CHALLENGES AND SOLUTIONS OF TECHNICAL ASPECTS OF HOUSEHOLD WATER SECURITY: Malaysian Cost Experience

Saturday, 18 May 2013
INTRODUCTION: HOUSEHOLD WATER SECURITY (HWS)

Components of HWS
1. Access to water supply
2. Access to sanitation
THE WATER CYCLE INTERACTIONS

Water supplied by 17 Water Operators nationwide

Sewerage system being operated and maintained by Indah Water Konsortium Sdn. Bhd. And Local Authorities
EVOLUTION OF SEWERAGE SYSTEMS IN MALAYSIA

Early Days

Prior to 1950s

Technology

- Pour Flush
- Septic Tank
- Imhoff Tank
- Oxidation Pond/Aerated Lagoon
- Activated Sludge/Biological Filters
- Fully Mechanised Plant

Year

- 1950s: Primitive / Primary Treatment
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s
- 2012

Address Public Health

Address River Pollution

Address Environment

Address Efficiency & Economic

Future Tertiary Treatment

Centralised Sewerage & Sludge System

Partial / Full Secondary Treatment

Address Efficiency & Economic

Centralised Sewerage & Sludge System

Future Tertiary Treatment
IWK’s COVERAGE AT APRIL 2013

MALAYSIA

5,933 Public Sewage Treatment Plants
907 Network Pump Stations
16,010 km Pipelines
TYPES OF PUBLIC SEWAGE TREATMENT PLANTS BEING OPERATED AND MAINTAINED BY IWK AS AT APRIL 2013

Extended Aeration (EA) 3,339 (56%)
Sequential Batch Reactor (SBR) 212 (4%)
Oxidation Pond (OP) 414 (7%)
Hi Kleen (HK) 258 (4%)
Oxidation Ditch (OD) 173 (3%)
Aerated Lagoon (AL) 163 (3%)
Activated Sludge (AS) 163 (3%)
Imhoff Tank (IT) 720 (12%)
Others 491 (38%)

Total STPs : 5,933
ASSET DIMENSION AS AT APRIL 2013

**All Plants**
- Total 5,933
- No. of STPs: 34, 93, 215
- Population Equivalent: 4,237, 5,685K

**EA Plants**
- Total 3,339
- No. of STPs: 9, 27, 67
- Population Equivalent: 2,595

**SBR Plants**
- Total 2,628,905
- No. of STPs: 6, 22, 37, 53, 54, 40
- Population Equivalent: 924K, 600K, 510K, 368K, 175K

**OP Plants**
- Total 1,652,053
- No. of STPs: 2, 6, 15, 48
- Population Equivalent: 1,27, 216

Legend:
- Red: Less than 2,000 PE
- Green: 2,000 - 5,000 PE
- Blue: 10,001 - 20,000 PE
- Orange: 20,001 - 50,000 PE
- Purple: 5,001 - 10,000 PE
- Teal: More than 50,000 PE

Population Equivalent (’000):
- Total 5,933
- Total 3,339
- Total 212
- Total 414
- Total 1,652,053
- Total 5,933
- Total 3,339
- Total 212
- Total 414
- Total 1,652,053
Note: 1 USD = MYR 3.06
FINAL EFFLUENT COMPLIANCE IN 2012

### All Plants

- **Total STPs:** 4,190
- **Total STPs Sampled:** 966
- **Total STPs Complied:** 390

### EA Plants

- **Total STPs:** 2,548
- **Total STPs Sampled:** 489
- **Total STPs Complied:** 152

### SBR Plants

- **Total STPs:** 217
- **Total STPs Sampled:** 127
- **Total STPs Complied:** 51

### OP Plants

- **Total STPs:** 217
- **Total STPs Sampled:** 126
- **Total STPs Complied:** 48
OPERATING COST BY PE BAND
2010 - 2012

EA Plants

SBR Plants
### OPERATING COST BY PE BAND
#### 2010 - 2012

#### Operating Cost per PE (USD)

<table>
<thead>
<tr>
<th>Year</th>
<th>&lt; 2,000 PE</th>
<th>2,001-5,000 PE</th>
<th>5,001-10,000 PE</th>
<th>10,001-20,000 PE</th>
<th>20,001-50,000 PE</th>
<th>&gt; 50,000 PE</th>
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<tbody>
<tr>
<td>2010</td>
<td>1.33m</td>
<td>3.34m</td>
<td>2.96m</td>
<td>0.37m</td>
<td>0.42m</td>
<td>1.56m</td>
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<tr>
<td>2011</td>
<td>1.28m</td>
<td>5.09m</td>
<td>3.49m</td>
<td>0.63m</td>
<td>1.85m</td>
<td>0.28m</td>
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<tr>
<td>2012</td>
<td>1.38m</td>
<td>5.58m</td>
<td>3.22m</td>
<td>0.96m</td>
<td>0.33m</td>
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#### Operating Cost per year (USD '000)

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<tr>
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<th>2,001-5,000 PE</th>
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<tbody>
<tr>
<td>2010</td>
<td>1.57m</td>
<td>6.22m</td>
<td>1.06m</td>
<td>1.05m</td>
<td>1.39m</td>
<td>0.63m</td>
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<tr>
<td>2011</td>
<td>1.19m</td>
<td>3.49m</td>
<td>1.06m</td>
<td>0.63m</td>
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<td>0.96m</td>
<td>0.33m</td>
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#### Operating Cost Summary

- **Electricity**: Shows a gradual increase from 2010 to 2012.
- **Security & Facility Maintenance**: Remains relatively stable across the years.
- **Operations & Maintenance**: Shows a slight decrease in 2012 compared to 2011.
- **Sludge Disposal & Desilting**: Consistent across the years.
- **Others**: Shows a slight increase in 2012 compared to 2011.

#### Chart Details

- The chart illustrates the operating cost per PE band for the years 2010 to 2012, with each bar representing a different PE band.
- The data is further segmented by cost category as mentioned above.
- The operating cost per PE is calculated for each category and year, with the bars showing the relative cost for each segment.
OPERATING COST COMPONENTS IN PERCENTAGES
2010 - 2012

EA Plants

<table>
<thead>
<tr>
<th>Year</th>
<th>&lt; 2,000 PE</th>
<th>2,001-5,000 PE</th>
<th>5,001-10,000 PE</th>
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<td>17%</td>
<td>23%</td>
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<tr>
<td></td>
<td>40%</td>
<td>46%</td>
<td>44%</td>
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<tr>
<td>2011</td>
<td>26%</td>
<td>19%</td>
<td>18%</td>
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<td>23%</td>
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<td>9%</td>
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<td>38%</td>
<td>44%</td>
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<td>40%</td>
<td>44%</td>
<td>50%</td>
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OPERATING COST COMPONENTS IN PERCENTAGES
2010 - 2012

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SBR Plants

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Legend:
- **Blue**: Electricity
- **Red**: Security & Facility Maintenance
- **Yellow**: Operations & Maintenance
- **Green**: Sludge Disposal & Desilting
- **Orange**: Others

*Note: The chart shows the distribution of operating cost components in different population equivalents (PE) categories for the years 2010, 2011, and 2012.*
OPERATING COST COMPONENTS IN PERCENTAGES
2010 - 2012

- Electricity
- Security & Facility Maintenance
- Operations & Maintenance
- Sludge Disposal & Desilting
- Others

2010
- < 2,000 PE: 22% Others, 20% Security, 13% Operations, 18% Sludge, 2% Others
- 2,001-5,000 PE: 25% Others, 18% Security, 36% Operations, 26% Sludge, 13% Others
- 5,001-10,000 PE: 25% Others, 38% Security, 23% Operations, 21% Sludge, 6% Others
- 10,001-20,000 PE: 25% Others, 29% Security, 20% Operations, 21% Sludge, 3% Others
- 20,001-50,000 PE: 19% Others, 18% Security, 30% Operations, 18% Sludge, 10% Others
- > 50,000 PE: 15% Others, 12% Security, 34% Operations, 15% Sludge, 9% Others

2011
- < 2,000 PE: 30% Others, 23% Security, 18% Operations, 16% Sludge, 14% Others
- 2,001-5,000 PE: 25% Others, 17% Security, 40% Operations, 43% Sludge, 6% Others
- 5,001-10,000 PE: 33% Others, 33% Security, 12% Operations, 12% Sludge, 3% Others
- 10,001-20,000 PE: 12% Others, 10% Security, 30% Operations, 32% Sludge, 3% Others
- 20,001-50,000 PE: 11% Others, 18% Security, 32% Operations, 31% Sludge, 3% Others
- > 50,000 PE: 9% Others, 14% Security, 34% Operations, 15% Sludge, 15% Others

2012
- < 2,000 PE: 30% Others, 28% Security, 19% Operations, 15% Sludge, 9% Others
- 2,001-5,000 PE: 38% Others, 37% Security, 25% Operations, 36% Sludge, 5% Others
- 5,001-10,000 PE: 38% Others, 37% Security, 25% Operations, 36% Sludge, 5% Others
- 10,001-20,000 PE: 14% Others, 14% Security, 4% Operations, 13% Sludge, 15% Others
- 20,001-50,000 PE: 18% Others, 21% Security, 20% Operations, 32% Sludge, 31% Others
- > 50,000 PE: 15% Others, 15% Security, 9% Operations, 12% Sludge, 12% Others
COST REDUCTION PROGRAMME IN IWK

**Electricity Management**
- Focus on lowering electricity consumption and energy requirement of the facilities without compromising the quality of the effluent

**Plant Optimisation**
- Use new and innovative approaches to operations and maintenance through process monitoring
- Rationalisation of small STPs
- Use of geotube for sludge disposal
- Benchmarking among IWK unit offices and with other organisations

**Standardisation**
- Standardisation of equipment and tools
- Push for Standard STP design
Elimination of Theft

- Substitution of materials that do have no or minimal resale value, such as stainless steel parts being replaced by galvanised iron and iron parts being replaced fibre reinforced plastic
- Electronic surveillance
- Customers‘ Eye Programme

Reuse and Recycle

- Turn the bio-solids into fertiliser for non-food crop
- Use of bio-effluent for industrial use and horticulture
- Bio-gas as a renewable energy source
BASIS OF DATA

1. The cost excludes cost recharged from Unit Office (Operational Planning), Regional Office and Head Office cost, doubtful debts and loan interests

2. Network cost is included

3. Depreciation of Sewage Treatment Plants and sewer network is included

4. Population Equivalent of Network Pump Stations is excluded but cost is included

5. Septage Management costs are excluded.
CONCLUSION

• Recurrent cost of sewage treatment plants varies by size and plant type
• Economy of scale is proven

• Cost components differ depending on size and plant type
• Electricity is a major cost component for mechanised plants

• Affordability: Need to find a balance among primary criteria—the capital cost of a STP, the recurrent costs, technology and the expected effluent quality—in selecting a plant to build.
• Other factors to consider: manpower and skill set to operate and maintain STPs, space requirement, etc.
THANK YOU

ขอบคุณคุณ
TERIMA KASIH
谢谢

Merci

Grazie

Danke

Cảm ơn bạn

Khawp-khum

May Lim
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