The dti, WRC, TIPS initiative on water and sanitation Research project

Opportunities and constraints for NGS and industrial development in South Africa

Development Dialogue
22 August 2018

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Introduction

- Universal access to clean water and proper sanitation is the desire of every country
- This has been a key objective on the international arena, as emphasised in the SDGs and the MDGs
- South Africa is a step further as the constitution and various policy documents highlight:
  - that access to water and sanitation is human right, and therefore concerted effort should be focused on ensuring that such a right is fulfilled

- SDG 6.1:
  - by 2030, achieve universal and equitable access to safe and affordable drinking water for all; and
- SDG 6.2:
  - by 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.

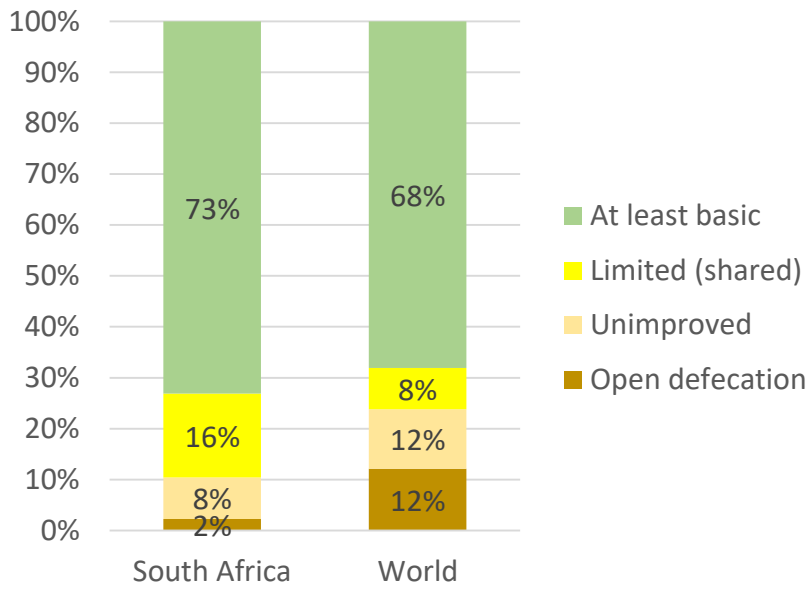
Background

- Sanitation is a multi-step process that manages human excreta from the point of generation to the point of use or ultimate disposal.

The Sanitation ladder

Safely managed	Use of improved facilities which are not shared with other households and where excreta are safely disposed in situ or transported and treated off-site
Basic	Use of improved facilities which are not shared with other households
Limited	Use of improved facilities shared between two or more households
Unimproved	Use of pit latrines without a slab or platform, hanging latrines and bucket latrines
Open defecation	Disposal of human faeces in fields, forest, bushes, open bodies of water, beaches or other open spaces or with solid waste

Proportion with sanitation services in 2015 (South Africa vs the World)



Source: Author based on JMP (2017)

A person spends to 2.5 days/year looking for a private location to OD

Background…

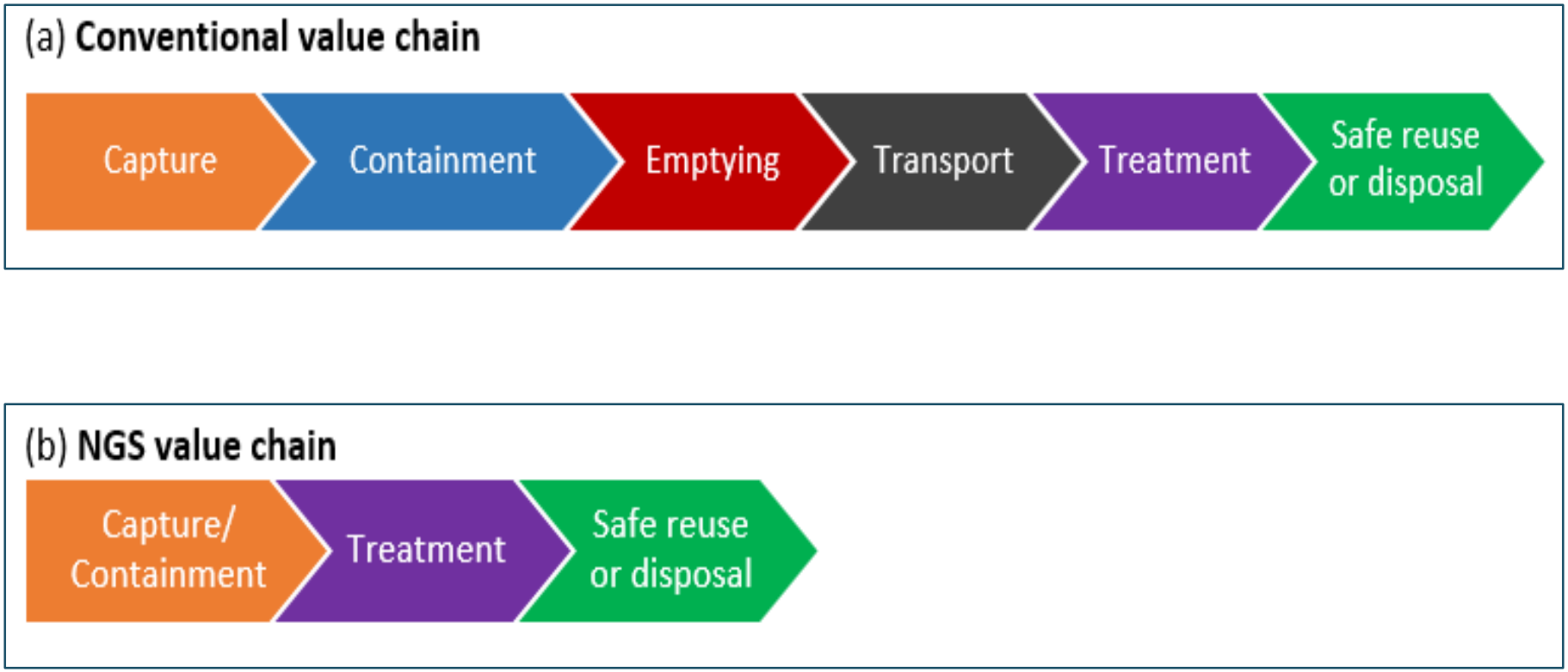
- Next Generation Sanitation (NGS) Cluster Development Programme aims to:
  - Expand sanitation industry to service the unserved 40% households and diversify the market with new products.
    - To enhance service delivery in rural, peri-urban and water-scarce areas
  - Increase water availability for social and economic needs using efficient technologies.
  - Unlock new private sector delivery mechanism for sanitation services.
    - expansion opportunity for manufacturing, service and supply sectors.

Next Generation Sanitation (NGS)

- **Definition**
- NGS is an integrated system in which the frontend collects and conveys the specific input to the backend which fully treats the waste within the non-sewered sanitation system, to allow for safe reuse or disposal of the generated solid, liquid and gaseous output (ISO, 2017).

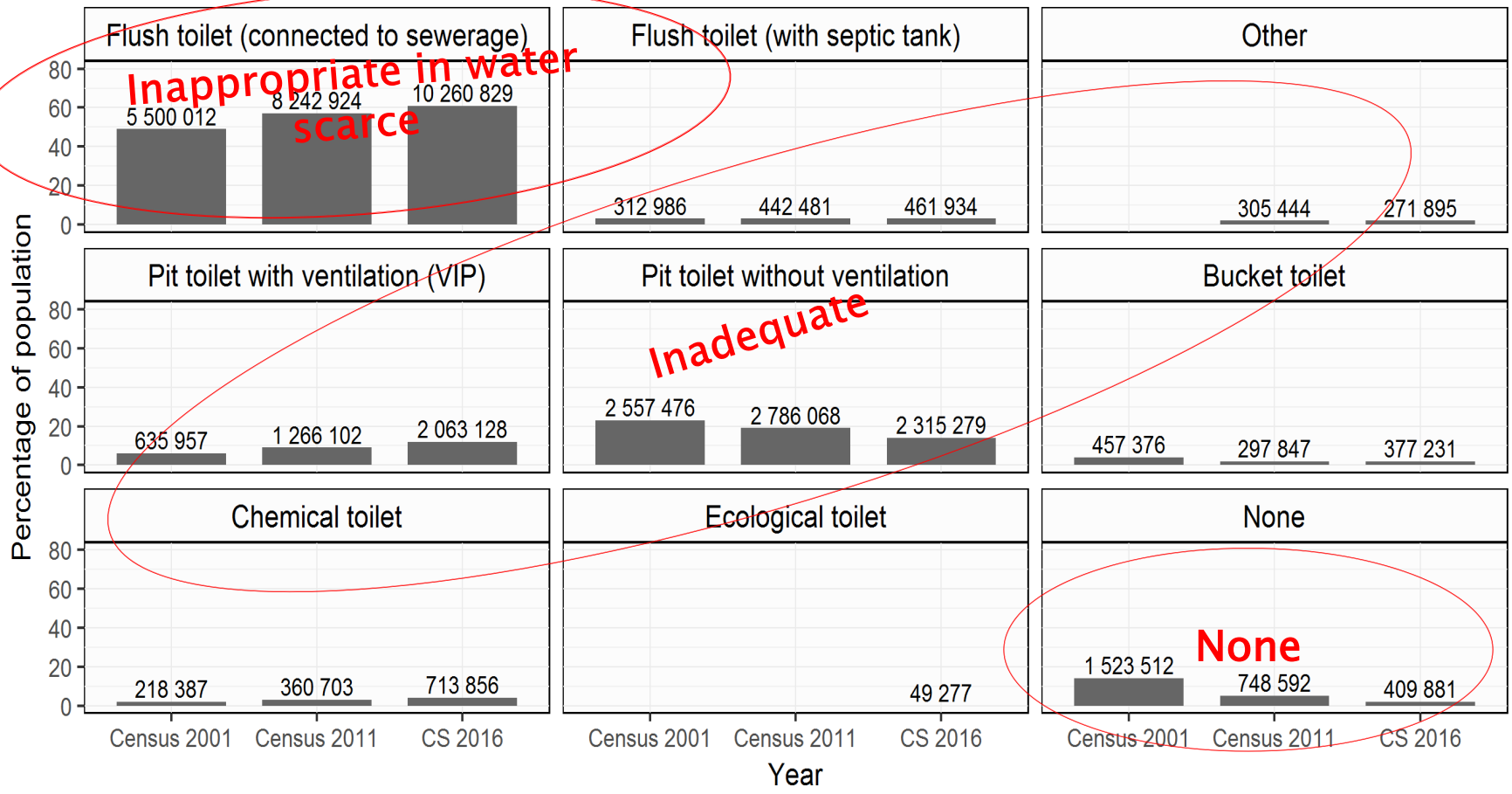
- NGS acts upon or treat human waste at source
- NGS technologies differ from traditional solutions in 3 main ways
  - do not require conveyance
  - require no (or minimal) usage of water
  - On-site treatment produces pathogen-free output and integrates resource and energy recovery in the process.

Sanitation value chain



Local trends

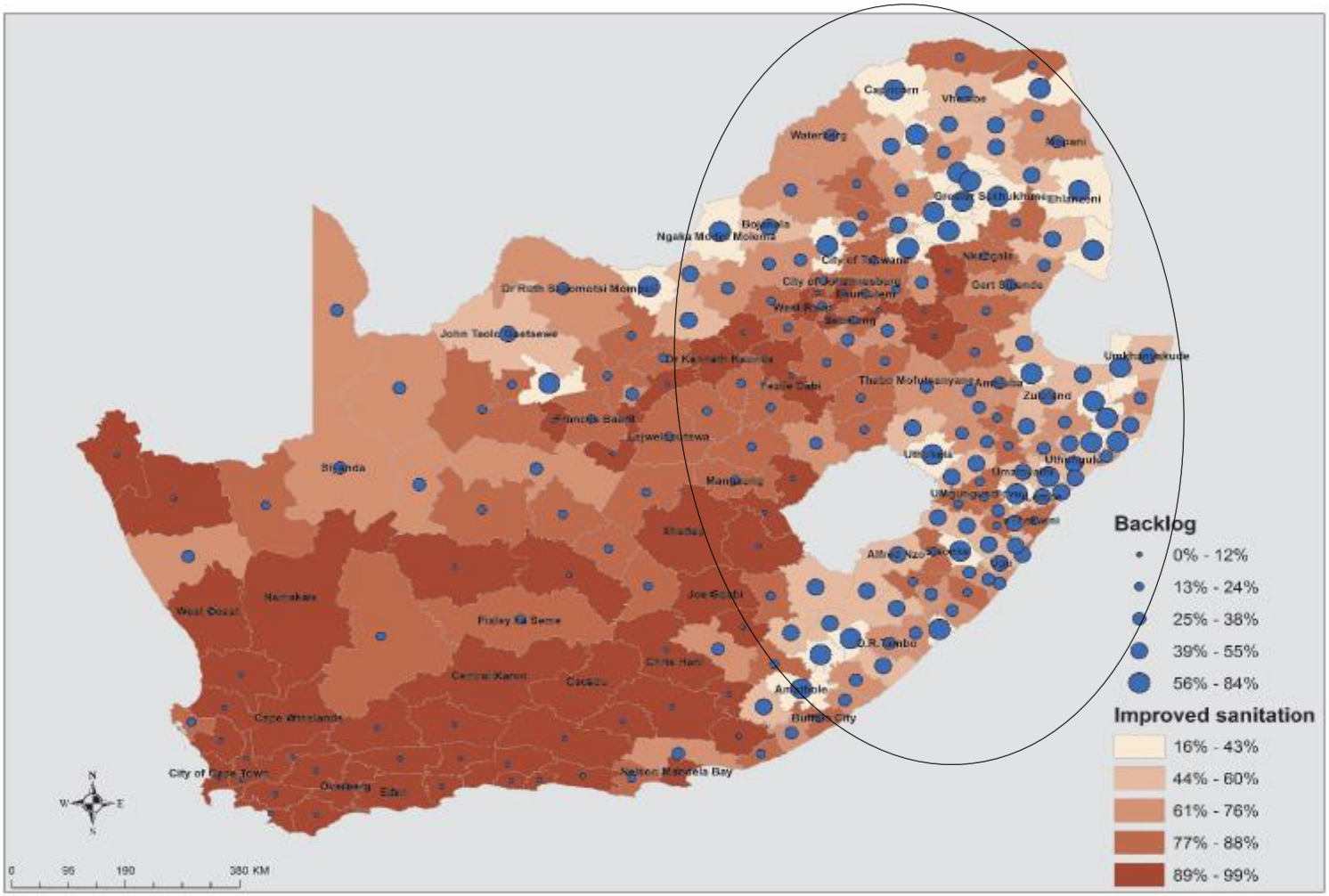
Household sanitation access by toilet facilities in South Africa in 2001, 2011, and 2016



Source: Author, based on Stats SA (2016a, 68)

Local trends…

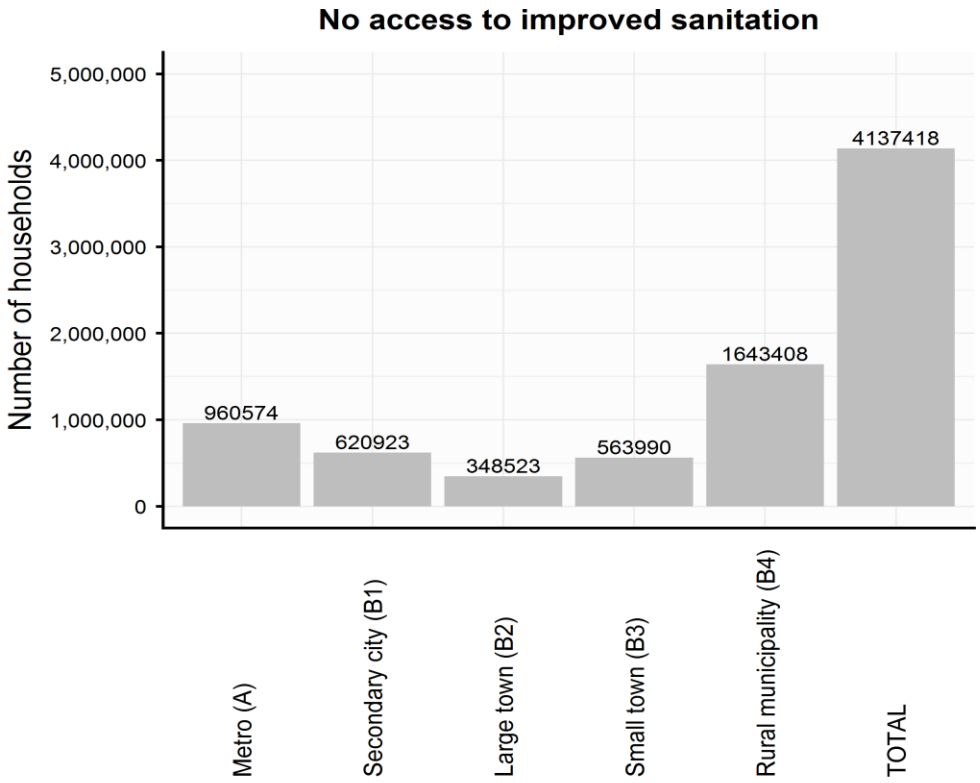
Access to sanitation in South Africa



Source: Statistics South Africa (2017, 37)

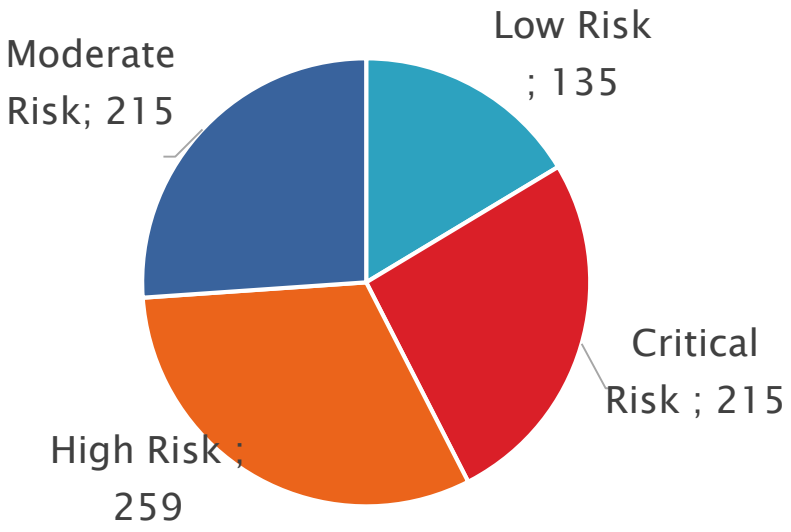
Local trends…

Household backlogs in terms of lack of access to improved sanitation is a key challenge …. can go up to 50% in rural municipalities



Source: Author, based on Stats SA (2017, 38)

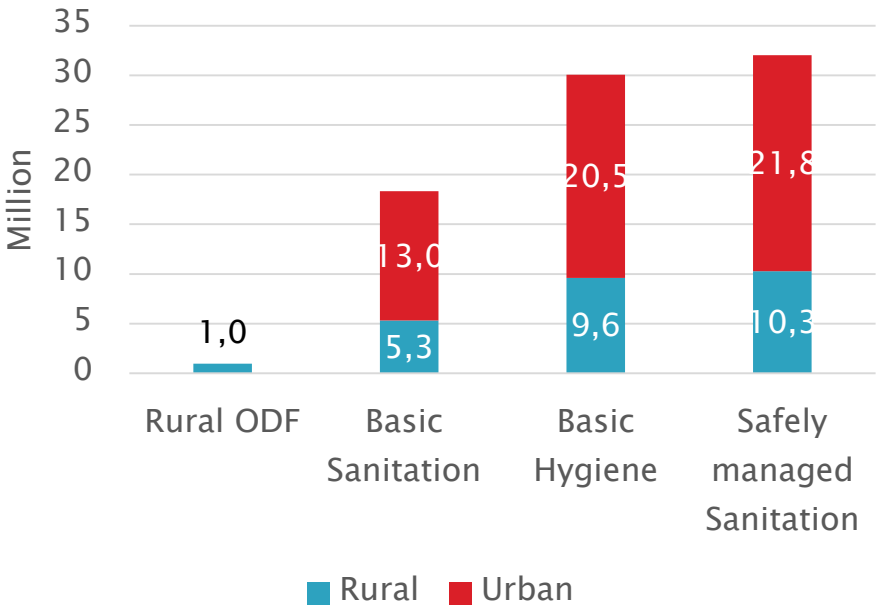
Risk profile of wastewater treatment plants in South Africa in 2014



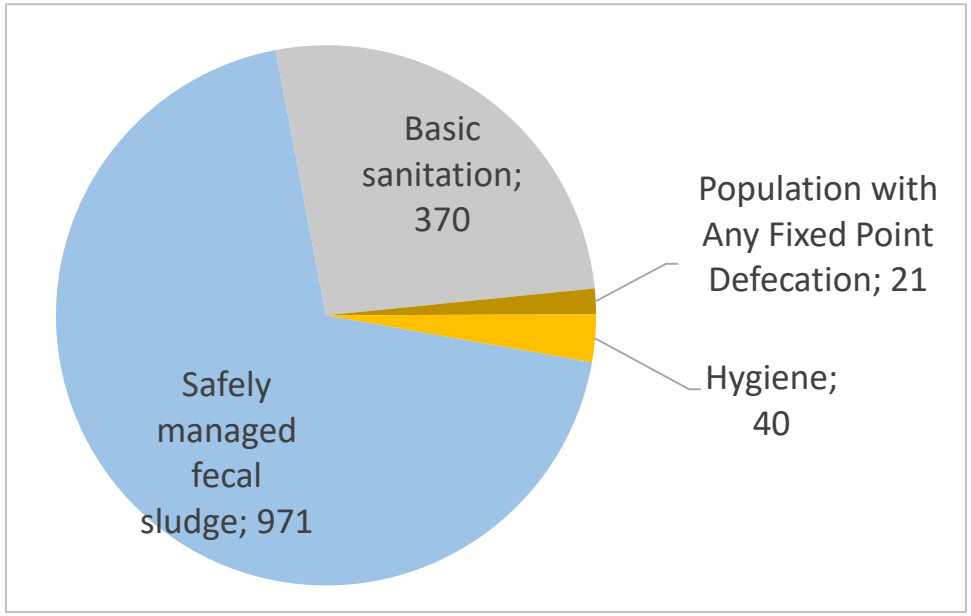
Source: DWS (2014, 19)

Local costs and size

Population to serve with new sanitation services from 2015 to 2030 in South Africa



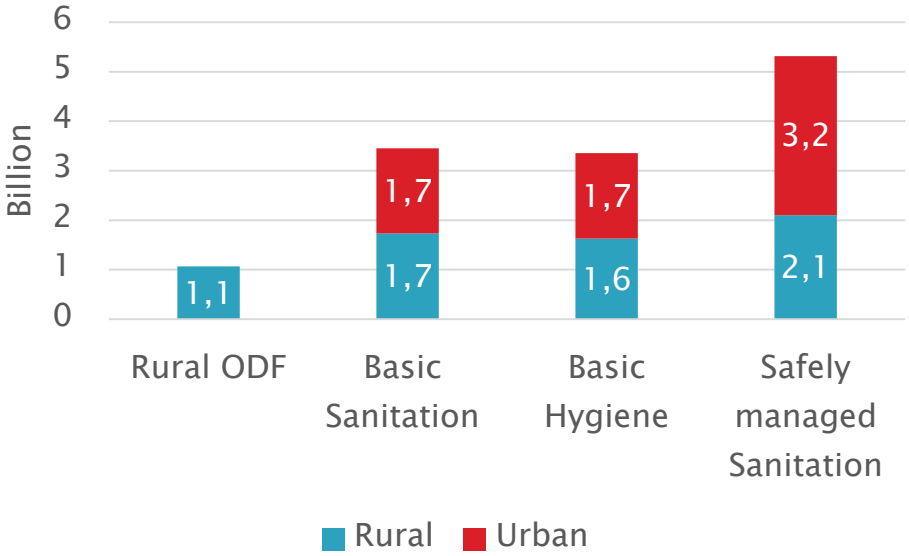
A bout US$ 1.4 billion (R 17.4 billion) is required annually from 2015-2030 in SA



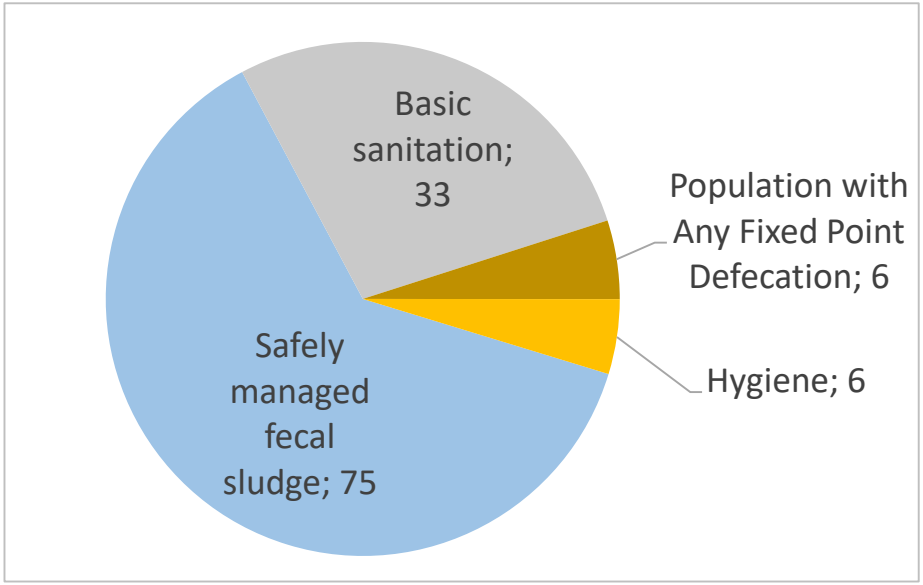
Source: Author, based on World Bank (2016)

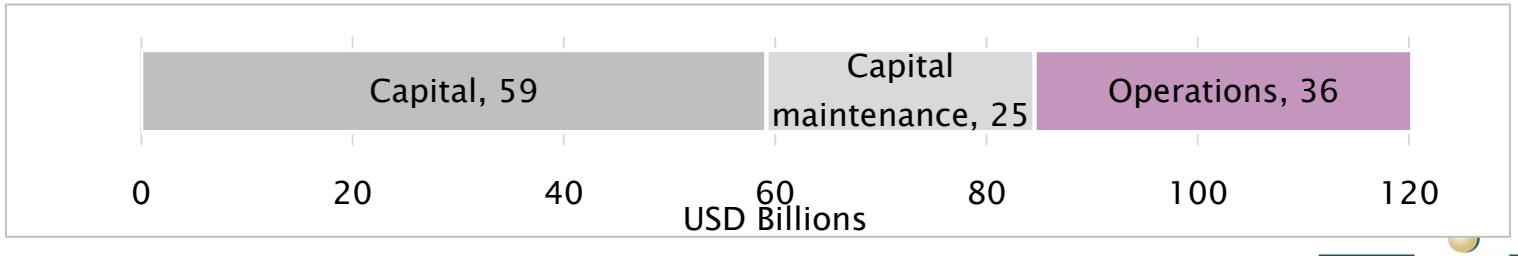
Global trends

Global population to serve with new sanitation services from 2015 to 2030



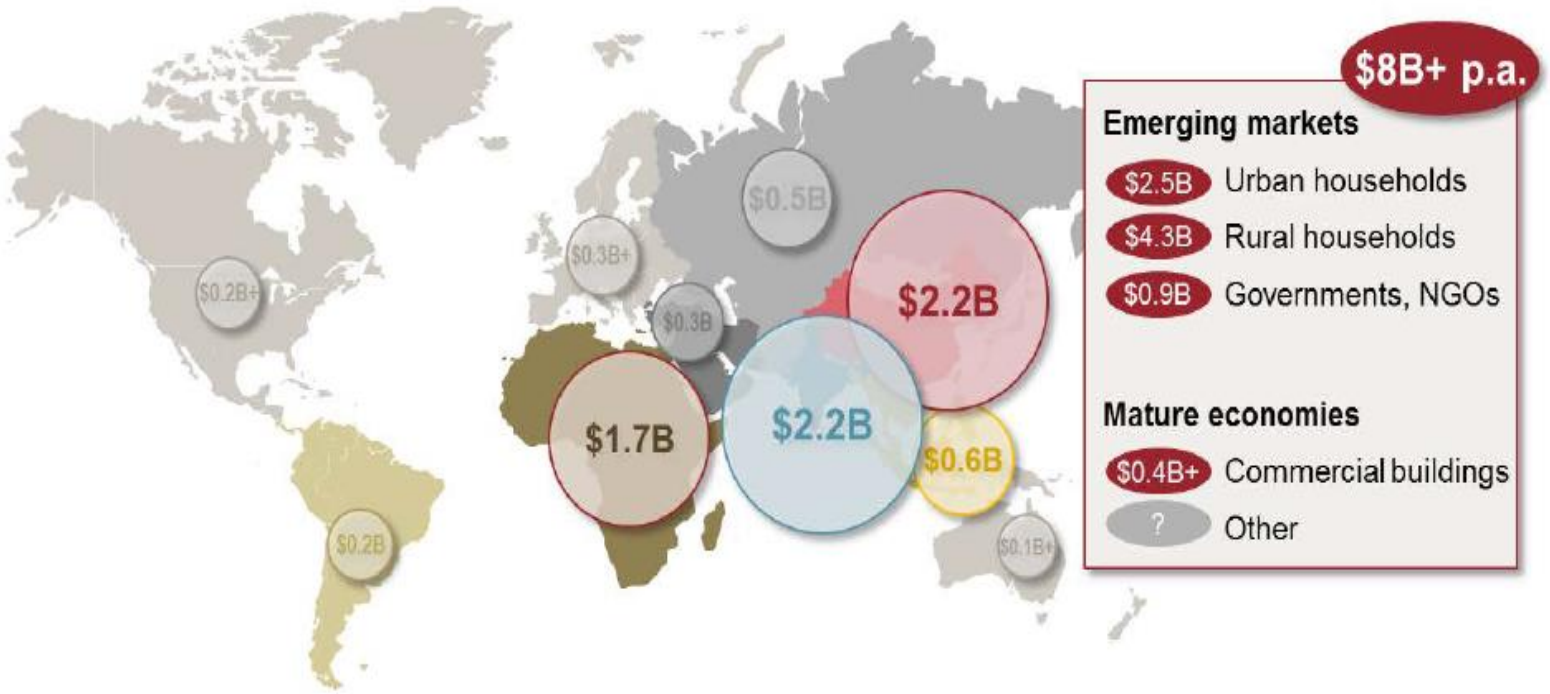
US$ 120 Billion required annually from 2015-2030 to address sanitation issues





Source: Author, based on World Bank (2016)

NGS market size (global)



Source: Kone (2017), citing the BCG analysis for the BMGF

Business model considerations..

Techno-socio-economic factors

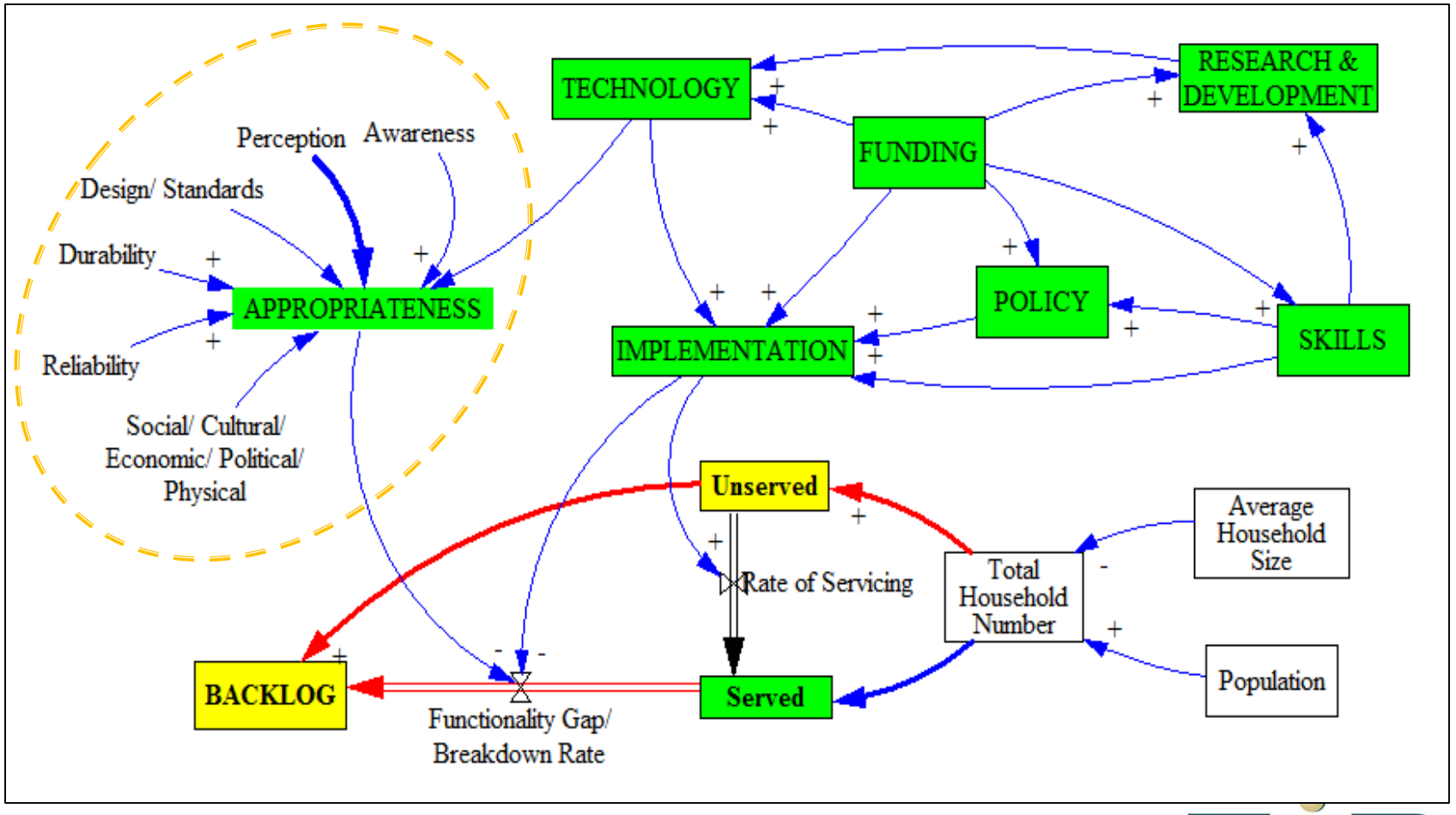
- Anchored on two broad market segments.
  - **Leapfrog** those who currently do not have access to sanitation services (no or inadequate).
  - **Disruptive** in the segment that have inappropriate sanitation services
- Waterborne sanitation in water scarce areas is a challenge
  - About 40% of water used by households in the country is used only to flush toilets, thus the wider adoption of NGS will contribute to massive water savings.

Drivers and barriers

Water efficiency
Water supply
Socio-economic development
Food security
Fit-for-purpose
Water quality
Energy security
Cost savings
Ease of implementation

Business model considerations

Techno-socio-economic factors



Business model considerations..

Financial arrangements

- The market generally public sector-driven and conservative
- Procurement system provides little incentive for proposing innovative solutions.
  - makes technology providers risk averse as the cheapest tenders get selected at the expense of best technologies.
- There challenge with households paying for municipal water services
  - households paying decreased from 62% in 2005 to 44% in 2015 (Stats SA 2016b).
- In 2015, household expenditure on water about R15 billion versus R1.5 billion for sanitation.

Characterisation of the potential market

Where can it be used?	Single unit (standalone)	• Residential houses • Offices • Business premises
	Multi-unit scale (complexes)	• Residential houses • Offices • Business premises (e.g. shopping malls, airports) • Community facilities (e.g. schools, stadiums)
Who pays?	Non-indigent	• Individuals • Community • Property developers • Investors
	Indigent	• Government/ municipalities • Donor support (if available)

R&D and Manufacturing

- NGS technologies are still nascent and in development – prototype development stage
- Will require testing and evaluation for large-scale implementation
- At the global level
  - Most NGS technologies derived from the research funded by the BMGF's Reinvent the Toilet Challenge (RTTC).

- The 2014 Reinvent the Toilet Fair held in India.
  - highlighted the key role of the USA, India and the UK in shaping NGS.
- South Africa featured one project

Product	Technology	Company
Data Acquisition and Field Support for Sanitation Projects	Characterises the physical and chemical properties of excreta streams from dry on-site sanitation systems or from decentralized low-water consuming sanitation systems. The data will be passed to other RTTC grantees for use in their research.	Pollution Research Group, UKZN; eThekwini Water and Sanitation

R&D and Manufacturing …

- South Africa has a long history of innovation in the sanitation sector,
- There has been increased and converging efforts by various organisations and government departments to promote the development of NGS in the country
  - This includes DST, the dti, WRC, TIPS, PRG, SABS, eThekwini Municipality
- There is need for a comprehensive study to scan the R&D landscape for NGS technologies

- **Partnerships and initiatives to leverage on:**
- BMGF with the WRC and DST.
- The PRG is a beneficiary of the Reinvent the Toilet initiative
- The Water Technologies Demonstration Programme (WADER)
- The Sanitation Innovation Challenge programme
- The Household Sanitation Technology Assessment and Evaluation Protocol in place
- South African Sanitation Demonstration Programme (SASTEP)
- Other institutions – CSIR and universities.

Some of SA sanitation technologies

Technology	Type	Brief Description	Manufacturer
EcosSan Waterless Toilet	Whole system	Dehydrates, evaporates and deodorises human waste for use as compost / fuel / disposal	G-Trade International
Enviro Loo	Whole system	A waterless dehydration toilet – separates liquids & solids on a drying plate.	Enviro Options
Biofil Wastewater Treatment	Whole system	A microflush toilet linked to a biofil digester	Biofil Technologies
Wetloo	Whole system	A flushing toilet using an anaerobic system to treat wastewater for reuse	Calcamite Water & Sanitation Solutions
EaziFlush	User end	Modular flushing system with natural wax on p-trap to prevent sticking	EnviroSan Sanitation Solutions
Biocore	Processing	A jet mixer used as mixer or aerator	BioPower Corporation
Biocoal	Processing	System to pelletise waste and convert to a fuel source	BioPower Corporation
Nano Biodigester System	Processing	Use of nano technology, high aeration multi strain bacteria to treat wastewater	Waste Intrique Services

Progress

The gears already moving

launched by President Cyril Ramaphosa – 14 August 2018

Policy implications…

- Demand is required for the uptake of technologies, this has to be stimulated through aligning local procurement, building regulations, and norms and standards.
  - e.g. Leverage on efforts by SABS to localise the ISO 30 500 standard on Non-Sewered Sanitation Systems
- It is important to enhance local capacity, through increased funding towards the development and manufacturing of local NGS technologies.
- There is need to strengthen skills and training necessary for NGS roll-out as the technologies.
  - Upskilling and reskilling of planners, plumbers and technicians

Trade & Industrial Policy Strategies

Supporting policy development
through research and dialogue

www.tips.org.za

Examples of NGS technologies

Blue Diversion
by Eawag (Swiss Federal Institute of Aquatic Science and Technology)

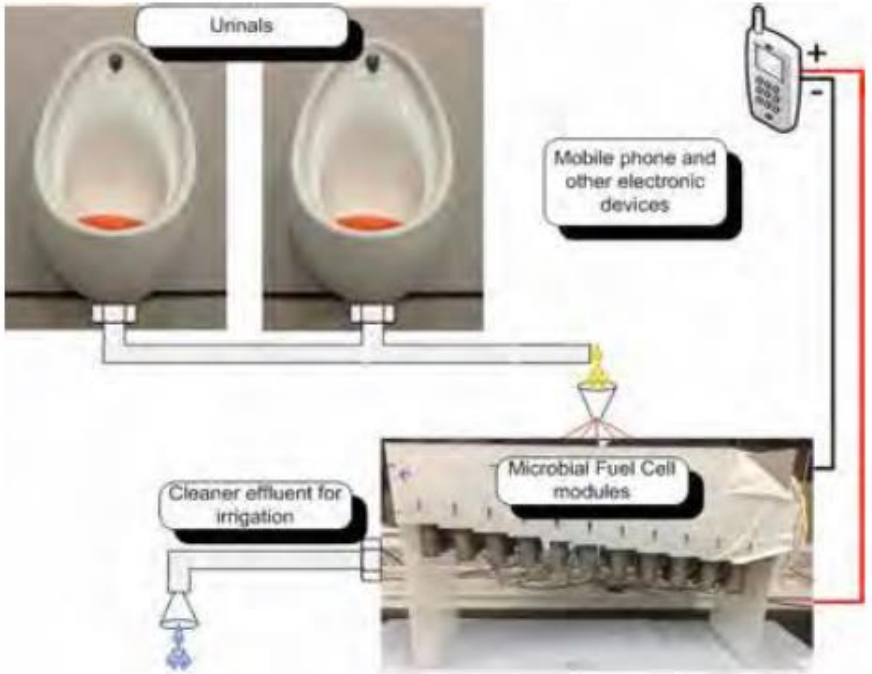
Reinventedtoilet@lboro
by Loughborough University

- The common types of waste treatment processing in NGS are: electrochemical, hydrothermal carbonisation, wet oxidation, dry combustion, biological.

Examples of NGS technologies

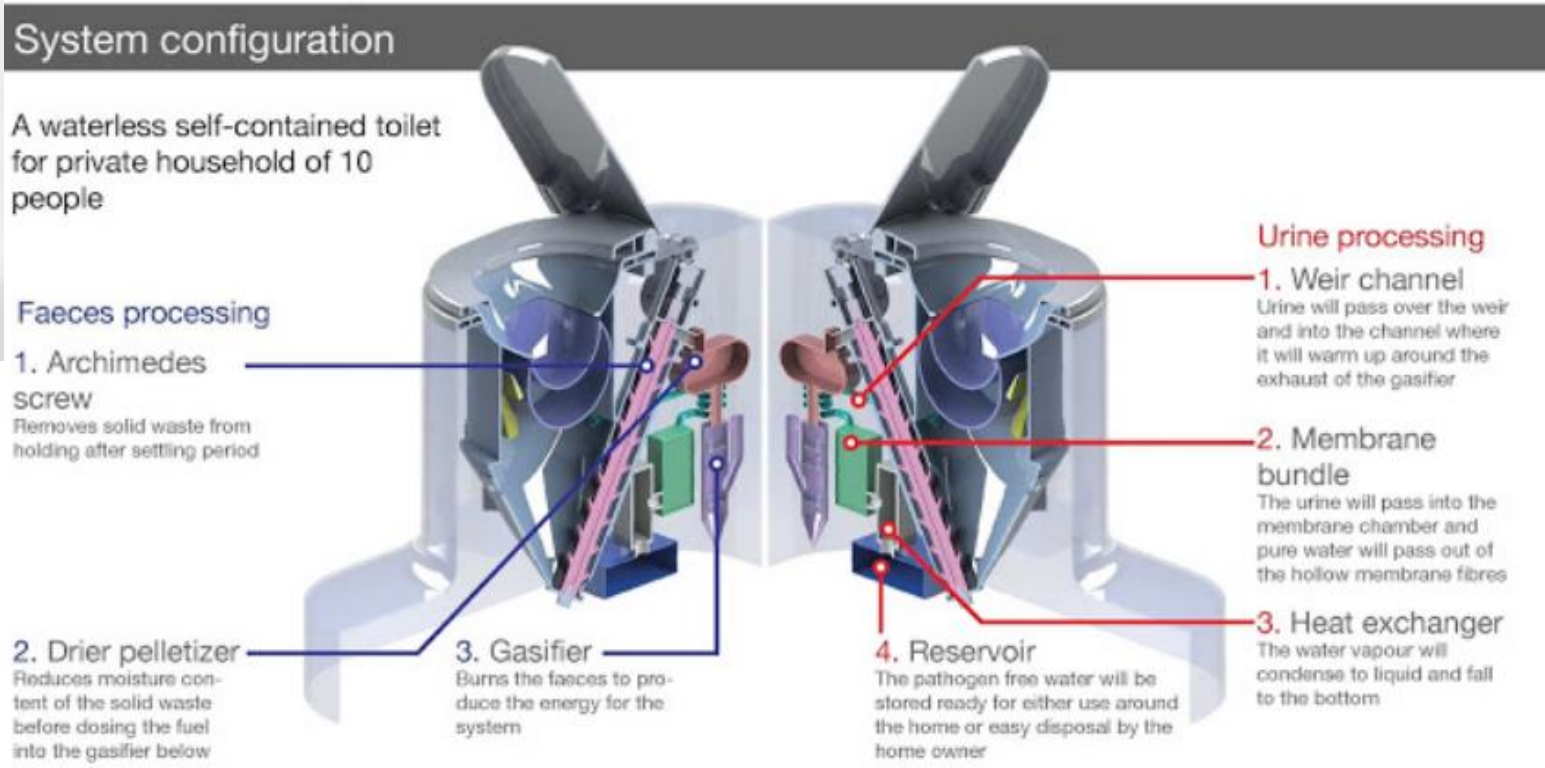
Caltech's Self-Contained, PV-Powered Domestic Toilet and Wastewater Treatment System

Urine-tricity by University of the West of England (UWE), Bristol



Examples of NGS technologies…

Nano Membrane Toilet by Cranfield University



Source: http://www.nanomembranetoilet.org/

Examples of NGS technologies…

Combines:

- Solid Fuel Combustion
- Steam Power Generation
- Water Treatment

Bill Gates drinking water derived from human waste (toilet resources

Source: https://www.gatesnotes.com/Development/Omniprocessor-From-Poop-to-Potable

The Sanitation Technology Demonstration Centre

- Established by the CSIR and the WRC
- Located on the CSIR Built Environment Innovation Site in Pretoria.
- Open to all
- The centre showcases full-scale examples of sanitation products and technologies
- Has 5 exhibition areas
- Various technologies that entail both conventional and improved systems are on display.
- These include dry sanitation, urine diversion and/or separation technologies, water-borne systems, ecological sanitation, and handwashing facilities.
- However, none of them qualifies as NGS