



# Climate Resilient, Inclusive and Environmental Sanitation Solutions

Innovating green solutions for an urbanizing world

1. Urbanization and the need for Green Sanitation
2. Understanding the different options of wastewater management
3. Why decentralized sanitation and wastewater treatment systems are green
4. Designing sustainable models for decentralized wastewater management

# Our Cities

Occupy only **3%** of **land space**

Produce **50%** of **waste**

Account for **60% - 80%** of **GHG emissions**

Consume **75%** of **natural resources**

Produce **80%** of **GDP**



# Challenges of Urbanization

*Insufficient infrastructure and service delivery for all*



Waste management



Transport



Wastewater and sewage  
management

Intensive and rapid urban growth creates challenges for municipal/local governments to provide basic infrastructure and services for all people

# Challenges of Urbanization

*Vulnerable to the impacts of Climate change and increased social instability*



- Fifteen of the world's twenty megacities (over 10 million inhabitants) are located in coastal zones threatened by sea-level rise and storm surges.
- 40% of the world's urban expansion takes place in slums

Unplanned urban expansion and limited urban infrastructure can exacerbate socio-economic disparities, leaving the urban poor most vulnerable to effect of climate change.

# The situation in Cambodia

- In Cambodia, there are three main centralized wastewater treatment systems.
- These facilities do not provide coverage to the entire city. Thus, other onsite systems are needed to provide complementarity.
- On-site systems are in place, such as septic tanks, and trucks collect waste from these tanks. These however are not monitored.
- Centralized systems are costly, and some are in partial operation. Moreover, disparities continue.

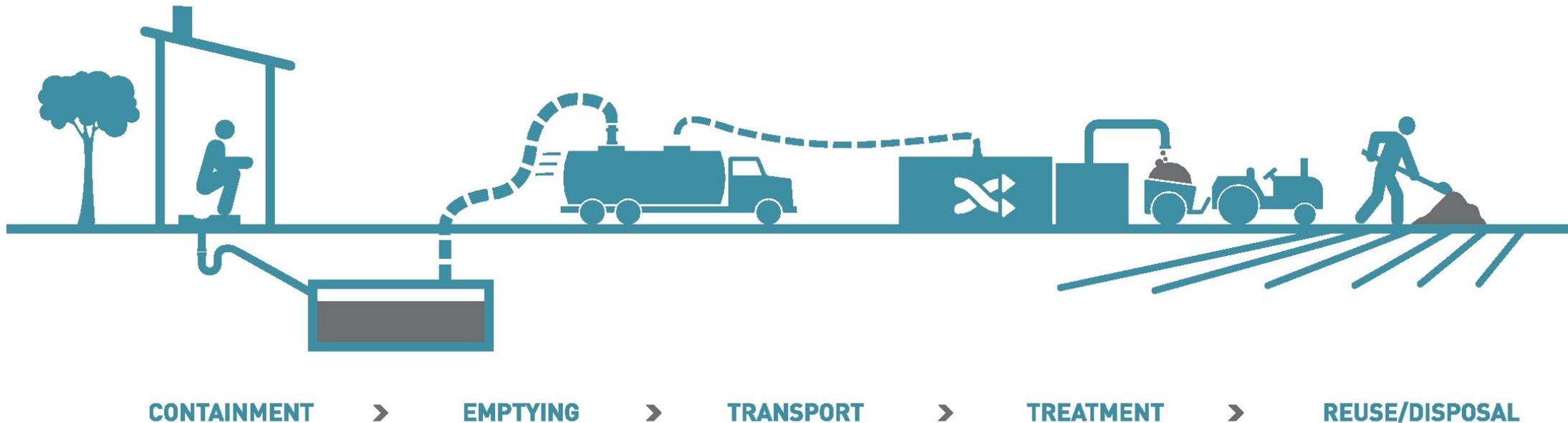
Description	Sihanoukville	Battambang	Siem Reap
Type of facility	Centralized treatment with Oxidation pond	Centralized treatment with lagoon	Centralized treatment with Oxidation pond
Construction cost	USD 11.19 million	USD 0.46 million	USD 29.96 million
Year completed	2005	1994	2013
Current status	In operation	Partially operated	Partially operated

**A large part of the sanitation problem is the focus only on **wastewater treatment, not overall wastewater management**. This includes attention to the full value chain**

# Sustainability means more than treatment!

Sustainable sanitation approaches focus not only on the wastewater treatment aspect but on the entire "sanitation value chain". The generalized chain includes five steps:

- i. Containment
- ii. Emptying
- iii. Transport
- iv. Treatment
- v. Disposal or reuse



## Why Green Sanitation for Cities?

Understanding the different options of wastewater management

How decentralized sanitation and wastewater treatment systems are green

Designing sustainable models for decentralized wastewater treatment systems

# Options for waste water management



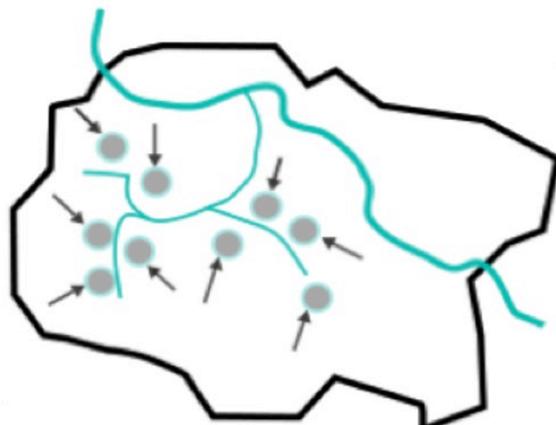
**On-site Systems**  
Households, institutions & industry



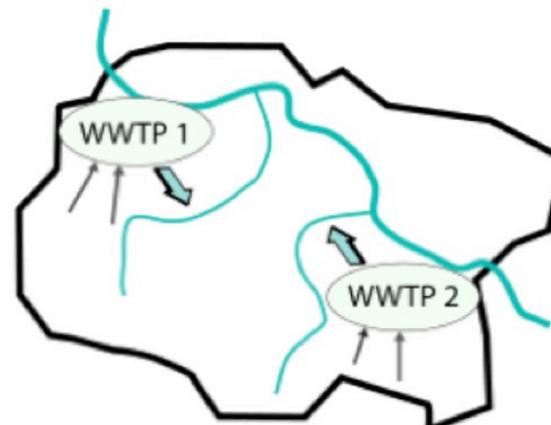
**On-site and off-site Cluster Systems**  
Real estates & settlements & villages



**Off-site centralized Systems**  
Cities & town ships



Fully decentralized



Partly Decentralized or  
decentralized clusters



Fully centralized

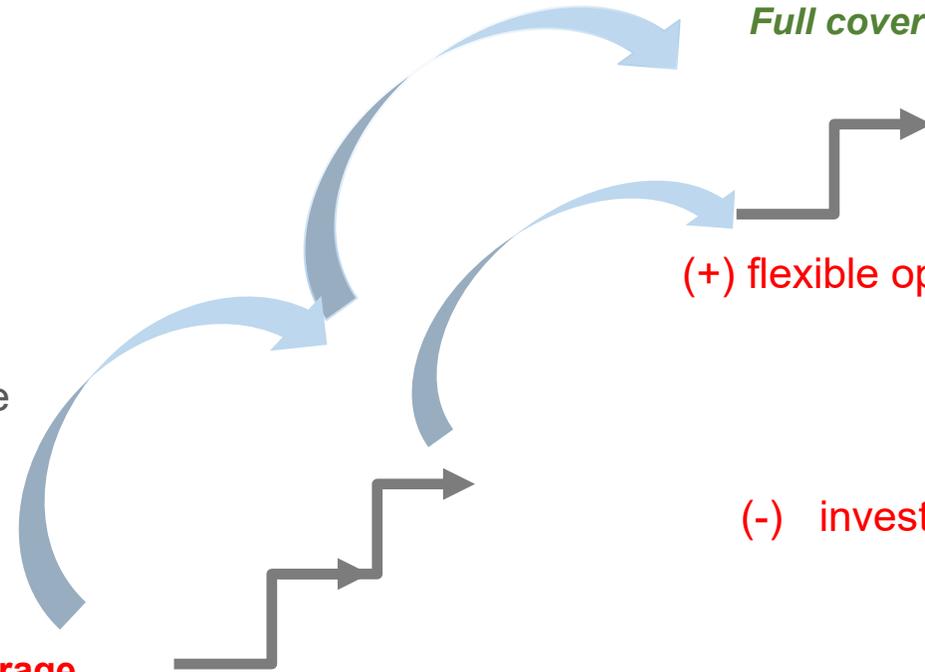
The range of different models  
for service delivery (IWA  
2014)

# Wastewater Management Options: Which one?

## Centralized service – *the big coverage*

- (+) **large coverage**
- (+) institutional sustainability
- (+) low specific costs
- (-) **required large investment**  
available often only once in a decade
- (-) do require complimentary public infrastructure like roads
- (-) high operation cost
- (-) **big negative impact if fails**

No coverage



Full coverage

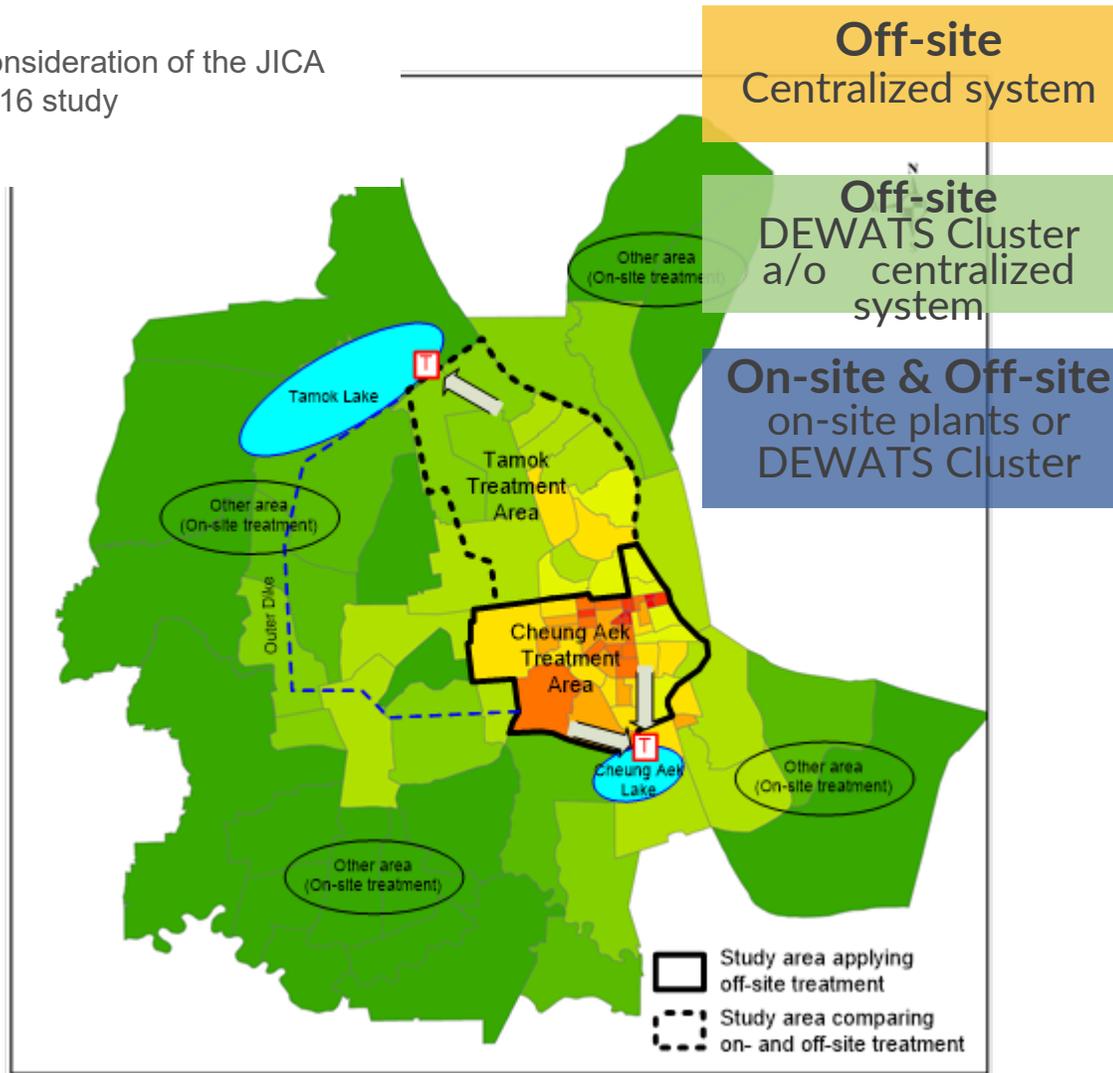
## Decentralized services – *the connecting clusters*

- (+) **low investment cost**
- (+) local capacities built
- (+) **flexible options that respond to a variety of needs**
- (+) **water re-use options**
- (-) higher specific costs
- (-) **investment for capacity building & regulations**
- (-) higher land requirements
- (-) finding effluent discharge points

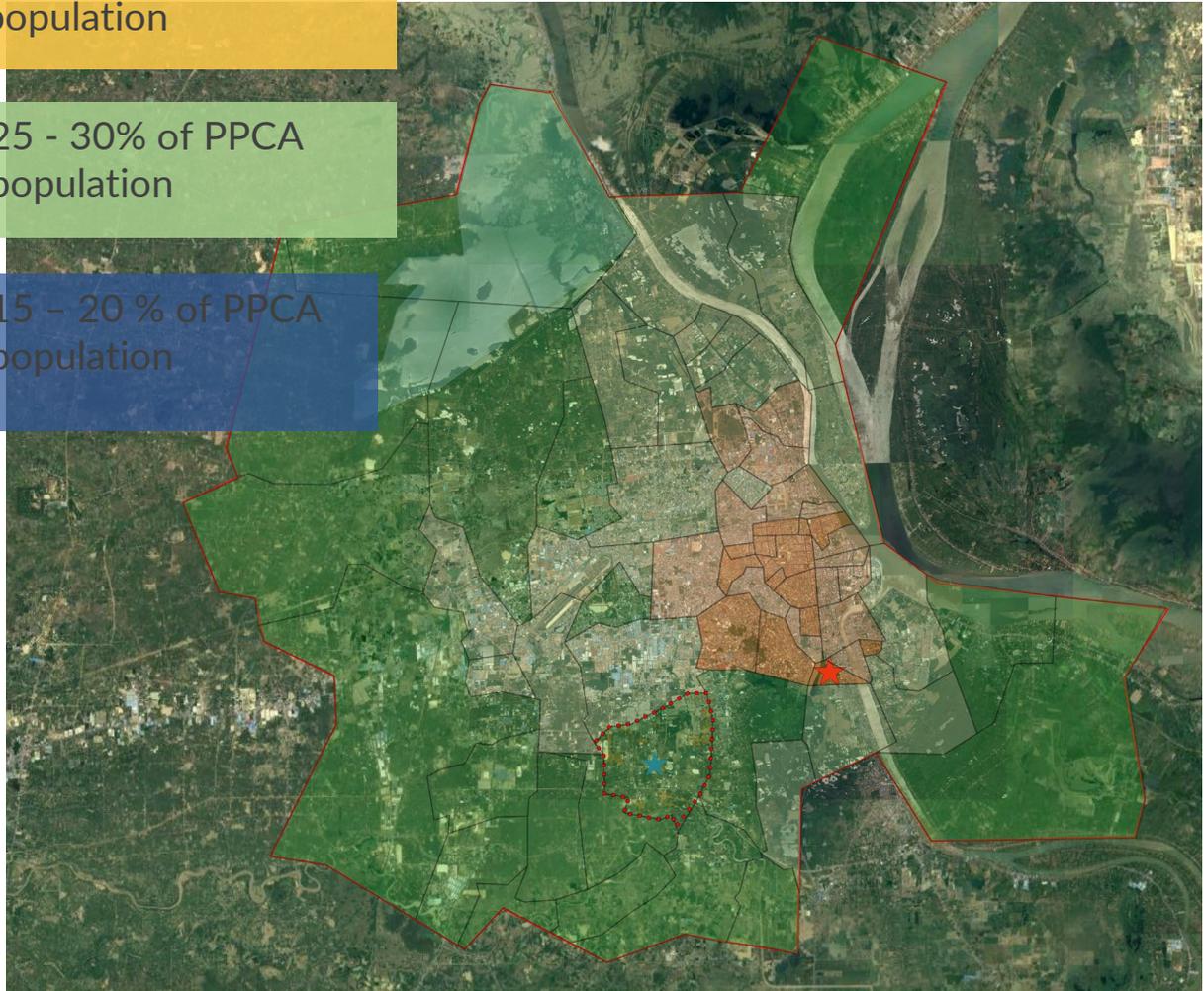
*Central & decentralized services can to be implemented and operated in a integrated and complimentary manner!*

# Wastewater management for Phnom Penh

Consideration of the JICA 2016 study



<p><b>Off-site</b> Centralized system</p>	<p>50 - 60 % of PPCA population</p>
<p><b>Off-site</b> DEWATS Cluster a/o centralized system</p>	<p>25 - 30% of PPCA population</p>
<p><b>On-site &amp; Off-site</b> on-site plants or DEWATS Cluster</p>	<p>15 - 20 % of PPCA population</p>



Why Green Sanitation for Cities?

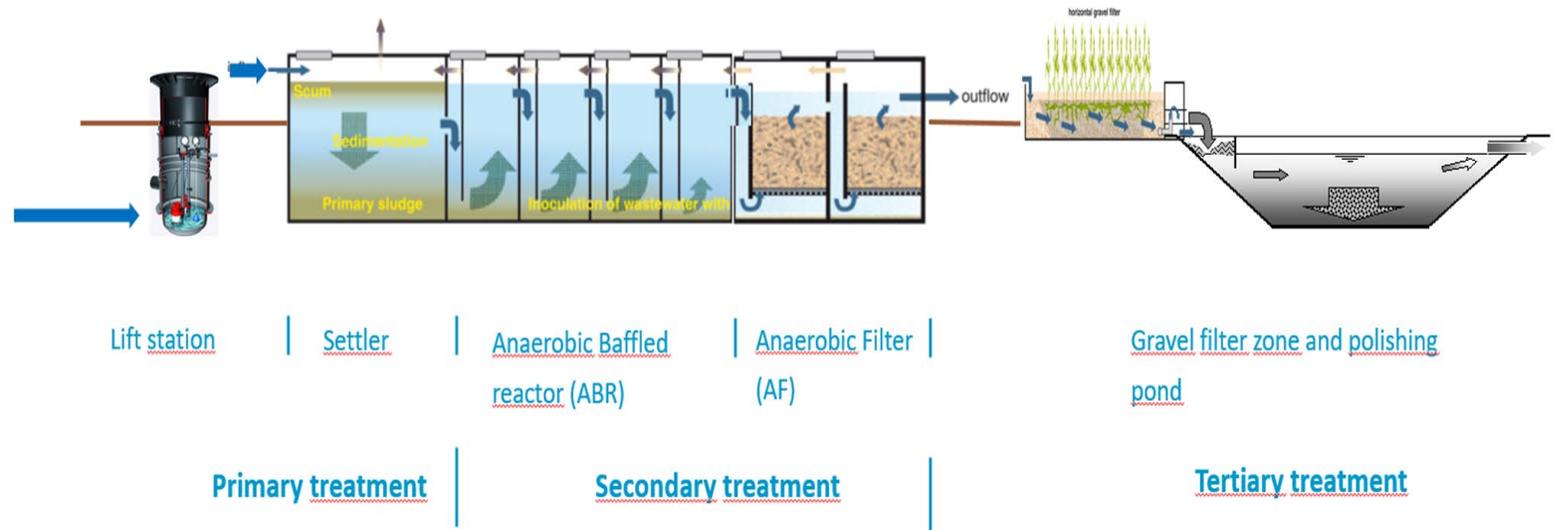
Understanding the different options

How decentralized sanitation and wastewater treatment systems are green

Designing sustainable models for decentralized wastewater treatment systems

# Decentralized Systems are Green

- ‘Off-grid’ or decentralized sanitation and wastewater solutions are climate resilient solutions that contribute towards climate adaptation and green growth in Cambodia:
  1. Increased liveability in peri-urban areas due to improved sanitation and stormwater management
  2. Fostering re-use as an integrated part of the a urban water management – climate change adaptive
  3. Run without electricity
  4. Flood Resilient Designs
  5. Low Carbon Operation, Emission Savings

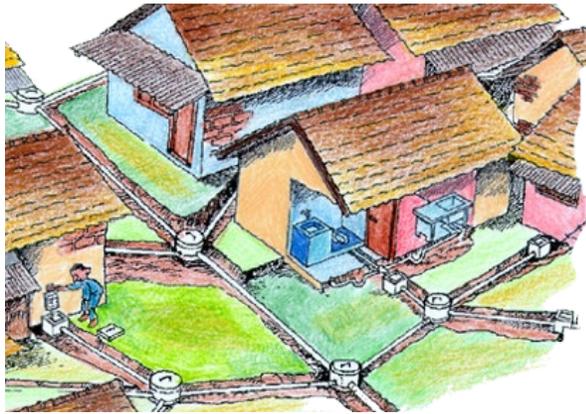


## Decentralized Systems are Sustainable, Inclusive and Adaptive



- **Quick implementation:** by mobilisation of local financial resources; complete implementation project cycle period down to 6 month is possible
- **Low-carbon:** requiring little or no input of outside energy and moving parts; construction with skills and material locally available
- **Simple and sustainable operation:** standardised low-tech solution at scale allows to localised operation management and to lower the barrier to engage private sector and community
- **Enhancing capacity building at all level** due to relatively short implementation project cycle and standardised low-tech solution
- **Closing the water and nutrient lope:** by finding context specific ways to re-use water for urban agriculture, landscaping and cooling
- **Progressive implementation:** DEWATs clusters can later be merged to more centralized wastewater collection and treatment cluster once the sector is evolved

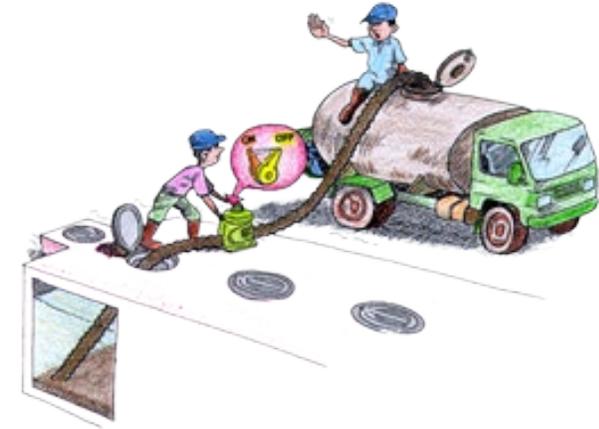
# Simple operation tasks for DEWATS



**Sewer control every month**



**Scum removal every 1 - 3 months**



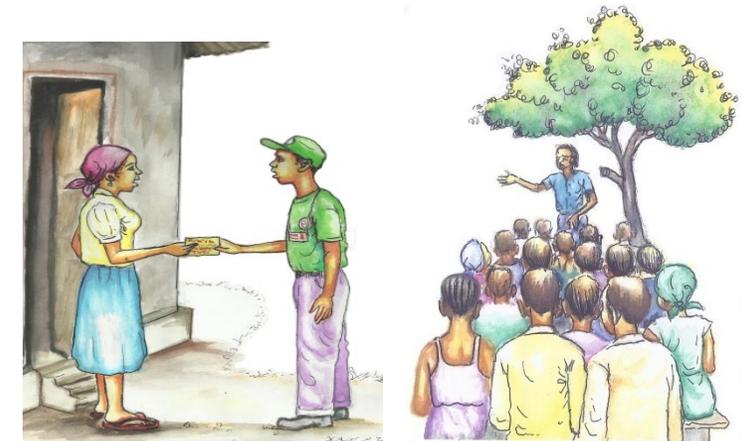
**Annually de-sludging of settler & ABR**



**Flushing of anaerobic filter once every 4 -5 years**



**Annual effluent monitoring**



**Community liaison office**

**Why Green Sanitation for Cities?**

**Understanding the different options**

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# Designing Sustainable Models

## *Financing for the costs of wastewater*

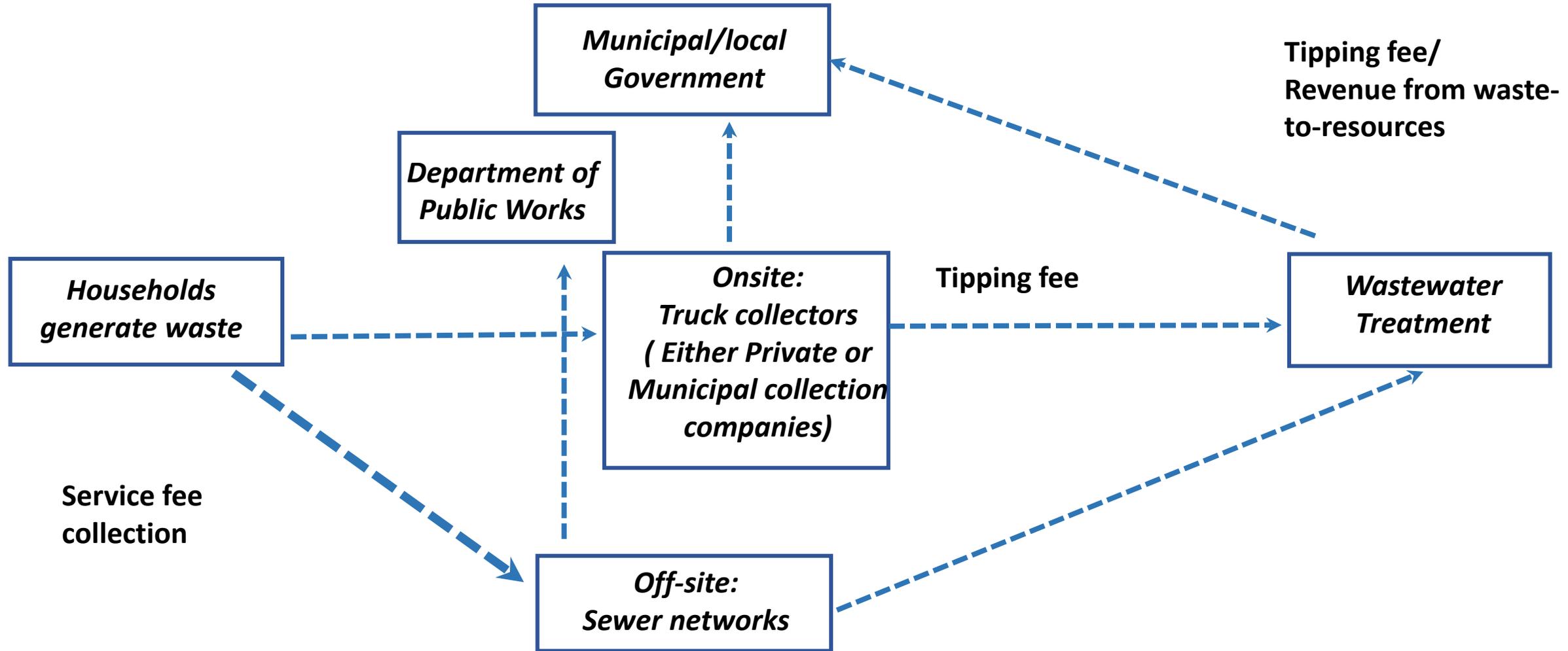


**Ensuring Sustainable financing** is very important, since without cost recovery, no system can continue running. Means of cost recovery can include:

1. Mix of tariffs, taxes and transfers (3Ts) to finance recurrent and capital costs and leverage other forms of financing
  2. Predictable public subsidies to facilitate investment planning
  3. Tariff policies that are affordable to all, including the poorest, while ensuring financial sustainability
- In developed countries, tariffs usually the same for different categories of users and for different levels of consumption.
  - In developing countries, **cross-subsidies to make water more affordable** for residential low-volume users that are assumed to be poor.
    - ***Industrial and commercial users charged higher. Also, metered users charged higher tariffs for higher levels of consumption (increasing-block tariffs).***

# Designing Sustainable Models

## Setting up the arrangements



---> Revenue streams

# Designing Sustainable Models

## Summary



At the heart of “green” sanitation and wastewater management problem is developing systems that are effective, sustainable and socially inclusive. This will mean a number of things:

1. Looking at the **full sanitation value chain** and going beyond treatment and looking at overall management. This includes setting up the **right institutional arrangements**.
2. Ensuring **low risks to the environment and natural resources**.
3. Ensuring solutions that are **adaptive to climate change**.
4. Looking at a range of solutions rather than the silver bullet ones – here decentralized solutions can complement centralized ones.
5. Ensuring **sustainable financing**, through a range of options. This could include additional revenue streams to make “productive” sanitation systems, including benefits from biogas, fertilizer etc.
6. Integrating **sanitation in a broader urban context** to ensure linkages with other sector.
7. Ensuring systems that are **inclusive and gender-responsive**.

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# Thank You

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