Wastewater – energy nexus in urban center of Kathmandu, Nepal

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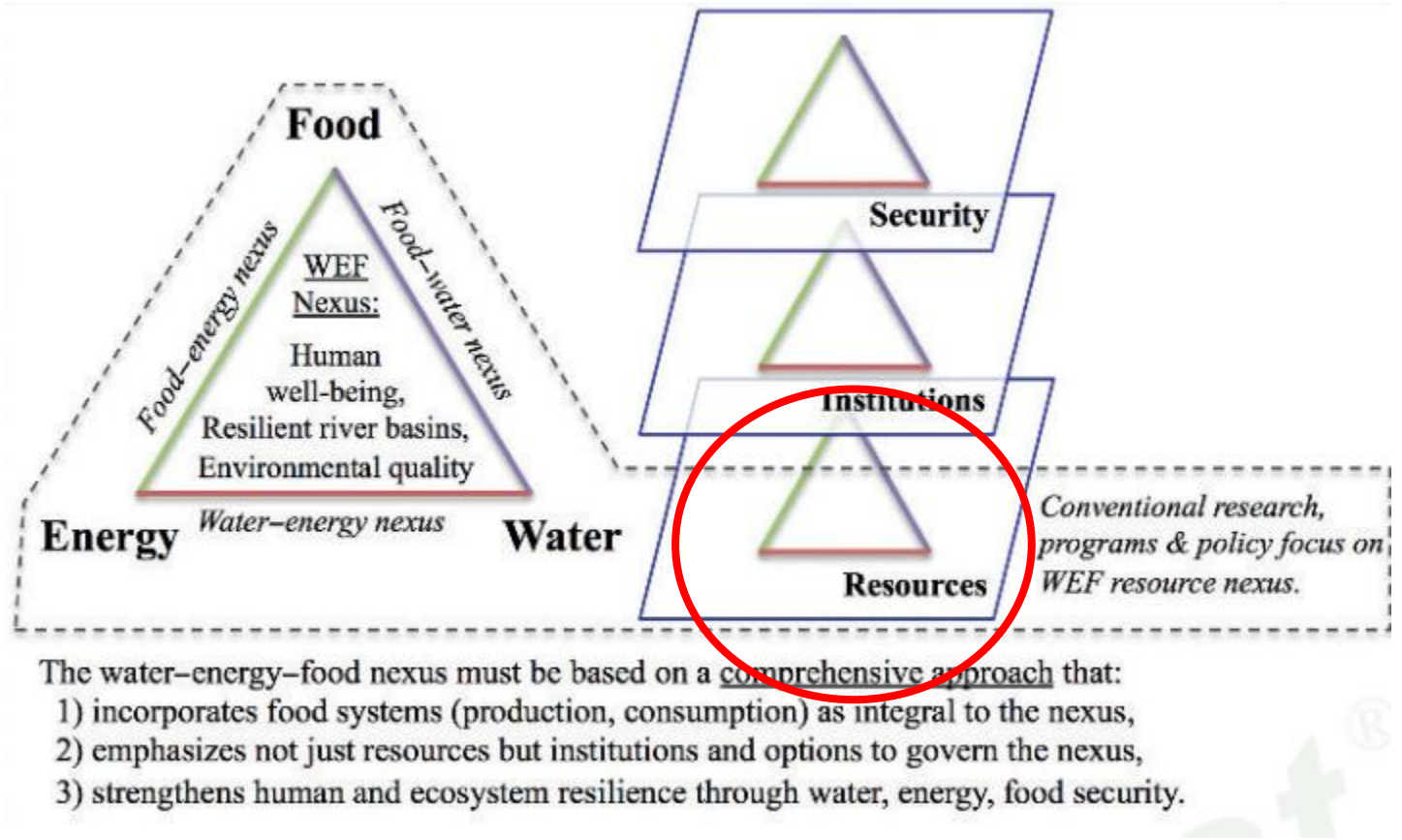
Based on:

Scott, C.A., A. Crootof, B. Thapa, R.K. Shrestha. 2016. The water-food-energy nexus in the Ganges Basin: Challenges and opportunities. In L. Bharati, B.R. Sharma, V. Smakhtin (eds.), *The Ganges River Basin: Status and Challenges in Water, Environment and Livelihoods*, Routledge, London, pp. 138-153.

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

Credit: https://thehimalayantimes.com/

Major WWTP in Kathmandu Valley

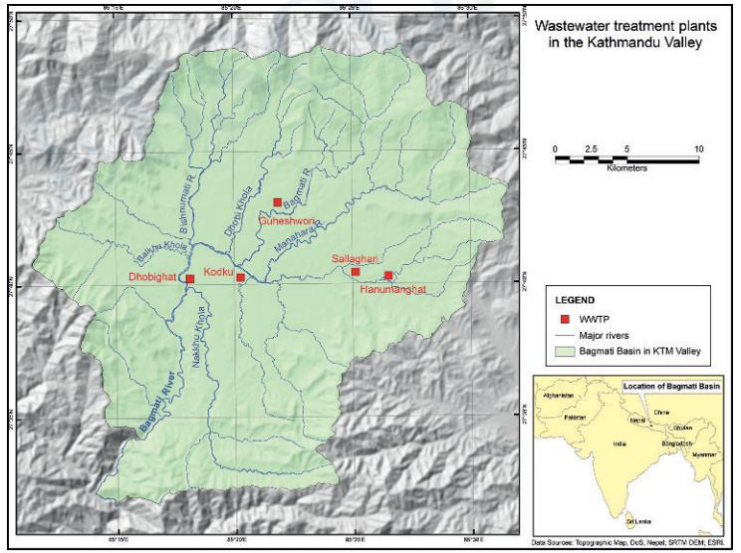


Figure 8.4 Wastewater treatment plants in the Kathmandu Valley

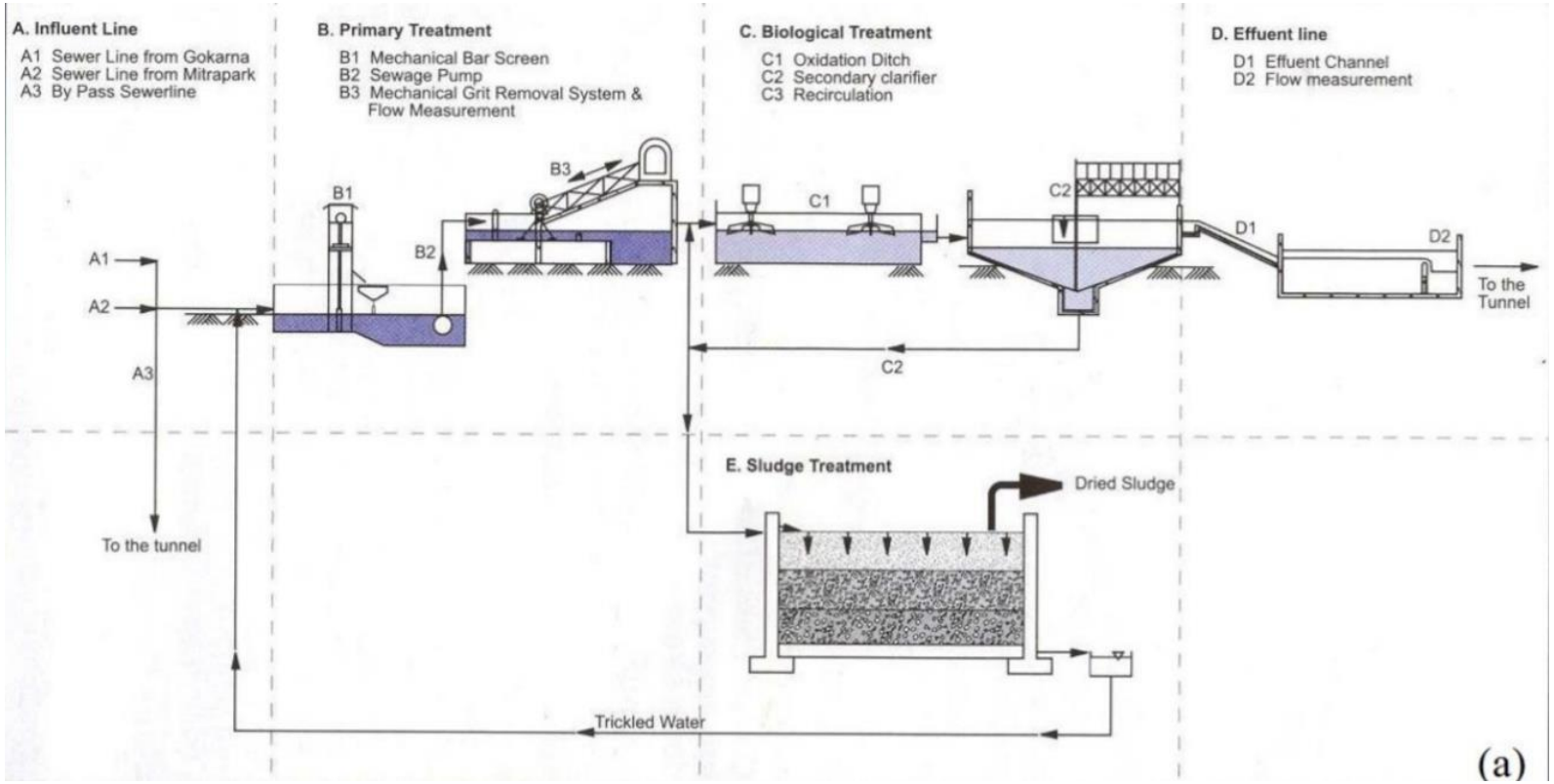
Name	Year of operation/ Treatment capacity	Type	Energy intensity	Remarks
Guheshwori	2002 (16.4 MLD)	Oxidation ditch	High	Functional
Sallaghari	1985 (1 MLD)	Aerated lagoon	Minimal	Partially functional
Kodku	1982 (1.1 MLD)	Waste stabilization pond	Minimal	Partially functional
Dhobighat	1982 (15.4 MLD)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

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



Source: Regmi 2013

Figure: Oxidation ditch

Figure: Secondary Clarifier

Opertalionalizing 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: Lincoln, Nebraska government (copyrighted)

Source: https://www.eia.gov

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

Source: Regmi 2013

Opertalionalizing wastewater-energy nexus

Co-benefits and trade-off with agriculture

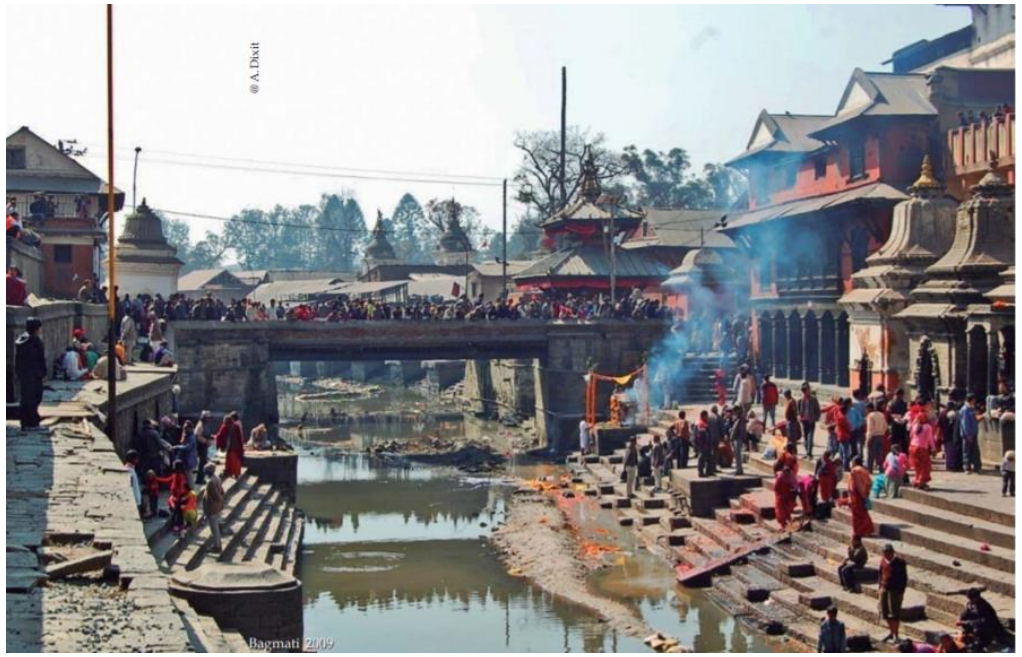
- Dry bed product as fertilizer
- Treated water use in agriculture

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

- Regmi, S. 2013. Wastewater treatment in Kathmandu: Management, treatment and alternative. Bachelor's thesis in Environmental Engineering, Mikkeli University of Applied Sciences, Finland.
- Scott, C.A., A. Crootof, B. Thapa, R.K. Shrestha. 2016. The water-food-energy nexus in the Ganges Basin: Challenges and opportunities. In L. Bharati, B.R. Sharma, V. Smakhtin (eds.), *The Ganges River Basin: Status and Challenges in Water, Environment and Livelihoods*, Routledge, London, pp. 138-153.