24X7 Water Initiative and Waste Water Reuse
Case Study Nagpur
23\textsuperscript{rd} Feb. 2015

Shashikant Hastak
Nagpur 24x7 - Policy & Strategy for Implementation

Implementation Steps

- Water Audit
- Pilot Project for improvement in SLB
- Full City Rehabilitation Plan
- O & M Strategy for Sustainability

Admin/Political Reforms

- Rationalization of Tariff
- Billing & Collection
- Customer Management & Awareness
- Slum Policy for Water Supply

Technical Efficiency

- Raw Water Energy Consumption
- Pumping Treatment Transport Storage
- Distribution Consumer Connection Metering
<table>
<thead>
<tr>
<th>Year</th>
<th>Population</th>
<th>Water Supply in mld</th>
<th>Ltrs / Person</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1921</td>
<td>145000</td>
<td>16.50</td>
<td>114</td>
<td>Ambazari + Gorewada</td>
</tr>
<tr>
<td>1941</td>
<td>302000</td>
<td>45.00</td>
<td>149</td>
<td>Ambazari + Gorewada + Kanhan</td>
</tr>
<tr>
<td>1961</td>
<td>644000</td>
<td>80.00</td>
<td>124</td>
<td>Ambasari + Gorewada + 1st Aug. Kanhan</td>
</tr>
<tr>
<td>1981</td>
<td>1217000</td>
<td>125.00</td>
<td>103</td>
<td>Ambazari (discarded ), Gorewada + 3 Times Aug. to Kanhan</td>
</tr>
<tr>
<td>2001</td>
<td>2150000</td>
<td>370.00</td>
<td>172</td>
<td>Gorewada + Kanhan + Pench -I + Pench -II</td>
</tr>
<tr>
<td>2004</td>
<td>2350000</td>
<td>470.00</td>
<td>200</td>
<td>Gorewada + Kanhan + Pench -I + Pench -II + Pench -III</td>
</tr>
<tr>
<td>2011</td>
<td>2500000</td>
<td>600.00</td>
<td>240</td>
<td>Gorewada + Kanhan + Pench -I (Jnnum-Partial) + Pench -II + Pench -III</td>
</tr>
<tr>
<td>2014</td>
<td>2750000</td>
<td>765.00</td>
<td>278</td>
<td>Gorewada + Kanhan + Pench -I + Pench -II + Pench -III+JnNURM</td>
</tr>
</tbody>
</table>
Bulk water Security – is not end of the problem ...

low efficiency resulted in to higher water losses, poor financial position, deteriorated assets, frequent contamination of water affected the public health specially urban poor and overall unsatisfied citizen services.

Augmentation in water supply is not a answer to above challenges
Water Tariff Revision Policy of NMC

Tariff revisions implemented before the entry of Private Operator with following objectives:

- No tariff revision since year 2000, and also need for rationalization for sustainability.
- Tariffs revision to meet Operating expenses and part of capex.
- Telescopic tariff to promote water conservation.
- Affordable supply for life line volume, subsidized supply for consumption within the norms and premium rates for consumptions higher than the norm.
- Tariff flexibility to cope up with ever increasing energy & raw water tariffs (which constitute almost 40% of the total cost) owing to inbuilt provision to pass on the increase in input cost of raw water and energy directly to the consumers as surcharge.
- Autonomy for tariff fixation and minimum 5% increase in tariff every year.
- ULB all tariff related issues of consumers before the entry of put operator.
Key Requisites for 24x7 W.S. Initiative

Water
- Sustainable source
- Adequate supply

Willingness
- Political
- Administration

Policies
- Service level
- Stakeholder Consultation
- Slum/Unauthorised
- Connect/disconnect
- PPP/Inhouse
- Tariff/Subsidy/Funding
- Bylaws/Act

Infrastructure
- Physical (Source to consumer)
- Organization capacity
- SCADA/Monitoring
- Customer services

Management
- People participation
- Supply Side Efficiency
- Demand Side Efficiency

Customer services
- Supply Side Efficiency
- Demand Side Efficiency
Nagpur Holistic Approach

24x7 water To Citizens

Policy /Bylaws
Tariff /Cross subsidy
Connection/disconnection
Urban poor/ Unauthorised
PPP / Inhouse

Management
Accountability
Incentive for performance
Customer centric Approach
Efficient operations

Infrastructure
Investment for Efficient delivery of water

Public

Private

Partnership
NAGPUR
(ULB)

Private Operator
SPC
OCW

-LEASE
CONTRACT

Operational Performance contract

Concession of ownership + investment obligations

Service performance Monitoring

Asset Holding SPV
NESL
NESL Water Company

Salient Features

• Ownership of assets with NMC.

• Transfer of assets of NMC to NESL for operation, maintenance and management only.

• Water charges will continue to be decided by NMC.

• Apart from water supply, company can take up work of sewage disposal and solid waste management in future.
PPP under JnNURM

NMC INTRODUCED PPP TO ADDRESS THE CHALLENGES OF INTEGRATED WS MANAGEMENT AND ACCOUNTABILITY FOR PERFORMANCE

- 24/7 Water Supply (Rs 20 Crore) – Demo Zone
  - 5 years O & M with performance based targets to reduce UFW and improvement in service level to customers in a pilot zone of 1.50 lakhs population.

- Improvement to Kanhan Water Supply (Rs 65 Crore)
  - 70% grant in aid, 30% by private operator
  - 15 Years O & M by operator

- Water Distribution Monitoring System
  - 25% investment by private agency
  - 5 years comprehensive O & M

- Meter replacement, Billing & Collection for 10000 large consumer
  - 50% of capital cost by Private agency
  - 5 years of O & M contract
PPP under JnNURM

– Pench-I WTP Improvement & Up gradation (Rs 6.42 Crore)
  • 70% grant in aid, 30% by private operator
  • 5 Years O & M by operator

– Water reuse For Power Plant (Rs 130 Crore)
  • 70% grant in aid, 30% by Mahagenco
  • Mahagenco to carryout O & M and pay to NMC the raw sewage charges @ Rs3.0 – 3.50 per 1000 Ltr. for 110 MLD. Annual revenue to NMC Rs 15 crore from sewage
PPP for City-wide water supply

Project inception

- In 2008, NMC’s General Body passed resolution for city-wide 24x7 water supply
- PMC was appointed for the project and DPR and PPP format were prepared
- Approval for funding under JNNURM was obtained in early 2009.
- Ring-fencing of water supply assets was done by transferring of water supply functions to a separate company i.e. the Nagpur Environmental Services Limited (NESL) as a wholly owned subsidiary of NMC.
- The bid process initiated with a Request for Qualification (RFQ) in 2008.
- 3 of the 10 applicants shortlisted and RFP was called for from
  - Veolia-Vishvaraj consortium,
  - IVRCL-Aqualia,
  - Cascal-Nagarjuna Construction
- Transparent bidding process adopted with extensive stakeholders consultations
  - Consortium of Veolia India and Vishvaraj Infrastructure Ltd. was declared the winning bidder with the final bid price of Rs. 7.90 per KL
  - Tri-party agreement between OCWPL (SPV was set up by Veolia-Vishvaraj consortium), NMC and NESL signed in June 2011.
Features of the PPP agreement

- **Project scope**
  - 25-year Performance Management Contract (extendable for another 25 years)
  - First 5-year OCWPL responsible for O&M of existing network and rehabilitation of the network
  - O&M of the water supply system for next 20 years
  - Revenue and collection risk loaded on Operator
  - Operator’s performance to be monitored against performance parameters
  - Remuneration based on metered volume that is billed and collected.
# Full City SLB Targets for PPP

To become first million plus city to achieve Service level Benchmark of water supply in India

<table>
<thead>
<tr>
<th>Service Level Benchmark (SLB)</th>
<th>Status at 2009</th>
<th>Benchmark (MoUD)</th>
<th>Targeted Year*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Coverage of Water Supply</td>
<td>84%</td>
<td>100%</td>
<td>5 Yrs</td>
</tr>
<tr>
<td>2 Per Capita Supply of Water</td>
<td>240 LPCD</td>
<td>150 LPCD</td>
<td>10 Yrs</td>
</tr>
<tr>
<td>3 Continuity of Supply</td>
<td>3 – 8 hrs</td>
<td>24 hrs</td>
<td>5 yrs</td>
</tr>
<tr>
<td>4 Extent of Metering of Water Connections (working meter)</td>
<td>&lt;50% (accuracy?)</td>
<td>100%</td>
<td>5 yrs</td>
</tr>
<tr>
<td>5 Extent of Non-revenue water</td>
<td>60 – 70 %</td>
<td>20%</td>
<td>10 yrs(&lt; 40% 5 yrs)</td>
</tr>
<tr>
<td>6 Efficiency in Redressal of Complaints in 24 hrs</td>
<td>No tracking</td>
<td>80%</td>
<td>5 yrs</td>
</tr>
<tr>
<td>7 Quality of Water</td>
<td>Mix supply</td>
<td>100%</td>
<td>5 yrs</td>
</tr>
<tr>
<td>8 Operating Cost recovery in water supply services</td>
<td>70-75%</td>
<td>100%</td>
<td>6 yrs</td>
</tr>
<tr>
<td>9 Efficiency in collection of water related charges</td>
<td>70-75%</td>
<td>95%</td>
<td>10 yrs</td>
</tr>
</tbody>
</table>
24x7 Pilot Project

• Feature
  – 15000 Connection including slum
  – 10 slum areas
  – Population 1.75 – 2 lakhs

• Contract
  – Study, Rehabilitate, Management contract with Private operator.
  – Penalty /bonus for targets in Water losses, Quality, Customer services and Continuity of supply

• Results Expected
  – 100% metering
  – Rehabilitation of tertiary network
  – Hydraulic modeling as per master plan
  – Installation of new billing system
  – Customer facility center
First Phase Conversion

Command areas

- Dhantoli (81(p), 87(p), 88)
- Ramdaspeth -81 (p)
- Laxminagar (old) 86(p), 87(p), 109 (p) 110(p)
- Pratap Nagar 117(p), 118(p), 119 (p)
- Laxmi Nagar (New) 108(p), 109(p)
- Burdi – Part 49(p), 80, 81(p)
- Shantinagar- 33, 34(p), 57, 58
- Bharatwadi (NMC)- 30(p), 59(p)

Coverage – 16 wards
81, 87, 88, 86, 33, 34, 57, 58 (100%)
Total 24311 connection

Additional Population connection – 175637

Expenditure (100%)
Network – 96.50 lacs (Laxminagar)
HSC – 139.71 lakhs

Time Period – 3 months (March 15)
Project progress and current status

- As on December 2014, physical progress of 75% achieved with over 434 km out of 564 km of pipeline replaced.

- Delays in provision of house service connections due to protests against imposition of connection charges. As against a target of 321,000 connections, about 75,000 connections have been completed.

- To overcome this NMC passed a resolution waiving connection charges for all connections in July 2014

- Round-the-clock call centre with a toll-free number setup to address consumer grievances.

- Online Water Bill payment facility put in place.

- Discontinuation of JNNURM scheme has hampered the progress of the project; A new follow up scheme at the earliest is needed
Important Lessons from 24x7 Water Supply Demo Project

• Public relation
• Customer services (Setting of Grievances Redressal Centre)
• Tariff
• Frequency of Bills
• Post meter leakages
• Awareness period – Dummy bills
• Restoration of Road Cuts, trenches
• Sensitive Water Meters
Challenges Ahead

1) Sustained support / commitment of Public Partner to the Project.

2) Timely release of grants by government & its timely utilisation

3) Specialist expertise and competency building.

4) Strengthen the public relations and communication function to gain improved support.

5) To strengthen performance focus at the field level.

6) Managing PPP relationship & public expectations.

7) Replacement of consumer connections and addressing last-mile and internal plumbing issues will need to be tackled head-on as these aspects are critical to consistently deliver 24x7 supply.
Recycle & Reuse of Waste Water
# Water Reuse Opportunity in Nagpur region

<table>
<thead>
<tr>
<th>Name of the Sewage Treatment Plant</th>
<th>Design Capacity STP (Mld)</th>
<th>Sewage Generation (Mld)</th>
<th>Name of User</th>
<th>Demand (Mld)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North Zone (Proposed)</td>
<td>0</td>
<td>117</td>
<td>Mah. State Power Generation Company (MAHAGENCO)</td>
<td>130</td>
</tr>
<tr>
<td>Central Zone</td>
<td></td>
<td>142</td>
<td>Reuse in Nagpur City</td>
<td></td>
</tr>
<tr>
<td>Existing</td>
<td>100</td>
<td></td>
<td>Immediate</td>
<td>10</td>
</tr>
<tr>
<td>Mahagenco</td>
<td>130</td>
<td></td>
<td>Ultimate</td>
<td>25</td>
</tr>
<tr>
<td>South Zone</td>
<td></td>
<td>86</td>
<td>Irrigation Project</td>
<td>70</td>
</tr>
<tr>
<td>Proposed under PPP</td>
<td>200</td>
<td></td>
<td>MIHAN (Cargo Hub)</td>
<td>40</td>
</tr>
<tr>
<td>Total Capacity (Mld)</td>
<td>430</td>
<td>345</td>
<td>Total Demand</td>
<td>275</td>
</tr>
</tbody>
</table>
### NMC WATER REUSE MASTER PLAN

<table>
<thead>
<tr>
<th>Consumer</th>
<th>Water Reuse In mld</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAHAGENCO Swap for ext</td>
<td>110 150</td>
</tr>
<tr>
<td>MIHAN</td>
<td>40</td>
</tr>
<tr>
<td>IRRIGATION</td>
<td>70</td>
</tr>
<tr>
<td>CITY BULK</td>
<td>25</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>245 +150 =395</strong></td>
</tr>
</tbody>
</table>

Additional reuse potential for future power plants and irrigation swapping to consume all effluent.
## ECONOMICS OF WATER REUSE

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Organisation / User</th>
<th>Non-Potable Water</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Demand (Mld)</td>
<td>Project Cost (Crores Rs.)</td>
</tr>
<tr>
<td>1</td>
<td>Nagpur City Reuse</td>
<td>25</td>
<td>37.00</td>
</tr>
<tr>
<td></td>
<td>Sewage Treatment Plant (South Zone: Ghogali 100 mld)</td>
<td></td>
<td>50.00</td>
</tr>
<tr>
<td>2</td>
<td>Mah. State Power Generation Co. Ltd. (MSPGCL)</td>
<td>110</td>
<td>125.00</td>
</tr>
<tr>
<td>3</td>
<td>Irrigation Project</td>
<td>70</td>
<td>5.00</td>
</tr>
<tr>
<td>4</td>
<td>MIHAN (Cargo Hub)</td>
<td>40</td>
<td>46.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>245</strong></td>
<td><strong>263.00</strong></td>
</tr>
<tr>
<td></td>
<td>Cost Per Mld (in Crores Rs.)</td>
<td></td>
<td><strong>1.07</strong></td>
</tr>
<tr>
<td></td>
<td>Average Fresh Water Project Cost per Mld (in Crores Rs.)</td>
<td></td>
<td><strong>3.00</strong></td>
</tr>
</tbody>
</table>
Future Bulk Water Security- Nagpur
Comparative Investment Analysis

Without Reuse of water

<table>
<thead>
<tr>
<th>DEMAND</th>
<th>SOURCES</th>
<th>QTY IN mm3/Yr</th>
<th>QTY IN mm3/Yr</th>
<th>INVESTMENT IN CRORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSUMER</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NMC</td>
<td>PENCH</td>
<td>112+78</td>
<td>450</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KANHAN</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RAHARI</td>
<td>128</td>
<td>300 + 700</td>
<td></td>
</tr>
<tr>
<td></td>
<td>KOCHI</td>
<td>20</td>
<td>250 + 300</td>
<td></td>
</tr>
<tr>
<td>CARGO HUB</td>
<td>LOWER WANNA</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIHAN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSED/POWER</td>
<td>PENCH</td>
<td>67 + 40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GENERATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>570</td>
<td>515 (-55)</td>
<td>2000</td>
</tr>
</tbody>
</table>

With reuse of water

<table>
<thead>
<tr>
<th>DEMAND</th>
<th>SOURCES</th>
<th>QTY IN mm3/Yr</th>
<th>QTY IN mm3/Yr</th>
<th>INVESTMENT IN CRORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSUMER</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NMC</td>
<td>PENCH</td>
<td>112+78</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>KANHAN</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>RAHARI</td>
<td>128</td>
<td>300 + 700</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARGO HUB</td>
<td>LOWER WANNA</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIHAN</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSED/POWER</td>
<td>PENCH</td>
<td>67 (+ may b swap with NMC)</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>GENERATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REUSE POTENTIAL</td>
<td></td>
<td>300 (395)</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>570</td>
<td>755 (+185 + 67 = 252)</td>
<td>1300 (600)</td>
</tr>
</tbody>
</table>
Objective

- Providing Sewage Treatment for 200 MLD and possible Reuse by potential Customers in Nagpur

Salient Features

- Project Cost: 260 Crs
- Revenue: Annuity Payment to Operator
- Option with resale with revenue sharing mechanism
- Concession Period: 32 years

Status – Operator already selected through bidding process, contract under execution
## Project 1 - 200 MLD STP Project – Key Terms

<table>
<thead>
<tr>
<th>Section</th>
<th>Details</th>
</tr>
</thead>
</table>
| Revenue from operations                      | • SPV is entitled to fixed Capital Grant & Operational Grant with adjustment for inflation from start of O&M Phase  
                                           | • Additionally Concessionaire has a right to sell 175 MLD of tertiary treated water on payment of Royalty to NMC                  |
| Alignment with operator’s economic interest  | • No charge for sewage  
                                           | • Option to sell tertiary treated water to industrial consumers  
                                           | • Any hike in electricity tariff will be pass through.  
                                           | • Electricity payment to be made directly by NMC and adjusted against O&M grant payment.                                      |
| Payment security                              | • Escrow receipts (Rs 15 Crore) from Mahagenco to secure its payments to SPV  
                                           | • Reserve equal to three months grant payment  
                                           | • NMC rated A+ by Fitch                                                                                                  |
| Security to lenders                           | • Step in rights to lenders by way of substitution agreement                                                                          |
Project 2 – 130 MLD STP at Bhandewadi

1) Partnership project between NMC and MAHAGENCO
2) MAHAGENCO to build 130 MLD STP
3) NMC to supply sewage @ cost of Rs. 15 Crs per annum (to be escalated)
4) Project under JNNURM
5) Project nearing completion
6) The treated water to take care full water demand of Koradi 660x3 MW new power plant

Status – Operator already selected through bidding process, contract under execution
Waste Water Initiatives for Nag River
Public Awareness Program
<table>
<thead>
<tr>
<th>Stretches Of The River</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Total Length</td>
</tr>
<tr>
<td>• Width of the river</td>
</tr>
<tr>
<td>• Depth of the river</td>
</tr>
<tr>
<td>No of Stretches</td>
</tr>
<tr>
<td>• Stretch I</td>
</tr>
<tr>
<td>• Stretch II</td>
</tr>
<tr>
<td>• Stretch III</td>
</tr>
<tr>
<td>• Stretch IV</td>
</tr>
<tr>
<td>• Stretch V</td>
</tr>
<tr>
<td>• Stretch VI</td>
</tr>
</tbody>
</table>
Public Participation And Awareness Programme
HUMAN CHAIN BY DIGNITORIES & CITIZENS OF NAGPUR AT BEGINNING OF DRIVE
Human Chain Continue...
• STRETCH NO - 1

AT COMPLETION
• STRETCH NO - 2

AT COMPLETION
• STRETCH NO - 3

AT COMPLETION
• STRETCH NO - 4

AT COMPLETION
• STRETCH NO - 5

THIS STRETCH WAS CLEANED BY REMOVING THE GARBAGE
• STRETCH NO - 6

AT COMPLETION
NMC Initiatives