Solid-free Sewer:

an approach to provide appropriate sewer services in urban areas of emerging and developing countries

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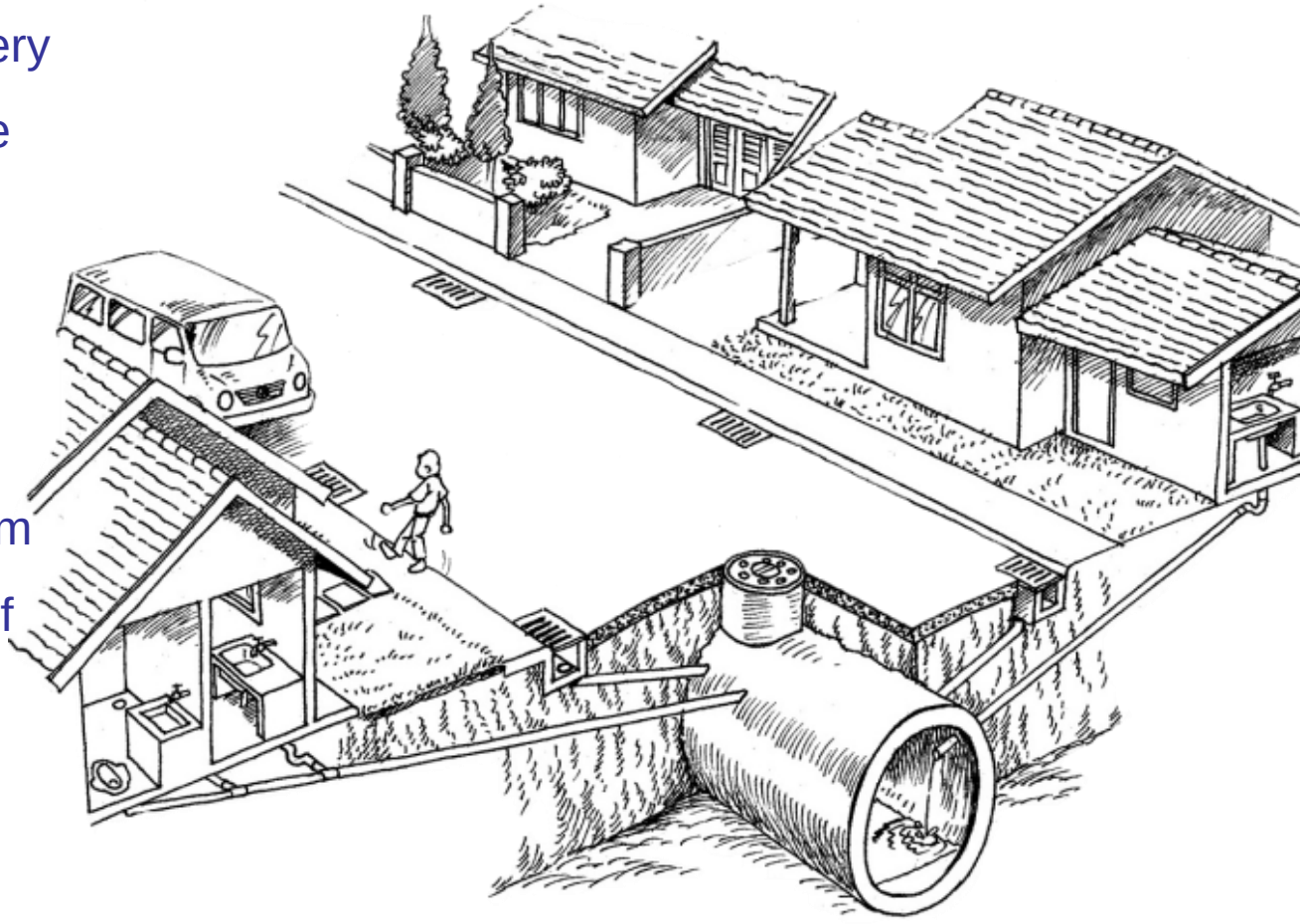
What is the function of a sewer?

To transport domestic and industrial wastewater and human faeces from there source to a treatment and disposal point

A very convenient but also very expensive community service

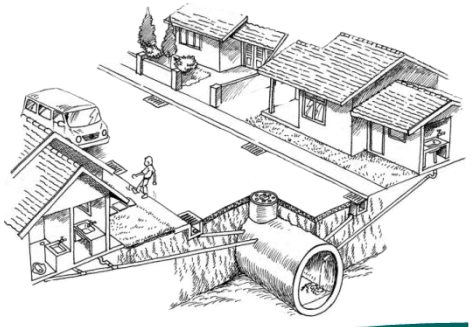


Major advantage:

Sewers are effective long term sanitation systems capable of serving densely populated areas and they have a high service area extension capacity

Towns in Zambia: Ndola

Urban sanitation coverage in most of the cities in East – & Southern Africa



Sewer-born sanitation
Coverage: 5 - 15 % (20 – 30 % extension within next 20 years)
WW generation*: 40%

On-site wet sanitation
Coverage 20 - 30%
WW generation*: 40%

On-site dry sanitation
Coverage 60 - 70%
WW generation*: 20%

* % of the total wastewater generation of a city

Challenges in providing sewer services to communities in Zambia

A – Commercial challenges

- Zambian income is still low, average GDP is 1100 USD per capita per year
- Urban household water connection rate is only 60 – 80%
- The water revenue is not sufficient to finance system operations and initial investment costs- water service still relies on donor funding
- The Sanitation Fee is only 20-30% of the water price

Challenges in providing sewer services to communities in Zambia

B – Technical challenges

- Limited engineers and qualified plumbers are available in the country

- Sewers clog very often because of:
  - water shortages caused by low water consumption by the community and pipe leakages resulting in high solid waste concentration in the sewers
  - solid waste disposal into sewer inspection chambers

- Often very flat terrains lead to deep sewer levels and installation of lifting pumps

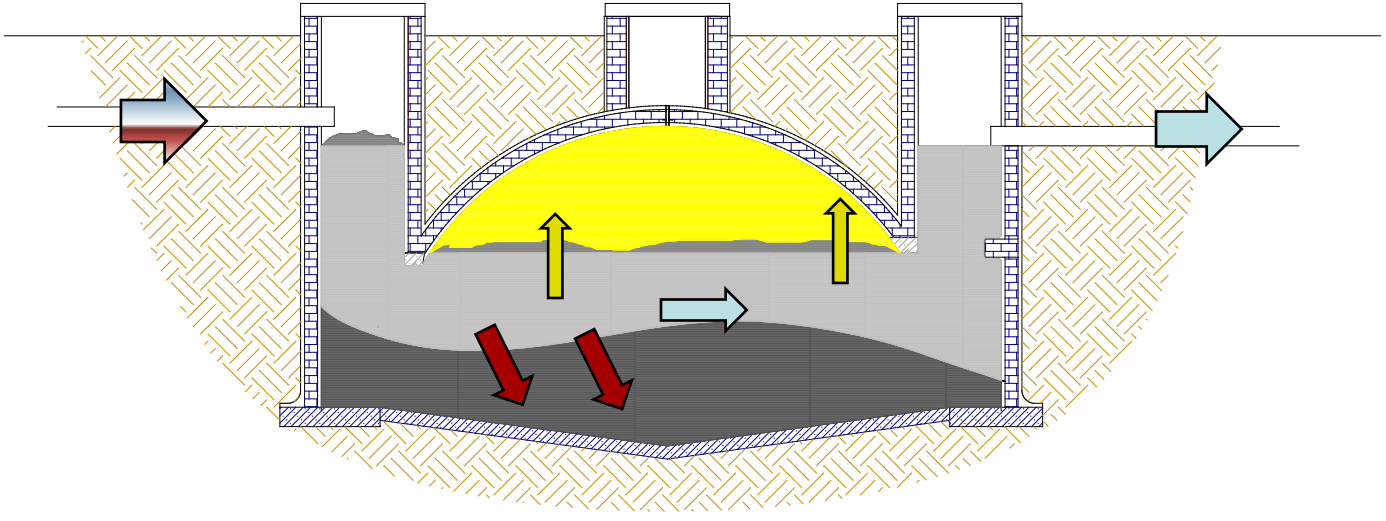
- Insufficient power supply and maintenance capacities for sewerage pumps

- All of these factors result in high maintenance and running costs

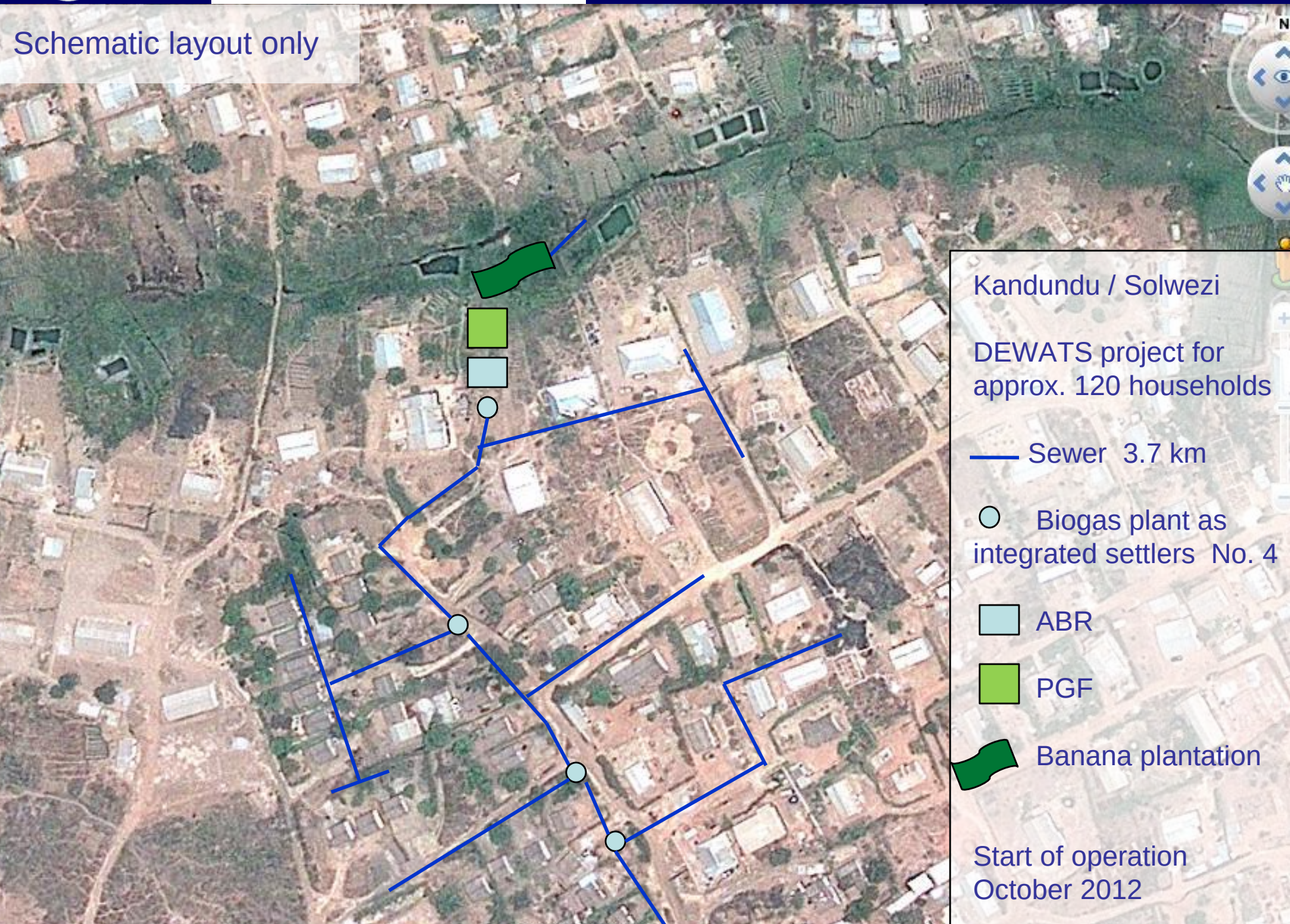
A new approach to address these challenges is:

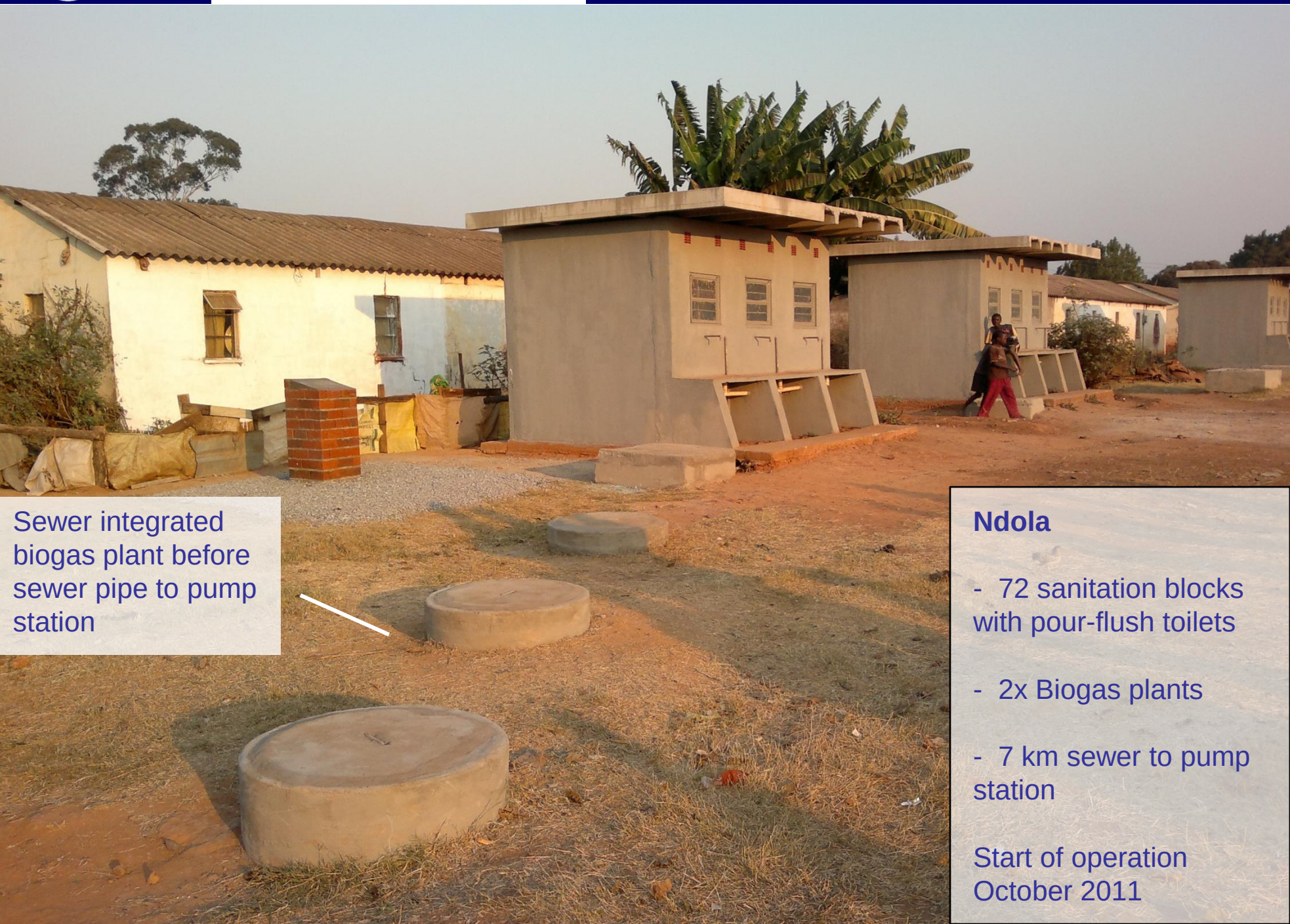
- to integrate into the sewer at designated places using a decentralized waste treatment component (**DEWATS**) in order to separate and break down sewerage solid components and to minimize the solid content in the down flow piping system
- to reduce sewer clogging & sewer maintenance costs and to increase the flexibility of laying pipes according to terrain conditions

Sewer integrated biogas plants for decentralized wastewater pre-treatment



Schematic layout only





Sewer integrated biogas plant before sewer pipe to pump station

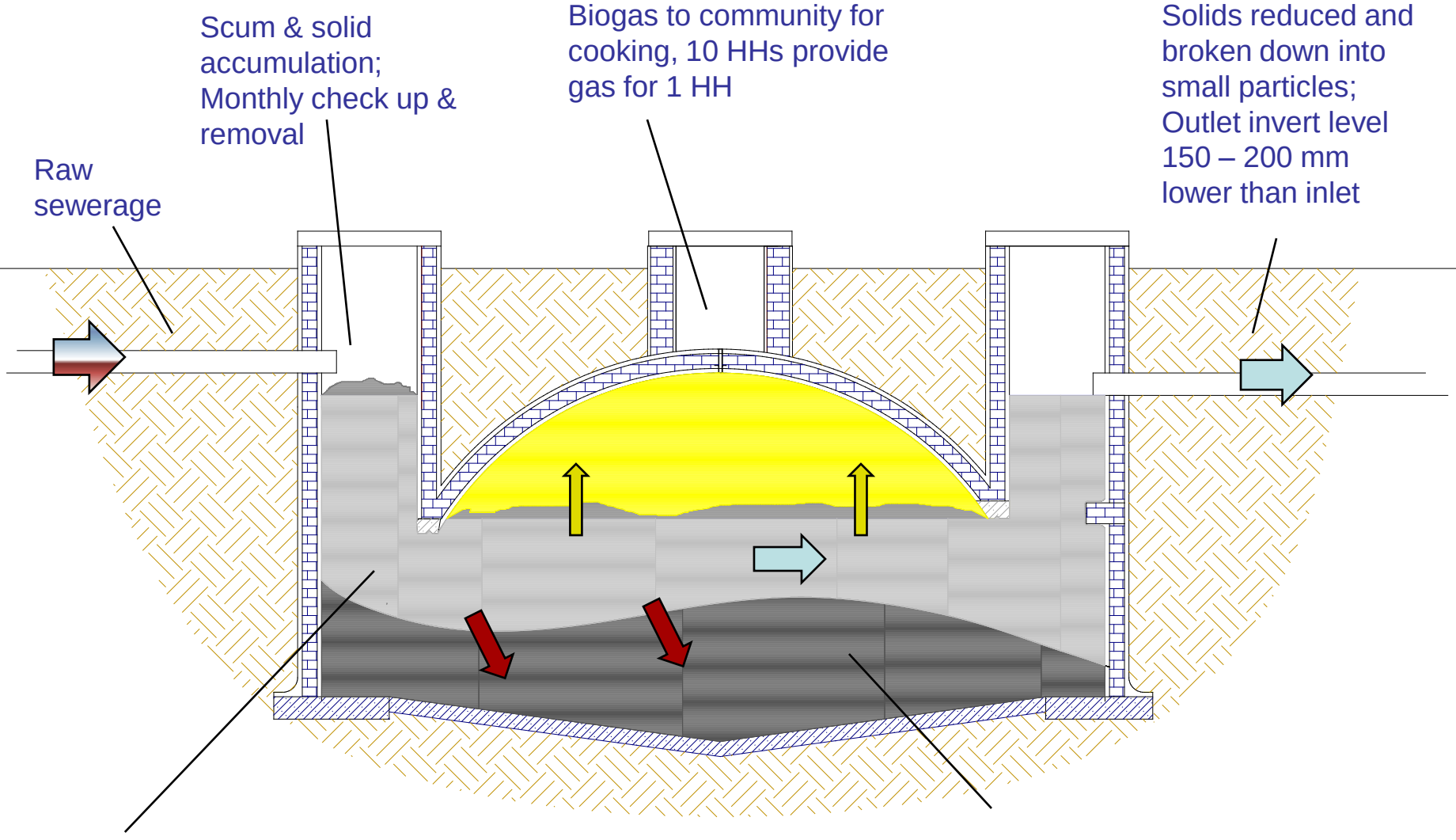
Ndola

- 72 sanitation blocks with pour-flush toilets

- 2x Biogas plants

- 7 km sewer to pump station

Start of operation October 2011



Brick built biogas plant

- 20 – 50 households connected
- 20 – 50 m³ digester volumes
- Usually no expansion chamber required due to continuesly inflowing water

Solid wastes settles and is biological degraded;
Sludge removal once every two years

Some technical consideration and comparison

	Conventional sewer	Solid-free sewer
Flow velocity & pipe gradient	0.5 – 5.0 m/s According to hydraulic requirements	< 0.5 m/s >= 1.0% according to ground slope
Distance of control chambers	<= 50 m	<= 100 m
Application	-High degree of household connections - sufficient hydraulic conditions	- Long distance connections - Flat terrains - Low water consuming communities
Advantages	- Minimum land requirement - High connection capacity - Keeps the waste water mainly under aerobic condition - All piping materials applicable	- Works in areas with water shortages - Less clogging = less maintenance - Less control chambers - Less pipe gradient required = less pipe depth = less pumping stations - Wastewater pre-treatment creates less organic load at the final treatment system
Disadvantages	- Hydraulic determines pipe gradient = deep pipe depth in flat terrain - high degree of clogging in case of water shortage, leakages & problem with control chambers	- Additional land required for the biogas plant - Additional community interaction - UPVC or HDPE piping material only

Challenges experienced by applying sewer integrated biogas plants

- Hydraulically best location for the biogas plant dos not always match land availability
- Additional community mobilization required including: information sharing, land acquisition, and biogas utilisation
- Construction capacities need to be locally developed first

Area for further research and development activities

- Long term monitoring of the new sewer system regarding:
  - ✓ solid treatment performances
  - ✓ biogas production
  - ✓ maintenance requirements
  - ✓ impacts on the final wastewater treatment system regarding organic load reduction and anaerobic/aerobic condition
- Detailed cost/benefit calculation and comparison with conventional sewers
- Engaging the community for simple O&M tasks for the biogas plant
- Community biogas utilisation and payment

Thank you for your attention !

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