Wastewater – energy nexus in urban center of Kathmandu, Nepal

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Based on:
Food-energy-water nexus

The water-energy-food nexus must be based on a comprehensive approach that:
1) incorporates food systems (production, consumption) as integral to the nexus,
2) emphasizes not just resources but institutions and options to govern the nexus,
3) strengthens human and ecosystem resilience through water, energy, food security.

Source: Scott et al. 2016
Wastewater treatment in Kathmandu Valley, Nepal

Trends of Asian Cities: Rapid, urbanization, limited infrastructure, and unregulated pollution
### Major WWTP in Kathmandu Valley

<table>
<thead>
<tr>
<th>Name</th>
<th>Year of operation/Treatment capacity</th>
<th>Type</th>
<th>Energy intensity</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guheshwori</td>
<td>2002 (16.4 MLD)</td>
<td>Oxidation ditch</td>
<td>High</td>
<td>Functional</td>
</tr>
<tr>
<td>Sallaghari</td>
<td>1985 (1 MLD)</td>
<td>Aerated lagoon</td>
<td>Minimal</td>
<td>Partially functional</td>
</tr>
<tr>
<td>Kodku</td>
<td>1982 (1.1 MLD)</td>
<td>Waste stabilization pond</td>
<td>Minimal</td>
<td>Partially functional</td>
</tr>
<tr>
<td>Dhobighat</td>
<td>1982 (15.4 MLD)</td>
<td>Waste stabilization pond</td>
<td>Minimal</td>
<td>Not operational since 1982</td>
</tr>
<tr>
<td>Hanumanghat</td>
<td>1975 (0.5 MLD)</td>
<td>Aerated lagoon</td>
<td>Minimal</td>
<td>Partially functional</td>
</tr>
</tbody>
</table>

Source: Scott et al. 2016
Guheshwari WWTP, Kathmandu Valley

Main infrastructure: Mechanical bar screen, Oxidation ditch (energy intensive~ 14,000 KWh/day)

Energy sensitive biological processes

Figure: Oxidation ditch
Credit: Kathmandupost

Figure: Secondary Clarifier
Credit: MyRepublica

Source: Regmi 2013
Operationalizing wastewater-energy nexus

• Energy efficiency and recovery
  • Energy audits for improving energy efficiency
    • Siltation unit, Sequence batch reactor (Regmi 2013)
  • Energy recovery (sludge digestion)
    • Biogas sludge digestion

Source: https://www.eia.gov

Source: Lincoln, Nebraska government (copyrighted)

Source: Regmi 2013

FIGURE 17. Different units of Guheshwori WWTP; (a) Usage of pump to pass the water through grit chamber; (b) Grab screen to remove large materials; (c) Blower aerators in action; (d) Feather like structures in settling tank; and (e) Settling tanks
Operationalizing wastewater-energy nexus

Co-benefits and trade-off with agriculture

- Dry bed product as fertilizer
- Treated water use in agriculture

Source: https://www.slideshare.net/

Source: https://www.burohappold.com
Discussion

- Resources dimension as important element in WEF nexus
- However, WEF to be situated within the sustainability framework (economic, environmental, equity)
- Synergies and trade-off prominent in WEF nexus
- Institutional, cultural, political drivers

Source: Pashupatinath Temple, a World Heritage Site, downstream of Guheshwori WWTP

Source: http://nwcf.org.np/
Thank you!

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Decentralized wastewater treatment (Credits: cseindia.org)
References
