National Workshop on Small-Scale Sanitation Systems

A Roadmap for Small-Scale STPs in India:
Fulfilling their Potential for Healthy and Water-Secure Cities

# Cost and Management of ssSTPs

## Improving Sewage Management and Reuse

5th April 2018; New Delhi

# Purpose of this Financial Study

1. Lack of detailed cost information on small-scale STPs
   - Understand cost of owning a STP over 10-20 years
2. Identify financially-driven  reasons for why STPs fail
3. Options for de-centralized STPs at city-scale

# Technologies Studied

| | | |
|---|---|---|
| 1. | MBR | Membrane Bio-Reactor |
| 2. | SBR | Sequencing Batch Reactor |
| 3. | MBBR | Moving Bed Biofilm Reactor |
| 4. | ASP | Activated Sludge Process |
| 5. | EA | Extended Aeration |
| 6. | P-MBBR | Packaged MBBR |
| 7. | DEWATS | ABR-based non-mechanized systems |
| 8. | SBT-CAMUS | Soil Bio-Technology (non-mechanized) |

# Many factors determine cost of a STP

1. Quality of components
2. Design Specifications: Capacity, component ratings etc
3. Climatic conditions
4. Soil type
5. Automation
6. Geographic location
7. Location within a site (underground/basement etc)
8. Profit margins of designer

**1. Lifecycle Cost of STPs**

2. Failure and Management

3. City-scale De-centralization

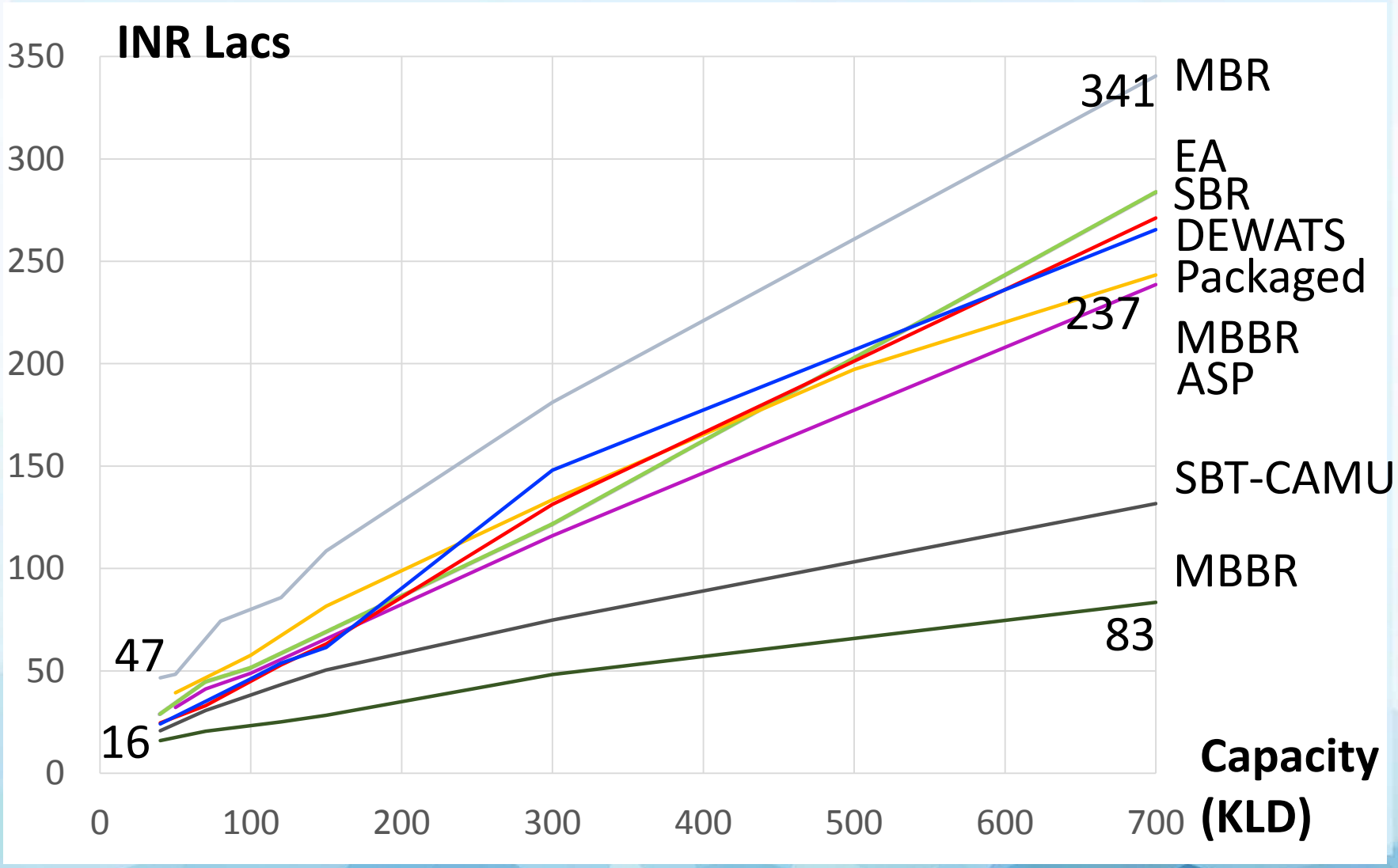
# Cost Headers

A. **Capital Costs**
   - Civil Construction and Tanks
   - Electro-mechanical components: Pumps, Blower etc.

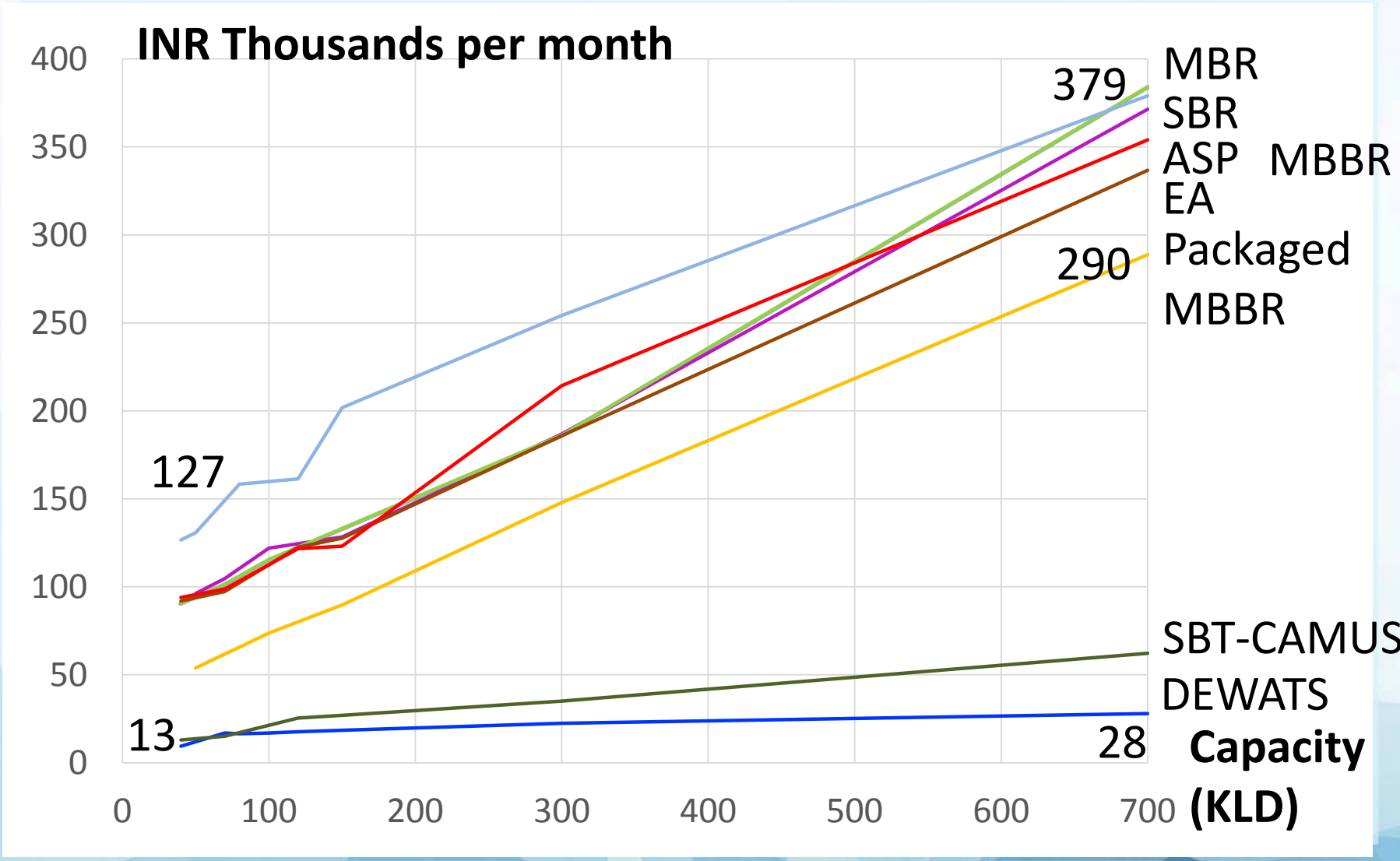
B. **O&M Costs**
   - Labor
   - Electricity
   - Consumables
   - Minor maintenance

C. **Capital Maintenance Costs**

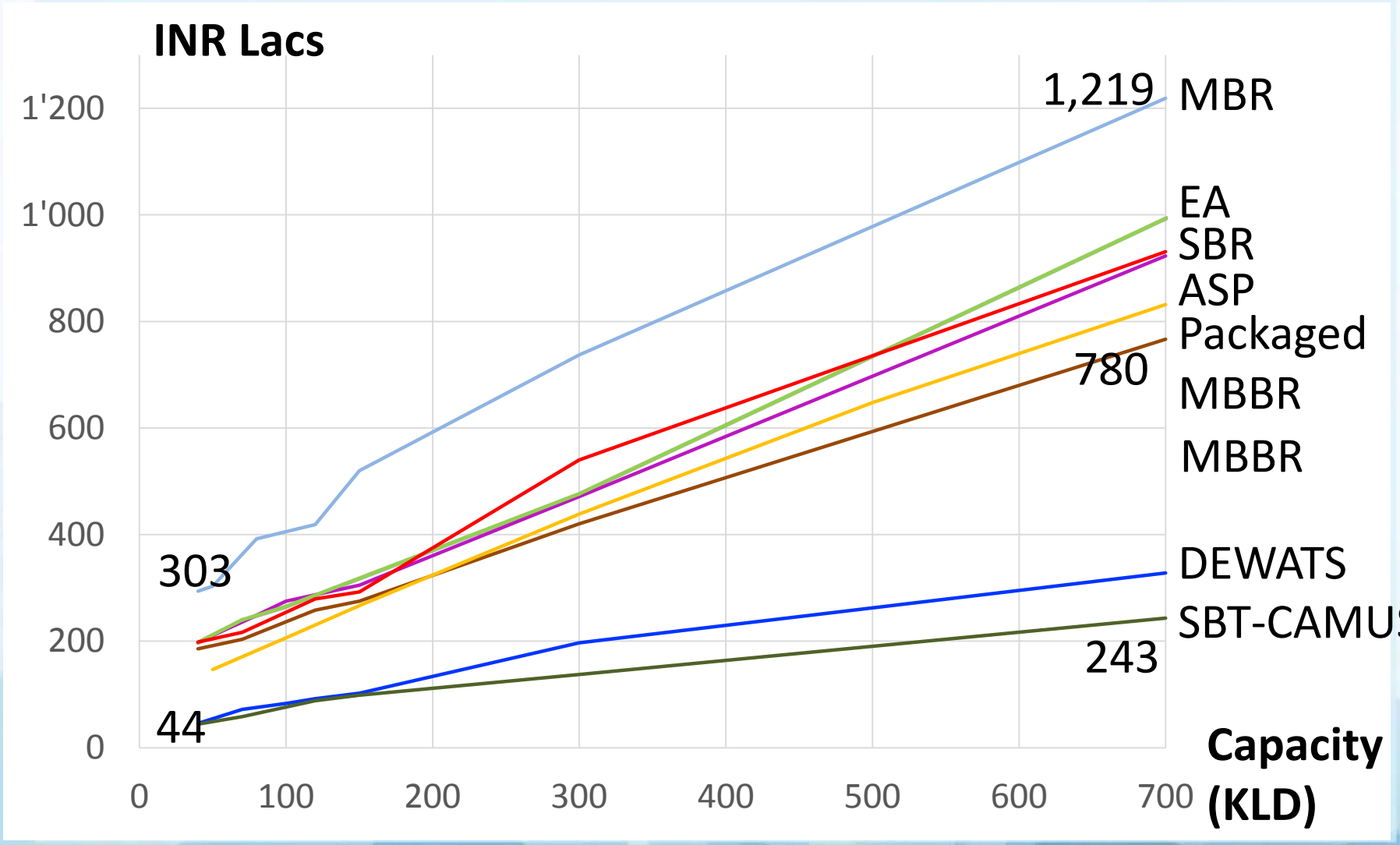
# Capital Costs



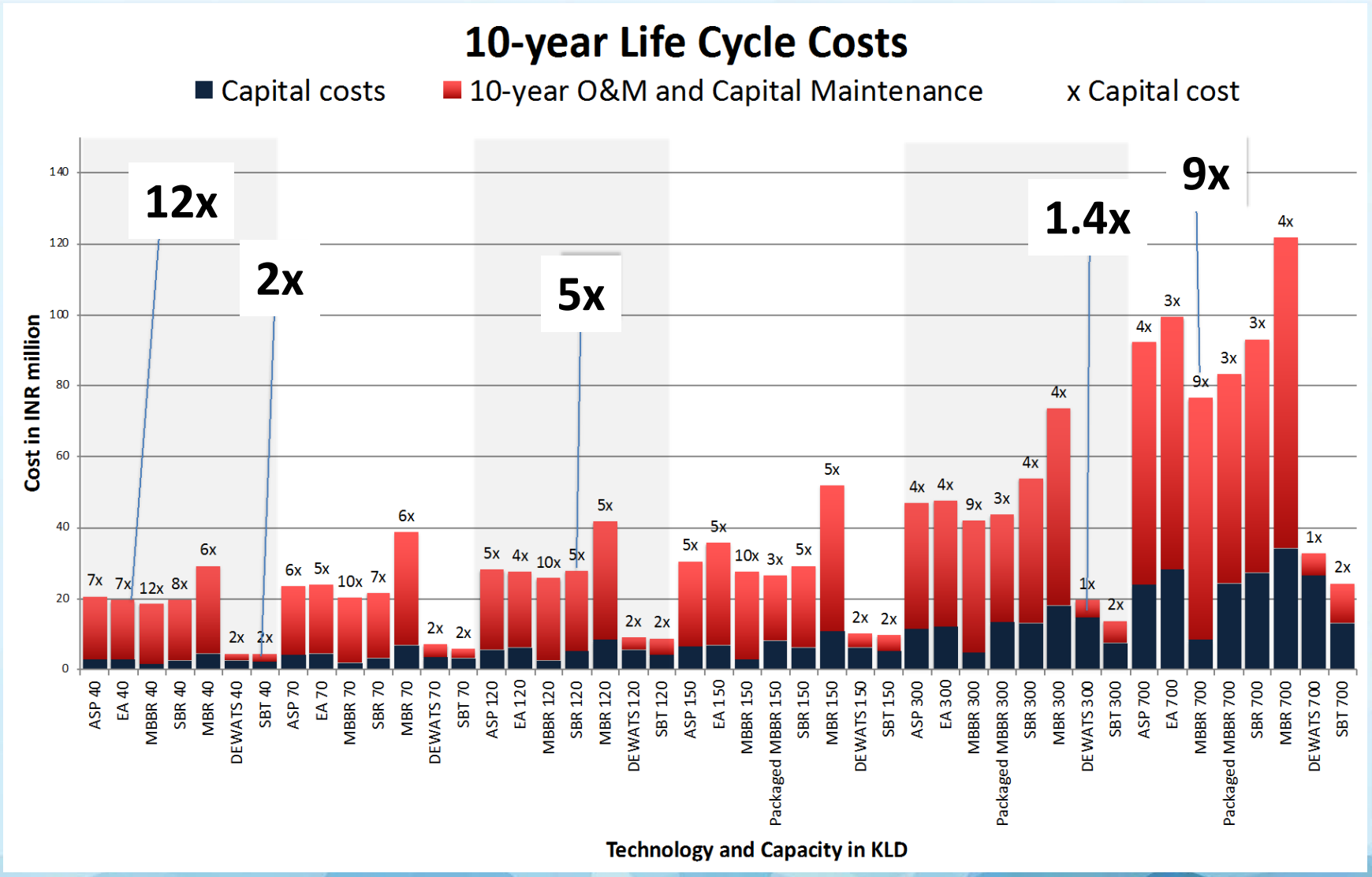
# Operation and Maintenance Costs



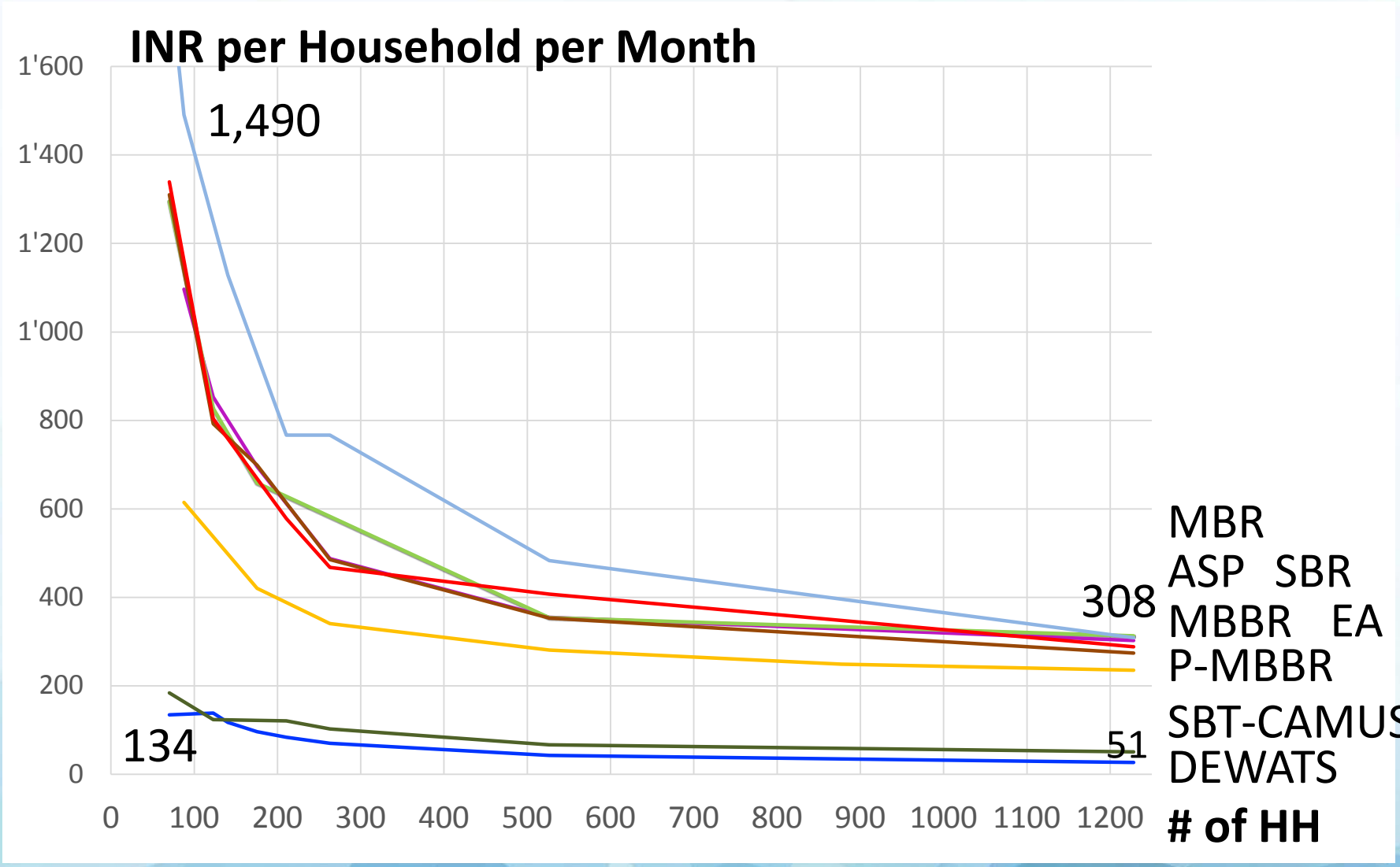
# Life Cycle Costs (LCC) (10 years)



# LCC (10yrs) = 2x-12x of Capital Costs

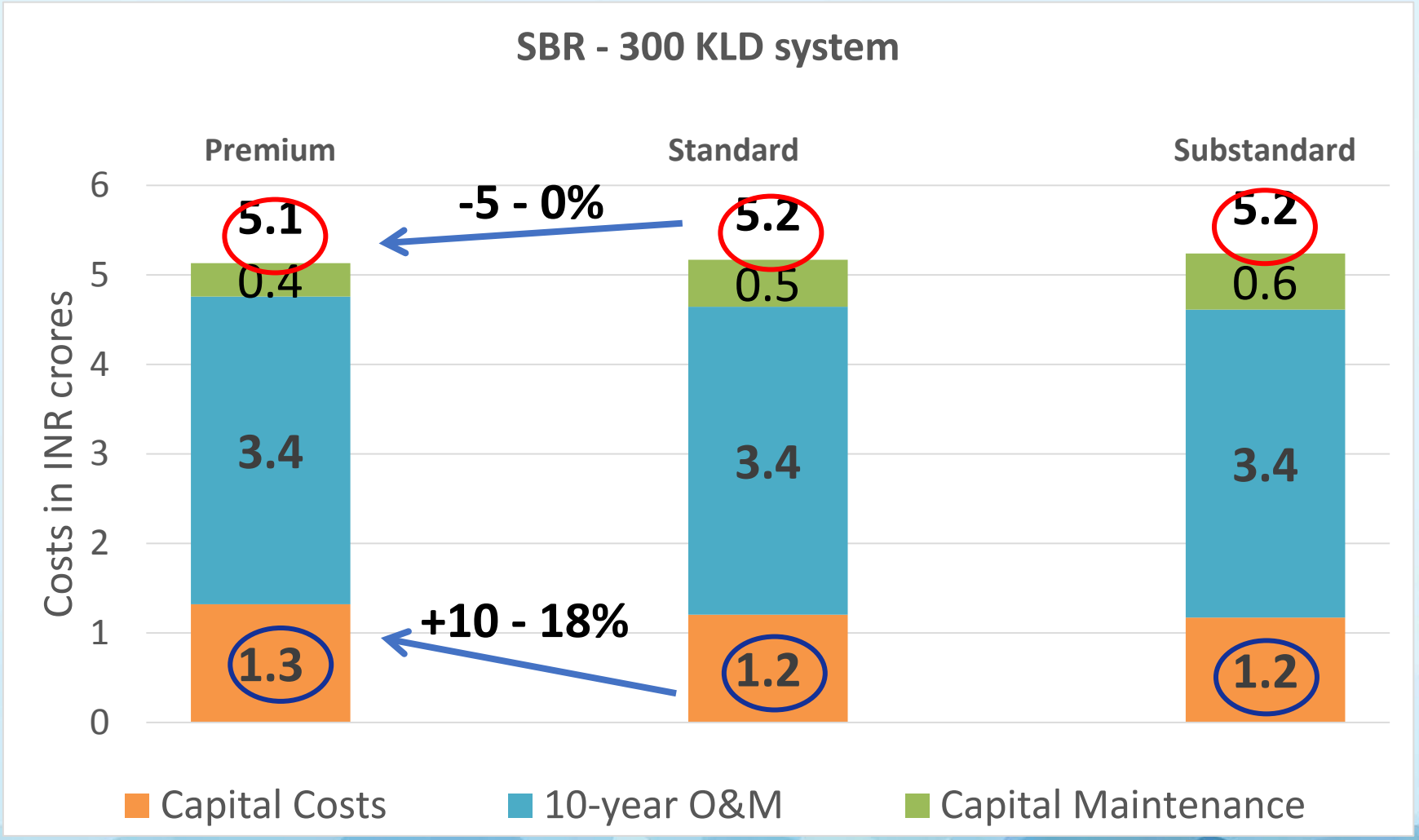


# Scale makes STPs more affordable



# Premium Components can be lowest LCC

- Premium components require least Capital Maintenance



1. Lifecycle Cost of STPs
2. **Failure and Management**
3. City-scale De-centralization

# Key stakeholders

**Planning, Design, Implementation**

- Real estate developer
- Architect, MEP Consultant, EPC Contractor etc
- STP designer and installer

**Operations and Maintenance**

- Owner / RWA
- O&M Service Provider
- O&M Staff

**Regulations and Permits**

- State Pollution Control Board
- Municipality: Building Permits
- Water and Sewerage Board

- Financial factors determine management choices
- Buyers and long-term owners are often different parties
- Conflicting incentives among Stakeholders

# 5 Common O&M Models

| Model | Cost | Risks and Challenges |
|---|---|---|
| 1. In-house staff (Part time) | $ | • Training, Quality, Absenteeism<br>• Risk of poor asset maintenance<br>• Supervision likely will be weak<br>• Automation can reduce risks |
| 2. In-house staff (Full-time) | $$ | |
| 3. O&M by System Designer | $$$$ | • Operator may not report system problems |
| 4. Independent Service Provider | $$$$ | • Can blame designer for problems |
| 5. Facility Management Company | $$$ | • Lack of specialization<br>• Can blame designer for problems |

# Why do systems fail?

| | |
|---|---|
| **Financial Issues** | • Cash flow and interruption during construction<br>• No earmarked funds for O&M<br>• Seen as a cost center, little benefit |
| **Quality Issues** | • Under-designing systems<br>• Cheap/low quality components |
| **HR Issues** | • Lack of skilled operators and Job Perception<br>• Low pay attracts low quality players |
| **Regulatory Issues** | • Consent process is uninformed<br>• Negligible inspections<br>• Corruption in lab testing<br>• Periodic tests not enough—real-time monitoring<br>• Low accountability and alignment among actors |

# Recommendations

## Financial Incentives

- Earmarking financial resources for O&M
- Significant penalties
- Credit for good STPs

## Boost Accountability

- Integrated contracts for build + O&M
- Installer liable for failure

## Governance Structures

- Blind testing, databases
- Certification of firms and operators
- Dedicated permit + monitoring unit in Govt.

## Market Initiatives

- Encourage shared STPs
- Price/supply of municipal water (cap/trade)
- Create used water markets

1. Lifecycle Cost of STPs
2. Failure and Management
3. **City-scale De-centralization**

# De-centralizing Sewerage Networks

- Centralized Sewerage systems take 7-12 years to build
- Sometimes connect only 30-50% of the population
- Failure of large STP is catastrophic (60% don’t meet stds)
- De-centralized is an option:
  - Neighbourhood-scale sewage networks
  - Many small STPs around the city (FSM for gaps)
- Requires a different approach by authorities
  - Different technologies, focus on re-use
  - New management processes

# Cost Comparison

- Depends on local conditions
  - Soil, water table, land gradient, materials, flow etc

| Component | Cost Comparison |
|---|---|
| 1. Feeder Networks | Similar |
| 2. Trunk Networks | Smaller Pipes—Cheaper |
| 3. Pumping Stations | Not required |
| 4. STP | Many more—higher Capital Cost |

- Overall Cost: Similar
- But can do by locality / ward, based on budget
- *Can reduce if norms for pipelines are changed*

# It's a New Way : Benefits and Challenges

- **Cap. Cost** Similar to centralized, but can do locality-wise
- **Time** Can operationalize segments quickly (1-3 yrs)
- **Tech** More choice—select ideal tech for each STP
- **Land** Need many smaller plots
- **Re-use** Easier at local level (5-60% water shortage)
- **Expansion** Easier over time (save $$ today)
- **Op. Cost** Depends on STP tech
- **Mgmt.** Many locations—new systems and processes

***Speed, Flexibility and Re-use are key advantages***

# Conclusions and Key Lessons

- STPs cost < 0.2% of building project cost
- Lifecycle cost is 2-12x Capital Cost
- Alignment of interest is needed for proper O&M
  - Better rules / regulations, training and O&M models
  - Financial investment, fines and incentives
- De-centralized STPs viable and beneficial for cities
- Wastewater re-use—cut water supply capital / O&M costs and improve water security, health etc

# Questions anyone?