DEWATS Cost and its Determinants: a case study from India

*Tsephel S, Vineeth K, Nair, A

Consortium for DEWATS Dissemination Society, Bangalore
DEWATS?

Decentralized Waste Water Treatment System

Surface level picture of a Constructed DEWAT

Inside a DEWATS

Fiber Glass DEWATS - Can be installed underground
What is the cost of DEWATS?
Relevance

• DEWATS is not a standardized product in conventional sense

• There is no liner relation between size and cost

• Mass-scale Dissemination requires more work on costing

• Limited academic literature coverage
Methodology

• Basic Costing
  – 63 DEWATS data –CDD Society, (RCC based unit)

• Data Analysis Techniques
  – Basic ANOVA, Regression

• Cost comparison
  – Case study: a single project in Bangalore
Study Results

Bremen Overseas Research & Development Association (BORDA)
COST DRIVERS

- **Total Cost** = \( f \{\text{Price of inputs} \times \text{DEWATS inputs quantity}\} \).

- **DEWATS Inputs Qty** = \( f \{\text{size of unit} + \text{combination of modules}\} \).

- **Combination of module** = \( f \{\text{Quantity of WW, Quality of WW, structural requirements}\} \).
Cost Function - modeling

For the settler,

$$TC_{settler} = 546564 Q^{0.372} t^{1.559}$$

where $Q$ = plant capacity in cubic meters per day.

$t$ = representative of structural design.

$TC_{settler}$ = total investment cost for settler.

For the ABR,

$$TC_{ABR} = 430659 Q^{0.635} t^{1.048}$$

For PGF,

$$TC_{PGF} = 82836 Q^{0.697}$$

The total cost for the installation of a DEWATS unit comprising of all the three can be expressed as

$$TC_{DEWATS} = TC_{settler} + TC_{ABR} + TC_{PGF}$$
Cost per Unit Capacity

BEHAVIOUR OF PER UNIT COST

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Components of cost

1. Human Resource cost - 42%
2. Cements, bricks, sand, gravels - 38%
3. Steel - 8%
4. Pipes, fittings, planks, poles - 10%
5. Others: - 02%
6. Taxes –
A Case Study

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Case Study Details

- Residential House Project, Bangalore
- 448 homes, 2240 habitants
- 300 cu m wastewater plant
- Reuse for flushing, landscaping
- Alternatives – DEWATS™, FAB, ASP
## Comparison

<table>
<thead>
<tr>
<th>Initial capital cost comparison</th>
<th>Fluidized Aerobic Bed Reactor</th>
<th>Activated sludge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total initial cost of STP (INR)</td>
<td>8164745</td>
<td>6741750</td>
</tr>
<tr>
<td>Total initial cost of STP/cu m (INR)</td>
<td>27216</td>
<td>22473</td>
</tr>
<tr>
<td>Total initial cost of STP/home (INR)</td>
<td>18225</td>
<td>15049</td>
</tr>
<tr>
<td>Total initial cost of STP/sq ft (INR)</td>
<td>33</td>
<td>27</td>
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</tbody>
</table>
Comparison

<table>
<thead>
<tr>
<th>Maintenance cost drivers</th>
<th>DEWATS™</th>
<th>Fluidized Aerobic Bed</th>
<th>Activated Sludge</th>
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</thead>
<tbody>
<tr>
<td>Desludging of settler</td>
<td>-118062</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Desludging of ABR</td>
<td>-36718</td>
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<tr>
<td>Maintenance of Anaerobic Filter</td>
<td>-21466</td>
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<td>Maintenance of PGF</td>
<td>-1070301</td>
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<tr>
<td>Consumables for sand filter</td>
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<td>-251461</td>
<td>-251461</td>
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<td>Consumables for carbon filter</td>
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<td>-96124</td>
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<tr>
<td>Consumables for UV tube</td>
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<tr>
<td>Consumables for chemicals</td>
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<td>Electricity charges</td>
<td>-1468535</td>
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<tr>
<td>Labor/Wages</td>
<td>-502923</td>
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<td>-2011691</td>
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<tr>
<td>Annual maintenance contract (AMC)</td>
<td>-167641</td>
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<td>-335282</td>
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<tr>
<td>Contingency spending for breakdowns</td>
<td>0</td>
<td>-76486</td>
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<tr>
<td>Total</td>
<td>-3754456</td>
<td>-9436591</td>
<td>-8908238</td>
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NPV of 10 year cost (10% discount rate and 8% inflation rate)

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<td>Total NPV for initial capital cost</td>
<td>-8164745</td>
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<td>Total NPV for 10 years total cost</td>
<td>-11919201</td>
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Centre for Advanced Sanitation Solutions (CASS)
Survey No. 205, (Opp. Beedi Workers Colony)
Kommaghatta Road, Bandemath
Kengeri Satellite Town
Bangalore 560 060 – Karnataka, India
Tel/Fax: +91-080-28486700 / 28482144
RnD.unit@cddindia.org, www.cddindia.org