act, 1949. The city limits have expanded from 112 sq km (2001) to 326.41 sq km in 2009 and cover a population of 3.85 million (2009 population estimate). The city is divided into seven zones, covering 38 election-cum-administrative wards. The municipal

[5] Excerpted from Surat, Wikipedia, 2010

corporation has established 16 civic centres for ease of reaching out to citizens and to improve administration. The data below relate to 2008-09[6].

City Demography

The city has a current population of about 3.8 million spread over 326 sq km and the density is 11,638 persons per sq km. Last decadal growth was 62 percent. As per the biometric survey conducted by SMC in the year 2008-09, the city has a slum population of 0.497 million, which is approximately 13 percent of city's population.

Population (Census 2011)	60,79,231
Population (census 2001)	27,02,304
Number of households	5,49,195
% of slum population (census 2011)	Na
% of slum population (census 2001)	18.82
Number of wards	38
Area (sq.kms)	112.28
Annual budget (2009-10), Rs million	17400.3
Contact details of municipal corporation	Municipal Commissioner Surat Municipal Corporation Muglisara, Main Road, Surat - 395003 Gujarat, India. Tel.: +91 - 261 - 2423751-6 Fax: +91-261-2451935 Email: commissioner@suratmunicipal.org www: suratmunicipal.org

[6] PAS Visit Notes 26-27/5/2010

5 TOWARDS ENSURING QUALITY WATER SUPPLY, REFORMING O&M AND ENERGY EFFICIENCY

Category: *Water Supply, Energy Efficiency*
Information provided by: *SMC website*

Abstract

Over the years, Surat Municipal Corporation has developed a well-networked supply system providing drinking water to a burgeoning population spread over 334 sq km. The challenging task of sustainable water supply cannot be accomplished without management, operational and conservation issues. In order to meet the challenges of ensuring improved, quality water supply while saving service costs, SMC installed state-of-the art technology and introduced quality control mechanisms. To improve O&M of the system, certain engineering related quality aspects were institutionalized with ISO standardized functions. Lastly, SMC's Energy Efficiency Cell carried out/coordinated systemic changes to reduce energy consumption and overall operating costs.

Situation before the Initiatives

Over the years, the SMC has developed a well-established, networked supply system providing drinking water to nearly 3 million people with 0.35 million service connections (2008-09) in the city limits comprising 334 sq km. There are 10 major water distribution stations and four pumping stations for the effective distribution of treated water in various parts of the city. All waterworks, water distribution stations and pumping stations are connected to the grid network, which interconnects them[7] .

The water supply system comprises a large network of 2,550 km length. Presently, SMC is supplying nearly 690 MLD of water against the installed capacity of 828 MLD. The challenging task of sustainable water supply cannot be without management, operational and conservation issues.

For example, with increase in water demand, SMC constructed an additional water reservoir and associated infrastructure such as water treatment plants (WTPs), storage tanks, and distribution stations. However, it was observed that the raw water quality was deteriorating due to absence of fresh water (during non-monsoon season) in River Tapi that passes through the city, and pollution-causing activities upstream of the river. Consequently, the WTPs were unsuccessful in maintaining the desired quality of treated water. SMC also faced constraints in monitoring the quality of treated and supplied water. These were in terms of various parameters like turbidity in raw water checked once a day; turbidity in supplied water; outdated equipment; instrumentation and generation of reports and need for more institutionalized approach towards water quality control.

[7] Excerpted and Collated from NUWA Winners, 2008

Pumping Station

Secondly, with a large operating network consisting of WDS, water works and pumping stations, it was also observed that the O&M practices in the existing system were highly inadequate. The O&M staff carried out only routine maintenance, particularly during breakdowns. They were not aware of quantity-related measurements, critical operating parameters, and did not have equipment to measure them. Roles and responsibilities were not properly delineated; awareness of minimum safety measures was lacking. The concept of preventive and predictive maintenance activities for electrical and mechanical machines was not there. Critical operating parameters like power factor, voltage, amperes and contract demand for power, water flow rate etc. were not measured or checked. Routine shutdown for cleaning and energy-conservation measures and related improvements, were not practised. All this led to the mismanagement of WTPs and consequently, non-performance in maintaining the desired quality of treated water.

Finally, there was the overarching concern regarding high costs of energy consumption by the water supply network. Growth-related increased demand for water led to the energy cost of water supply going up to Rs 431.2 million in 2003-04 from Rs 390 million in 2001. On an average, operating the water supply system contributed nearly 60 percent of the total annual electricity charges. SMC realized the need for several steps to increase energy efficiency in water sector.

Initiatives

1. SMC installed state-of-the art technology and introduced quality control mechanisms, including HRD, all towards monitoring water quality and ensuring quality supply to citizens.
2. To improve operations and maintenance of the system, certain aspects related to engineering quality were institutionalized. SMC also standardized the functions in accordance with ISO 9001:2000, procured new technology and introduced refined maintenance schedules; further, several aspects of service and maintenance were outsourced.
3. The Energy Efficiency Cell, established in 2001, carried out/coordinated systemic changes to reduce energy consumption and overall operating costs.

Implementation Strategies

1. Monitoring Water Quality
   SMC's Hydraulic Department established various water-testing laboratories with modern instruments and equipment. A decentralized water-quality monitoring system was established with one main laboratory at a key water distribution station and water-quality testing facilities at other waterworks stations. Appropriate technology, instruments and equipment were

installed in accordance with IS 10500 standards for effective sampling and monitoring of water quality. In addition, the Water Quality Surveillance Program was implemented to ensure the quality of water supplied.

Bulk Flow Meter and Pressure Monitoring Equipments

To check and measure parameters like pH, turbidity, total dissolved solids, dissolved oxygen, chlorine, ammonical nitrogen, and to achieve the desired result, on-line meters like multi-parameter deployable river-monitoring instrument, digital turbidity meter and a digital residual chlorine analyzer were installed. Arrangements were made for conducting in-house chemical as well as bacteriological tests on a regular basis. Uniform procedures were followed for record keeping at all the workstations. Fogging activities were taken up in surrounding areas of WTPs.

Human Resource Development (HRD)

As part of HRD, continuous education and capacity-enhancing programs were organized for lab technicians, operators, etc., for effective performance of duties. A number of experience-sharing sessions were organized to exchange good practices in the sector. In addition to the above, SMC approached the Central Industrial Security Force (CISF) to conduct a comprehensive survey to assess the vulnerable points in water supply system against any terrorist attack. As per recommendations, SMC installed an Online Total Organic Carbon Analyser as a water-contamination information tool.

2. Improving O&M Systems

All operational functions of waterworks were standardized in accordance with Quality Management System ISO 9001:2000. Accordingly, responsibilities were clearly delegated.

Preventive and predictive maintenance schedules for electrical and mechanical machinery and those relating to routine breakdown, as well as water quality control measures were formulated and executed. A dedicated electrical and mechanical maintenance team for preventive and predictive maintenance work was constituted.

Calibration, service and maintenance works of the instruments/ equipment were outsourced to authorized service agencies. Safety measures relating to electrical and mechanical systems were undertaken as per the Factory Act, including mock drills.

A Quality Control Engineering Department for quality monitoring of engineering materials was created departmentally. An online Water Quality Monitoring System was established to monitor and judge the performance of WTPs. Material management software was introduced to maintain inventories, and to generate periodic reports for material under stock, re-order quantity etc.

Through a unique grid network approach, a capability and self-sufficiency plan was developed to ensure uninterrupted water supply even in a contingency/ abnormal situation. Flow meters were installed at WTPs, distribution stations and for industrial customers.

Security measures at waterworks stations and reservoirs were strengthened with the assistance of the CISF.

Lastly, a vendor-appraisal system was developed for a smooth and transparent tendering process.

3. Reducing/Optimizing Energy Consumption
   SMC identified the following major energy consumption areas:

   (a) Raw/filtered water collection,

   (b) Filtration of raw water including chlorination

   (c) Filtered water transmission and

   (d) Filtered water distribution

   SMC water supply system consists of four WTPs, nine WDS and four pumping stations. Most of the water distribution stations are interconnected and a water transmission grid has been made for achieving reliability in availability of water. Detailed studies, including an energy audit, were made of interconnections between WDS and WTP in the context of specific energy consumption i.e. kWh/ML required for transmitting the water. Accordingly, the most economical route for transmitting water has been derived. The studies revealed that savings were possible in the filtered water transmission; dedicated efforts were made in re-engineering of the filtered water transmission routes.

   Re-engineering of filtered water transmission routes included calculation of specific energy consumption in transmission of water in the existing situation, and determining the more economical channels for transmission for all water distribution stations. Actions taken for making transmission more economical include:

   - making connections between existing transmission lines more effective
   - laying new transmission lines and connecting to existing ones, and
   - replacing existing pumps as per energy auditor's suggestion

   Other energy saving measures taken up included installation of thyristor-based APFC panels in the WDS, coating of pumps at the booster house of head waterworks, installation of pump sets at old and new booster pump houses, replacement of impeller at booster house and raw water wells and replacement of energy-inefficient pumping machinery.

   To further augment efforts in energy conservation, SMC installed a 0.5 MWe capacity power plant based on bio-gas generated from liquid sewage waste at Anjana Sewage Treatment Plant, becoming the first urban local body in India to do so. SMC currently has four such STPs.

Results & Impact

1. Monitoring Water Quality
   a. Technical and financial measures, in particular the institutionalization of predictive and preventive maintenance, have resulted in marked reduction in failures of equipment and downtime of plants. Further, revenue from industrial consumers has shown a significant increase. Overall customer satisfaction is also perceptible.

b. Four laboratories at the waterworks and one at the main distribution station have been installed with state-of-the-art technology and modern instruments and equipment.
c. The staff was specially trained in water-quality monitoring and positioned as microbiologists, technicians and operating chemists. Consequently, there is now regular and accurate monitoring of the quality of raw and treated water.
d. Parameters such as turbidity, chlorine, total dissolved solids, pH, colour, dissolved oxygen, etc. are measured and monitored. Microbiological parameters are also monitored at the dedicated microbiological laboratory. Tapi river water quality is also measured and monitored through the use of imported deployable instrument. Various test formats and logbooks are being maintained for recording water quality. An agency is authorized to perform external maintenance and calibration, and standardized reporting procedures as defined in ISO 10500 standards are being strictly followed.
e. A weeding machine was procured to avoid impurities at the source itself and the operation has been outsourced to a third party. Further, the installation of online Total Organic Carbon (TOC) analyzer is planned.
f. During 2006–07, 99 percent samples collected on a daily basis were found to be of good quality.

Water Quality Testing Lab

2. Improving O&M Systems

a. As part of O&M reforms, several innovative practices were introduced. These are as follow:
   - a grid-connected water network was put in place to maintain continuity in water supply, to ensure consistent quality and quantity of water supplied, and for transmitting water via energy-efficient routes;
   - Emergency Response Centre was established to ensure uninterrupted water supply even during emergencies;
   - Conventional coagulant alum was replaced with advanced coagulant—poly aluminium chloride (PAC) since 2003–04;
   - A weeding machine was purchased for removal of floating, submerged and rooted vegetation.

b. Preventive and predictive maintenance has become part of regular maintenance. With a dedicated electrical and mechanical maintenance team in place, breakdowns in electric and mechanical systems have been reduced significantly.
c. Installation of ultrasonic-type flow meters for water quantity measurement has helped the Hydraulic Department of SMC to assess water losses during water treatment. Online water-quality monitoring system has minimized the wastage of chemicals and assured better quality of water to the customers. Timely calibration of inspection has enabled the department to generate reliable data on performance of instruments/equipment.

3. Reducing/Optimizing Energy Consumption

a. Energy audit of 34 services with contract demand of more than 75 kWh was done by an auditor approved by the government of Gujarat. SMC was successful in revising its tariff (a process done through Gujarat Electricity Regularity Commission); from HTP-I to HTP-II (A) for 18 HT (high tension) services meant for water supply and sewage disposal system. It resulted in saving of Rs 14.5 million per annum. The audit identified total energy saving possibilities of Rs 22.1 million/annum with an initial investment of Rs 18 million.
b. From the overall perspective of SMC Energy Cell that also includes street lighting, the corporation reduced its overall energy consumption from 342.29 kWh/ML (2003-04) to 316.95 kWh/ML (2006-07).
c. Savings achieved by re-engineering the pipelines at four major locations amounted to Rs 32.667 million. For example, by changing the transmission route for Umarwada WDS underground tank from Varachha Water Works to Sarthana Water Works, SMC has annually saved Rs 16.8 million till 2009 (4.163 Million KWH/ annum).
   Similarly, SMC has saved Rs 8.5 million per annum (2.08 million KWH/ annum) by modifying the transmission route for filling underground tanks of Athwa and Khatodara WDS.
d. Average power factor for all HT services improved to 0.991 from 0.986 by installing Thyristor-based APFC panels (HT sensing) and quick replacement of faulty and de-rated capacitors wherever required. This has resulted in the saving of Rs. 1.769 million/annum.
e. The energy consumption of SMC water supply system is monitored regularly on a daily basis and was found to have reduced from 356.87 kWh/ML in 200-2001 to 316.95 kWh/ML in 2007.
f. The total energy savings achieved through re-engineering and energy conservation was Rs 35.023 million per annum.
g. The bio-gas plant had, till December 2008, generated 80.11 kWh of energy, leading to a direct saving of Rs 32.2 million.
h. As a result of these concerted actions, SMC received the first National Urban Water Award from MoUD in 2008 for 'Operation & Maintenance Practices in Water Management'.

Lessons Learnt

In every urban local body, as far as water supply infrastructure and related human resource development are concerned, there is always great scope for improvements, improvisations and efficiency measures so necessary for expenditure control and sustenance of revenues. SMC has shown that rather than a piece-meal approach, it is profitable, in the long term, to look at water sector as a whole and institutionalize integrated reforms

Sustainability

SMC's integrated approach to improving water quality, operation and maintenance of water infrastructure and to conservation of energy has resulted in a cascading effect – sustainable finances, sustainable services to the benefit of the consumers and, most importantly, contribution to sustainability of environment.

Transferability

The challenging task of sustainable water supply in a large city such as Surat cannot be accomplished without management, operational and conservation issues. It is possible to replicate similar efforts in an integrated manner in other large cities of India.

6 OUTSOURCED DOOR-TO-DOOR GARBAGE COLLECTION

Category: *Solid waste Management*
Information provided by: *E.H. Pathan, Exe Engg, SWM Deptt, SMC; SMC website*

Abstract

Surat was once a filthy city with unaesthetic appearance of the streets. The city was earlier provided with containers and dustbins to collect the waste being generated and brought to site by sweepers. However, the container spots continued to remain dirty. Overcoming serious challenges, Surat Municipal Corporation outsourced to three agencies, the garbage collection activity at the doorstep of the households on payment-by-weight basis. It was a carefully planned initiative in a participatory manner. The goal was to develop a habit among householders to store garbage in a segregated manner in bins till vehicles for door-to-door collection reach the vicinity. The various strategic actions taken were found to be sustainable, both, financially and environmentally. It brought about a drastic visual change in Surat apart from inculcating among citizens a disciplined sense of segregation of waste at the household level, not throwing it away on the streets, but waiting for the pick-up van service. This is one of the initiatives that have led to Surat being ranked second in the country in the National Sanitation Survey conducted by the Ministry of Urban Development, Government of India in 2010.

Situation before the Initiative

Before the implementation of door-to-door garbage collection system in Surat city, it was a normal practice for householders to throw waste on to the streets from where it was collected by sweepers in handcarts for its disposal in nearby containers. This resulted in an overall filthy and unaesthetic appearance of the streets as well as around the container point.

Containers and dustbins were placed in various locations to collect the waste being generated. Ward wise nuisance spots were identified from where MSW was collected for its transportation and disposed at the final disposal site. The main drawback of this collection system was stray animal nuisance at each dustbin and nuisance spot; even rag-pickers were found segregating recyclable waste at spots creating an unhealthy appearance.

Door-to-door collection system was earlier implemented as a pilot project through tractors which did not have closed bodies i.e. the transportation was not being done as per prescribed norms in MSW Rules 2000.

Initiative

The main aspect addressed by Surat Municipal Corporation (SMC) was the compliance to MSW Rules-2000. This system has been developed as a garbage collection activity at the doorstep of the household. In doing so, the objective was also to develop a habit among householders to

store their garbage in bins till vehicles for door-to-door collection reach the vicinity, that too, in a segregated manner.

In 2008-09, of the total 8,60,930 households, 7,84,200 were covered under door-to-door collection, while 1,45,319 out of 2,62,053 non residential properties were covered.

Implementation Strategies

The main objective of the door-to-door system was to implement MSW Rules-2000. The other objectives were:

- to improve overall health and hygiene environment by timely collection of waste from every house/shop on everyday basis
- reducing number of container spots
- reducing stray animals around containers spots
- reducing nuisance of foul smell associated with container spots.

Before the implementation of this system, a feasibility study with reference to the size of ward, its population and network of roads with existing road width was carried out for fixation of Time, Place and Movement (TPM) Schedule.

The door-to-door collection system was first started as a pilot project in one ward of each of the zones. This activity was initially carried out in open tractor and thereafter, based on the results of the pilot, was extended to three of seven zones through a tender process. Three agencies to whom the work was entrusted for the period up to February 2011, have deployed brand new close fabricated vehicles of various categories, i.e. Heavy goods vehicles (HGV) / medium goods vehicles (MGV) / large goods vehicles LGV), painted in green.

Door to Door Collection

Process

- Usually, the vehicles reach the concerned ward office early in the morning every day to get confirmation regarding route monitoring.
- Complaint redressal system is developed at each ward office where a householder can register a complaint regarding any non-coverage.
- Phone numbers of the supervisory staff are provided to residents of the areas under their control so that if a vehicle fails to arrive, the affected households can directly approach the staff.
- Several meetings with residents of areas under control of concerned ward officer are also held to improve the collection system.

Some other strategic action steps are:

- Selection of kind of vehicle based on width of road
- Coverage of number of units on each route between 1,000 and 3,000
- Strengthening of the existing system of garbage collection
- Creating public awareness on garbage management

- Drivers and *Swachchhta Mitras* are provided with uniforms and identity cards.
- Concession period of this project is kept as seven years, keeping in mind the life of vehicle, and the long term financial interest of the agencies.
- All the garbage vehicles are equipped with proper alarm system when they go to every door step regularly at scheduled time.
- Facility of second shift for collecting waste from commercial units between 4 pm and 11pm daily in each zone
- First shift collection timing is 7 am to 1 pm daily for residential zone.
- This system operates round the year.
- Creating public awareness through campaign mode is part of contractor's scope of work.
- Centralized complaint management system at head office at Mugalsarai, and at contractor's office with modern communication facilities.
- Provision for segregated waste collection (dry & wet)

Overcoming Challenges and Constraints

a. To arrive at the basis of payment to contractors, various options were thought of, such as lump sum basis, city as a whole, zone as a whole and payment on number of units covered. The present practice of making payment on weight basis was found to be appropriate.
b. As payment is made on weight basis, constant monitoring is required to avoid malpractice in collection of waste from areas not under the scope of agency (to deliberately increase the weight).
c. Public awareness played a key role in the success of the system, especially segregation of garbage into dry and wet waste at source.

Roles / Activities of the Partners at Each Stage

a. Handling of door-to-door garbage collection system is carried out entirely by SMC through its own budget. Hence, there is no involvement of any partner in respect of financial collaboration / aid.
b. However, the initial investment on the procurement of vehicles was made by the contractors/agency.
c. While inviting tenders, due care was taken to include the clause for propaganda for garbage collection system. This is the responsibility of the contracted agency.
d. The agency is paid for the work executed on metric tonne (MT) basis.
e. As part of innovative activities, agencies conduct survey at regular intervals and make changes in TPM schedule for maximum coverage.

Results and Impact

- During 2008-09, 784,200 residential households, and 145,319 establishments were covered by door-to-door collection services. The coverage of door-to-door waste collection was 91 percent
- Improvement in the overall environment has been achieved because of public consciousness and habit of keeping waste in domestic bins
- Timely collection of waste from every house / shop every day
- Reduction in numbers of stray animals around containers spots
- Reduction in nuisance due to smell which otherwise is the part associated with container spot
- Avoiding multiple handling of waste
- Reduction in number of containers
- Spare sweepers/workers can be engaged for carrying out sanitation work of new developing areas in most effective manner

- Curtailment of old collection system through open tractors
- Awareness of citizens about the need for cleanliness has improved the environment
- Environment around the community containers improved
- Health and hygiene parameters have changed significantly in people
- Cost curtailment; savings used by SMC for repairing and maintenance of containers and hydraulic dumper placers
- Reduction in number of container spots resulted in curtailment of costs for lifting of containers
- Overall appreciation of the program implemented by SMC

Lessons Learnt

Some notable factors of success were: payment on weight basis; awareness of public; close monitoring of system; the seven years' contract period.

Sustainability

The system of door-to-door garbage collection involves a huge cost of capital investment in procurement of vehicles for collection of garbage. It also involves the manpower component to run the system effectively and efficiently. The system has been outsourced. As SMC is paying the agency for the garbage collected from residential and commercial units on weight basis, it has become viable for it to run the system effectively. SMC pays Rs.180 million per annum to various agencies against collection of a total of 625 MT of garbage per day. The rate for first year of collection was kept as Rs 630 per MT and thereafter, a 5 percent increase in the rate is being allowed to agency to compensate for the inflation.

As indicated above, all the capital investment has been done by agencies and the contract period is kept as seven years. This is an attractive period for the agency to recover the capital investment. The other main factor of sustainability is the mode of payment on weight basis, which is also an attraction for the agency to work with effectiveness.

As far as finances of the municipal corporation are concerned, user charges are imposed from 2007-08 for MSW management system which help recover the cost of door-to-door collection system to some extent.

Transferability

The door-to-door collection of MSW is presently being replicated in many cities in Gujarat.








7

GREEN ENERGY GENERATION FROM SEWERAGE
SETTING UP OF SEWAGE GAS-BASED POWER PLANTS

Category: *Sewage Management*
Information provided by: *Mayank Mithaiwala, Engg, Sewerage Deptt, SMC; SMC website*

Abstract

To keep the city free from liquid waste pollution, Surat Municipal Corporation (SMC) over the years has progressively established a well-networked sewerage system. Six STPs have also been set up. SMC realized that operation and maintenance of sewage-related projects involves consumption of electricity which in turn increases SMC's revenue expenditure.

Looking at the trend of increasing electricity bills of SMC, the challenging step of power generation from the sewerage gas at STPs was initiated. SMC first established the required technology at Anjana STP as a demonstration project in 2003. Later, in 2008, with well-proven technology and results from Anjana STP, the corporation replicated the project process for the Singanpore, Karanj and Bhatar STPs. Besides green power generation and cost savings in energy bills, the sewage gas-based power plant project led to claims for the Certified Emission Reduction (CER) under Clean Development Mechanism of United Nations Framework Convention on Climate Change (UNFCCC).

Situation before the Initiative

To save the city from from liquid waste pollution, SMC had established a sewerage scheme with sewage lifting stations — Singanpor, Karanj, and Bhatar — in 1954 and an STP at Anjana in 1958. The STP had a capacity 25 MLD with primary and secondary digester systems. All this happened even before the constitution of Central Pollution Control Board (CPCB) and Gujarat Pollution Control Board (GPCB), thus indicating the attitude and keenness of SMC to keep the urban environment clean and pollution-free.
With the development of Surat city, it was required to increase the capacity of the STP. Over the years, an elaborate network of sewers supported by sewage pumping stations has been set up to transport the domestic sewage to the STPs. The network of sewer lines and rising mains has increased from 757.39 km in 1996 to 1,028.5 km in 2008, while 28 sewage pumping stations and six STPs have been set up.

Table 1: Details of STPs at Surat

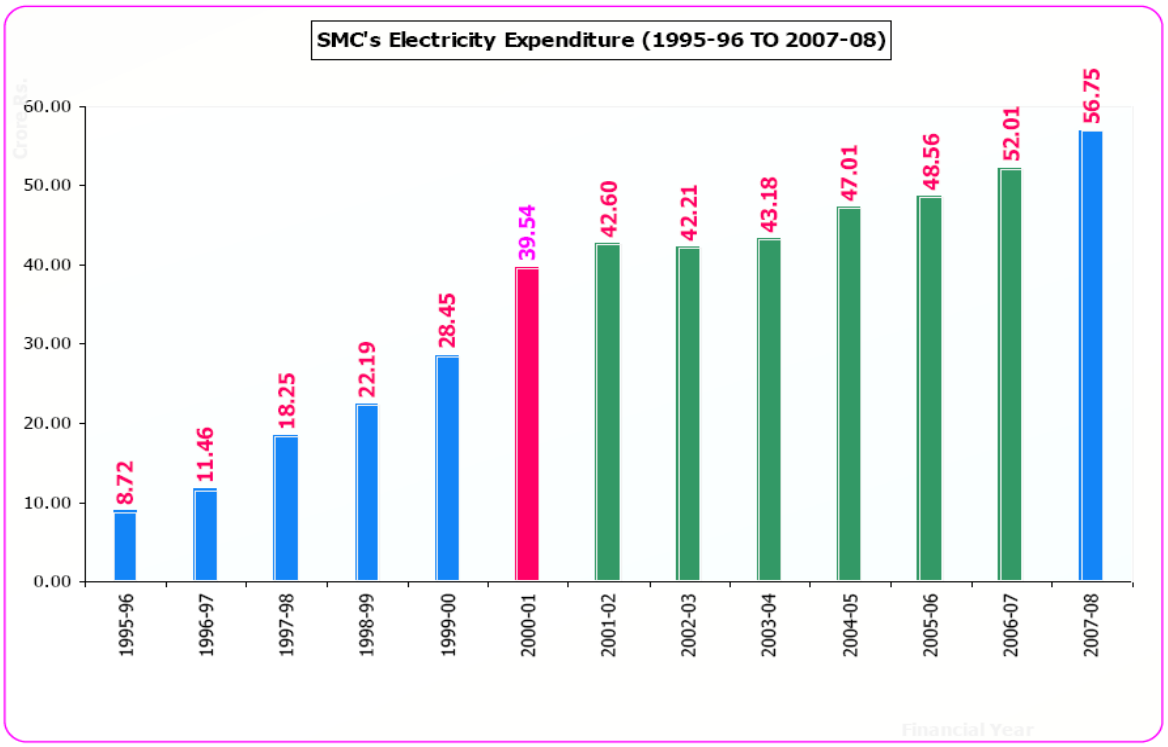
Sr. No.	Name of the STP	Capacity (MLD)	Treatment Technology	Year of Commissioning
1.	Anjana	82.5	CASP*	1956
2.	Bhesan	100	CASP	1995
3.	Karanj	100	CASP	1998
4.	Bhatar	100	CASP	2003
5.	Singanpore	100	CASP	2003
6.	Bamroli	100	UASBr**	2001

*CASP : Conventional Activated Sludge Process
**UASBr : Up flow Anaerobic Sludge Blanket Reactor

Energy Consumption

With development of Surat, SMC has increased its infrastructure investments in water supply, drainage and sewerage sectors. Operation and maintenance of these projects involves consumption of electricity which in turn has imposed an increased burden on SMC's revenue expenditure. The increasing trend in expenditure on energy consumption of last few years is as shown below.

Electricity Bills of Surat Municipal Corporation (in Rs. crore)



Looking to the trend of increasing electricity bills, the challenging step of power generation from the sewerage at STPs was initiated.

Initiative

Generation of electricity by utilizing gas generated from the STP is a proven technology. SMC first established the required technology at Anjana STP in 2003, as a demonstration project. Later, in 2008, SMC replicated the Anjana process at Singanpore, Karanj and Bhatar STPs and came out with well-proven results from these sewage gas-based power plants.

Besides power generation and cost savings in energy bills of the corporation, the sewage gas-based power plants project led to processing of claims for the *CER* under Clean Development Mechanism of UNFCCC. This is an added benefit to SMC.

Implementation Strategies

Under the umbrella of the National Program on Energy Recovery from Urban and Industrial Wastes, the Ministry of Non-Conventional Energy Sources (MNES) has been promoting and financially supporting demonstration projects involving recovery of energy from wastes of a renewable nature, besides attempting to reduce emission of green house gases into the atmosphere. SMC initiated a proposal with the MNES for productive use of the energy-rich constituents of sewage gas emanating from the existing digesters at Anjana STP as a demonstration project.

SMC, which is known for its readiness in adopting new technology and implementing new systems, has always taken a keen interest in the project of power generation through from sewage gas. Conceived in January 1997, a blue print of the project was prepared by SMC and tabled before the MNES in July 1997 for scrutiny. This early initiation led to in-principle agreement between MNES and SMC to co-steer such a project subject to scientific confirmation about its techno–commercial feasibility and viability. Finally, MNES and SMC agreed to move forward toward setting up sewage gas-based power generation project at Anjana. It was agreed that financial assistance of up to 50 percent of the total project cost would be provided as grant by MNES.

This prestigious project, first of its kind in India to generate green energy from sewage gas, was based on use of an imported, 100 percent sewage gas-based engine of Spanish make, duly complemented with high levels of automation and a state-of-the-art, polymer-based, inflatable gas-holding balloon. To oversee the project, SMC formed the Project Implementation Committee constituted by leading consultants from academia and industry. In October 2003, the completely integrated plant had successfully generated 500 kWe of electricity during the trial runs leading to commissioning. The present generation of power from this plant is 8000 to 9000 units/day, which is consumed to run Anjana STP itself.

Processes in STP

SMC has five STPs having Sludge Treatment Process and one STP on Up-Flow Anaerobic Sludge Blanket Reactor (UASB) process.

During the treatment process, sewage is passed through various stages of treatment, such as inlet chamber, screen chambers, primary clarifiers/UASB reactors, primary sludge pump house, aeration tank, secondary clarifier, return sludge pump house, sludge thickener, sludge feed pump house, anaerobic digester, digested sludge pump house, sludge drying bed or mechanical sludge dewatering system, final treated sewage chlorination system, etc.

Each unit has its own function in the process of treatment of sewage. STPs generate gas during the treatment of sewage sludge as part of the treatment processes.

Conventional Activated Sludge Treatment process has a digester for the treatment of sludge. The objective of the sludge digester is to reduce volatile organic matters from the sludge by anaerobic digestion. The sludge digester is a closed circular RCC tank. The sludge from the sludge thickener is pumped to the digester for effective digestion before it is dewatered in sludge drying beds or mechanical sludge dewatering system. The digester is provided with a screw pump type stirrer/gas mixing system/sludge circulating system for maintaining the uniformity of the sludge concentration. In the digester, proper volatile acid/alkaline ratio is maintained for digestion. The digested sludge is periodically withdrawn to the sludge drying beds or to mechanical sludge dewatering system for dewatering.

Anaerobic fermentation or digestion is the most common process for converting organic material to methane and other gases. Sewage gas usually contains about 60 to 70 percent methane, 30 to 40 percent carbon dioxide, and other gases, including ammonia, hydrogen sulfide and other noxious gases. It is also saturated with water vapor. Precautions are required to be taken while processing and handling the gas. It is highly explosive and also difficult to detect. Sewage gas, which is a mixture of methane and other gases, is also known as swamp gas, sewer gas or fuel gas. The calorific value of sewage gas is 4700 kCal/SM3 to 5500 kCal/SM3.

General Calculations for Sewage Gas Generation at STP

Present Sewage Characteristic at STP

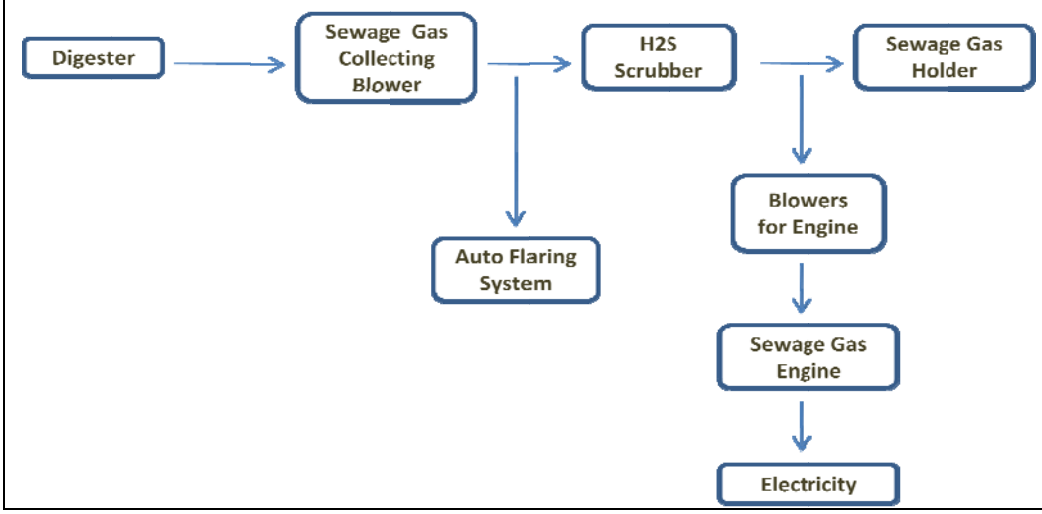
Parameter	*Inlet Parameters*	*Outlet Parameters*
BOD	357 ppm	20 ppm
SS	365 ppm	30 ppm
COD	758 ppm	100 ppm
Flow	70 MLD	-

- Primary Sludge VSS = 11498 kg/day
- Secondary Sludge VSS = 7422 kg/day
- Total VSS of Prim. & Sec. Treatment = 18919 kg/day
- Sewage gas generation will be 13007-20811 m3/day
- Sewage gas calorific value 5200 Kcal/nm3
- Considering Loading on Generator as 80 percent & Electrical Efficiency of

Engine as 36 percent: - Approx Electricity generation capacity = 1180 to 1888 Kw

According to the practical experience and actual figures of conversion efficiency, effect of temperature due to seasonal variations on anaerobic treatment of sludge, etc., it was estimated that a minimum 120 units of electricity per 1 MLD of sewage flow can be generated from the sewage treatment.

Process Diagram of Conversion of Sewage Gas into Electricity



Some important components in the Process Diagram

Gas Collection System

Sewage gas generated in the digester has low gas pressure. Hence, a gas extraction system is required in order to make up for the line losses and convey the gas to a storage unit via gas cleaning mechanism. This is done by sewage gas blowers, which are operated depending on the pressure of digester.

Gas Cleaning System

The sewage gas contains hydrogen sulfide (H_2S), which is a corrosive gas. The corrosion will reduce the life of machinery involved in the system. Hence, level of H_2S needs to be reduced. For that, H_2S scrubber is required to reduce its level in the sewage gas before utilizing methane for power generation.

Gas Storage System

The gas generation rate of digester depends on various process operational aspects. To enable the gas generation to be evened out, so as to provide a constant flow to power generation unit, a Sewage Gas Storage system is required. This storage unit acts as buffer storage to match the load requirement with the generation rate of sewage gas.

Power Generation System

At present, the most efficient method of converting sewage to electricity is through the sewage gas engine generator set. The sewage gas is fed through the sewage gas feed blowers at specific pressure. The engine is spark-ignited, which is connected with the alternator. Electricity generated at the alternator terminals is fed to the sewage treatment plant itself to run various units. The technology for the sewage gas engine generator set is provided by various manufacturers.

Excess Gas Flaring System

The excess gas flaring system is provided to flare the sewage gas when the engine generator set is under maintenance, and storage is full. As methane is a greenhouse gas and highly inflammable, it cannot be released into atmosphere in that form.

(Top to bottom) Machinery used for generation, storage and flare up of methane gas

Supervisory Control and Data Acquisition (SCADA) System

This system is implemented for precise and efficient control over plant process, as also to collect and store data generated from various field instruments such as digester pressure transmitter, sewage gas flow meter, on line CH4 and on line H_2S analyzer, various engine generator set parameters, etc.

Results and Impact

Cost Economics of Anjana Sewage Gas Power Plant

Total Cost of project	Rs. 28.653 million
Grant from MNES /GEF	Rs. 13.023 million
Total Fund of SMC	Rs. 15.63 million
Present Power Generation	9500 - 10500 Units/day
Total Unit Generated (till Jan. 09)	82,93,364 KWH
Equivalent Value of total Electricity Generation in Rs.	Rs 37.32 million
Net Saving after subtracting Auxiliary Consumption and O&M Cost (till Jan. 09)	Rs 34.37 million
Power generation cost per Unit	Rs. 1.20 per Unit
Pay Back Period (for SMC fund)	40 months (After deducting plant shutdown period of two months due to engine inter cooler problem and eight months due to modification work of Anjana Sewage Treatment Plant.)

Replication of Anjana STP Gas Power Plant

After successfully commissioning of purely sewage gas-based power plant at Anjana STP, SMC took quick actions to set up other sewage gas power plants at three STPs at Singanpore, Karanj and Bhatar. These projects were commissioned in 2007-08 in a short duration of 10 months, and are now operational and providing electricity to respective plant equipment.

Power Generation at various Sewage Gas-based Power Plants

Sr. No.	Name of STP	Installed Capacity of Power Plant (MWe)	Year of Commissioning	KWH units generated since commissioning	Generation in Rs. (till July 2008)
1	Anjana	0.5	October,2003	82,93,364	3,73,20,138
2	Singanpore	1.0	March, 2008	16,67,916	75,05,622
3	Karanj	1.0	March, 2008	23,28,443	1,04,77,993
4	Bhatar	1.0	August, 2008	6,68,092	30,06,414

SMC now incorporates biogas-based power plant along with construction of STP in tendering processes so that power production can start as soon as construction work is completed. Tenders are floated for construction of new STPs by SMC at Dindoli and Variav, and installation of biogas power plant has been incorporated with construction of treatment plant. The work contract specifies the minimum electricity that should be generated from power plant based on incoming sewage quality and quantity. Failing this pre-condition, the shortfall in guaranteed power generation will have to be borne by the contractor.

Benefits

- A sewage gas-based power generation plant requires less manpower and is simple to operate with SCADA.
- The production of electricity purely through sewage gas-based engine generator technology has many more advantages and cost benefits over the earlier technology of duel fuel engine generator set.
- Nearly, 80-85 percent electricity required in the STP is generated from sewage. This will reduce the use of fossil fuel for power generation.
- Power generation and its utilization in STP reduce the electricity consumption of grid power. It also saves on the electricity bills, thus reducing revenue expenditure of the STP, which contributes to reduced municipal taxes to the citizens.
- It is well known that 1 unit of energy saved at user end will reduce generation of 2 units (considering the transmission loss, etc.). Therefore, distributed power generation through such type of power plant is always beneficial to project proponent and society.
- Reduction of emission of green house gases for the protection of environment.

After successful implementation of the project, various organizations, municipal corporations, private agencies and industries at national and international levels have visited the Anjana STP. Presently, several municipal corporations in India have implemented or taken up implementation of similar kind of projects in their cities.

Registration of Project under Clean Development Mechanism

The Clean Development Mechanism (CDM) is a project-based flexibility mechanism designed to facilitate voluntary contribution of developing countries to the achievement of the greenhouse gas emission mitigation targets to which industrialized countries have committed themselves under the Kyoto Protocol. The achieved emission reductions can be certified and sold to countries that have taken on binding targets under the Kyoto Protocol. The host countries may reap a share of the credit sale revenue and secure 'Sustainable Development' benefits from the project activity.

CDM and Sewage Gas-based Power Generation by SMC

The sewage gas-based power generation at STPs at Karanj, Singanpore and Bhatar are eligible for assistance under CDM mechanism for various reasons. The STPs are designed to generate the sewage gas by treating the sludge generated from primary and secondary clarifier of sewage in an anaerobic processing system (Digester) so as to restrict the atmospheric emission of methane gas. At the same time, the methane gas is recovered without leak in the atmosphere

The electricity generated from the utilization of sewage gas in gas engine is used for captive purpose, thus greenhouse gas reduction by decreasing consumption of fossil fuel for grid power supply equivalency is possible.

For the registration of these projects under CDM, the project falls under the small scale in following categories:

- TYPE III.H. Methane recovery in wastewater
- TYPE I.D: Grid connected renewable electricity generation

SMC will obtain:

- 39,630 CERs from Methane recovery from wastewater and

- 16,624 CERs from grid connected renewable electricity generation categories.

Work Progress
- A consultant has been appointed for registration of these projects under CDM, obtaining CER and sale thereof.
- Project Design Documents have been prepared and Host Country approval has been obtained from Ministry of Environmental & Forest, Government of India, New Delhi, which is Designated National Authority for CDM.
- Registered Validator of UNFCCC has been appointed for the validation & registration of these projects at UNFCCC.
- Validation process is in progress.

Lessons Learnt

The sewage gas-based power plant projects are beneficial in sustaining the environment and reducing global warming in following ways:

- Prevent free methane emission from the digester.
- Generate electricity which reduces the use of grid power. This will reduce use of fossil fuel for power generation.

Distributed power generation at user end (load centre) is always beneficial to the power generation and transmission system. It will reduce the transmission losses of the grid and also improve the grid voltage. Confirming to the advantages as described in the above case study, it can be concluded that power generation through sewage gas should be adopted as an integral part of sewage treatment system. This will reduce the power need of STP and revenue expense of the urban local bodies besides providing environmental benefits to the cities.

Sustainability

Both, from points of view of cost benefit and environment, the sustainability of the sewage gas-based power production is self-evident, given the discussions above.

Transferability

Operation and maintenance of sewage-related projects involves consumption of electricity which in turn imposes an increased burden on revenue expenditure of the ULB. The demonstration project already exists in Surat. Newer technology is also presently available. SMC's initiative and project processes can be replicated in other mega cities in India.

Ahmedabad Municipal Corporation

‘500 NOC’ initiative towards slum improvement

Ahmedabad City Profile

Ahmedabad is the largest city of Gujarat. As per the Census 2001, it is the seventh most populous city of the country. The boundary of the city was expanded from 190 sq km to 446 sq km in the year 2006. The population also grew from 3.5 million to 5.5 million.

Ahmedabad gained prominence as the commercial capital of Gujarat after the formation of the state in 1960. It is a thriving centre for chemicals and pharmaceuticals. The city, formerly known as Manchester of India, has a number of textile mills which have now almost ceased functioning. However, it continues to be the largest supplier of denim in the country.
In recent years, the investment in the modernization of the city's infrastructure has gone up tremendously

Profile of Ahmedabad Municipal Corporation

Ahmedabad Municipal Corporation (AMC) was established in July 1950.
As per the data of March 2009, the corporation has 57 wards. For administrative purposes the city is divided into six zones - central, east, west, north, south and new west. Each ward is represented by three corporators.
AMC has forged partnerships with NGOs, private industry, educational institutions and international agencies for enhancing its urban development capacities and for improving municipal service delivery and infrastructure for the same.

City demography
The population of Ahmedabad city is around 56 lakh (Census 2001). It is spread over an area of 466.2 sq km. There are 1813 slum settlements within the corporation.

Services

AMC has formed 26 Citizens Civic Centres which offer facilities like tax collection, approval of building plans, shops and establishment, estate hawkers etc. The corporation has set a unique example of e-governance. It has a tie-up with a private bank, which accepts tax collections from citizens through internet.
AMC also operates the Ahmedabad Municipal Transport Services (AMTS) and runs various medical colleges and hospitals.

Population (Census 2011)	NA
Population (census 2001)	5606728
Number of households	1191014
% of slum population (census 2011)	Na
% of slum population (census 2001)	28
Number of wards	57
Area (sq.kms)	466.2
Annual budget (2008-09), Rs million	32934.97
Contact details of municipality	Municipal Commissioner, Ahmedabad Municipal Corporation 1st floor, Danapith, Ahmedabad Tel: +91-79-25321484 Email: info@egovamc.com www.egovamc.com

8 '500 NOC' INITIATIVE TOWARDS SLUM IMPROVEMENT

Category: *Slum Upgradation*
Information provided by: *Anand Patel, Addl City Engineer, AMC; Mahila Housing Trust*

Abstract

A scheme, then known as '500 NOC' Scheme, was launched in 2002 by AMC. It aims at providing slum residents with a 'No Objection Certificate' (NOC) that enables them to apply for legal individual sewerage and water connections for their dwellings. AMC's initiative shows an innovative way out of illegal status of slum dwellers vis-à-vis provision of minimum of basic amenities. The provision of civic utilities has brought about a sea change in the attitude of slum dwellers, and consequent improvement in living conditions and self-esteem.

Situation before the Initiative

Earlier, Ahmedabad city had around 60 textile mills most of which have now ceased functioning. Employment opportunities in these textile mills attracted many people from outside the city. These people preferred settling around the mill complexes on open vacant land belonging to state government or AMC, and even private holdings. The closure of the textile mills and the simultaneous rise of the industrial sector deterred them from abandoning the city, as they got engaged in alternative employment sectors including labour, services, self-employment, or employment in other industries. Consequently, their dwellings—a makeshift arrangement—came up on any open available land in a very irregular and unorganized manner, giving rise to slums. These settlements were devoid of basic amenities given by AMC as the residents were considered as encroachers with no ownership titles, This resulted into varied issues faced by such people and also by the society at large including institutions like the municipal corporation, police department, traffic department and revenue department. The resultant severe unhygienic conditions led to grave and even complex issues.

The Initiative

AMC launched 500 NOC Scheme in 2002. As the name suggests, it aims at providing slum residents with a 'No Objection Certificate' (NOC) that enables them to apply for legal individual sewerage and water connections for their dwellings. '500' relates to the amount the applicant has to pay to get the NOC (This amount was later revised to Rs 1,500 as demand grew).

Process

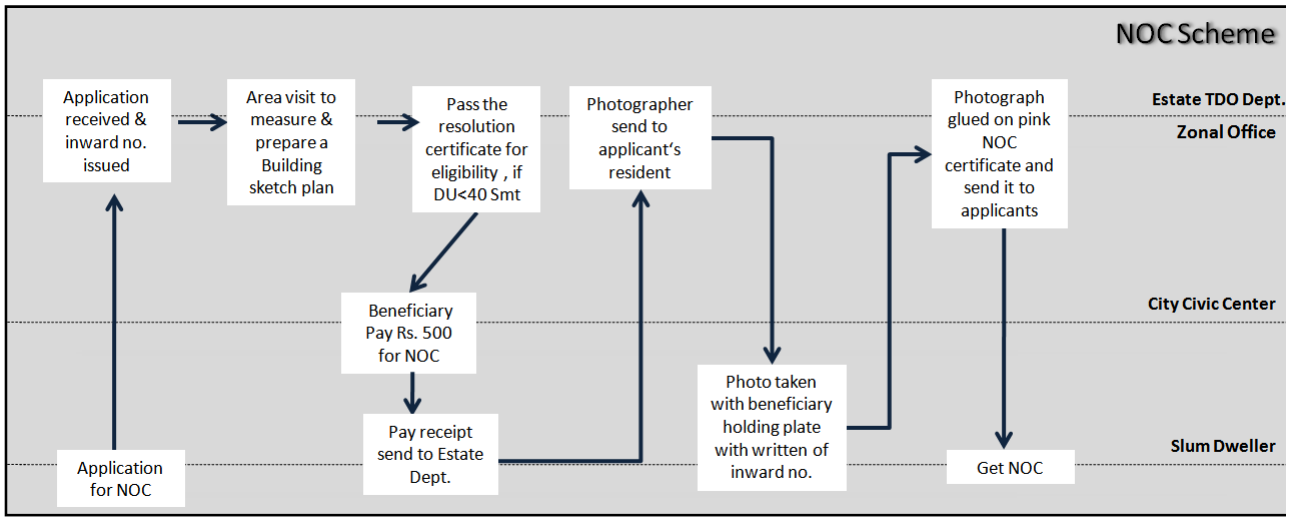
An individual household was required to purchase a form for Rs 10, fill it up and submit to AMC along with Rs 500 (later Rs 1,500) for the NOC. An NGO, Mahila Housing Sewa Trust, was roped in to coordinate processes between AMC and the slum dwellers.

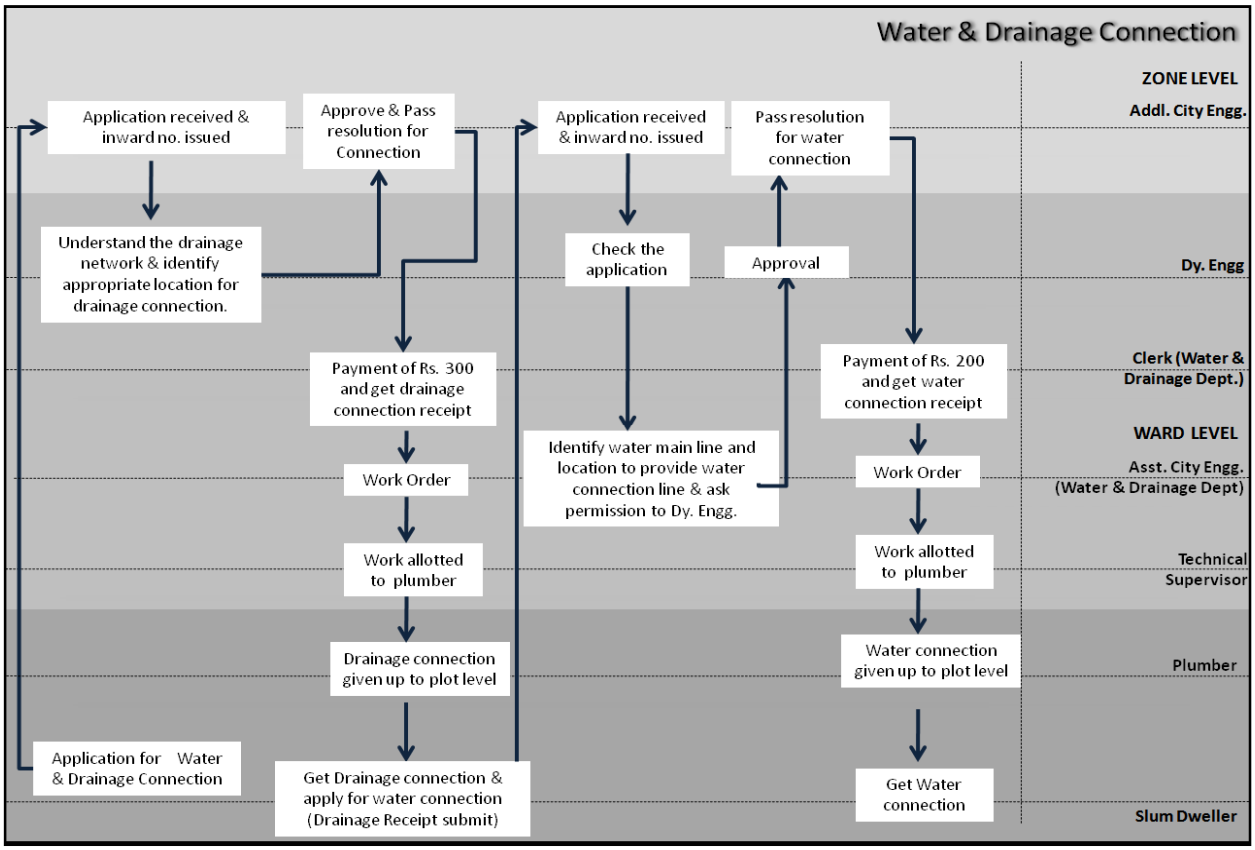
The households were required to fulfill the following eligibility criteria:

1. The applicant should be residing in a slum dwelling of no more than 40 sq m area

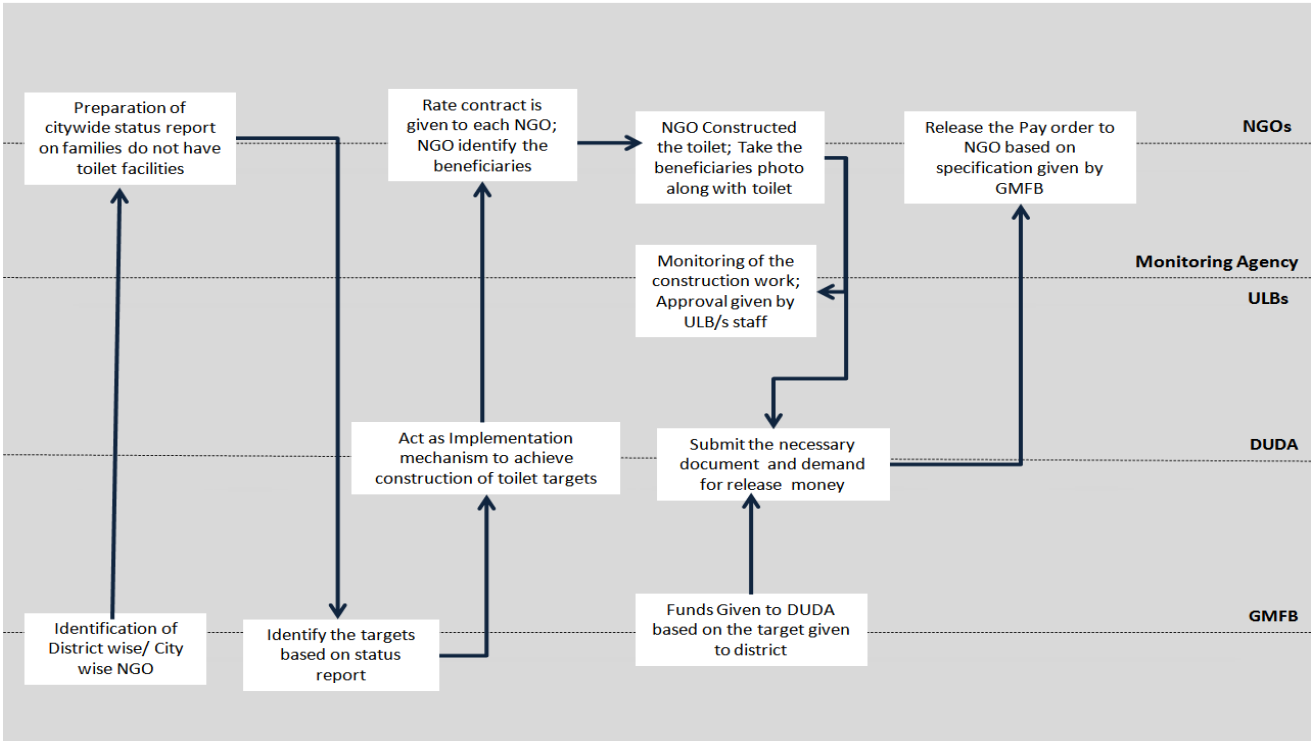
2. The applicant should have any one of the several types of residence proof, such as a government ration card, voter ID, or tax or electricity bill or 7/12 *utaro* etc.

Process Flow Chart





NGSP (GMFB) Toilet Scheme



Implementation Steps Explained

1. Any individual could apply for the scheme. (Alternatively, the NGO identifies potential target communities, raises awareness among residents and organizes the households willing to participate in the scheme. It also can co-ordinate between the beneficiaries and the corporation).
2. The individual applies to the zonal office on a form available for Rs 10. S/he has to submit a proof of residence along with the form. The zonal office issues an 'inward number' to the applicant. Alternatively, the NGO delivers the application forms to the community, collects the Rs 10 fee with completed forms, and the fee for the NOC. It then delivers the documents to the zonal office, pays the form fee and receives inward numbers issued by the office to be handed over to the applicant. Meanwhile, the NGO gives the applicant a temporary receipt which gets replaced by the regular one received from the office.
3. An officer from Estate department visits the applicant's residence for verification of the plot size conforming to the eligibility criteria and also prepares a rough sketch. (Alternatively, the NGO accompanies the official and helps in measurement verification and sketch drawing).
4. Once the dwelling unit is found to match the prescribed criteria laid down as eligibility conditions, the Estate department of the zonal office issues a 'resolution' certificate to the City Civic Center (CCC). (It is a time consuming process because the resolution can be passed only when a group of 10-15 applicants applies for NOC.)
5. Beneficiaries pay NOC fee to tax department or CCC and get the NOC receipt. (The NGO co-ordinates with Estate department, collects a list of beneficiaries, directly pays fee to tax department and gets an NOC receipt.)
6. After receiving the proof of the payment made, the office arranges to send a photographer to take a picture of the residence along with the applicant holding a

small slate with the 'Inward No' written on it. This photograph is pasted at the bottom of the pink NOC certificate which is then laminated by the applicant to ensure protection from any possible damage. The NOC is delivered to the applicant who can now apply for water-sewer connection, or use it while getting the existing illegal connection legalized.

7. In case the dwelling unit is more than 40 sq m, the applicant's other family member can apply on another form, and the procedure to be followed remains the same.

Individual Water & Drainage Connection:

1. The applicant is eligible for a water connection only if s/he possesses a drainage connection. S/he is required to apply for a drainage connection and is only then eligible for water connection. This is done following the similar procedure/steps explained above.
2. If the applicant does not have a drainage connection, s/he has to apply for the same to the sub-zonal office or CCC along with NOC receipt and latest tax bill.
3. This application is sent to dy. city engineer.
4. The concerned civic official checks for the existing network availability, and if found feasible, sends the application back to the assistant city engineer along with the site map and location permission.
5. After getting permission from assistant city engineer, the dy. city engineer passes a resolution permitting the drainage connection for the applicant. In case of non-feasibility of a water connection, permission will not be granted for drainage and therefore, the water connection.
6. Once the resolution is passed and permission is granted, the applicant is expected to pay Rs 300 for the drainage connection and get the receipt.
7. The duplicate receipt and the application are sent back to dy. city engineer who then sends the documents to the concerned ward's technical supervisor.
8. The work is then allotted to a plumber and the applicant gets the drainage connection. This procedure takes minimum of 10 days. The applicant gets the connection up to plot level at AMC's cost.
9. For procuring individual water connections, the procedure remains the same, except that s/he has to pay additional Rs 200. Here, the cost of puncturing and road cutting up to settlement level is borne by AMC. The miscellaneous costs like road cutting and filling within the settlement, pipe cost etc. has to be borne by the applicant.

Cost for the services

- Application form for NOC: Rs 10
- NOC Fee: Rs 1500/500
- NGO Fees: Rs 100 per HH (If NGO involved in the process)
- Drainage Connection Fee: Rs 300
- Water Connection Fee: Rs 200
- Miscellaneous Charges: Rs 500-550*

* Miscellaneous charge varies and is location-specific. It also varies across zones. It consists of cost of pipeline, road cutting and filling. This charge depends on the kind of contract awarded to contractors.

Results and Impact

AMC's initiative shows an innovative way out of illegal status of slum dwellers vis-à-vis provision of minimum of basis amenities. With necessary legal riders, that do not make them eligible for any right of, or title to ownership, the innovation comes in the wake of high court direction for

providing slum dwellers with basic services. The provision of civic utilities has brought about a sea change in the attitude of slum dwellers, and consequent improvement in living conditions and self-esteem.

Impact of 500 NOC scheme

Kokilaben Bohra, a slum dweller of Rajivnagar in West Zone, Ahmedabad, and now a house owner, suffered a lot in past 10 years mainly due to lack of civic utilities like water-sewer connection, and toilet. She was forced to collect water from the street bore that was polluted by the soak pit located nearby. In absence of individual community toilet facility, she had to go out for open defecation at night or at dawn. Under the scheme, she and many like her in the neighborhood applied for NOC by paying Rs 500, as she was fully eligible under the prescribed criteria. It was a long wait for them and following vigorous representation, water tankers were offered on alternate days. The tankers often got diverted to the more influential and powerful people who bribed the tanker drivers. Ultimately, water and sewer connections were released; she was also able to get an individual toilet constructed on her premises. This enabled her to get cleaner water that too at her door step, and avail the privacy of individual toilet. This was made possible by the issue of the NOC certificate by AMC and the help rendered by the NGO SEWA. Kokilaben sums up stating, "I have struggled a lot for past 10 years, and can now live in comfort."

Lessons Learnt

Slum areas are the most unhygienic areas of a city. This is mainly because the residents are deprived of basic civic utilities. The major impediment in granting permission for the ULBs is the unauthorized dwellings that have come up of government or municipal or private land. Consequently, the slum dwellers do not get clear drinking water, do not have sewerage connection to discharge their liquid wastes, and have no toilet. Over the years, this has resulted in mushrooming of unhygienic conditions not only in the slums but across the city. AMC has taken a holistic view of the prevailing conditions in the slum areas and implemented innovative measures to provide slum dwellers with minimum basic amenities. This indicates that it is possible to provide amenities legally to illegal settlements.

Sustainability

Any rights-based approach that leads to environmental improvement leading to improved living standards of urban poor is a sustainable process.

Transferability

This can be well replicated in other cities of the state and create better environment not only for the slum dwellers but all of the city people at large.

Anand Municipality

Door-to-door waste collection
Tax Collection efficiency

Anand City Profile

Anand is the administrative centre of Anand District in the state of Gujarat. It is administered by Anand Municipality. It is part of the region known as Charotar, covering Anand and Kheda Districts. Anand is known as the Milk Capital of India. It became famous for Amul Dairy and its milk revolution. This city hosts the National Dairy Development Board of India and Anand Agricultural University.

Geographical Location and Connectivity

Anand lies between Ahmedabad and Vadodara on the Western Railway, 101 km from state capital Gandhinagar. It is a railway junction.
The national express highway from Ahmedabad to Vadodara also passes through Anand.

Profile of Anand Municipality

Population (Census 2011 Provisional)	1,96,000
Population (Census 2001)	1,56,050
Number of households (present year)	38207
% of slum population (Census 2011)	1.34
% of slum population (Census 2001)	5.15
Number of wards	14
Area (sq.kms)	21
Annual budget (2009-10), Rs million	23374.1
Contact details of municipality	Chief Officer Anand Municipality Anand, Tel: +91-2692-243943/42 Fax: +91-2692-244881 e-mail: anand_nagarpalika@yahoo.co.in

9 DOOR-TO-DOOR WASTE COLLECTION

Category: *Solid Waste Management*
Information provided by: *Vibhakar Rao (Chief Sanitary Inspector), Anand Municipality*

Abstract

Anand has achieved 100 percent door-to-door garbage collection. All its 38,207 households, as per year 2010-11, have been covered by the service. This target could be achieved by outsourcing the service to sakhi mandals. The number of complaints received by the municipality has also reduced.

Situation before initiative

Anand Municipality had hired a contractor for door-to-door garbage collection. The coverage of the service was 76 percent then. All complaints including those related to SWM were registered zone-wise. Regular reports were submitted to the municipality. However, this left scope for possibility of some complaints being missed out either deliberately or by chance. On an average, 25 complaints were received for door-to-door garbage collection every month.

However, this contract was terminated by the end of 2007. For a few months after that, there was no door-to-door collection. The ULB did not have enough staff. Of the sanctioned 182, it had only 143, which included the ULB staff and the daily wagers.

Initiative

In 2009, when a new governing body took over, the door-to-door collection was outsourced to three *sakhi mandals*. Advertisements were placed in local newspapers informing the citizens of such a change. Also, residents were invited to register complaints in case of any lapse on part of the *sakhi mandal* workers.

Simultaneously, the municipality centralized the complaint registration. Complaints are now to be registered directly at the municipality office. Earlier, when the complaint registration was zone-wise, the zonal in-charge was required to submit a report of the complaints received.
In absence of IT-enabled services that would provide seamless movement of zonal data to the chief officer, it was observed that many times, information of the true situation of services at zones didn't reach the central office.

Complaint registration at the central municipality office ensured that the ULB got the true picture of the field. Once the door-to-door collection was outsourced, the *sakhi mandals* were accountable for regular collection of waste. For every complaint received of irregularity in garbage collection, a certain amount was deducted from the remuneration paid to the *sakhi mandals*.

As part of the strategy, the municipality hired three *sakhi mandals*. In total, these *sakhi mandals* have 120 sweepers. The equipment used by the *sakhis* for waste collection is arranged for by the *sakhi mandals*.

The *sakhi mandal* workers collect garbage from individual houses and dump them in secondary dustbins. From there, the ULB staff collects the garbage and dumps it at the disposal site. The *sakhis* are paid Rs 12 per house per month. Anand Municipality has 142 workers in the garbage collection chain. Of these, 120 are employed by the *sakhi mandals*.

There are ward-wise sanitary inspectors who monitor the work of the *sakhi mandals* and submit daily reports to the chief sanitary inspector.

Results

The step worked positively for both the ULB and the residents. For the short-staffed ULB, it was a burden off their shoulders and for the residents, it meant smoother daily operations. The number of complaints received has reduced drastically. Now there are 20 complaints on an average per month, as against 25 earlier. Post outsourcing to *sakhi mandals*, the waste collection is 100 percent which translates into increased citizen satisfaction.

Lessons learnt

While the door-to-door collection has been taken care of, the municipality has not succeeded in its attempt to put in place segregation of waste as per rules. The reason is being attributed to the lackadaisical approach of the residents. According to the chief sanitary inspector of Anand Municipality, Vibhakar Rao, the ULB's efforts of total segregation have been unsuccessful so far because, as he says, "People cannot spare a few extra seconds to segregate the waste at their ends. Till the residents understand the importance of segregation, there is not much that we can do."

Another aspect that is of equal importance is the litter on the roads. "Roads are swept every morning. But, if they are strewn with litter by afternoon, it is a waste of time, money and energy," says Rao.

Through a government grant, the municipality had received tricycles for garbage collection in 2007, containers in 2010 and lifter in 2011. But, the equipment could not be put to optimum use as their delivery was scattered.

Sustainability

With public and government participation, this approach can be very much sustainable. Such an arrangement promises to be favorable for both, the local body and the residents.

Transferability

Door-to-door waste collection is being carried out in many ULBs. (A case study of Khedbrahma Municipality that has a segregated chain of MSW from source to vermi-compost plant has been discussed elsewhere in this volume.)

10 TAX COLLECTION EFFICIENCY

Category: *Tax collection efficiency*
Information provided by: *Gaurang Soni, Chief Accountant, Anand Municipality*

Abstract

Anand Municipality posted an increase of Rs 11.969 million in tax collection in the financial year 2010-2011 as compared to the previous year. This has been mainly due to a series of exercises undertaken by the ULB towards tax recovery.

Situation before the initiative

In Gujarat, water, sewerage and SWM taxes are included in the general property tax bill. It was observed that for the year 2008-09, while the demand for water tax was Rs 8.8 million, the collection has been Rs 7.0 million, a collection efficiency of 79 percent.

Similarly, as against the demand for sewerage tax of Rs 6.8 million, the collection figures are Rs 5.3 million, the collection efficiency being 77 percent.

For SWM services, the demand for special tax was Rs 4.3 million, while the collection has been Rs 3.1 million, the collection efficiency being 72 percent.

Initiative

A ward-wise list of people who had not been paying taxes was prepared and notices were served to them. Appeals were made in local newspapers and cable TVs urging people to pay up their taxes. The ULB also issued warnings of disconnection of water supply and sealing of properties if the taxes were not paid.

	Demand (in Rs million)			Collection (in Rs million)		
Year	Pending	Current	Total	Pending	Current	Total
2007-8	44.129	58.177	102.266	10.117 (22.93%)	45.554 (78.36%)	55.672 (54.44%)
2008-09	44.818	70.106	118.924	14.731 (30.18%)	49.743 (70.95%)	64.474 (54.41%)
2009-10	58.388	73.101	131.489	19.242 (32.96%	56.063 (76.69%)	75.306 (57.27%)

The ULB introduced a 10 percent rebate for payment of tax made within 30 days of issuing of the bill. An 18 percent penalty per annum for non-payment of dues within 90 days was also introduced.
Drum-beating exercise was taken up at the doorsteps of defaulters. The exercise was aimed at embarrassing the defaulters and getting them to pay up the dues. The step that followed these measures was sealing of connections. The ULB cut the water connections of 50 properties. Besides, it also sealed 113 shops and issued closure notices to 1,450 properties.
In 2010, Anand Agricultural University paid up taxes totaling Rs 5.792 million. After being served a closure notice, the university paid up Rs 2.928 million in March 2011.

Results

In the year 2010-11, Anand Municipality collected Rs 19.443 million of pending taxes and Rs 56.525 million of current taxes.


આણંદ પાલિકાતંત્રએ વેરાવસૂલાત ઝુંબેશ અસરકારક
બનાવવા બાકીદારો સમક્ષ ઢોલ વગાડ્યાં

A news article on the drum beating exercise

Lessons learnt

Taxes form a major chunk of municipal revenues and every effort should be made to mop up maximum taxes. Most often, political and administrative will plays a critical role. Anand Municipality was able to successfully implement its tax collection strategies, including sealing of shops, and a major chunk of the credit goes to the support that it received from the political and administrative wings.

Drum beating exercise

Sustainability

A very determined elected body facilitates the administration to seal properties or cut off water/sewerage connections if taxes are not paid. Thus, a no-nonsense approach of the administration supported by political will plays a very important role in efficient collection of taxes that supports the local government in efficient governance.

Transferability

Already other ULBs are following the practice of offering rebates, charging penalties and undertaking drum-beating exercises. These steps have been quite effective in improving the collection efficiency of the ULBs.

Jasdan Municipality

Organized solid waste management

Jasdan City profile

Jasdan is a Class C municipality in Rajkot district. It is the biggest taluka in the district and has 102 villages. Jasdan has an average literacy rate of 67 percent, higher than the national average of 59.5 percent: male literacy is 74 percent, and female literacy is 60 percent Geographically, it is at the heart of the Mandav hills from where majority of the rivers of Saurashtra originate and flow into the Arabian Sea and Gulfs of Kutch and Khambhat and where two major rivers of Saurashtra peninsula, Aji and Bhadar, originate.

Geographical Location and Connectivity

Jasdan is located approximately 180 km from Ahmedabad. The nearest railway station from Jasdan is Khijadia junction (33 km) while the nearest airport is at Civil Airport at Rajkot (53 km)[8]

Profile of Jasdan Municipality

Population (Census 2011)	48560
Population (census 2001)	39046
Number of households (estimated)	6868
% of slum population (census 2011)	15.75
% of slum population (census 2001)	Na
Number of wards	9
Area (sq.kms)	51
Annual budget (2009-10), Rs million	44.1
Contact details of municipality	Chief Officer, Jasdan Nagar Seva Sadan, Jasdan Tel: +91 2821-221550 Fax: +91 2821-222060 e-mail- jasdannagarpalika@yahoo.com

[8] http://holyindia.org

11 TOWARDS ORGANIZED SOLID WASTE MANAGEMENT

Category: *Solid Waste Management*
Information provided by: *Tilak Shastri, Chief Officer, Jasdan Municipality*

Abstract

Jasdan's is a story of determined efforts paying off. Challenged by open disposal of domestic waste, Jasdan Municipality took up some innovative measures to make the city cleaner. Seven sakhi/ sakha mandals were hired to collect waste from every house.

Situation before the initiative

As per the provisional data of Census 2011, there are nearly 10,000 households in Jasdan. Prior to 2010, Jasdan did not have organized door-to-door waste collection service. Its 25-member staff (13 permanent and 12 daily wagers) was grossly inadequate to meet the requirement of the municipality.

As a result, garbage from all the houses in Jasdan was dumped in the open; streets would always be dirty. This led to unhygienic conditions in the city.
To clean up the city, the municipality used to give periodic contracts to private agencies. These contractors would employ local people belonging to the Valmiki samaj and get the work done, but would not pay them adequately, indirectly exploiting the workers.

Jasdan also had a vermi-compost plant set up by GUDC which lay idle for want of operators, this despite the fact that the daily generation of solid waste in Jasdan was 11 TPD.

Initiative

In 2010, the chief officer of Jasdan, Tilak Shastri, undertook micro planning for preparing the sanitation plan for the municipality. Zones, wards, beats and blocks were identified. The city was divided into three zones. Beats were identified for street sweeping and blocks for door-to-door collection. One beat is made up of 450 sq m or 650 running metres. There was demand for 85 sanitation workers. The then existing staff (23 were available as two were due to retire) was insufficient.

SWM : 2010-11 Data

Number of Households (Census 2011, Provisional)	9393
Total Commercial properties (2010-11)	2047
Door-to-door primary collection – HH coverage @ 90%	8453
Door-to-door primary collection – Commercial properties coverage @ 90%	2047
Total Waste Generated (2011 Estimated)	11.0 TPD
Waste processed at vermi-compost plant	4.0 TPD
Compost produced (estimated)	1.0 TPD
Efficiency in Collection of MSW (%)	81
No. of Complaints per month/all resolved in 24 hrs	50
No. of containers (1.5 ton capacity)	57

Human Resource

Against 53 sanctioned staff for SWM, only 28 persons are working. There is one sanitary inspector on a permanent position. While 50 *safai karmacharis* have been sanctioned, only 24 are actually working.

Transportation

A total of 10 trips are made by two tractor trolleys and three lifters/dumper placers to the vermi-compost plant for directly dumping the waste.

Primary Collection

Of the nine wards, the municipality carries out door-to-door primary collection of waste in three wards; work at the remaining six has been outsourced.

Street sweeping

The chief officer directly approached members of the Valmiki samaj, the community that is commonly involved in sanitation sector. He explained to them that their exploitation at the hands of private contractors could be avoided if they worked directly for the municipality. He advised them to form *sakhi mandals*, and even registered eight such groups. Each *sakhi mandal* is required to have 10 members. One of the registered groups was unable to meet this requirement and hence could not be given the work. The remaining seven were assigned the work of street sweeping, door-to-door waste collection, cleaning of open drains and spraying of insecticide as and when required. The insecticide is as per the norms laid down by the government (70:30 ratio of lime powder and melathion dust). Normally, the insecticide is sprayed once a week, but it is sprayed daily if there are chances of spread of diseases, for instance, in monsoon.

The municipality provided the *sakhi mandals* with containerized wheel barrows having six bins each. When the insecticide has to be sprayed, one of the six bins is filled with it. The workers first clean up the place and then spray it over the area. 24 *safai karmacharis* are employed for a road length of nearly 23 km.

To monitor the work of the *sakhi mandals*, a sanitary supervisor has been hired, one for each zone. These supervisors prepare daily reports which are submitted to the chief officer.

For all these tasks, each *sakhi* is paid Rs 72.50 per day as per the Minimum Wages Act (half day pay as they work for four hours)

Every fortnight, a review meeting is held with the *sakhi mandals*. Besides, every month, a *'chintan shibir'* is organized for sanitary workers. Cash prizes of Rs 501, 251 and 151 are awarded to the three best sanitary workers based on the reports submitted by the sanitary supervisors.

For secondary collection, particular spots were identified. Closed bins of 4 m^3 capacity, provided by GUDC, were placed at these spots.
As part of the communication strategy, residents were informed of the garbage collection initiative. For every complaint received of non-collection of garbage, Rs 10 is deducted from the salary of the worker. Currently, slums have not been covered in the collection. However, they are cleaned up on a regular basis.

Rules pertaining to littering in public places are being enforced. In another instance, shop owners were asked to put up dustbins and instruct their customers to throw the waste in the dustbins. Failure to comply with these instructions would entail a fine of Rs 500. The municipality has recently started charging Rs 200 as administrative charges from shopkeepers who throw waste in the open.

A ban has been placed on sale of water pouches. Jasdan gets a number of visitors from surrounding villages every day. These people purchase water pouches and discard them carelessly on the streets. As a result, streets that have been cleaned in the morning are filled with plastic pouches by evening. To avoid this, the municipality has decided to enforce the ban strictly and is working out methods for the same.

The idle lying vermi-compost plant at Jasdan, having capacity of 6.7 tons, has been revived and an NGO has been roped in for the operation and maintenance of this site. The responsibility of the municipality is to ensure that the waste reaches the vermi-compost site. The recyclable waste is segregated and the biodegradable waste is sent ahead for vermi-composting.

The municipality also aims to make the city free of open defecation. It is focusing on slum pockets in the area. For this, it has identified 18 spots and city-level committee has been formed to meet the target.

Recently, a budget of Rs 0.5 million has been approved for IEC campaign for solid waste management. The campaign will be launched soon.

Results

- The decision to hire members of the Valmiki samaj directly has had a social impact. As the interference of middle men was done away with, exploitation of the community has been stopped. It has also generated employment for those who did not have work.
- While it has provided employment to more members of the Valmiki community, it has also meant increased satisfaction for citizens as well as delivery of services at a reasonable cost for the ULB.
- Earlier, all the garbage from houses was thrown on the streets. But, after the hiring of *sakhi/sakha* mandals, the coverage of door-to-door waste collection has reached 90-95 percent.
- Today, Jasdan has among the best organized garbage collection systems in Rajkot district.
- The NGO that produces manure from the vermi-compost process sells it for Rs 2 per kg.

- Though the ULB is not paid anything by the NGO, at least, the waste generated daily is taken care of, leading to cleaner surroundings.

Lessons learnt

With proper leadership from ULB, citizens can be taken into confidence for improving SWM service delivery. Integrating institutional approach to SWM into overall sanitation scenario can bring about a clean city.

Sustainability

This initiative is socially as well as financially sustainable. However, the biggest impediments to the initiative could be the lack of civic sense and irregularity of sanitary workers.

Transferability

A year ago, Jasdan had little infrastructure to support its dream of improving solid waste management in the city. However, with focused efforts, a lot has been achieved. Jasdan's initiative can be easily replicated by any ULB that faces a similar situation.

Khedbrahma Municipality

Segregated chain of MSW—From source to processing site

Khedbrahma City Profile

Khedbrahma is a class C municipality in Sabarkantha district. It is a historically significant place.

Geographical location and Connectivity

Khedbrahma is 122 km away from Ahmedabad. It has a state transport bus station and a meter gauge railway station.

Profile of Khedbrahma Municipality

Population (Census 2011 Provisional)	Na
Population (Census 2001)	25556
Number of households	4150
% of slum population (Census 2011)	Na
% of slum population (Census 2001)	Na
Number of wards	16
Area (sq.kms)	27.32
Annual budget (2009-10), million	35.7
Contact details of municipality	Chief Officer Khedbrahma Municipality Nr. Mamltadar Kacheri Khedbrahma Tel - +91 2775-220021 Fax: +91 2775-222778 e-mail - np_kbrhma@yahoo.co.in

12 SEGREGATED CHAIN OF MSW—FROM SOURCE TO PROCESSING SITE

Category: *Solid Waste Management*
Information provided by: *Narendrasinh J. Parmar, Sanitary Inspector*

Abstract

Most large and small urban local bodies in Gujarat are yet to comply fully with rules regarding door-to-door collection of municipal solid waste (MSW). Various reasons are given, including "difficulties in persuading people to undertake segregation at source". The waste continues to come at a landfill or a dump site with both, dry, recyclable waste mixed with organic, wet waste. Khedbrahma is a rare city in that it truly practices segregation of waste. From source to processing site, the MSW remains segregated.

Situation before the Initiative

Prior to 2006, the streets of Khedbrahma were littered with waste and overflowing waste storage containers. People went about their life unmindful of the situation till the municipality decided to do something about it, considering that the famous Ambukaji temple attracted the devout to Khedbrahma.

Initiative

In late July 2006, the general body of Khedbrahma Municipality decided to organize a public meeting, involving community leaders, intellectuals, temple trustees and *Vehpari mandal* representatives in decision making process for cleaning up the city. The public-private scheme for collection of waste door-to-door was proposed and approved by the people's representatives. The scheme was implemented in August 2006 with total cooperation of the citizens. [9]
Natural Foundation of Modasa, was given the task of door-to-door collection of waste on contract. The municipality provided the foundation with 27 containerized tricycles with four bins in each.
Maintenance of vehicles and manpower provision is the responsibility of the contractor. The municipality pays the contractor Rs 7 per property, per month.
In case of failure to collect waste from any household/shop, and on the basis of any telephonic complaint, Rs 7 is deducted per property from the payment due to contractor after consultations with him.

Communication & Education Strategy
The citizens were made aware of the need for and benefits of segregating waste at the household level. Volunteers from NGOs Yuva Unstoppable and Yuva Khedbrahma went around

[9] UMC -PAS II Team visit 30.12.2010

house to house and in the main market. Pamphlets were distributed and rickshaws fitted with microphone system were used for announcements. The Yuva volunteers also swept some streets to demonstrate solidarity with public, and for motivating them to join the campaign for a clean Khedbrahma.

Process

- The municipality, in consultation with the contractor, has placed 47 containers of 4.5 cu m capacity each, at strategic points. 23 containers were coloured green for wet waste, and 24 black for dry waste.
- The contractor's job is to collect segregated waste from households and dump it in separately marked municipal containers.
- The municipality had initially distributed 8,000 bins to households for storing segregated waste.
- The municipality uses one container carrier in 10-trips-per-day cycle to carry the waste to the vermi-compost site started under the aegis of GUDC, 3 km away from the city. There, the wet and the dry waste dumps are separate.
- Street sweeping is done by a road browser and road brush machines every Saturday. 35 municipal sweepers are employed (7 permanent staff, rest daily wagers) every day. The street waste is dumped in the 'black containers'. The dust and stones are used for filling eroded land around the city.

Door to Door waste collection

- A householder or a shop owner throwing waste on the streets is duly warned, failing which s/he is fined Rs 500 (as donation to municipality). In the worst case scenario, the policy is that water connection be withdrawn.

Results

- There are 8,382 properties in Khedbrahma of which 6,591 are residential properties and 1,791 are commercial properties. The residential properties include those in five slums numbering 1,500. All the 8,382 properties are covered under door-to-door waste collection system of the municipality. There are the other 1,209 properties that are mainly agricultural farms that are not participating in waste collection scheme as they re-use or recycle their waste. Overall therefore, the door-to-door collection of segregated waste covers nearly 93 percent of the total properties in Khedbrahma.
- The total MSW generated at Khedbrahma is 4.5 tonnes per day (TPD). The municipality uses a private weighbridge for weighing the tonnage. Accordingly, of the total waste generated, dry waste constitutes 3 TPD and wet waste (procured mostly from commercial and vegetable market sources) constitutes 1.5 TPD.
- Khedbrahma is visually very clean with even tea stalls keeping waste bins on the road side.
- In 2007, the municipality received a cash reward for sanitation under the Nirmal Gujarat scheme.

Lessons learnt

While most cities are not able to involve citizens in segregating the MSW at source, Khedbrahma has succeeded in creating two separate streams of dry and wet waste. Apart from political leadership, the design and implementation of communication and education strategies are important for the success of a project. In case of Khedbrahma, involving citizens in decision-making process has been perhaps the most decisive step that is worth emulating by other cities. Participatory approach, such as involving local CBOs, will always bring positive results, especially since solid waste management needs mass participation, and therefore, mass appeal. Khedbrahma exemplifies people's will to implement SWM in toto, if only led properly by good-intentioned leaders and a spirit of partnership.

Sustainability

Privatization and public participation in municipal programs such as solid waste management are processes that lead to their sustainability, and that of environment.

Transferability

The need to segregate dry and wet waste need not be over-emphasized in view of the existing SWM (M&H) Rules 2000 of the Government of India. The participatory process of segregation of waste and the administrative steps for logistics involved in transportation of waste in segregated manner should be replicated in other cities where mixing the wastes is still the norm.

Bhayavadar Municipality

Natural composting of municipal solid waste

Bhayavadar City Profile

Bhayavadar is a Class D municipality in Rajkot district and an erstwhile princely state of Kathiawar. It has a major agricultural base.

Geographical location and connectivity

The closest airport is Sardar Vallabhbhai Patel Airport in Ahmedabad (281 km). By road, it is well-linked to Upleta and Dhoraji.

Profile of Bhayavadar Municipality

Population (Census 2011)	Na
Population (census 2001)	18254
Number of households	3795
% of slum population (census 2011)	Na
% of slum population (census 2001)	Na
Number of wards	7
Area (sq.kms)	9.3
Annual budget (2009-10), Rs million	61.79
Contact details of municipality	Chief Officer Bhayavadar Municipality Bhayavadar, Tel: +91-2826-274413; 274413; 274905 Fax: +91-2826-274544

13 NATURAL COMPOSTING OF MUNICIPAL SOLID WASTE

Category: *Solid Waste Management*
Information provided by*: D D Meswania (General Admin, Bhayavadar Municipality)*

Abstract

Since Bhayavadar has an agricultural base, around 70 per cent of the waste generated is organic in nature. To avoid unhygienic dumping of the waste as well as to produce manure, the municipality started composting of the waste at two wastelands. The ULB also identified composting as a source of revenue.

Situation before the Initiative

The town of Bhayavadar generates around 4.5 tons of solid waste per day. 70 percent of the total waste generated is organic in nature, which can be easily decomposed. The composting of MSW has been a regular practice for past 50 years plus.

Initiative

The municipality has identified two wastelands (area approximately 2 acres) under the ownership of the state government outside the town limits, which are used as dumping sites. It has created 80 pits of 5'x 20'x 3' deep dimension over the two identified wastelands.

A municipality-owned tractor collects waste from all areas as per the identified route. This tractor collects residential waste once in two days while the waste generated from the commercial and main market area is collected daily. The waste is directly transported to the dumping sites where the municipality workers segregate the organic and the inorganic waste. The organic waste in dumped into the pits sequence-wise.

The sullage collected from the open drains in the city is also dumped into these pits; apart from adding the required moisture content, it also improves the nutrient content of the compost produced.

Just before monsoon every year, the municipality invites per-pit bids for auction of the compost.

Results

- The organic solid waste generated is completely decomposed preventing litter and unhealthy environmental conditions in the town.
- The municipality incurs a monthly expense (including wages of workers, diesel expense etc) of about Rs14,500 for carrying out the entire process.
- The municipality gets approximately Rs 900 to 1500 for the manure per pit from the local farmers in Bhayavadar area.

- In the year 2010-2011, the municipality made a net profit of Rs 78,050 from selling the compost.

Lessons learnt

Bhayavadar, although a very small town, has efficiently managed its solid waste by composting the same.
Although, the process adopted is not very scientific and no care has been taken for leachate handling, the local body has demonstrated that even with a small staff and meager resources, 100 percent of organic solid waste generated could be efficiently and productively handled.

Sustainability

Conventional composting method of simply burying the waste and letting nature take care of it has a long history in India. A ULB like Bhayavadar practising this simple method is a novelty. In this case, there is not only cost recovery but generation of significant excess revenue.

Transferability

The initiative is very simple to replicate. With certain soil profiles, managing the leachate is advisable so that the groundwater may not be contaminated. More scientific options of spraying inoculums on the waste and reducing the composting time are also available. The remaining inorganic waste-plastic material etc after recovering all recyclable material should be sent to sanitary landfill sites.

Dharampur Municipality

Towards improved sanitation

Dharampur City Profile

Dharampur is a Class B municipality situated on the banks of the Swargavahini River and is surrounded by the Sahyadri mountain range on east, west and south sides. Due to its location, the town enjoys a very pleasant climate throughout the year.

Situated in Valsad district in South Gujarat, Dharampur was a capital of the former princely state of Dharampur. Originally, it was known as Ramnagar. The present day Dharampur dates back to 1764 AD and was founded by King Dharmdevji. The city of Dharampur had two major phases of development — the first in the late 18th century, when the Rana undertook the construction of Raj Mahal, public buildings, step wells and temples, and the second in the late 19th century, when as a part of the Queen Victoria Golden Jubilee celebrations, the Anglo Vernacular School, jail and hospitals were constructed[10].

Profile of Dharampur Municipality

Population (Census 2011 Provisional)	29000
Population (Census 2001)	19930
Number of households	2979
% of Slum Population (Census 2011)	5.52
% of Slum Population (Census 2001)	Na
Number of wards	5
Area (sq.kms)	15.51
Annual Budget (2009-10), Rs million	58.1
Contact Details of Municipality	Chief Officer Dharampur Municipality Mota Bazar, Dharampur Tel -+91-2633-242035 e-mail: np_dharampur@yahoo.com.in

[10] Excerpted from Dharampur, Wikipedia, 2010

14 TOWARDS IMPROVED SANITATION

Category: *Solid Waste Management*
Information provided by: *Vipul Chowdhary (Sanitary Inspector)*

Abstract

Dharampur Municipality has to its credit, several initiatives for improving the town's sanitation. It has also won several awards from the state government for its various initiatives. These initiatives range from door-to-door garbage collection and waste processing to construction of pay-and-use toilets for the urban poor.

The campaign for a plastic-free Dharampur has yielded encouraging results. Whether optimizing distances for waste pick-up or strategizing the points for tractors or even sale of compost, the municipality continues to evolve itself.

Situation before the Initiative

Until 2008, there was no organized door-to-door primary collection of waste. The tractor-trolleys used to go around partly for primary collection and partly to clear the open dumps. It was only after the trolleys were full that each made a trip to the open dump site. Some of the municipal *safai karmachari*s were allotted the task of assistance in primary collection

Initiative

The door-to-door waste collection service was privatized. After due procurement process, Sai Om Sakhi Mandal was given the annual contract that continues to be renewed each year till date as no other party responds to the advertisement. The *sakhi mandal* is paid Rs 3.50 per household/shop. Communication, waste transportation and training strategies were chalked out to make the initiative as productive as possible.

Some relevant data	
Number of Households (Census 2011, provisional)	4500
Total Commercial properties (2011)	1072
HH served by Primary collection (estimated)	3600 (80%)
Commercial properties served by Primary Collection	700 (70%)
Total Waste Generated (2011 Estimated)	6.0 TPD
Waste processed at vermin-compost plant	1.0 TPD
Compost produced (estimated)	0.3 TPD

As per 2010-11 data, the city generates an estimated 6 TPD of municipal solid waste. Approximately 1 TPD of organic waste is processed at the vermi-compost plant with capacity of 4 TPD. The inerts are transported to an open dump site, 3 km outside the city.

The municipal administration had prior consultation with elected representatives. This was followed by ward-wise meetings, organized to educate people. The following steps have been taken over the years to improve sanitation.

- *Sakhi Mandals* were trained and educated for collection of domestic waste from households. They were motivated by the potential for income besides contributing to the cleanliness of the city areas.
- The municipality distributed 500 dustbins with wheelbarrows among the women members for collecting dry and wet waste separately.
- Tractors are made to stand at definite points. Domestic wet waste is transported to designated tractor points by the *sakhi mandal* members.
- The vermi-compost plant was also constructed in 2008-09 with support from GUDC.
- The sale of compost brings in additional revenue of nearly Rs 8,000 every month.

Processing the Vermi -Compost and (R) the compost

Towards plastic-free city

In 2008-09, the municipality embarked on the mission to make Dharampur plastic-free, while educating people about its advantages and benefits. It has strictly enforced the ban on use of plastic bags with thickness less than 20 microns. The municipality, with the help of local people and NGOs, has distributed 5,000 eco-friendly bags.

The municipality's resolve in enforcing the ban is a lesson in governance. In one instance, 879 kg of banned plastic bags was confiscated by municipal inspectors and sold to a recycling agency for Rs 14,400.

Door to Door Campaign

Results

Dharampur Municipality has enhanced its revenue generation through its initiatives. The designation of tractor picking points has led to reduction in fuel bill by 20 percent even as the

sakhi mandal members earn Rs 300-500 monthly from segregating the dry waste for recycling. Sale of vermi-compost brings in additional revenue for the municipality.
On the financial front, and in order to support its various developmental activities, the municipality has strengthened its tax recovery. It has recovered 93.19 percent of its tax demand in 2008-09, and as on March 31, 2010, the tax recovery was at 97.18 percent.
The campaign for a plastic-free Dharampur has yielded encouraging results.

Toilets
Dharampur Municipality has been able to achieve 100 percent target (2008-09) in constructing five pay-and-use toilets. During 2008-09, the municipality also completed construction of 200 individual toilets for the urban poor in Dharampur. Under the state government's *Swarnim Jayanti Mukhya Mantri Shaheri Vikas Yojna*, Dharampur embarked upon an ambitious project of lake beautification at a planned cost of Rs 22.5 million.

14,250 saplings for increasing the green cover of Dharampur

It is in this background and under various incentive awards, the State Government has awarded citations and various prizes totaling Rs 3 million to date to Dharampur Municipality.

Lessons learnt

Resolving issues in sanitation sometimes requires a holistic approach that includes strategizing procurement procedures. IEC strategies for all stakeholders, transportation logistics and marketing ideas are necessary in order to bring about environmental and financial benefits for a municipality.

Sustainability

Improving sanitation each year is a step towards environmental sustainability. Such initiatives are all the more sustainable if there is revenue-generation or savings.
The elected wing in synergy with the municipal administration can play a highly pro-active and motivating role in keeping the city clean.
Privatization of primary collection is often a tool towards its increased coverage of households and commercial establishments

Transferability

There are several small cities in a similar category such as Dharampur. Such cities can devise strategies for primary collection of waste in a manner that is not only cost-saving but can be beneficial to the society at large.

Himmatnagar Municipality

Binless solid waste management

Himmatnagar City Profile

City Profile

Himmatnagar in Sabarkantha district is a central site for the ceramic industry of India, and is home to several major manufacturing units. The town has also been home to small scale industries. On the outskirts of Himmatnagar lies the cooperative diary factory, Sabar Dairy, which produces dairy based products for Amul. The suppliers include local dairy farmers from Himatnagar and surrounding villages[11].

Himmatnagar, a Class B municipality, has a current (2011) estimated population of 79,000 and has 13 property tax-cum-administrative wards. There are 39 elected councilors.

Geographical location and connectivity

Himmatnagar is located about 125 km north-east of Ahmedabad on the state highway enroute to Udaipur in Rajasthan.

Profile of Himmatnagar Municipality

Population (Census 2011 Provisional)	79,000
Population (Census 2001)	56,464
Number of households (Census 2011)	15,863
% of slum population (Census 2011)	22.20
% of slum population (Census 2001)	19.17
Number of wards	13
Area (sq.kms)	8.82 sq km
Annual budget (2009-10), Rs million	131.7
Contact details of municipality	Chief officer, Himmatnagar Municipality Tower Road, Himmatnagar Tel - +91-2772 – 241710 Fax: +91-2772 – 249305 Email: np_himmatnagar@yahoo.com

[11] Excerpted from Himmatnagar, Wikipedia, 2010

15 BINLESS SOLID WASTE MANAGEMENT

Category: *Solid Waste Management*
Information provided by: *Rajendra Chauhan (Sanitary Supervisor)*

Abstract

Himmatnagar has achieved 100 percent coverage of primary collection of waste – with or without privatizing the services. Moreover, the requirement of containers/bins has been done away with as the collected waste totaling nearly 24 tons per day is transported directly to the vermi-composting site.

Situation before the Initiative

It was in 2001 that Himmatnagar Municipality began door-to-door collection of municipal solid waste with its own staff. Prior to that, open dumping was a regular practice and it led to unhygienic conditions. There was no composting facility then. In between, from 2008 to 2011, the municipality experimented with a private operator for door-to-door primary collection of waste. With a number of complaints and a general dissatisfaction with privatization, the municipality once again took over primary collection beginning April, 2011.

Initiative

Under the direct, weekly supervision of the chairman of the SWM committee, the SWM staff aimed at 100 percent primary collection by various transportation vehicles, and directly dumping the waste so collected, estimated at 24 tons per day (TPD), at the GUDC-operated vermi-compost plant located outside the city. Thus, there are no containers/bins which are a ubiquitous sight in most of the cities in Gujarat.

Implementation Strategies

Human Resource

It is significant to note that the government-sanctioned total staff for SWM numbers only 48. This includes the labourers, sanitary inspector, sanitary supervisors, etc. However, 199 persons are actually working, most of them on daily wages or fixed pay. There is no sanitary inspector despite there being a sanctioned position; the ULB has only one sanitary supervisor on daily minimum wages.

Of the 48 sanctioned posts, 43 are for *safai karmacharies.* Against this, 169 are actually working for street cleaning over 116 km of road length. In addition, the municipality has a mechanized road browser for picking up dust from the sides of a major arterial road.

Four positions for drivers for transportation of the waste have been sanctioned while a total of 18 drivers are actually operating.

Some significant data:

Number of Households (Census 2011, estimated)	15,863
Total Commercial properties (Census 2011, estimated)	12,444
Waste generated by households (estimated)	9.0 TPD
Waste generated from road-sweeping (116 kms)	5.0 TPD
Waste generated by Hotels/restaurants	2.5 TPD
Waste generated by Markets	3.0 TPD
Waste generated by Commercial establishments	4.5 TPD
Total Waste Generated (2011 Estimated)	24.0 TPD
Recyclables taken away by ragpickers	6.0 TPD
Waste processed at vermin-compost plant	6.0 TPD
Compost produced (estimated)	1.8 TPD

Primary Collection and Transportation of Waste

One truck, 12 tractor trolleys and a three-wheeler rickshaw (for narrow streets) move from door to door, among markets, commercial establishments and institutions to collect the waste. The vehicles carry informal rag pickers for sorting out recyclables on the vehicle itself.

A total of 27 trips are made by all transport vehicles to the vermi-compost plant for directly dumping the waste, thus obliterating the need for containers on street corners.

Results

The primary collection of waste has 100 percent coverage of households and commercial/institutional establishments. This has resulted in a clean environment for Himmatnagar. Almost the entire 24 TPD of waste generated at Himmatnagar is directly transported to the vermi-compost site.

There are no containers/bins on the street corners. This means that there are no placement areas for containers that usually present a dirty, foul smelling site, with overflowing garbage. The need for special container lifters is also avoided.

The chairman of the SWM committee has a review meeting with the SWM staff every Friday. This ensures regular monitoring and feedback from concerned staff and mitigation of issues, thus reducing the complaints to a current minimum of approximately 15 complaints in a month.

Lessons learnt

Privatization of primary collection of waste is not a necessary condition for 100% coverage. The ULB can achieve this target on its own. Despite a majority of the ULB staff being on daily minimum wages in most of the smaller cities, it is possible to inspire them to achieve 100 percent coverage of the city.

The pros and cons of having containers or not and the cost benefits of direct transportation can be strategized. The elected wing, represented by the chairman of the SWM committee for a city, can play a highly pro-active and motivating role towards man-management and improved SWM.

Sustainability

It is for past 10 years that the Himmatnagar Municipality has succeeded in streamlining the waste collection process in a manner that containers have been done away with. The initiative is logistically and environmentally sustainable.

Transferability

There are several small cities in a similar category such as Himmatnagar. Many of them have containers that lie unutilized because of lack of space and/or narrow streets. Such cities can formulate strategies for primary collection of waste in a manner that the coverage of the service is 100 percent while also ensuring that there is no spilling of containers on their roads.

Amreli Municipality

Water conservation through check dam renovation

Amreli City Profile

Amreli is a Class B municipality. The ancient Sanskrit name of Amreli was 'Amarvalli'. Amreli, now a district headquarters, was earlier part of former Gaekwadi State of Baroda. After independence, the district became a part of Bombay State and later, a separate district in Gujarat State after the bifurcation of Bombay State in 1960. Amreli is now an important centre in the Saurashtra region of Gujarat.
Amreli is the smallest district in Saurashtra. Its economy depends on agriculture.

Geographical location and connectivity

Amreli is located 289 km away from state capital Gandhinagar.

Profile of Amreli Municipality

Population (Census 2011 Provisional)	1,05,653
Population (Census 2001)	90,230
Number of households	17,232
% of slum population (Census 2011)	3178
% of slum population (Census 2001)	Na
Number of wards	12
Area (sq.kms)	13.43
Annual budget (2009-10), Rs million	29.75
Contact details of municipality	Chief Officer Amreli Municipality Dr. Jivraj Mehta Chowk, Amreli Tel: +91 2792 - 220917, 223582 Fax: +91 2792 - 220917 E-mail: amrelimunicipality@yahoo.com

16 WATER CONSERVATION THROUGH CHECK-DAM RENOVATION

Category: *Water Conservation*
Information provided by: *Hasmukh V. Khasariya, Engineer*

Abstract

Amreli Municipality completed a project in water conservation and repaired a check dam as part of a public-private partnership model. The required funding was obtained from Rotary International under its 'Health-Hunger-Humanity' (3-H) Program.

Further, as an exercise in hygiene improvement, a polluted stretch of two rivulets passing through the city and used for sewerage discharge, was replaced by a bypass.

Situation before the Initiative

Scanty rains have always led to frequently occurring drought and severe drinking water problems in Amreli and its surrounding areas. Two rivulets, *Vadi* and *Thebi* passing through the middle of the town, had almost turned into sewer drains. Both were major sources of pollution, causing unhealthy and unhygienic conditions in the town.

Initiative

Amreli Municipality resolved to deal with the drinking water and pollution issues. An old check-dam, constructed about 80 years ago during the Gaikwadi rule, was in a dilapidated state with the foundation weakened and no closure gates at its 31 openings. An ambitious project to renovate the check dam was planned as a PPP model funded by Rotary International after sanctioning the project under its 3-H Program.

Measures to strengthen the check dam were undertaken along with setting up gate closures. To prevent sewage inflow in the area, a by-pass was laid down through a 2,500-metre-long pipeline. Lagoons were created at the discharge pipe end for adequate treatment. Landscaping of the surroundings and development of parks and gardens was undertaken along with setting up entertainment facilities.

Support for the project was provided by Rotary International. The Amreli chapter of the club initiated and formulated the feasibility of the project and financial assistance to the tune of Rs 14.25 million was provided.
Lake deepening work was undertaken through community donations, contributions from NGOs, State Government and the municipality.

Results

- The check dam, earlier in disused state, was reconstructed
- Impounded water body helped in raising local water table

- The lagoons served the purpose of sewage treatment adequately
- Improved environment conditions due to setting up of parks and gardens with entertainment facilities
- A spirit of ownership was cultivated through the project

Lessons learnt

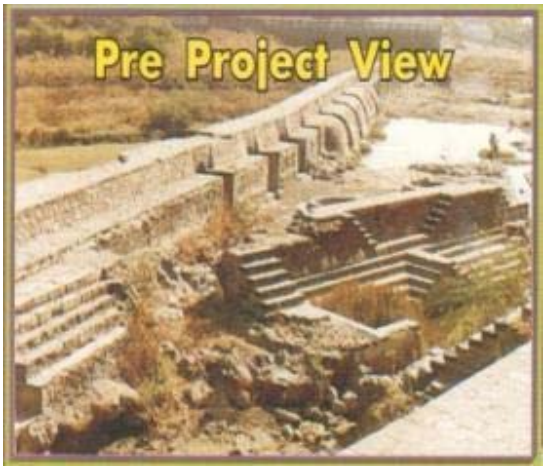
It is possible for a small municipality to bring about a major collaborative effort including funding for resolving urban issues. The question is whether there is a strong desire and motivation among municipal authorities.

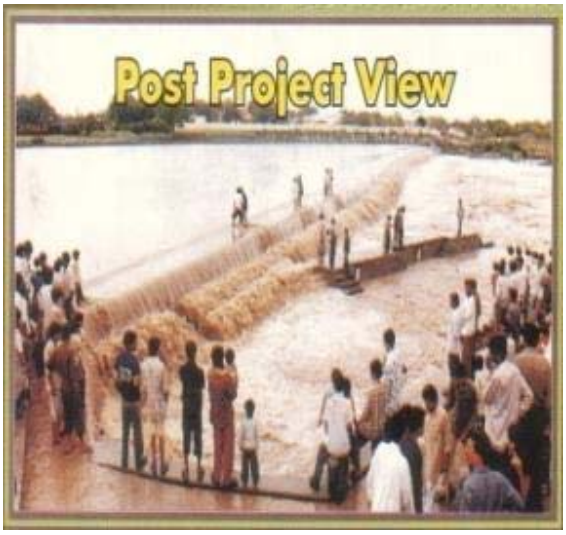
Sustainability

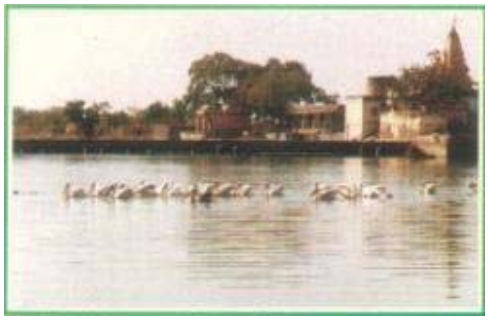
Any partnership effort towards water conservation and improvement in habitat leads to sustainable urban management supported by the all stakeholders.

Transferability

Many small cities have rivulets or drains passing through. These are usually clogged with solid waste and/or have untreated sewage flowing, thus presenting an ugly, unhygienic environment. The methodology followed by Amreli is easy to replicate in such cities.







Navsari Municipality

Improved water service delivery and lake revitalization

Navsari City Profile

Navsari is a Class A municipality located in the south-eastern part of Gujarat along Purna river. It is fondly known as the twin city of Surat. It is known for its floriculture activities and sugar business. It is also one of the largest diamond cutting centres in the world. The city has two lakes—Dudhiya talao and Sharbatiya talao. It holds religious importance for Parsis, with one of the seven Atash Behrams of the world located here.

Geographical connectivity

Navsari is located 37 km south of Surat. It lies on the Mumbai-Delhi railway link. By road, it is connected by NH 228, also known as Sabarmati-Dandi highway. The nearest local airport is at Surat.

Profile of Navsari Municipality

Population (Provisional Census 2011)	163000
Population (Census 2001)	134009
Number of households	31465
% of slum population (census 2011)	na
% of slum population (census 2001)	20.39
Number of wards	18
Area (sq.kms)	8.5
Annual budget (2009-10), Rs million	428.65
Contact details of municipality	Chief officer, Navsari Municipality Near Vegetable Market Navsari Tel: +91-2637-258029, 02637 250253 Fax: +91-2637-258029 e-mail- mail@navsarinagarpalika.com, navsarinagarpalika@yahoo.com

17 IMPROVED WATER SERVICE DELIVERY AND LAKE REVITALIZATION

Category: *Water supply*
Information provided by: *R. J. Patel, Engineer*

Abstract

Due to proximity to the sea and unchecked drawing of groundwater, Navsari was facing acute drinking water problem. Navsari Municipality undertook revitalization of Dudhiya Talao, a lake situated in the centre of the town. It was then brought into use as a primary storage tank for raw water from nearby Kakrapar canal. The project was funded by Life Insurance Corporation (LIC) and Government of Gujarat and implemented by the Navsari Municipality. The municipality is now able to provide clear drinking water to the citizens.

Situation before the Initiative

Earlier, Navsari Municipality depended mainly on bore wells for providing drinking water to its citizens. Before year 2000, the city was drawing water from 28 bore wells located in different parts of the city with depths ranging up to 200 feet. Due to proximity to the Arabian Ocean, the city was facing an acute problem of salinity ingress. Salinity in water in the city was as high as 2,600 mg/l to 4,000 mg/l TDS (The desirable limit for drinking water is 500 mg/l. The maximum permissible TDS limit as per IS 10500:1991 is 2000 mg/l). People faced problems due to such high salinity of water. Besides, the municipality also faced problems with operation and maintenance of the bore wells.

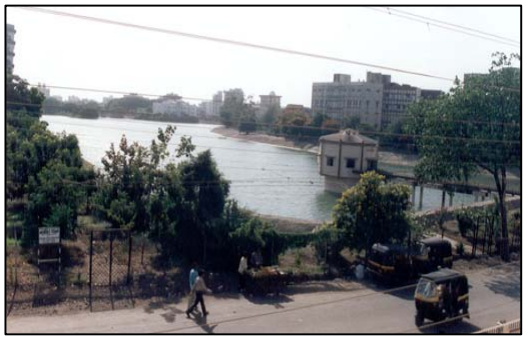
Since water had to be drawn from great depths, the expenditure on electricity was immense. Bills amounted to almost Rs 12.5 million per annum towards operating the tube wells, the pumping machinery and the three water works.

The city has a huge lake called Dudhiya Talao within its jurisdiction. However, the lake was ill-managed. Drainage lines of buildings along the lake discharged sewage into the lake. The situation was further aggravated due to the pollution caused by slum dwellers living around the *talao*.

Initiative

The municipality reviewed the situation and concluded that it was possible to bring water from the Kakrapar Canal, situated 3 km from the city, by gravity and store it in the existing Dudhiya Talao. Navsari Municipality prepared a proposal and submitted the same to the irrigation department, Government of Gujarat, for obtaining necessary permissions. The Narmada Water Resources and Supply Board approved this proposal, following which detailed project reports were prepared for the water supply scheme. The project was funded by loans from Life Insurance Corporation of India and Gujarat Municipal Finance Board and grant from Gujarat Water Supply and Sewerage Board.

As part of revitalization, the lake was cleaned up. Dredging was carried out in the lake bed to remove silt and to increase the capacity of the lake. The lake bed has been lined with low density polypropylene (LDP) sheet and brick pitching.



Dudhiya Talao

Dudhiya Talao was thus revitalized and converted into a storage place for raw water to be obtained from the Kakrapar canal. A filtration plant was also set up. The new filtration plant has been installed at the Navsari Nagarpalika Water Works. This is based on latest technology, which includes Sludge Blanket Lamella Clarifiers and High Rate Rapid Gravity Sand Filters. The construction of the filtration plant was awarded to a consultancy after tendering process. This system is of 36 MLD capacity and has been designed to cater to a population till the year 2020. It requires less area and consumes less chemicals and power as compared to conventional water treatment plant.

Water treatment plant

To ensure that the lake was free from pollution, it was important to relocate the slums that had come up on its periphery. Navsari Municipality obtained a financial sanction from Gujarat Slum Clearance Board worth Rs 30 million. The 350 slum dwellers around the Dudhia Talao were shifted to Tighra, a site on the fringes of the city which was reserved for economically backward sections. The slum dwellers were given plots as per the Sites and Services scheme. They were given plots on ownership basis and also given Rs. 2,000 as shifting charges. The new site is connected to the main city by a bus service and the settlement has facility of roads, streetlight and drinking water.

Results

The problem of high TDS in drinking water, which had persisted for last 40 years, has been solved by this project. Citizens of Navsari now get potable water.
Dependence on ground water has been reduced. This has controlled the problems of salinity ingress. Many citizens have closed their private bore-wells and have applied for new water connections to the Navsari Municipality. This has further resulted in increase in the revenue from water tax.

Slum dwellers have been successfully relocated to land reserved for economically weaker sections of the society and rehabilitated.

The municipality's energy bills have also gone down. Now, instead of running 10 pumps of 25 HP, it operates just one pump of 75 HP. One estimate suggests that the municipality will save about Rs 4 million in operational costs.
The municipality could also increase the water charges that will bring an additional income of Rs. 4.5 million.

Lessons learnt

A ULB need to realize an opportunity that has the potential to resolve so many inter-linked issues on the side lines, and bring about resolution in an integrated manner and to make it a financially and socially viable mode.

Sustainability

The various components of the project, including shifting of slums, development of lake periphery, cleaning of Dudhiya Talao and other pollution abatement measures prior to using the same as a storehouse for raw water, make up for an environmentally and socially sustainable process.
It is also a financially viable project, having used multiple sources for funding, including cost recovery through increased water charges. Cost-recovery strategies (for loan and interest payments) by Navsari Municipality have made the project more viable.

Transferability

The municipality has replicated the process for Sharbatiya Talao near Lunsi Kui. All cities and towns mostly have such lakes within their boundaries which are ill managed and become dumping grounds. Such lakes are great resources for cities in terms of their capacities for water harvesting, recreation and aesthetics. The initiative undertaken by the Navsari Municipality could be contextualized and replicated by other cities of Gujarat.

Petlad Municipality

Establishing civic centre with highly responsive complaint cell
Improved recovery of O&M of water supply

Petlad City Profile

Petlad is a Class B municipality of Anand district. Many renowned scholars, including Sardar Vallabhbhai Patel, the first Deputy Prime Minister of India, studied in Petlad. Petlad has historically been a major industrial contributor in Gujarat. Because of its textile mills and dye works, Petlad had been on the global export map since the British times. Petlad has also been home to a variety of other industries as well as a social movement that led to the establishment of co-operative dairies, companies, banks and housing societies.

Petlad is an important taluka of Kheda district. It has a very rich historical importance which dates back to Mughal era. The municipality was established in 1876 with the help of government intervention.

Geographical Location and Connectivity

Petlad lies between Ahmedabad and Vadodara, off the highway. It is about 150 km from Ahmedabad.

Profile of Petlad Municipality

Population (Census 2011)	57,000
Population (census 2001)	51,147
Number of households	11400
% of slum population (census 2011)	23.40
% of slum population (census 2001)	26.08
Number of wards	12
Area (sq.kms)	9.19 sq km
Annual budget (2009-10), Rs million	83.8
Contact details of municipality	Chief Officer, Petlad Municipality Court Compound, Petlad Tel: +91 2697-224101 – 224440 Fax: +91-2697-224101 e-mail : np_petlad@yahoo.co.in

18 ESTABLISHING CIVIC CENTRE WITH HIGHLY RESPONSIVE COMPLAINT CELL

Category: *Complaint Redressal*
Information provided by: *Arpit Patel, Computer Operator, Petlad Municipality*

Abstract

Most of the citizens were unhappy with the service delivery of Petlad Municipality. To top it, their complaints were not being redressed timely. To solve this problem, a review committee was formed, which studied all the present formats and procedures and decided to make these formats as simple as possible along with an e-registering center using ICT approach. The centre was called 'Jan Suvidha Kendra'.

Situation before the Initiative

It was felt that services provided by Petlad Municipality were not up to the mark. People had to wait for long to get information from any department as the procedures were lengthy and there were many formalities to be adhered to. Petlad Municipality, with its limited staff, was overburdened with work. The output was very slow and raised a lot of queries. It was not possible for higher authorities to get up-to-date reports immediately. Besides, there was lack of accountability and it was difficult to track the status of the complaint registered. At the same time, staff members were not able to maintain a database of all the complaints.

Initiative

Petlad Municipality formulated a special review committee to study the issue of complaint redressal threadbare. It identified and evaluated the processes, and studied the existing formats followed by the complaint cell. It evaluated adoption of the modern technology and devising new methods that would enable speedy communication to the concerned department. The entire effort was directed towards tracking the complete process and providing information of the complaint status and its redressal to the complainant. The municipality gave the contract to prepare the required software to Bhaskaracharya Institute for Space Applications and Geo-informatics. As a result, the Jan Suvidha Kendra with ICT-enabled services for government-to-citizen delivery was established in May 2008. Once this center was developed, the municipality identified and trained its own staff to operate it.

Each case is registered after filling a simple form which has a barcode on it. This is done either at the time of issuing the form or just before the submission of the form. There is no need to log the name of the applicant at the time of the issue of the form or the barcode. This helps avoid queues and makes the process more convenient to the applicants. Registered citizens can obtain partly-filled forms by giving their fingerprint or registered government photo ID.

The applicant visits the token issue counter, where an operator scans the barcode on the form and the computer system directs the applicant to one of the counters, on the basis of the type of the issue. This ensures minimum waiting time for the applicant.

The computerized token system also helps ensure optimal use of the resources at the center, as well as avoids the formation of queues there. Citizens can sit and wait till they are called to the assigned counter according to their token numbers.

Operator at Jan Suvidha Kendra

The operator at the counter checks the enclosures with computer assistance and registers its receipt on the computer screen. The applicant does not need to re-submit enclosures previously submitted in any other application. The operator performs qualitative check to ensure the complete fill-up of the form and marks that on the computer. Once all the required enclosures are checked, the software issues a bar-coded acknowledgement slip in two copies. One copy is given to the applicant and the second is attached to the application. The applicant copy shows up Jan Suvidha Kendra's help line number, latest delivery date and time.

The back office operator at Jan Suvidha Kendra scans the barcode on the application. The system shows up the concerned office and this way the received papers are sorted out. A list is generated for acknowledgement by the concerned branch.

Message received by Complainant about his complaint

Every department can access the information on pending cases on-line, through SMS query, or by requested printouts. Reminders and alerts are sent to the officers by the system to ensure timely completion of the cases. The Chief Officer also monitors the pending cases on his/her own computer.

Once the complaint is received, it is forwarded to the respective department. Simultaneously, an SMS is sent to the complainant on the number that has been registered at the centre. Depending on the issue, the time expected for redressal of the complaint is conveyed to the complainant. This way, there is a single spot where the citizen can go to get any complaint registered.

Results

- With the establishment of the Jan Suvidha Kendra, there has been significant saving of the citizens' time for the public. For example, the processing time for several issues has been reduced from several days to less than a few hours. The process of complaint redressal has become speedier and more organized.
- There has been notable change in the attitude of government employees due to transparent systems including tracking the work in process.

- Transparency has helped increase the confidence of citizens in the administration. People can know the status of their paperwork through SMSes at any time from any place.
- Complete accountability is maintained as papers are delivered to people within the promised time printed on the acknowledgement slips. Daily summary of SMS as well as availability of details of pending cases to the higher level officers has boosted the performance of the administrative staff.
- The efficiency of the administration has increased due to significant saving of time by the government officers as they receive all the applications in a completed manner and they do not have to meet people directly. Besides, the common man does not have to face the hassles of personally contacting concerned officers.
- Information and communication technology is applied and accepted in the true sense: Bar Code for traceability, SMS for alerts, and MIS software for continuous monitoring, tracking and reforms.
- Minimization of corruption as there is a single, systems-driven, computer-based front-end interface for the citizens. Incomplete applications cannot be accepted; processing is always in-turn; applicant-to-officer interface is significantly reduced and time limits are observed in a highly transparent manner.

Lessons learnt

A dedicated complaint redressal cell is an interface between the citizens and the departmental staff in a municipality. The process of redressal leads to improved governance to the satisfaction of the people.

Sustainability

Once the local government is perceived to be genuinely in the service of people, technological innovations are bound to succeed leading to good governance. Only good governance can sustain that local government in every sense of the word.

Transferability

The complaint redressal system with a special cell as an interface is easily replicable.

19 IMPROVED COST RECOVERY IN O&M OF WATER SUPPLY

Category: *Cost recovery*
Information provided by: *Mahesh Patel (Engineer)*

Abstract

Petlad Municipality has, in 2008-09, made an approximate 100 percent recovery of O&M expenses for water supply. The reason behind this, as observed, is the regular maintenance and repair of the pumping machinery and the water distribution system as a whole.

Situation before initiative

Nearly 10 years ago, the scenario at Petlad Municipality was bleak with the ULB incurring huge expenditure on operation of the machinery of the water supply system. Even the electricity bills were high, with the municipality paying a penalty of approximately Rs 33,000 every month.

Initiative

Using groundwater sources, the municipality supplies 8 MLD of water through four WDS and through nearly 36 km of distribution network to 9089 water connections.
It took determined efforts by the qualified staff of Petlad Municipality to revamp the water supply system of the ULB. The engineer at the municipality began reviewing the situation, including the distribution lines and the electric lines in the water distribution channel. Hydraulic audit and energy audit were conducted. Automation was made as required. Protection devices were installed on the machinery and the electrical appliances so that damage could be minimized.

Over the years, pumps have been regularly checked for head statistics, switches, capacitors and other related parts; repairs/replacement has been done immediately whenever necessary.

Mahesh Patel, engineer at Petlad Municipality, says, “We believe in taking precautionary measures to keep the system efficient. It is known as preventive maintenance.” Patel is a qualified mechanical engineer and has working knowledge of electrical engineering. He oversees the working of the pumping machinery and the entire water distribution system. He visits the head works every morning and takes cognizance of the defects detected at any point.

<u>O&M figures</u>

Total annual operating expenditure: Rs 39,45,660
Total annual operating revenue: Rs 39,27,932
(The cost recovery comes out to be 99.55 percent)

<u>Strategies towards cost recovery</u>

Some of the O&M activities include the following:

- Preventive maintenance. Daily regular visit to site, inspecting electrical appliances and tracing faults for immediate recovery
- Before designing any hydraulic system, parameters like diameter of pipe, head, discharge capacity, friction, head loses, quality of water, quantity of water etc. were considered
- Regularly check is conducted to ensure that electrical contract demand is near to requirement; excess power deal with GEB was disconnected
- Regularly checking of electricity bill is done for the unit consumption which is close to designed motor HP/kW; efficiency of motor is checked
- Auditing of the bills is done for unit consumption, tariff, power factor penalty etc.
- Installation of capacitor on each motor as per HP capacity

Results

With the revamping of the water supply system, the expenditure was reduced significantly. The revenue income and revenue expenditure for water supply (2008-09) indicate that Petlad Municipality recovered an estimated 100 percent of the total operating expenses for water supply (O&M). As the approach towards O&M involved taking precautionary measures, expenditure was reduced.

Lessons learnt

It is important to plug holes that result in wastage of resources. Petlad Municipality succeeded in achieving a milestone in O&M cost recovery as it managed to bring in some discipline in the area of repair and maintenance, besides optimizing the utility value of its equipment.

Sustainability

The initiative is financially sustainable. Striking a balance between expenditure and generation of revenue is important for any ULB to continue providing any service satisfactorily. Besides, the administrative wing has complete support of the elected wing to carry out activities to improve service delivery. The process was gradual, but over a period of time, the benefits have become obvious.

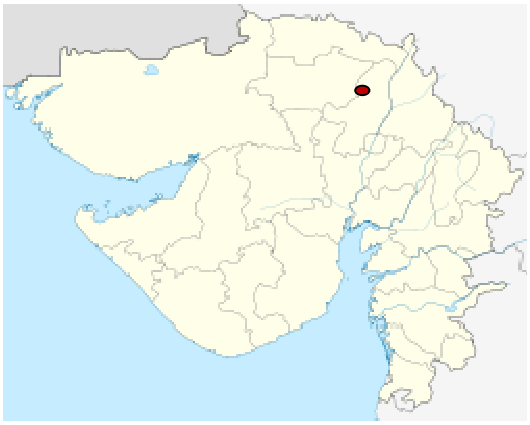
Transferability

As this initiative involves regularizing the work of operation and maintenance, it is easily replicable as well as advisable for ULBs working towards improving their cost recovery figures.

Vadnagar Municipality

Efficiency in collection of water supply-related charges

Vadnagar City profile



Vadnagar, is a Class 'C' municipality in the Mehsana District of Gujarat.

The history of Vadnagar goes well beyond 2500 years. Recent archaeological excavations have established the existence of a thriving city of religious and cultural activity at the location around the first century. It is a town of temples, wells, step wells and giant gates with archaeological values and beautiful carvings.[12]

Vadnagar has eight property tax-cum-administrative wards. There are 24 elected councilors, one-third being women.

Geographical location and connectivity

Vadnagar is situated 112 km from Ahmedabad and 34 km from Mehsana, It is well connected with major cities. The nearest railway station is at Mehsana while the nearest airport is at Ahmedabad. The bus service to Vadnagar is also good.

Profile of Vadnagar Municipality

Population (Census 2011 Provisional)	27307
Population (Census 2001)	25003
Number of households (Census 2011)	5420
% of slum population (Census 2011)	32.84
% of slum population (Census 2001)	
Number of wards	8
Area (sq.kms)	44
Annual budget (2009-10), Rs million	23.4
Contact details of municipality	Chief Officer Vadnagar Municipality Darbar Road Vadnagar Tel - +91 2761 – 222052, Fax: +91-2761 - 222052 e-mail: np_vadnagar@yahoo.co.in

[12] Excerpted from Vadnagar, Wikipedia, 2010

20 EFFICIENCY IN COLLECTION OF WATER SUPPLY-RELATED CHARGES

Category: *Tax collection*
Information provided by: *Alpesh Patel (Accountant), Vadnagar Municipality*

Abstract

Vadnagar has been posting impressive results in terms of water tax collection. This is mainly due to the systematic and organized approach of the ULB towards tax collection.

Initiative

Performance Efficiency

As per data of 2008-09, Vadnagar Municipality sources 3 MLD of drinking water from Dharoi Dam irrigation scheme and supplies the same, through four Water Distribution Systems, to 4,204 connections.

The water taxes are included in the general property tax bill. It was observed that for the year 2008-09, while the demand for water tax was Rs 1.6 million, the collection has been Rs 1.59 million, an excellent performance efficiency of 99 percent.

Financial year	Water tax (%)
2008-09	99
2009-10	101.99*
2010-11	96.30

** The excess figure is due to the charge on issuing a new connection after prior disconnection*.

Strategies towards Efficiency

The municipality sets an incremental target of 10 percent over previous year's collection and sets about accordingly.

The bills are prepared in August and dispatched by September 30. A 10 percent rebate is offered for one month after the date of issuance of the bill. A penalty of 18 percent is charged over the tax for payment between January and March. The first notice to pay up taxes is issued in January, followed by the second in March. A seizure notice is issued in April.

At the outset, the ward level staff is directed to begin the drive for tax collection from major institutional contributors.

There are general announcements, mainly at the library. Senior citizens play a key role in motivation through word-of-mouth publicity. In fact, the 10 percent rebate draws a major response. A list of defaulters is displayed on public notice boards.

The elected wing plays a major role in motivating and supporting the tax collection staff.

Results

Adopting a systematic approach facilitates smoother operations. Since Vadnagar issues property tax bills in September, its collection begins in October itself, with a major chunk getting collected in the first month due to the 10 percent rebate system. This can be considered a good practice as many ULBs take much longer to prepare and dispatch the bills. As a result, their collection is delayed.

In the past three years, Vadnagar has posted an impressive figure. ULB sources say that the deficit is due to locked or vacant properties whose owners are unable to pay the taxes on time.

Lessons learnt

Systematic approach towards tax collection is important for better efficiency.

Sustainability

The entire procedure is financially sustainable. Vadnagar has been able to sustain its efforts at systematic tax collection for a few years now. This has been the reason behind excellent tax collection efficiency year after year.

Transferability

Many ULBs are faced with very low tax collection efficiency. They may adopt Vadnagar's approach and organize their tax collection procedures. Timely preparation and disbursement of bills will enable better collection efficiency.

વડનગર નગરપાલિકા

દરબાર ચોક, વડનગર-૩૮૪૩૫૫

વા.વડનગર,જી.મહેસાણા

ટેલીફોક્સ ફોન નં :- ૦૨૭૬૧,૨૨૦૫૨

E-mail :- np_vadnagar@yahoo.co.in

(ગુજરાત નગરપાલિકા અધિનિયમ – ૧૯૬૩ની કલમ – ૧૩૩ની પેટા કલમ(૧))

જપ્તી / સીલ કરવા અંગેનું વોરંટ

(વોરંટ બજાવનાર શ્રી.પટેલ ભરતભાઈ જી. હોદ્દો ઓફિસ સુપરીટેન્ડન્ટ,વડનગર નગરપાલિકા)

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મુખ્ય અધિકારી
વડનગર નગરપાલિકા

Seal Notice issues by Vadnagar

Unjha Municipality

Efficiency in collection of water and
Sewerage-related charges

Unjha City Profile

Unjha is a Class 'B' municipality in Mehsana district of North Gujarat. It has a current, estimated population of 61,594 distributed among its 12 election wards. The average income of the population of Unjha is very high as compared to the national average as it is a major hub of cumin trade

Geographical location and connectivity

Unjha is located nearly 90 km from Ahmedabad. The nearest airport is in Ahmedabad (appx 84 km) while the nearest major railway junction is Palanpur (appx 23 km)

Profile of Unjha Municipality

Population (provisional Census 2011)	Na
Population (census 2001)	53,876
Number of households	10,734
% of slum population (census 2011)	Na
% of slum population (census 2001)	Na
Number of wards	12
Area (sq.kms)	35
Annual budget (2009-10), Rs million	372.7 (estimated)
Contact details of municipality	Chief Officer Unjha Municipality Gandhi Chowk Unjha Tel: +91-2767-248587 Fax: +91-2767-248587 Email: np_unja@yahoo.co.in

21 EFFICIENCY IN COLLECTION OF WATER AND SEWERAGE CHARGES

Category: *Tax collection efficiency*
Information provided: *Sureshbhai (Tax Inspector)*

Abstract

Unjha has consistently recorded commendable tax collection figures. In the last three years, starting FY 2008-09, the collection efficiency has been more than 90 per cent, which is high. The high collection efficiency is attributed to the fact that most people here have greater paying capacity. Also, the ULB has come up with a novel way to ensure that maximum residents pay up their taxes.

Context of the Initiative

Unjha is a major trading centre for Cumin and Isphaghula. The average income of the population living here is very high compared to national average. A sense of financial well-being with a good paying capacity pervades the town.

Initiative

Tax collection in Unjha is not incentivized. Unlike other ULBs, there is no 10 percent rebate However, there is a 15 percent notice fee collected after March 31. The payment capacity of the residents is good, which is seen as the major reason behind taxes being paid on time.
To improve the collection efficiency further, the municipality came up with a unique plan. Whenever a citizen approaches the municipality office for a document, the status of his tax payment is checked. If it is found pending, the person is asked to first pay up the taxes and then take the document. This practice is being followed for almost 10 years now. Therefore, the tax collection, towards both water and sewerage charges, has been found to be very efficient.

Performance Efficiency
The water and sewerage taxes are included in the general property tax bill.

Some significant data:

Financial year	Water tax collection (%)	Sewerage tax collection (%)
08-09	91.15	92.56%
09-10	91.53	91.13
10-11	91.25	92.20

Strategies towards Efficiency

Policy level

Ascribing reasons for the efficiency in tax collection, the chief officer of Unjha Municipality mentions a good administration, improved urban management and overall good governance by the elected wing and its whole-hearted support to tax staff. The combined effect of these aspects has also led to citizens' faith in the municipality.

Unlike other municipalities, an important aspect of tax collection in Unjha is the 'defaulters-first' approach during the first three months of the new financial year, and meant for the defaulters of the previous fiscal. A list is prepared and the notice includes bill with 15 percent penalty and a threat of water supply disconnection if the taxes are not paid within a certain period.

Administrative

Other steps taken by Unjha Municipality towards efficient tax collection include:

- Computerized and timely billing (by October of the previous year, the deadline being March ending) supported by awareness creation through loudspeakers, particularly in the market yard
- A tax collection drive by a special municipal team includes door-to-door serving of bills and/or notices and spot collection. These teams make four visits annually to remind people to pay up their taxes, both current and previous years'. [13]
- Collection
- Tax-related complaints can be lodged with ward inspectors whose telephone numbers are well publicized.

Lessons learnt

The practice of 'give-and-take' has proved to be a good way to ensure more tax collection.

Sustainability

The measure is financially viable. No extra expenditure is involved. Besides, it means more revenue for the ULB.

Transferability

ULBs with low tax collection efficiency can emulate Unjha's practice to improve their tax collection efficiency.

[13] As per the data provided by the ULB in 2011

Kheralu Municipality

Energy saving initiative

Kheralu City Profile

Kheralu is a Class D municipality in the north of Mehsana district.

Geographical location and Connectivity
Kheralu is approximately 95 km away from Ahmedabad. The nearest airport to the municipality is in Ahmedabad and the nearest railway station is Siddhpur (26 km)

Profile of Kheralu Municipality

Population (Census 2011)	NA
Population (census 2001)	20141
Number of households	4032
% of slum population (census 2011)	NA
% of slum population (census 2001)	NA
Number of wards	7
Area (sq.kms)	3.5 sq km
Annual budget (2009-10), Rs million	38.5
Contact details of municipality	Chief officer, Kheralu Municipality Kheralu Tel: +91-2761 – 231021 Fax: +91- 2761 – 230117 Email: np_kheralu@yahoo.co.in

22 ENERGY SAVING INITIATIVE

Category: *Energy Saving*
Information provided: *Nitin Parmar, Junior Clerk, Kheralu Municipality*

Abstract

With an area of an area of 3.5 sq km, Kheralu Municipality has a requirement of 1,500 street lights. In 2010, it started installing Compact Fluorescent Light (CFL) on the street-lighting poles instead of the conventional tube lights. It replaced almost half of the existing luminaries with energy-efficient Compact Fluorescent Lights (CFL) luminaries. This has led to considerable energy saving for the municipality.

Situation before the Initiative

Prior to 2010, the streets of Kheralu Municipality were lit up by conventional luminaries. These luminaries, though not very expensive, consumed a lot of energy. As a result, the electricity bills of the municipality were also high.

Initiative

The decision to go for energy saving in street lighting was taken during 2008-09. In early 2010-11, the municipality started installation of CFL on the street-lighting poles. CFL lights are basically energy saving lights. They use less power and have a longer rated life. The city has a total of 1500 street lights and they have fixed around 743 CFL luminaries till now.

To spread awareness among the citizens about use of CFL lights at household level, the city has also designed a banner which shows the importance of use of CFL lights. (Banner displays the distribution loads of 100w tube light. As normal 100w tube can light up the only room but CFL s of a total of 100w can light up the entire house).

The city has also equipped a few poles with 25 DP – Automatic timer switches. The system will automatically start switching the appliance ON and OFF at timings set manually according to seasons; this would further help to lower down the electricity bill.

Results

This being a recent initiative by Kheralu Municipality, detailed figures in terms of monetary savings were not available at the time of documentation of the practice. However, the officials agree that they have been able to make considerable savings in the electricity bills incurred on the street-lighting of the municipality.

CFLs have higher purchase price than the normal lamps, but being energy-savers, have a great pay-back value in terms of unit price savings. It has been estimated by ULB staff that 32w of electricity is saved per month, per pole with CFL luminary.

Lessons learnt

Looking at the viability of using CFL for street-lighting, the chief officer has announced that the ULB will use only the CFL lights and avoid conventional luminaries in the ULB office.

Sustainability

The move to replace conventional luminaries with CFLs is financially as well as environmentally sustainable as it saves both money and energy.

Transferability

While the capital investment to be made for installing CFLs may be more than conventional luminaries, the long-term economic viability of the practice makes it a more logical option. It can be replicated by ULBs that wish to cut their energy expenditure.