Wastewater Reclamation in India: From Policy to Execution

Kartiki S. Naik Ph.D.
Michael K. Stenstrom, Ph.D., P.E., BCEE
University of California, Los Angeles

http://www.reddit.com/r/india/comments/19xant/marine_drivemumbai/
Centralized Treatment
Decentralized Treatment
Hollywood, CA

- 6.9 miles (11 km)
- 2.4 miles (3.85 km)
- 2.3 miles (3.7 km)
- 1.5 miles (2.4 km)

Lift station markers do not depict capacity.
Hypothetical Scenarios

Central plant:
45 MGD (170,100 m³/d)
Footprint: 6,942,500 m²

Decentralized plant
7.4 MGD (28,000 m³/d)
< 2 miles from Hollywood area
Total Footprint: 91,500 m²

Identical process trains
Percent wastewater recycled : 90%
Cost and Energy Components

Capacity expansion
Pumpback energy consumption
Lift Stations cost
Capacity expansion
Pumpback Energy Consumption

Typical treatment energy consumption
4000 kWh/MG

Total pumpback energy consumption
7000 kWh/MG
Pumpback Energy Consumption

Piping cost: $1.7 million/MG
Lift stations: $0.4 million/MG
Cost and Pumpback Energy Comparison

### Type of configuration
- **Centralized**
- **Decentralized**

#### Cost and Pumpback Energy Comparison

- **Pumpback stations cost**: 0.26 MW/MG
- **Expansion cost**: 0.08 MW/MG
- **WWTP Construction cost**
- **Sewer reconstruction**
- **Pumpback pipe**

#### USD per MG

- **Centralized**:
  - Pumpback stations: 8 USD/MG
  - Expansion: 6 USD/MG
  - WWTP Construction: 4 USD/MG
  - Sewer reconstruction: 2 USD/MG
  - Pumpback pipe: 1 USD/MG

- **Decentralized**:
  - Pumpback stations: 4 USD/MG
  - Expansion: 2 USD/MG
  - WWTP Construction: 1 USD/MG
  - Sewer reconstruction: 1 USD/MG
  - Pumpback pipe: 1 USD/MG
Three Examples from India

Nagpur  Poor Source Water
Gurgaon  Lack of Capacity
Noida    Lack of Capacity
Nagpur, Central India

Population Density
5300-11,500 per sq. mile
31% population lives in urban areas
(2% of total area)

800 km north east of Mumbai

http://commons.wikimedia.org/wiki/File:India-map-en.png
Mokshadham Residential Plant: installed

Reshim Bagh
Commecial Land dispute with developer

Shankar Nagar
Residential NIMBY!

VNIT University Land dispute

Central treatment plant

Nagpur, Western India

Nag River
University and Treatment Plan

Potential plant
6.5 MGD (5000 m$^3$/d)
5000 ft$^2$ (465 m$^2$)
Gurgaon and NOIDA, North India

Gurgaon city
30 km (19 miles) south of New Delhi

http://commons.wikimedia.org/wiki/File:India-map-en.png
Gurgaon and NOIDHA, North India

Noida
12.5 miles southeast of New Delhi

http://commons.wikimedia.org/wiki/File:India-map-en.png
Gurgaon-NOIDA, North India
Gurgaon-NOIDA, North India

Additional 35,000 m³/day (9 MGD) installed 8 years after capacity exhaustion

Flow (m³/day)

- Gurgaon: 225,000 m³/d (60 MGD)
- Noida: 150,000 m³/d (40 MGD)
- Installed: 375,000 m³/d (100 MGD)
Decentralized Solutions

• Decentralized solutions exist for all three locations
• Problems exist due to land restrictions and “NIMBY”
• Water Reclamation needs exist and will drive decentralization
• Different priorities for different cultures
Recommendations

- Smaller footprint
- Multiple plants – Flexibility
- Modularize capacity expansion
- Community participation