Sanitation Technology Landscape 200310

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
▼	**1a User Interface Types**								
	1a User Interface Types	**Open Defecation**	The ground is the interface. Practiced by over one billion people in high-resource and low-resource settings. Access to toilets is not a guaranteed panacea.	-	-	-	-	-	-
	1a User Interface Types	**Cistern Flush Toilet**	Common flush toilet - generally relies on sewer connection or septic tank / cess pool. Can be used where there is sufficient water supply and means of dealing with waste water. Tech level is higher than straight drop toilets. Manufacturing and internal mechanism is complex. Viability in low for the poor and higher/high for wealthier households.	Multiple	-	-	-	-	Available
	1a User Interface Types	**Dry Toilet**	Dry toilets operate without flush water. A dry toilet can be any of the following types of toilets: a composting toilet, urine-diverting dry toilet, arborloo, container-based toilet, bucket toilet, simple pit latrine (but not those that operate on a "pour flush" basis), incinerating toilets, or freezing toilets.	Multiple	-	-	-	-	Available
	1a User Interface Types	**Pour Flush Toilet**	Flush toilet using water deposited in to bowl by the user.	Multiple	-	-	-	-	Available
	1a User Interface Types	**Sitting or Pedestal Toilet**	Self-explanatory. Can rely on gravity, pour flush, or flush for conveyance.	Multiple	-	-	-	-	Available
	1a User Interface Types	**Squat Toilet**	Self-explanatory. Can rely on gravity, pour flush, or flush for conveyance.	Multiple	-	-	-	-	Available
	1a User Interface Types	**Urinal - Dry**	Dry Urinals are receptacles, typically attached to a wall in a public toilet, into which men may urinate and then the urine flows down a drain pipe due to gravity.	Multiple	-	-	-	-	Available
	1a User Interface Types	**Urinal - Flush**	Flush Urinals are receptacles, typically attached to a wall in a public toilet, into which men may urinate and which a water supply is used to clear the urine from the receptacle.	Multiple	-	-	-	-	Available
	1a User Interface Types	**Urine Diverting Dry Toilet (UDDT)**	A urine-diverting dry toilet (UDDT) is a type of dry toilet with urine diversion that can be used to provide safe, affordable sanitation in a variety of contexts worldwide. Through the separate collection of feces and urine without any flush water, many advantages can be realized, such as odor-free operation and pathogen reduction by drying. Some are used in conjunction with resource recovery schemes.	Multiple	-	-	https://sswm.info/water-nutrient-cycle/water-use/hardwares/toilet-systems/urine-diverting-dry-toilet-(uddt)	-	Available
	1a User Interface Types	**Urine Diverting Flush Toilet (UDFT)**	The Urine Diverting Flush Toilet (UDFT) is similar in appearance to a Cistern Flush Toilet except for the diversion in the bowl. The toilet bowl has two sections so that the urine can be separated from the feces. Both sitting and squatting models exist. Urine is collected in a drain in the front of the toilet and feces are collected in the back. The urine is collected without water, but a small amount of water is used to rinse the urine-collection bowl when the toilet is flushed. The urine flows into a storage tank for further use or processing, while the feces are flushed with water to be treated. Most likely to be used in high-resource setting in new constructions and where there is significant focus on sustainable sanitation methods. Only used in a limited number of locations in the developed world.	Multiple	-	-	https://akvopedia.org/wiki/Urine_Diverting_Flush_Toilet	-	Available
▼	**1b Toilet Component LRS**								
	1b Toilet Component LRS	**Ecological Urinal**	The Ecological Urinal was created as a solution for places like Uganda's capital, Kampala, where on average, 1,000 people have to share the same toilet. The make-shift urinal is an adaptable funnel that connects to locally available jerrycans. It collects urine, stores it in a sanitary way, and turns it into a high-quality fertilizer. It costs only $3	Design without Borders					Available
	1b Toilet Component LRS	**Separett Privy Kit**	The Separett Privy is a urine-separation kit that easily can be fitted in an existing outdoor toilet. Urine and solids are kept separate land the urine is routed via a hose to a soakaway or tank	Separate			https://www.separett.com/en-gb/our-products/accessories/toilet-seats/privy-500		Available
	1b Toilet Component LRS	**PeePoo Bags**	A single use biodegradable bag with urea, with an inner layer that unfolds to form a wide funnel to receive urine and feces	PeePoople	Kenya		http://www.peepoople.com/peepoo/start-thinking-peepoo/		Available
	1b Toilet Component LRS	**SaTo Pan**	The SaTo pan was developed by American Standard. It is a low-cost (2-5 USD per unit) toilet pan that relies on a physical shutter with a mechanical seal and water to separate the user and vault contents. When sufficient material or flush water is deposited into the pan, the mechanical shutter opens, allowing the waste to fall into the vault, then the shutter closes again. The shutter blocks the view of the vault contents, prevents odors from escaping, and keeps flying insects from contacting the waste and transmitting diseases. While the SaTo Pan does rely on water for flushing, the design is well optimized and uses only 1/2 liter of water per flush.	Lixil			https://www.sato.lixil.com	BMGF	Available
	1b Toilet Component LRS	**Sabine Schober Toilet**	The Sabine Schober toilet uses the Terra Preta Sanitation technology, which treats pee and poo by mixing it with charcoal to produce highly fertile soil for reforestation. It is also unique because it can be used in both the sitting and the squatting position. The toilet can be built using three robust components made of sanitary ceramic on the outside and a plastic container on the inside that collects pee and poo for only about $70.						Concept
▼	**1c Toilet Component HRS**								
	1c Toilet Component HRS	**Piet Urine Diversion Toilet**	No mix toilet the keeps urine and feces separate	Typish Theo			http://typischtheo.nl		Concept

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	1c Toilet Component HRS	**Aquatron**	Urine separating toilet that relies on cyclone effect	Aquatron	Europe		www.aquatron.se		Available
	1c Toilet Component HRS	**Toilet with grinder pump**	Toilet includes a pump to move waste upwards. Used in basement toilets that are below the sewer-line of a house. At a lower cost / complexity, it would be a good way to move waste to an above ground storage tank.	-	HRS	-	-	-	Available
	1c Toilet Component HRS	**save! Toilet**	The latest urine-diverting toilet, known as “save!”, is based on an innovative idea from the designer Harald Gründl of the Austrian design studio EOOS. It dispenses altogether with a valve, which had always been required to date. The toilet is designed in such a way that urine drains correctly almost automatically, by the force of gravity, while most of the flushwater “overshoots” and enters the sewer system. The innovation is the so-called urine trap, which conveys urine across the inner surface of the toilet bowl into a concealed outlet, working purely by surface tension. This phenomenon is known as the teapot effect	EAWAG	HRS				
	1c Toilet Component HRS	**ENVIVAC**	Low-flush vacuum toilet.	Envirosystems	China		https://techdirectory.stepsforsanitation.org/subcomponents/enabling/6/	BMGF	Available
	1c Toilet Component HRS	**Vacuum Toilet**	Vacuum toilets are flush toilets that use suction for the removal of feces and urine resulting in a minimal requirement of water (0.5 to 1.5 liters). Uses a pump to create low pressure downstream of UI so that atmospheric pressure pushes the waste to storage tank. Used in airplanes for example.	Evac Multiple	HRS		https://evac.com https://sswm.info/water-nutrient-cycle/water-use/hardwares/toilet-systems/vacuum-toilet	-	Available
▼	**2a Storage & Conversion Tech Types**								
	2a Storage & Conversion Tech Types	**Dehydration Vault**	Dehydration vaults are used to collect, store and dry (dehydrate) feces. Feces will only dehydrate when the vaults are well ventilated, watertight to prevent external moisture from entering, and when urine and anal cleansing water are diverted away from the vaults. Similar to UD dual VIP but relies on cover material. Also similar to Earth Auger toilet.	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Tank**	Watertight chamber of concrete or plastic with no outflow - must be pumped	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Septic Tank** • **Conventional System** • **Chamber System** • **Drip Distribution System** • **Aerobic Treatment Unit** • **Mound Systems** • **Recirculating Sand Filter System** • **Evapotranspiration System** • **Constructed Wetland System** • **Cluster / Community System**	A septic tank is a watertight chamber made of concrete, fibreglass, PVC or plastic, through which blackwater and greywater flows for primary treatment. Septic systems treat wastewater from household plumbing fixtures (toilet, shower, laundry, etc.) through both natural and technological processes, typically beginning with solids settling in a septic tank, and ending with wastewater treatment in the soil via the drainfield.	Multiple		-	-	-	Available
	2a Storage & Conversion Tech Types	**Single Pit Latrine**		-					
	2a Storage & Conversion Tech Types	**Cesspool or Pit**	A cesspit, or cesspool is a tank pit used for the temporary collection and storage of sewage or waste. The pit is sometimes lined with bricks or concrete and mostly covered with a slab. In case the pit is constructed water-tight, it needs to be emptied frequently. When the pit is not tight, liquids leached out if soil conditions allow, while solids decay and collect in the base. The treatment effect of a cesspit is very low. Emptying can result in high operation and maintenance costs. Cesspits which allow soil infiltration require less frequent emptying but groundwater pollution can occur	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Composting Chamber**	Storage container that promotes aerobic digestion. They work better when a UD toilet is used. More complex than a VIP, often made of plastic, includes ventilation & drainage, low volume. Molded units unlikely to be used in resource poor environments.	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Container**	Container-based sanitation (CBS) relies on liquid-tight containers to temporarily store waste. CBS can be used with squat plates, pedestal toilets, and urinals. Often, a service provider collects the waste on a regular basis (daily, weekly, on-demand) and transports the waste to a local facility for treatment and use.	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Fossa Alterna (double pit latrine)**	The Fossa Alterna is a short cycle alternating, waterless (dry) double pit technology. Compared to the double VIP which is just designed to collect, store and partially treat excreta, the Fossa Alterna is designed to make an earth-like product that can be used as a nutrient-rich soil conditioner.	-		-	https://www.appropedia.org/Fossa_Alterna	-	Available
	2a Storage & Conversion Tech Types	**None - direct discharge**	Waste is not contained but rather sent directly to a gutter, into the environment, or into a body of water.	-		-	-	-	Available

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	2a Storage & Conversion Tech Types	**Single Pit**	The single pit is one of the most widely used sanitation technologies. Excreta, along with anal cleansing materials (water or solids) are deposited into a pit. Lining the pit prevents it from collapsing and provides support to the superstructure.	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Single Ventilated Improved Pit (VIP)**	Improvement over conventional pit latrine. Uses vent pipe to control odors and insects.	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Twin Pits for Pour Flush**	This technology consists of two alternating pits connected to a pour flush toilet. The blackwater (and in some cases greywater) is collected in the pits and allowed to slowly infiltrate into the surrounding soil. Over time, the solids are sufficiently dewatered and can be manually removed with a shovel and reused on-site, much like compost, to improve soil fertility and fertilise crops . Although most pathogens are filtered during soil infiltration or die-off with time and distance, there remains a risk of groundwater pollution, particularly in densely populated areas or in areas with a high groundwater table	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**UD Black Soldier Fly Toilet**	Urine diversion toilet that diverts solids into chamber where black soldier fly larvae can process the waste.	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**UD Vermicomposting Toilet**	Urine diversion toilet that diverts solids into chamber where worms can process the waste.	-		-	-	-	Available
	2a Storage & Conversion Tech Types	**Ventilated Improved Pit Latrine (VIP)**	Excreta drops into an unlined pit. Ventilation and screens are designed to reduce smells and insects that might transmit waste. Waste water leaches into the soil.	-		-		-	Available
	2a Storage & Conversion Tech Types	**Composting Toilet**	Composting toilets are toilet systems comprised of a superstructure, a pan or slab, and a vault or pit in which feces or excreta fall together with cleansing material (the composting chamber). Dry organic material such as sawdust is added to adjust moisture content and C/N ratio in order to obtain optimum conditions for thermophilic composting. Composting toilets can be used to treat both excreta and organic household or garden waste and to transform it into a valuable soil amendment. Composting toilets rarely work. Users misuse them and the composting chamber doesn't get hot enough or remain hot enough for composting and treatment to occur. UD Composting toilets are better but are still problematic.	Multiple		-	-	-	Available
	2a Storage & Conversion Tech Types	**Double Ventilated Improved Pit (VIP)**	The double VIP has almost the same design as the single VIP with the added advantage of a second pit that allows it to be used continuously and permits safer and easier emptying	Multiple		-	-	-	Available
	2a Storage & Conversion Tech Types	**Container Based Sanitation (CBS)**	Container-based sanitation (abbreviated as CBS) refers to a sanitation system where toilets collect human excreta in sealable, removable containers (also called cartridges) that are transported to treatment facilities. This type of sanitation involves a commercial service which provides toilets and delivers empty containers when picking up full ones. The service transports and safely disposes of or reuses collected excreta. This is essentially a dry, urine diverting toilet. Excreta is deposited into relatively small containers (i.e. 20L for urine and 50L for feces). The waste is collected on a daily to weekly basis by a service provider. Typically used in dense population settings.	Multiple Sanergy			www.sanergy.com	-	Available
	2a Storage & Conversion Tech Types	**Corbelled Latrine**	ow-cost rural sanitation pit latrine design (corbelled latrine). The typical corbelled pit latrine consists of a 3 m-deep pit with a dome in the middle to reduce the diameter towards the top keyhole (squat hole). No cement.	Mzuzu University		Rochelle Holm rochelle@rochellehol m.com	http://mzuniwatsan.com		Available
	2a Storage & Conversion Tech Types	**Incineration Toilet**	An incineration toilet burns biological waste at high temperatures, leaving only an insignificant quantity of ash amounting to the equivalent of about one teacup for four people during one week of use. Waste is burned in an enclosed incineration chamber, and combustion gases are expelled through a separate ventilation pipe.	Cinderella Incinolet Ecojohn Sirius Technology Jets Storburn International Dirac Inc. KAIST			https://www.cinderellaeco.com/ch-en/articles/what-is-an-incineration-toilet/	-	Available
▼	**2 Storage & Conversion Tech**								
	2 Storage & Conversion Tech	**Cess to Fit**	Cess-to-Fit consists of a closed container equipped with support media for microbial growth, biogas pipe and hydraulic mixing mechanism fitted within. Only treated effluent is allowed to leach into the soil.	Asian Institute of Technology	Thailand China				Concept
	2 Storage & Conversion Tech	**Solar Septic Tank**	Solar energy (heat) used to accelerate biological digestion of septage	Asian Institute of Technology			http://serd.ait.ac.th/serd/	BMGF	Prototype
	2 Storage & Conversion Tech	**BioFil Digester**	Biofil Digester is an affordable, on-site fecal waste treatment system that works with most toilet systems. Our product replaces existing systems at a much lower cost of $ 300 - $ 600. It requires no prior infrastructure to install. This compares very favourably with septic tanks and central sewers which require investments of thousands and hundreds of thousand respectively. In addition to the Biofil Digester, our new innovation which makes use of waste water for flushing makes it possible for people without safe sanitation to afford decent sanitation.	Biological Filters & Composters Ltd		Kweku A. Anno E: info@biofilcom.org | E: kaannoeng@yahoo.com T: +233 244 389 636	www.biofilcom.org		
	2 Storage & Conversion Tech	**Change: Waterless toilet**	The toilet uses a simple membrane to rapidly evaporate 95% of sewage without using any type of energy. This innovative technology provides homes with a working toilet, without the need for power or plumbing	Change Water Labs			http://www.change-water.com/solution		Research / Prototype

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	2 Storage & Conversion Tech	**Recycling Toilet**	Clear Recycling Toilet uses a double membrane treatment process that produces a high quality effluent for reuse	Clear Environmental Technology			http://www.clearet.com/pros/lqC1g.html	BMGF	Available
	2 Storage & Conversion Tech	**Anaerobic Digestion Pasteurization Latrine (household system)**	The Anaerobic Digestion Pasteurization Latrine (ADPL) is a self-contained and energy neutral on-site sanitation system using anaerobic digestion of fecal sludge to generate biogas and then uses the biogas to pasteurize the digester effluent at 65–75°C to produce a safe effluent that can be reused locally as a fertilizer.	Duke University			http://sanitation.pratt.duke.edu/		
▼	**2 Toilet System LRS**								
	2 Toilet System LRS	**Zyclone Cube**	Integrating with a conventional flushing toilet, the Zyclone Cube is designed for efficiently separating and effectively treating both solid and liquid fractions. The unique Zyclone shape achieves liquid separation at greater than 98%. The solids fraction is dropped into a screw heating device that operates intermittently in dehumidifying and inactivating pathogenic contents. The liquid is further treated by integrated adsorptive media (e.g. modified soil and zeolite) in a series of anaerobic, aerobic, and anoxic chambers prior to a final step of electrochemical disinfection.	AIT SCG Chemicals CO., LTD			https://www.scgchemicals.com/en/products-services/technology-service-solutions/reinvented-toilet-total-solution	BMGF	Prototype
	2 Toilet System LRS	**Otji Dry Toilet Solutions**	A perforated container as collecting device under the toilet pot separates solid from liquid. The solid stays in the container while the liquid runs through a perforated concrete panel underneath the container, from where it filtrates into the ground. After approximately six months the container is filled up with solid		Namibia		https://www.susana.org/_resources/documents/default/2-915-otji-toilet-new-2009-eu-version1.pdf		
	2 Toilet System LRS	**Banza Toilet**		Banza Sanitation			https://banzasanitation.wordpress.com		Discontinued
	2 Toilet System LRS	**Easy Latrine**	The Easy Latrine consists of a pan, a bucket of water with a ladle, and pipes to connect a hut to a latrine buried in the ground. The latrine itself has three receptacles made of rings of concrete bound by the ash of rice husks — material that's readily at hand and much cheaper than cement.	Engineering for Change			https://www.engineeringforchange.org		
	2 Toilet System LRS	**Ecodomeo**	Ecodomeo dry toilets seperate the liquids from the solids: The first are evacuated through the household used-water system, the second evacuated to a closed space where they are then reduced into compost by earthworms.	Ecodomeo			http://www.ecodomeo.com/english/		
	2 Toilet System LRS	**Ecosan Waterless Toilet**	A sanitation system that does not require any water to function. It is entirely isolated from the surrounding environment and cannot contaminate underground water resources. The system utilizes a natural biological process to break down human waste into a dehydrated odorless compost-like material.				http://www.ecosan.co.za		
	2 Toilet System LRS	**ArborLoo**	A single pit toilet (can be VIP) that when full becomes a planting bed for a tree. This is only viable in rural areas.	-		-	-	-	Available
	2 Toilet System LRS	**S.P.U.D. Toilet**	A self-contained urine-diverting unit. The toilet is solar powered to dry and process the waste anaerobically, and composts waste to be disposed of by users. Designed at a household scale, target users are families of 4-6 people.	African Sanitation Outsourcing	South Africa				Concept
	2 Toilet System LRS	**SanBox**	Manufactured by RFL, SanBox is an innovative, simple, easy and high quality toilet in a box. Designed by iDE-Bangladesh, SanBox's simplicity eliminates many of the challenges around complex designs that consumers are unable to understand, install or even use. The SanBox bundles together all the components of a latrine midstructure (user interface to pit) removing concerns with household level quality control.	iDE Bangladesh RFL	Bangladesh	Banga Building Materials Ltd. Chowdhury Hasan Tariq E: coo.bbml@prangroup.com T: +88 029 881 792	www.rflbd.com		
	2 Toilet System LRS	**EcoSan UDT**	Ecological Sanitation is an approach to sanitation provision which aims to safely reuse excreta in agriculture. It desires to "close the loop" mainly for the nutrients and organic matter between sanitation and agriculture. One of the aims is to minimize the use of non-renewable resources. When properly designed and operated, ecosan systems provide a hygienically safe system to convert human excreta into nutrients to be returned to the soil, and water to be returned to the land.	Multiple		-	http://www.ecosanres.org/factsheets.htm	-	Available
	2 Toilet System LRS	**Tiger Toilet**	The Tiger Toilet faecal waste solution consists of a strong and durable toilet room and the Tiger biodigester attached to it	TBF Environmental Solutions			www.tbfenvironmental.in		Available
▼	**2 Toilet System LRS HRS**								
	2 Toilet System LRS HRS	**E-Toilet**	Prefabricated community toilets	ERAM Scientific Solutions			https://eramscientific.com/e-toilets/	BMGF	Available
▼	**2 Toilet System HRS**								
	2 Toilet System HRS	**Airhead Composting Toilet**	Composting toilet that separates solids and liquids	Eos Design LLC			https://airheadtoilet.com		
	2 Toilet System HRS	**Kazuba Waterless Composting Toilets**	Waterless composting toilet	Kazuba			https://kazuba.eu/en/home/		
▼	**2 Storage & Conversion Tech LRS**								
	2 Storage & Conversion Tech LRS	**Dutch Latrine Bag**	Our Dutch Latrine Bag (DLB) offers a simple and effective solution for this pollution problem. The DLB is a large strong plastic bag placed into the pit latrine preventing human waste to pollute the groundwater table. In effect the DLB delivers the opportunity to close the sanitation cycle and re-use human waste for agricultural and biogas applications.	Aqua-Aero Watersystems BV					Discontinued

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	2 Storage & Conversion Tech LRS	**Low-volume Storage - Fast & Frequent Emptying**	Sealed vaults for storage of urine & feces (separate / combined) with low volume (<1m^3) with no leeching. Emptied frequently. Higher volume and fixed containers but otherwise similar to Container Based Sanitation.	Beaumont		Andrew Whitesell abw@beaumontllc.com	-	-	Concept
	2 Storage & Conversion Tech LRS	**UV Cured, low-volume pit liner**	Epoxy impregnated liner that is inflated within pit latrine pit then UV cured to create sealed, inexpensive, storage tank	Beaumont		Andrew Whitesell abw@beaumontllc.com	-	-	Concept
	2 Storage & Conversion Tech LRS	**Earth Auger**	Elevated UD toilet with integrated manually operated auger that pushes waste through a chamber where it is aerated and dried.	Critical Practices LLC			http://www.earthauger.org	BMGF	
	2 Storage & Conversion Tech LRS	**EcoLoo**	Permanent, Odor-Free & Long-Term Toilets for Rural Areas to service the needs of the Underprivileged	Ecoloo Group			http://www.ecoloogroup.com/ecoloo.html		Available
	2 Storage & Conversion Tech LRS	**Aqua Privys (Septic Tank)**	Aqua-privy. An aqua-privy has a watertight tank immediately under the latrine floor. Excreta drop directly into the tank through a pipe. The bottom of the pipe is submerged in the liquid in the tank, forming a water seal to prevent escape of flies, mosquitos and smell. The tank functions like a septic tank.	-					
▼	**2 Storage & Conversion Tech LRS HRS**								
	2 Storage & Conversion Tech LRS HRS	**Biogas Reactor**	A biogas reactor or anaerobic digester is an anaerobic treatment technology that produces (a) a digested slurry (digestate) that can be used as a fertilizer and (b) biogas that can be used for energy. Biogas is a mix of methane, carbon dioxide and other trace gases which can be converted to heat, electricity or light. Biogas Reactors are simple and effective. They are used globally in low to high resource settings.	-		-	-	-	Available
	2 Storage & Conversion Tech LRS HRS	**LooWatt**	he Loowatt is a waterless toilet system that transforms human waste into biofuel. The composting toilet is molded from 90% horse dung and features a biodegradable lining that stores excrement in a sealed, odor-free container. Once the toilet is full, the user takes the package of poo to an outdoor biodigester, which in exchange, provides a free source of biofuel for cooking.	LooWatt					Concept
	2 Storage & Conversion Tech LRS HRS	**DEWATS**	DEWATS is a technical approach to decentralized wastewater treatment in developing communities. The passive design uses physical and biological treatment mechanisms such as sedimentation, floatation, aerobic and anaerobic treatment to treat both domestic and industrial wastewater sources. DEWATS is designed to be affordable, low maintenance, use local materials, and meet environmental laws and regulations. DEWATS has service packages available for the sanitation needs of small and medium sized enterprises including communities, schools, municipalities, agro-industry, emergency settlements, hospitals, hotels, and prisons.	BORDA	Asia, Africa, Latin America		https://www.borda.org/solutions/decentralised-sanitation-systems-2/		Available
▼	**2 Storage & Conversion Tech HRS**								
	2 Storage & Conversion Tech HRS	**Caltech Electrochemical toilet**	Multi-user Reinvented Toilet (MURT) that anaerobically digests mixed urine/feces followed by electrochemical oxidation of the supernatant, biological treatment, and ultrafiltration. Settled, digested solids removed 1-2x per year.	Cal Tech			http://hoffmann.caltech.edu	BMGF	Available
	2 Storage & Conversion Tech HRS	**Nanomembrane Toilet**	The Nano Membrane Toilet will be able to treat human waste on-site without external energy or water. It is designed for single-household use (equivalent to 10 people) and will accept urine and faeces as a mixture. The flush uses a unique rotating mechanism without using any water whilst simultaneously blocking odour and the user's view of the waste.	Cranfield			http://www.nanomembranetoilet.org	BMGF	Prototype
	2 Storage & Conversion Tech HRS	**Empower Sanitation Platform**	On-site processing includes electrochemical disinfection and recycling of liquids, and drying and sterilization of solids with optional combustion.	Duke University			http://washaid.pratt.duke.edu/sites/washaid.pratt.duke.edu/files/u71/Empower.March2019.Updated.Final_.pdf	BMGF	Prototype
	2 Storage & Conversion Tech HRS	**Blue Diversion Autarky**	The Blue Diversion Autarky toilet is a sanitation system which provides hygiene and comfort without relying on water and wastewater infrastructure. Water, urine and feces are collected separately and treated on site in specific modules	EAWAG			https://www.eawag.ch/en/research/human-welfare/wastewater/projekte/autarky/	BMGF	Prototype
	2 Storage & Conversion Tech HRS	**ECO-SAN Toilet**	Commercialization partner of Cal-Tech. This is a very high tech toilet system.	ECO-SAN			http://www.eco-san.cn/e_main.html	BMGF	Available
	2 Storage & Conversion Tech HRS	**HTClean**	Vacuum toilet with high pressure and temperature treatment of waste (hydrothermal carbonization)	Helbling			https://www.youtube.com/watch?v=kdL0BnwaFC4	BMGF	Prototype
	2 Storage & Conversion Tech HRS	**Johkasou Systems**	Package onsite wastewater treatment units. These are essentially advanced septic tanks that (may) include filter media, biofilm reactors, nutrient capture, calcium hypochlorite disinfection. They typically use anaerobic and aerobic digestion.	Multiple		-	-	-	Available
	2 Storage & Conversion Tech HRS	**Scion Toilet**	Vacuum pump sucks the waste away to reactor that uses wet oxidation (high heat and pressure with the addition of oxygen) to break down solids and kill bacteria and pathogens.	Scion Research			www.scionresearch.com	BMGF	Prototype
	2 Storage & Conversion Tech HRS	**Firelight Toilet**	The Firelight Toilet works by drying fecal material via boiling. The steam that is generated then undergoes a pressure and temperature increase by a compressor and is used as the heat source for the drying process. The dried biomass is then metered into a controlled fire where it is burned, creating heat to kill pathogens and boil water, which is then utilized within a steam engine Rankine cycle to generate electricity.	Sedron Technologies			https://www.sedron.com/firelight-toilet/	BMGF	Prototype

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	2 Storage & Conversion Tech HRS	**Sol-Char Toilet**	The Sol-Char Toilet utilizes concentrated solar power (CSP) to convert human waste into char, an odorless product that can be used as fuel or soil-amendment. A waterless, self-contained toilet that functions off-the-grid. Concentrated sunlight is delivered to fiber optic bundles located at the focus of parabolic concentrators illuminating the inner collection container and disinfecting the waste though conduction, convection, and radiation heat transfer. The reactor is designed to achieve high temperatures (300C to 750C) and produces a safe and useable product	University of Colorado Boulder			https://www.colorado.edu/solchar/	BMGF	Prototype
	2 Storage & Conversion Tech HRS	**NEWgenerator**	The NEWgenerator uses a multistage disinfection process. A fine-pore microscopic membrane filter traps bacteria and viruses.Clean water that passes through is then disinfected with chlorine, similar to municipal drinking water. The recycled water can be used for toilet flushing in the sanitation facilities, thereby drastically cutting down on water demand, especially during times of drought. The water can also be used for irrigation.	University of South Florida			http://news.usf.edu/article/templates/?a=8667&z=232	BMGF	Pilot
	2 Storage & Conversion Tech HRS	**The Toronto Toilet**	Dry-combustion Toilet	University of Toronto Sankoya			https://cgen.utoronto.ca/research-initiatives/current-projects/re-invent-the-toilet-challenge/ https://www.sankoya.com/toilet	BMGF	Prototype
	2 Storage & Conversion Tech HRS	**Urinetricity Microbrial Fuel Cell**	Microbial Fuel Cells (MFCs) fed with urine.	University of West England-Bristol			http://www.brl.ac.uk/researchthemes/bioenergyselfsustainable/urine-tricity.aspx	BMGF	Prototype
▼	**3 Conveyance Tech - Extraction & Transportation LRS**								
	3 Conveyance Tech - Extraction & Transportation LRS	**Human Powered Emptying & Transport**	Waste is removed from vaults with simple mechanical devices powered by the emptiers. These devices are intended to reduce the effort spent emptying the vaults and spillage. Manual pumps are typically coupled with manual transportation of the collected waste.	-		-	-	-	Available
	3 Conveyance Tech - Extraction & Transportation LRS	**Manual Emptying - Jerry Can, bucket, or similar**	Human waste is removed from vaults by submerging a small container into the waste, then taking the collected waste somewhere to dispose of it, often a river, lake, or less trafficked area in the community such as a ditch.	-		-	-	-	Available
	3 Conveyance Tech - Extraction & Transportation LRS	**P10**	Manual Pump	Beaumont		Andrew Whitesell abw@beaumontllc.com	www.beaumontllc.com	BMGF Self	Research / Prototype
	3 Conveyance Tech - Extraction & Transportation LRS	**Flexcevator**	The Flexcrevator is a portable vacuum system coupled with a trash excluding attachment. Our unique device aspirates fecal sludge while simultaneously leaves trash in pits. By separating fecal sludge from trash during operation, we reduce the risk of jamming in the vacuum hoses. This makes the overall process of emptying more sanitary and hygienic.	North Carolina State University			https://facultyclusters.ncsu.edu/global-wash-researcher-receives-gates-foundation-grant/		Prototype
	3 Conveyance Tech - Extraction & Transportation LRS	**ROM 2**	Mobile desludging unit suited for mounting on lighter vehicles or trailers towed by any vehicle with a towing capacity of 1200 kg. Petrol driven vacuum pump combined with a water pressure pump and nozzles for fluidizing sludge thick sludge to facilitate pumping	ROM B.V.			http://www.rombv.com/rom-mobile-desludging-unit-3		Available
	3 Conveyance Tech - Extraction & Transportation LRS	**Vacutug**	Vacuum tank and a pump run by a small petrol or diesel engine	UN Habitat			http://mirror.unhabitat.org/downloads/docs/2527_1_595414.pdf		Available
	3 Conveyance Tech - Extraction & Transportation LRS	**Mini Desludging Unit**	Small trailer-based system with pump and storage tank Used in Ethiopia. Suitable for urban settlements.	WASTE			http://www.waste.nl/causes/mdu-ethiopia/		Available
	3 Conveyance Tech - Extraction & Transportation LRS	**Diaphragm Pump**		-					
	3 Conveyance Tech - Extraction & Transportation LRS	**eVac**	• Vacuum pumping machine • Powered by a 2hp motor/engine • <70kg						Concept
	3 Conveyance Tech - Extraction & Transportation LRS	**Excluder**				Nicola Greene Nicola@triangle-environmental.com	www.triangle-environmental.com		Pilot
	3 Conveyance Tech - Extraction & Transportation LRS	**Excrevator**							
	3 Conveyance Tech - Extraction & Transportation LRS	**Gulper**							Concept

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	3 Conveyance Tech - Extraction & Transportation LRS	**Pit Screw Auger**							
	3 Conveyance Tech - Extraction & Transportation LRS	**Poo Pump**							
	3 Conveyance Tech - Extraction & Transportation LRS	**Sewer system (simplified, solids-free, conventional)**		-					
	3 Conveyance Tech - Extraction & Transportation LRS	**Sludge Digger**							
	3 Conveyance Tech - Extraction & Transportation LRS	**Omni-Ingestor - AGI**		AGI					Discontinued
	3 Conveyance Tech - Extraction & Transportation LRS	**Omni-Ingestor - DCI**		DCI Engineering					Discontinued
	3 Conveyance Tech - Extraction & Transportation LRS	**Omni-Ingestor - Synapse**		Synapse Product Development					Discontinued
▼	**3 Conveyance Tech - Extraction & Transportation LRS HRS**								
	3 Conveyance Tech - Extraction & Transportation LRS HRS	**Motorized Emptying & Transport**	Waste is removed using portable pumps or with a vacuum truck. The waste should then be trucked to a sanctioned dump site (sewer entry point, WTP, or composting facility) but more frequently the waste will be dumped into the environment.	-		-	-	-	Available
	3 Conveyance Tech - Extraction & Transportation LRS HRS	**Powered Pumps**	There are a wide variety of powered pumps (rotary vane, centrifugal, diaphragm, piston, etc). All move a fluid by reducing pressure on the intake side so that ambient pressure pushes the material to the pump. On the discharge side, the pump creates a pressure higher than ambient and pushing the fluid out.	-		-	-	-	Available
	3 Conveyance Tech - Extraction & Transportation LRS HRS	**Vacuum Truck**	Vacuum pumps and a tank mounted on a truck chassis or on a trailer pulled by a tractor. FS is pumped into the tank and transported to the treatment/disposal point	-		-	-	-	Available
	3 Conveyance Tech - Extraction & Transportation LRS HRS	**Oystra**	Mobile waste extraction and dewatering on a truck	Crane Engineering			https://blog.craneengineering.net/news	BMGF	Prototype
	3 Conveyance Tech - Extraction & Transportation LRS HRS	**Mobile Treatment Unit**	MTU uses off-the-shelf separation technologies to produce a clean effluent quickly and cost-effectively. Treat and discharge septage onsite. Save time, fuel, and money.	Duke University	India	WASH Institute	https://www.washinstitute.org/		Research / Prototype
▼	**3 Conveyance Tech - Other LRS HRS**								
	3 Conveyance Tech - Other LRS HRS	**Transfer Station - Above Ground**	Transfer stations (above or below ground) act as intermediate dumping points for faecal sludge when it cannot be easily transported to a (semi-) centralized treatment facility. A vacuum truck is required to empty transfer stations when they are full.	-		-	https://sswm.info/content/transfer-station	-	Concept
	3 Conveyance Tech - Other LRS HRS	**Transfer Station - Below Ground**	Transfer stations (above or below ground) act as intermediate dumping points for faecal sludge when it cannot be easily transported to a (semi-) centralized treatment facility. A vacuum truck is required to empty transfer stations when they are full.	-		-	https://sswm.info/content/transfer-station	-	Available
▼	**3 Conveyance Tech - Network**								
	3 Conveyance Tech - Network	**Combined Sewer**	These networks have storm drains that are connected to the sewerage such that rainfall is also directed to the treatment plant. Combined sewers have higher operating costs due to the larger volume of wastewater that has to be treated, and they may require larger treatment plants, as well. In addition, when it rains very hard, the treatment plant will not be able to keep up, which can result in untreated wastewater being dumped into the plant's outfall, which may be a river, lake or ocean. Approximately 800 cities in the U.S. have combined sewer systems that are designed to overflow in heavy rains leading to at least some raw sewage entering lakes and rivers.	-		-	-	-	Available
	3 Conveyance Tech - Network	**Conventional Gravity Sewer**	The baseline for modern conveyance methods. Sanitary sewers transport wastewater from homes and businesses. Gravity sewers require pipes be laid at slope of 0.5% to 1.0%. For a gravity system to work, sometimes a 10-foot-diameter tunnel might have to be dug to a depth of 82 feet at the other end	-		-	-	-	Available

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	3 Conveyance Tech - Network	**Simplified Sewer**	Also called small-bore sewerage, is a sewer system that collects all household wastewater (blackwater and greywater) in small-diameter pipes laid at fairly flat gradients. It is suitable for existing unplanned low-income areas, as well as new housing estates with a regular layout. Investment costs can be up to 50% compared to conventional sewerage. Blockages are more common.	-		-	-	-	Available
	3 Conveyance Tech - Network	**Solids-Free Sewer**	Effluent sewer systems, also called septic tank effluent drainage (STED) or solids-free sewer (SFS) systems, have septic tanks that collect sewage from residences and businesses, and the effluent that comes out of the tank is sent to either a centralized sewage treatment plant or a distributed treatment system for further treatment. Most of the solids are removed by the septic tanks, so the treatment plant can be much smaller than a typical plant. In addition, because of the vast reduction in solid waste, a pumping system can be used to move the wastewater rather than a gravity system.	-		-	-	-	Available
	3 Conveyance Tech - Network	**Vacuum Sewage**	Wastewater is transported in a low-pressure system by using air instead of water as transport medium. A vacuum sewer or pneumatic sewer system is a method of transporting sewage from its source to a sewage treatment plant. It maintains a partial vacuum, with an air pressure below atmospheric pressure inside the pipe network and vacuum station collection vessel. Valves open and reseal automatically when the system is used, so differential pressure can be maintained without expending much energy pumping. A single central vacuum station can collect the wastewater of several thousand individual homes, depending on terrain and the local situation.	-		-	-	-	Available
	3 Conveyance Tech - Network	**Pressure Sewage**	Pioneered in 1969 by Environment One Corporation (E/One, Niskayuna, N.Y.), ATS pressure sewers are found today in 42 countries and U.S. territories, and on almost every continent. E/One's ATS begins with a grinder pump station, which has a tank about the size of a dishwasher that is buried in the ground, its lid easily camouflaged with minor landscaping. Inside, the primary component is a 1-hp, semi-positive displacement pump.The pump's robust torque can propel wastewater through small-diameter, inflow-and-infiltration-free pressurized pipe buried just below the frost line for a distance of more than two miles — or even straight up 186 feet — to a force main or treatment plant. The total dynamic head provides a nearly identical flow rate regardless of the network's contours and fluctuating elevations. Investment costs can be up to 50% compared to conventional sewerage. Blockages are more common.	Environment One Others			https://eone.com/sewer-systems	-	Available
▼	**4 Treatment & Conversion**								
	4 Treatment & Conversion	**Ion Exchange Treatment**	Ion exchange is a water treatment method where one or more undesirable ionic contaminants are removed from water by exchange with another non-objectionable, or less objectionable ionic substance. Both the contaminant and the exchanged substance must be dissolved and have the same type of electrical charge (positive or negative). A typical example of ion exchange is a process called "water softening" aiming to reduce calcium and magnesium content. Nevertheless, ion exchange is also efficient in removing toxic metals from water.	Multiple		-	-	-	Available
	4 Treatment & Conversion	**SMART-PLANT**	Scale-up of low-carbon footprint MAterial Recovery Techniques in existing wastewater treatment PLANTs	Smart-Plant Consortium			http://smart-plant.eu/index.php/processes-and-products-at-a-glance		Research / Prototype
	4 Treatment & Conversion	**Electrodialysis Reversal (EDR)**	an electrodialysis reversal water desalination membrane process that has been commercially used since the early 1960s. An electric current migrates dissolved salt ions, including fluorides, nitrates and sulfates, through an electrodialysis stack consisting of alternating layers of cationic and anionic ion exchange membranes. Periodically, the direction of ion flow is reversed by reversing the polarity of the applied electric current. Because of the polarity reversal design, EDR for wastewater reuse is a self-cleaning, durable membrane system ideal for turbid wastewater	Suez GE Saltworks		-	https://www.suezwatertechnologies.com/products/edediedr/electrodialysis-reversal-edr	-	Available
	4 Treatment & Conversion	**Waste Water Bio Refinery**	A biorefinery is an integrative, multifunctional over-arching concept that uses biomass as a diverse source of raw materials for the sustainable generation of a spectrum of intermediates and products while ensuring the minimization of waste products. A wastewater biorefinery expands this application to include wastewater as a source of raw materials, operating in the wastewater arena and designed to generate products of value from waste nutrients and simultaneously producing clean or 'fit for purpose' water as the non-negotiable product. (adapting the De la Fuente, 2014 definition)	University of Cape Town			http://www.futurewater.uct.ac.za/FW-wwbr	-	Available
	4 Treatment & Conversion	**Bola Bondeh Project: Organic Compost**	Producer of high quality, clean compost by recycling organic matter from the agrofood industry and waste water.	Bola Bondeh			http://bolabondeh.com		Research / Prototype
▼	**4a Treatment & Conversion Types**								
	4a Treatment & Conversion Types	**Conventional Waste Water Treatment Plant**	Solids are incinerated, land applied, or composted	-		-	-	-	Available
	4a Treatment & Conversion Types	**Decentralized Treatment**	Can be low-tech such as a large community run anaerobic digester or a sophisticated package plant. Reliable package plants are now available which can be monitored remotely. In an urban setting, a plant with a treatment capacity of 100,000 population equivalents could be considered a 'satellite' plant	Multiple		-	https://www.fluencecorp.com	-	Available

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	4a Treatment & Conversion Types	**Individual Wastewater Systems**	An IWS is a decentralized system that receives and disposes domestic wastewater from one or multiple buildings that are not connected to a centralized wastewater treatment plant. Some IWSs treat wastewater by removing pollutants such as solids, organic matter, nutrients and bacteria. Not all systems provide equal levels of treatment. Suspended growth aerobic treatment systems provide secondary levels of treatment, for example, while others (such as septic tanks) only provide primary treatment of wastewater. Other IWSs only dispose of wastewater (e.g., cesspools). With an IWS, wastewater is dispersed or reused very close to where it was generated. If several adjacent parcels are serviced by a single system, the treatment and water dispersal system can also be referred to as a *cluster system*.	Multiple		-	-	-	Available
	4a Treatment & Conversion Types	**Pre-treatment**	Pre-treatment is the preliminary removal of wastewater or sludge constituents, such as oil, grease, and various solids (e.g., sand, fibres and trash). Built before a conveyance or treatment technology, pre-treatment units can retard the accumulation of solids and minimize subsequent blockages. They can also help to reduce abrasion of mechanical parts and extend the life of the sanitation infrastructure.	Multiple		-	-	-	Available
	4a Treatment & Conversion Types	**Waste Water Package Plant**	Package plants are pre-manufactured treatment facilities used to treat wastewater in small communities or on individual properties. According to manufacturers, package plants can be designed to treat flows as low as 0.002 MGD or as high as 0.5 MGD, although they more commonly treat flows between 0.01 and 0.25 MGD (Metcalf and Eddy, 1991). The most common types of package plants are extended aeration plants, sequencing batch reactors, oxidation ditches, contact stabilization plants, rotating biological contactors, and physical/chemical processes (Metcalf and Eddy, 1991). This fact sheet focuses on the first three, all of which are biological aeration processes.	Multiple		-	https://www.cstwastewater.com/package-treatment-plants/ http://www.veoliawatertechnologies.co.za/municipal-water-treatment/sewage-treatment/sewage-treatment-package-plants/ http://www.pollutioncontrolsystem.com/packaged-plants	-	Available
▼	**4b Treatment & Conversion - Biolgical**								
	4b Treatment & Conversion - Biolgical	**Laccase Enzyme Secreting Fungi**	Microorganisms that produce unspecific oxidative enzymes such as laccases are a potential means to improve biodegradation of these compounds	Laboratory for Environmental Biotechnology, Lausanne, Switzerland			-		Research / Prototype
	4b Treatment & Conversion - Biolgical	**Integrated Fixed Film Activated Sludge**	Integrated fixed film activated sludge (IFAS) is a relatively new technology that describes any suspended growth system that incorporates an attached growth media within the suspended growth reactor (U.S. EPA 2010). Biofilm carriers are generally divided in 'dispersed media' or 'fixed media'. This technique, used in highly developed wastewater treatment plants, can be used as an upgrade for existing facilities or can be constructed newly. The design needs expert knowledge and the system must be operated by skilled labourers.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Biological - AMBR**	anaerobic membrane bioreactor The sewage is filtered and separated leaving the effluent and sludge apart. This sludge is treated anaerobically by mesophilic bacteria which release methane as a byproduct. The biogas can later be combusted to generate heat or electricity. AnMBR is considered to be a sustainable alternative for sewage treatment because the energy that can be generated by the methane combustion can exceed the energy required for maintaining the process	-		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Biogas Settler**	A settler is a primary treatment technology for wastewater; it is designed to remove suspended solids by sedimentation. It may also be referred to as a sedimentation or settling basin/tank, or clarifier. The low flow velocity in a settler allows settleable particles to sink to the bottom, while constituents lighter than water float to the surface. The liquid phase continues to further treatment steps after a relatively short hydraulic retention time, while the sludge is kept in the tank for several months to years. In airtight settlers, known as anaerobic biogas settlers, sludge is transformed to biogas via anaerobic digestion. The reactors are round or square - much like a septic tank, but with biogas collection. Biogas thus recovered can be transformed into heat, light or any other energy	-		-	-	-	Available

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	4b Treatment & Conversion - Biolgical	**Biological - Anaerobic Baffled Reactor (ABR)**	An anaerobic baffled reactor (ABR) is an improved Septic Tank with a series of baffles under which the grey-, black- or the industrial wastewater is forced to flow under and offer the baffles from the inlet to the outlet . The increased contact time with the active biomass (sludge) results in improved treatment. ABRs are robust and can treat a wide range of wastewater, but both remaining sludge and effluents still need further treatment in order to be reused or discharged properly Should be considered medium tech due to manufacturing complexity and need for maintenance. Use in low resource setting with support. This technology is suitable for areas where land may be limited since the tank is most commonly installed underground and requires a small area. However, a vacuum truck should be able to access the location because the sludge must be regularly removed (particularly from the settling compartment). Also, it should not be installed in areas with a high groundwater table or prone to flooding as infiltration will affect the treatment efficiency and contaminate the groundwater.	-		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Anaerobic Filter**	An anaerobic filter is a fixed-bed biological reactor with one or more filtration chambers in series. As wastewater flows through the filter, particles are trapped and organic matter is degraded by the active biomass that is attached to the surface of the filter material. Anaerobic filters are widely used as secondary treatment in household black- or greywater systems and improve the solid removal compared to septic tanks or anaerobic baffled reactors. Since anaerobic filters work by anaerobic digestion, they can be designed as anaerobic digesters to recover the produced biogas.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Anaerobic Filter**	An anaerobic filter is a fixed-bed biological reactor with one or more filtration chambers in series. As wastewater flows through the filter, particles are trapped and organic matter is degraded by the active biomass that is attached to the surface of the filter material. This technology is easily adaptable and can be applied at the household level, in small neighborhoods or even in bigger catchment areas. It is most appropriate where a relatively constant amount of blackwater is generated. The anaerobic filter can be used for secondary treatment, to reduce the organic loading rate for a subsequent aerobic treatment step, or for polishing. This technology is suitable for areas where land may be limited since the tank is most commonly installed underground and requires a small area. Accessibility by vacuum truck is important for desludging. The increased surface area for microbes reduces digestion time and permits greater throughput or reduced system size.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Biofilm Reactor**	Category of digesters that include: • Moving Bed Biofilm Reactor • Aerated Biofilm Reactor	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Biogas Reactor**	A biogas reactor or anaerobic digester is an anaerobic treatment technology that produces (a) a digested slurry (digestate) that can be used as a fertilizer and (b) biogas that can be used for energy. Biogas is a mix of methane, carbon dioxide and other trace gases which can be converted to heat, electricity or light. A biogas reactor is an airtight chamber that facilitates the anaerobic degradation of blackwater, sludge, and/or biodegradable waste. It also facilitates the collection of the biogas produced in the fermentation processes in the reactor. The gas forms in the slurry and collects at the top of the chamber, mixing the slurry as it rises. The digestate is rich in organics and nutrients, almost odorless and pathogens are partly inactivated. Biogas reactors are simple, well understood, and common in many parts of the world. 30 million households have biogas reactors in China.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Biorotor**		Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Composting & Co-Composting (at facility)**	Composting at the household level is an important method for managing organic waste, which is normally the largest portion of household waste. Composting reduces the environmental impacts of waste and the produced compost is essential for improving soil fertility and structure. Besides the organic waste, composting can also be applied as secondary treatment for feces and excreta collected in urine diversion and composting toilets. Degradation of organic material is a natural process, but composting allows us to control and accelerate this process by optimizing the environment for microbial activity in the waste. Composting involves three stages: preparation of the waste by adjusting its size, moisture content and carbon-nitrogen ratio; degradation of waste in pits, piles, vessels or vermi-composting; and finally preparing finished compost by curing and screening. Composting facilities that accept sludge from urine diversion toilets, biogas reactors, and constructed wetlands can safely convert the sludge to compost for agricultural purposes. An appropriate facility needs to be professionally designed, be located out of flood zones if possible, prevent groundwater infiltration, and prevent odors, insects, and rodents from becoming a nuisance in the community.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Membrane Bio Reactor**	Membrane bioreactor (MBR) is the combination of a membrane process like microfiltration or ultrafiltration with a biological wastewater treatment process, the activated sludge process. It is now widely used for municipal and industrial wastewater treatment.[1]	Multiple		-	-	-	Available

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	4b Treatment & Conversion - Biolgical	**Moving Bed Biofilm Reactor (MBBR)**	It's a combination of activated sludge process (suspended growth) and biofilter processes (attached growth). Moving Bed Biofilm Bioreactor (MBBR) process uses the whole tank volume for biomass growth. It uses simple floating media, which are carriers for attached growth of biofilms. Biofilm carrier movement is caused by the agitation of air bubbles. This compact treatment system is effective in removal of BOD as well as nitrogen and phosphorus while facilitating effective solids separation. The MBBR system consists of an aeration tank (similar to an activated sludge tank) with special plastic carriers that provide a surface where a biofilm can grow. The carriers are made of a material with a density close to the density of water (1 g/cm^3). An example is high-density polyethylene (HDPE) which has a density close to 0.95 g/cm^3. The carriers will be mixed in the tank by the aeration system and thus will have good contact between the substrate in the influent wastewater and the biomass on the carriers. To prevent the plastic carriers from escaping the aeration it is necessary to have a sieve on the outlet of the tank.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Sequence Batch Reactor (SBR)**	Sequencing batch reactors (SBR) or sequential batch reactors are a type of activated sludge process for the treatment of wastewater. SBR reactors treat wastewater such as sewage or output from anaerobic digesters or mechanical biological treatment facilities in batches. Oxygen is bubbled through the mixture of wastewater and activated sludge to reduce the organic matter (measured as biochemical oxygen demand (BOD) and chemical oxygen demand (COD)). The treated effluent may be suitable for discharge to surface waters or possibly for use on land. Activated sludge reactors are aerobic suspended-growth type processes. Large amounts of injected oxygen allow maintaining aerobic conditions and optimally mixing the active biomass with the wastewater to be treated. Activated sludge systems are highly efficient for organic matter and nutrient removal, though pathogen removal is low. In the view of reuse of the effluent in agriculture, it is not beneficial to remove all nutrients while standards for pathogen removal are barely met.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Upflow Anaerobic Sludge Blanket Reactor (UASB)**	The upflow anaerobic sludge blanket reactor (UASB) is a single tank process. Wastewater enters the reactor from the bottom, and flows upward. A suspended sludge blanket filters and treats the wastewater as the wastewater flows through it. The sludge blanket is comprised of microbial granules (1 to 3 mm in diameter), i.e., small agglomerations of microorganisms that, because of their weight, resist being washed out in the upflow. The microorganisms in the sludge layer degrade organic compounds. As a result, gases (methane and carbon dioxide) are released. The rising bubbles mix the sludge without the assistance of any mechanical parts. Sloped walls deflect material that reaches the top of the tank downwards. The clarified effluent is extracted from the top of the tank in an area above the sloped walls. Due to the need for constant power, these systems are not recommended for decentralized WWTP except in high-resource settings.	Multiple		-	-	-	Available
	4b Treatment & Conversion - Biolgical	**Biogas**	Biogas sanitation is the treatment of waste and wastewater by a process called anaerobic digestion. During anaerobic digestion, the organic matter in the waste and wastewaters is transformed to biogas, a mix of methane (CH4) and carbon dioxide (CO2) and a nutrient rich sludge. Biogas can be transformed into heat or power and has therefore a large potential as a renewable energy source. The nutrient-rich sludge can be composted and used as fertilising soil amendment in agriculture. Typical biogas sanitation technologies are biogas settlers, upflow anaerobic sludge blanket (UASB) reactors, anaerobic baffled reactors (ABRs) and anaerobic filters for municipal wastewaters; and biogas reactors (batch, fed-batch PFR or CSTR) for the treatment of slurries and solid organic wastes from agriculture and industry.	Multiple University of South Florida			https://www.usf.edu/pcgs/research-and-initiatives/biofuels-and-bioproducts-development.aspx	-	Available
	4b Treatment & Conversion - Biolgical	**Membrane Aerated Biofilm Reactor**	Membrane Aerated Biofilm Reactor is a unique attached growth biofilm (fixed film) aeration system which allows for low energy delivery of oxygen from the carrier side.	Oxymem			https://www.oxymem.com	-	Available
	4b Treatment & Conversion - Biolgical	**Anaerobic Digestion**	The researchers estimate that a full scale anaerobic plant capable of operating at 15 million gallons per day might save as much as $3,000 per day in energy demand — $1 million per year — over a comparable aerobic plant. Factoring in other savings from the more efficient process, the researchers estimate potential savings of more than $2 million per year.	Quantum Biopower			https://cr2c.stanford.edu https://www.nvpenergy.com/technology/ https://www.waste360.com/anaerobic-digestion/walk-through-connecticut-s-only-anaerobic-digestion-facility https://seabenergy.com	-	Available
	4b Treatment & Conversion - Biolgical	**Anaerobic Baffled Reactor**		-					
	4b Treatment & Conversion - Biolgical	**Anaerobic Filter**		-					
	4b Treatment & Conversion - Biolgical	**Anaerobic Membrance Bioreactor (AnMBR)**		-					
	4b Treatment & Conversion - Biolgical	**Co-composting**		-					

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	4b Treatment & Conversion - Biolgical	**Upflow Anaerobic Sludge Blanket Reactor**		-					
	4b Treatment & Conversion - Biolgical	**Waste Stabilization Ponds**		-					
▼	**4c Treatment & Conversion - Filtration**								
	4c Treatment & Conversion - Filtration	**Reverse Osmosis**	Reverse osmosis (RO) is a water purification process that uses a partially permeable membrane to remove ions, unwanted molecules and larger particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property, that is driven by chemical potential differences of the solvent, a thermodynamic parameter. Reverse osmosis can remove many types of dissolved and suspended chemical species as well as biological ones (principally bacteria) from water, and is used in both industrial processes and the production of potable water.	Multiple		-	-	-	Available
▼	**4d Treatment & Conversion - Nature Based**								
	4d Treatment & Conversion - Nature Based	**Constructed Wetland - Free-Water Surface**	A free-water surface constructed wetland (also called free water surface, FWS) is a series of flooded planted channels or basins. It aims to replicate the naturally occurring processes of a natural wetland, marsh or swamp. As water slowly flows through the wetland, particles settle, pathogens are destroyed, and organisms and plants utilize the nutrients. This type of constructed wetland is commonly used as an advanced treatment after secondary or tertiary treatment processes.	-		-	-	-	Available
	4d Treatment & Conversion - Nature Based	**Constructed Wetland - Vertical Flow**	A vertical flow constructed wetland (vertical flow CW) is a planted filter bed for secondary or tertiary treatment of wastewater (e.g. greywater or blackwater) that is drained at the bottom. Pre-treated Wastewater (e.g. from a septic tank or an Imhoff tank) is poured or dosed onto the surface from above using a mechanical dosing system. The water flows vertically down through the filter matrix to the bottom of the basin where it is collected in a drainage pipe. The water is treated by a combination of biological and physical processes. The filtered water of a well functioning constructed wetland can be used for irrigation, aquaculture, groundwater recharge or is discharged in surface water A vertical flow constructed wetland (vertical flow CW) is a planted filter bed for secondary or tertiary treatment of wastewater (e.g. greywater or blackwater) that is drained at the bottom. Pre-treated Wastewater (e.g. from a septic tank or an Imhoff tank) is poured or dosed onto the surface from above using a mechanical dosing system. The water flows vertically down through the filter matrix to the bottom of the basin where it is collected in a drainage pipe. The water is treated by a combination of biological and physical processes. The filtered water of a well functioning constructed wetland can be used for irrigation, aquaculture, groundwater recharge or is discharged in surface water. To design a vertical flow constructed wetland, expert knowledge is recommended. They are relatively inexpensive to build where land is affordable and can be maintained by the local community. The important difference between a vertical and horizontal wetland is not simply the direction of the flow path, but rather the aerobic conditions.	-		-	-	-	Available
	4d Treatment & Conversion - Nature Based	**Constructed Wetland - Horizontal Subsurface Flow**	A horizontal subsurface flow constructed wetland (horizontal subsurface flow CW) is a large gravel and sand-filled basin that is planted with wetland vegetation. It is used for secondary or tertiary treatment of wastewater (e.g. greywater or blackwater). Solids are removed in a primary treatment (e.g. in a septic tank or Imhoff tank). As wastewater flows horizontally through the basin, the filter material filters out particles and microorganisms degrade the organics. The effluent of a well-functioning constructed wetland can be used for irrigation and aquaculture or safely been discharged to receiving water bodies. HFCWs are secondary treatment facilities for household, municipal and industrial wastewater, and they can also be used as a tertiary treatment system for polishing. Pre-treated wastewater flows horizontally through a planted filter bed. Plants provide suitable environments for microbiological attachment, aerobic biofilm growth and transfer of oxygen to the root zone. Organic matter and suspended solids are mainly removed by filtration and degradation.	-		-	-	-	Available
	4d Treatment & Conversion - Nature Based	**Nature Based - Planted Drying Beds**		-		-	-	-	Available
	4d Treatment & Conversion - Nature Based	**Nature Based - Unplanted Drying Beds**		-		-	-	-	Available
	4d Treatment & Conversion - Nature Based	**Algae Farming**	A 3D, modular algae farm that serves as the scaffolding for zero input aquaculture farm; provides healthy food and helps improve water quaility and reduce dissolved CO2	Algenie			https://conservationx.com/project/id/228/algenie	-	Available
	4d Treatment & Conversion - Nature Based	**Nature Based - Phytoremediation**	Phytoremediation is a cost-effective plant-based approach of remediation that takes advantage of the ability of plants to concentrate elements and compounds from the environment and to metabolize various molecules in their tissues. It refers to the natural ability of certain plants called hyperaccumulators to bioaccumulate, degrade, or render harmless contaminants in soils, water, or air.	Ayala Aqua			http://www.ayala-aqua.com		Available

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	4d Treatment & Conversion - Nature Based	**Chennai Vertical Gardens**	Frameworks that support vertical gardens are installed on piers underneath bridges and metro rail pillars watered with sewage. 5000 square meters of garden will use 5000 liters of sewage per day.	Greater Chennai Corporation	Chennai, India Bengaluru and Nagpur where vertical gardens have come up on .. Read more at: http://timesofindia.indiatimes.com/articleshow/74019327.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst		https://timesofindia.indiatimes.com/city/chennai/chennai-vertical-gardens-under-bridges-to-use-treated-sewage/articleshow/74019327.cms		Active
	4d Treatment & Conversion - Nature Based	**Black Soldier Fly**	Black soldier fly larvae (BSFL) are used to compost waste or convert the waste into animal feed. The harvested pupae and prepupae are eaten by poultry, fish, pigs, lizards, turtles, and even dogs.[12] The wastes include fresh manure and food wastes of both animal and vegetable origin.	Multiple		-	-	-	Available
	4d Treatment & Conversion - Nature Based	**Constructed Wetlands**	Constructed wetlands and particularly ICW could be utilised more widely in Ireland as a sustainable solution for wastewater treatment of small communities. However, ICW is a relatively new treatment system and more monitoring is needed long term to assess and understand absorption capacity of phosphorous and nitrification of ammonia. In the investigated size class, CW systems could provide effective alternatives to mechanical treatment plants or complement the latter by providing a tertiary treatment step for effluents from mechanical units. Sites in catchment areas of water bodies with sensitivity towards eutrophication could utilise the hybrid systems for zero discharge. Sites with very restricted space could employ tertiary CWs with storm management. This would increase compliance with environmental standards set by the Water Framework Directive and associated legislation, for example, the Bathing Water Directive. The poor results for underperforming CW categories such as tertiary HSSF systems could be attributed to very small specific areas, poorly operated upfront mechanical plants and issues related to storm control. ICW systems appeared to perform well at nutrient retention; this was most apparent for those sites, whose construction followed Department of Environment Housing and Local Government design guidelines. The correct sizing of CW systems together with appropriate storm management are preconditions for optimal nutrient retention A treatment technology for wastewater that aims to replicate the naturally occurring processes in wetlands. Constructed shallow ponds are lined and filled with some sort of filter material (substrate), usually sand, gravel, rock or soil, and planted with vegetation tolerant of saturated conditions (e.g. reeds). As wastewater flows through the ponds, the filter material filters out particles and microorganisms degrade the organics. Free-Water, Horizontal Flow, and Vertical Flow Constructed Wetlands are just some types.	Organica Multiple		-	https://www.organicawater.com	-	Available
▼	**4e Treatment & Conversion - Thermal**								
	4e Treatment & Conversion - Thermal	**Ankur Omni-Processor**	See Janicki Omni-Processor	Ankur Scientific			https://www.ankurscientific.com	BMGF	Prototype
	4e Treatment & Conversion - Thermal	**Biomass Controls - Fecal Sludge Treatment Unit**	The Biogenic Refinery is a thermal treatment solution using patented technology that provides treatment products such as pathogen free biochar, heat and electricity. Uses pyrolysis	Biomass Controls		-	https://biomasscontrols.com	BMGF	Prototype

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	4e Treatment & Conversion - Thermal	**CRRC Omni-Processor**	See Janicki Omni-Processor	CRRC			-	BMGF	Prototype
	4e Treatment & Conversion - Thermal	**Janicki Omni-Processor**	Waste combustion driving steam powered generator	Sedron Technologies			https://www.sedron.com/janicki-omni-processor/how-it-works/	BMGF	Prototype
	4e Treatment & Conversion - Thermal	**Tide Fecal Sludge Processor**	Pyrolysis-based fecal sludge treatment plant	Tide Technocrats			https://www.tidetechnocrats.com/key-projects	BMGF	Prototype
	4e Treatment & Conversion - Thermal	**Hydrothermal Carbonization (HTC)**		-		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Thermal - Carbonization**	Complete pyrolysis of organic matter usually leaves a solid residue that consists mostly of elemental carbon; the process is then called carbonization.	-		-	-	-	
	4e Treatment & Conversion - Thermal	**Thermal - Coalification**	Essentially a slow version of carbonization	-		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Thermal Decomposition Processes**	Coalification, carbonization, and pyrolysis can be used to destroy pathogens and result in usable resources but they are generally discouraged due to inefficiency, the consumption of other resources, and the release of pollutants.	-		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Supercritical Water Oxidation**	Supercritical water oxidation is a process that occurs in water at temperatures and pressures above a mixture's thermodynamic critical point. Under these conditions water becomes a fluid with unique properties that can be used to advantage in the destruction of hazardous wastes such as PCBs. SCWO occurs in water at temperatures and pressures above a mixture's thermodynamic critical point. Under these conditions water becomes a fluid with unique properties that can be used to advantage in the destruction of hazardous wastes such as PCBs.	Duke University			http://sanitation.pratt.duke.edu	BMGF	Research / Prototype
	4e Treatment & Conversion - Thermal	**Incineration - Small Scale**	Burning of waste material	Evac			https://evac.com	-	Available
	4e Treatment & Conversion - Thermal	**Combined Power & Heat (CPH)**		Multiple		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Gasification**	Gasification is a process that converts organic- or fossil fuel-based carbonaceous materials into carbon monoxide, hydrogen and carbon dioxide. The resulting gas mixture is called syngas (from synthesis gas) or producer gas and is itself a fuel. The power derived from gasification and combustion of the resultant gas is considered to be a source of renewable energy if the gasified compounds were obtained from biomass. The advantage of gasification is that using the syngas (synthesis gas H2/CO) is potentially more efficient than direct combustion of the original fuel because it can be combusted at higher temperatures or even in fuel cells, so that the thermodynamic upper limit to the efficiency defined by Carnot's rule is higher or (in case of fuel cells) not applicable. Syngas may be burned directly in gas engines, used to produce methanol and hydrogen, or converted via the Fischer–Tropsch process into synthetic fuel. Gasification can also begin with material which would otherwise have been disposed of such as biodegradable waste. In addition, the high-temperature process refines out corrosive ash elements such as chloride and potassium, allowing clean gas production from otherwise problematic fuels. Gasification of fossil fuels is currently widely used on industrial scales to generate electricity	Multiple		-	-	-	Available

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	4e Treatment & Conversion - Thermal	**Hydrothermal treatment of sewage sludge**	Hydrothermal treatment (or thermal hydrolysis) is a process in which the sludge is heated as an aqueous phase to temperatures (normally) varying between 120 and about 400°C. The hydrothermal treatment process aims to disintegrate the sludge and results in a formation and accumulation of dissolved products. This makes it possible to recover and recycle useful resources from the sludge, such as volatile fatty acids, phosphorous compounds, organic compounds for enhanced anaerobic biogas production, and coagulants. The potential of hydrothermal treatment for the recovery of energy from sewage sludge strongly depends upon the process performance. Over 150 C for the destruction of pathogens and denaturing of protein. The exact conversion of biomass to bio-oil is dependent on several variables:[1] • Feedstock composition • Temperature and heating rate • Pressure • Solvent • Residence time • Catalysts While water acts as a catalyst in the reaction, other catalysts can be added to the reaction vessel to optimize the conversion.[11] Previously used catalysts include water-soluble inorganic compounds and salts, including KOH and Na_2CO_3, as well as transition metal catalysts using Ni, Pd, Pt, and Ru supported on either carbon, silica or alumina. The addition of these catalysts can lead to an oil yield increase of 20% or greater, due to the catalysts converting the protein, cellulose, and hemicellulose into oil. This ability for catalysts to convert biomaterials other than fats and oils to bio-oil allows for a wider range of feedstock to be used. The HTL process differs from pyrolysis as it can process wet biomass and produce a bio-oil that contains approximately twice the energy density of pyrolysis oil.	Multiple		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Incineration - large scale**	Burning of waste material	Multiple		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Pyrolysis**	Pyrolysis is a thermal treatment process in which the sludge (or biomass) is heated under pressure to a temperature of 350–500°C in the absence of oxygen. In this process, the sludge is converted into char, ash, pyrolysis oils, water vapor, and combustible gases. Part of the solid and/or gaseous products of the pyrolysis process are incinerated and used as heating energy in the pyrolysis process. Pyrolysis has been used for turning wood into charcoal since ancient times. Pyrolysis is a related process to HTL, but biomass must be processed and dried in order to increase the yield.[13] The presence of water in pyrolysis drastically increases the heat of vaporization of the organic material, increasing the energy required to decompose the biomass. Typical pyrolysis processes require a water content of less than 40% to suitably convert the biomass to bio-oil. This requires considerable pretreatment of wet biomass such as tropical grasses, which contain a water content as high as 80-85%, and even further treatment for aquatic species, which can contain higher than 90% water content. Pyrolysis is one of various types of chemical degradation processes that occur at higher temperatures (above the boiling point of water or other solvents). It differs from other processes like combustion and hydrolysis in that it usually does not involve the addition of other reagents such as oxygen (O_2, in combustion) or water (in hydrolysis).[3] Pyrolysis produces solids (char), condensable liquids (tar), and noncondensing/permanent gasses.	Multiple		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Thermal - Advanced Thermal Decomposition Processes**	The following thermal processes rely on varying degrees of high temperatures, pressure, specific environmental conditions, and the presence or absence of oxidizing elements. While some are frequently used in industrial processes, use in sanitation is not common although it is being explored and adopted in limited cases. It is applicable in high-resource settings. Due to the temperatures and pressures involved, and the strict operating conditions that must be maintained, the technology relies on high cost materials, components, and sensors. Improper design, operation, and maintenance can result in dangerous conditions.	Multiple		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Thermal - Co-incineration of sewage sludge in coal-fired power plants**		Multiple		-	-	-	Available
	4e Treatment & Conversion - Thermal	**Hydrothermal Algae Liquefaction**	Converts Algae to biodiesel	Plymouth Marine Laboratories			http://www.pml.ac.uk		Research / Prototype
	4e Treatment & Conversion - Thermal	**Hydrothermal Deconstruction**		Scion Research			https://www.youtube.com/watch?v=_jWeVcRAdkY		Available
	4e Treatment & Conversion - Thermal	**Thermal - Biochar (Also see Pyrolisys)**	Carbonizer/Catalyst: The waste is charred and sanitized when it is heated to a temperature between 300-700 degrees in the absence of oxygen.	The Climate Foundation			http://www.climatefoundation.org/our-projects.html		Available
	4e Treatment & Conversion - Thermal	**Super Critical Water Oxidation (community level)**		-			http://sanitation.pratt.duke.edu/		

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
▼	**4f Treatment & Conversion - Mineral Recovery**								
	4f Treatment & Conversion - Mineral Recovery	**Nitrification**	Nitrifying Activated Sludge helps remove micro pollutants	-		-	-	-	Available
	4f Treatment & Conversion - Mineral Recovery	**Phosphorus Capture**		Multiple		-	-	-	Available
	4f Treatment & Conversion - Mineral Recovery	**Urine > Struvite**	Struvite is a form of precipitated phosphourous, MgNH4PO4•6H2O), sometimes also called Magnesium Ammonium Phosphate Hexahydrate (M-A-P). It is produced from urine can be applied to fields just like any other fertilizer.	Multiple		-	-	-	Available
	4f Treatment & Conversion - Mineral Recovery	**Urine > Fertilizer from Urine**	Use of urine as fertilizer. 80% of the nitrogen, phosphorous, and potassium excreted by humans is in the urine. This can be immediately used as fertilizer but benefits from stabilization and disinfection. Pharmaceuticals, which may be taken up by plants and enter the food chain, can be removed by passing the urine through a charcoal filter. Nitrification also reduces some pharmaceuticals. Despite the common refrain that urine is sterile, it can contain bacteria and parasites. Also, urine-feces cross-contamination can occur at the source. Urine does contain ammonia which is a biocide and can inactivate some of the pathogens. Nitrification also inactivates some, but not all, pathogens. Adding a pasteurization step (80C for 30 minutes) is very effective.	Multiple Rich Earth Institute Vuna		-	https://richearthinstitute.org/about-us/our-mission/	-	Research / Prototype
	4f Treatment & Conversion - Mineral Recovery	**Ostara Pearl**		Ostara			https://ostara.com/nutrient-management-solutions/		Available
	4f Treatment & Conversion - Mineral Recovery	**Ostara WASSTRIP**		Ostara			https://ostara.com/nutrient-management-solutions/		Available
	4f Treatment & Conversion - Mineral Recovery	**Urine > Vuna**	Urine converted to commercially available fertilizer	Vuna			http://www.vuna.ch/index_en.html	BMGF	Available
▼	**4g Treatment & Conversion - Electrical Conversion**								
	4g Treatment & Conversion - Electrical Conversion	**Electrical Conversion - Microbial Electrolysis Cells**	A microbial electrolysis cell (MEC) is a technology related to Microbial fuel cells (MFC). Whilst MFCs produce an electric current from the microbial decomposition of organic compounds, MECs partially reverse the process to generate hydrogen or methane from organic material by applying an electric current.[1] The electric current would ideally be produced by a renewable source of power. The hydrogen or methane produced can be used to produce electricity by means of an additional PEM fuel cell or internal combustion engine.	-		-	-	-	Research / Prototype
	4g Treatment & Conversion - Electrical Conversion	**PEE Power**	Microbial Fuel Cells (MFCs) supplied with urine. The membrane-less MFCs were made out of ceramic material and employed plain carbon based electrodes	Bristol BioEnergy Robin (Spin-off)			https://www.bristolroboticslab.com/bristol-bioenergy-centre https://www.robial.org/	BMGF	Available
	4g Treatment & Conversion - Electrical Conversion	**Electrical Conversion** **Electrically Activated Organisms** **Mircrobrial Fuel Cells (MFC)**	Cambrian Innovation is developing and marketing a portfolio of environmental products with support from government and industry partners. These exciting new products include advanced bioelectrochemical wastewater treatment systems for industrial facilities and municipalities and a complementary bioelectrochemical sensor platform for precision agriculture applications. Bioelectrochemical systems (BES) are a new technology based on the ability of certain microbes (termed *exoelectrogens*) to generate electricity via direct contact with electrodes. Traditional fuel cells and electrochemical systems use chemical catalysts that oxidize fuel (such as hydrogen) at anodes, and reduce oxygen at cathodes. A circuit between the anode and the cathode captures electrical energy released in the process. BES technology can be thought of as fuel cells with a regenerative, living microbial catalyst. These microbes are capable of oxidizing and reducing a broad range of organic fuels, including negative cost fuel such as wastewater. The technology works because the exoelectrogenic bacteria can respire through direct contact with the electrodes in our systems. BES have a range of advantages over current technologies depending on the exact domain of application.	Cambrian Innovations			https://cambrianinnovation.com	-	Research / Prototype
	4g Treatment & Conversion - Electrical Conversion	**Organic Rankine Cycle**	Organic Rankine Cycle (ORC) engines operate using the same principles as a steam engine but with low boiling point, high molecular weight organic fluids instead of water, to extend operational ranges to lower temperature processes. ORC engines provide a way to harness energy from processes that cannot not generate the high temperatures needed for steam power operation. Avoiding the use of water, ORC systems can operate at lower pressures and do not suffer from corrosion due to the working fluid, leading to longer life expectancies (20+ years). The increasing development of so-called micro-ORC systems expands the reasonable application of these devices from medium to large scale thermochemical treatment options. In our search we identified eight manufacturers and eighteen products that met our inclusion criteria.	Multiple		-	https://airsquared.com/news/introducing-plug-play-micro- orc/ http://www.cogenmicro.com/index.php?select=159 https://www.rank-orc.com/wp-content/uploads/2019/02/FICHA-MICRO_EN.pdf https://www.kaymacor.com/en/products/	-	Available

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	4g Treatment & Conversion - Electrical Conversion	**Steam Engines**	Steam engines can be powered with any heat source and, per kilowatt, are the cheapest electrical generation option. Eleven manufacturers and sixteen products were identified that met the inclusion criteria. Steam engines operate across a range of thermal inputs making them suitable for medium to large scale thermochemical treatment options. Viable products could generate between 1.5 and 18.6 kWe and operated at pressures from 60 to 1,000 psi.	Multiple		-	https://www.brashpower.com/reliable-power http://cyclonepower.com http://quasiturbine.promci.qc.ca/EProductQT75 SCPneumatic.htm	-	Available
	4g Treatment & Conversion - Electrical Conversion	**Stirling Engines**	Stirling engines have near silent operation and have some of the highest efficiencies on the market. We identified eleven manufacturers and fourteen products that met our inclusion criteria. Identified products could generate between 0.6 and 25 kWe. Many of the available Stirling engines are adapted to use one particular fuel source to generate the required thermal energy, and so may not be suitable for incorporation with Reinvented Toilets or Omni Processors.	Multiple		-	https://www.azelio.com/solutions/stirling/ http://coolenergy.com/ https://www.inresol.se/products/inresol-v2-6-cx https://www.microgen-engine.com/products/engines/	-	Available
	4g Treatment & Conversion - Electrical Conversion	**Thermoelectric Generators**	Thermoelectric generators have no moving parts, require no maintenance, and can generate some electricity with even a small heat differential. The larger the heat differential, the more electricity they can produce, however, most units have a maximum hot side temperature around 750—850°F (400C—450°C) and are destroyed when overheated. Larger units (generally those producing over 30 W) use fans or liquid coolant systems to maximize the heat differential and subsequent output power. Electrical efficiencies of the products ranged from 0.5 - 5.0%. Due to low electrical output, thermoelectric generators are only suited as an option for small scale thermochemical treatment options, like the Reinvented Toilet.	Multiple		-	https://tecteg.com/store-thermoelectric- power-module-selection-purchase/56x56/ http://www.devilwatt.com/products	-	Available
	4g Treatment & Conversion - Electrical Conversion	**Thermoacoustic Heat Engines**	Thermoacoustic heat engines have no moving parts, no annual maintenance, high life expectancy, and are capable of generating 1–5 kWe. This could make this an ideal electrical generation technology for small-scale thermal processors. In contrast to other engines, thermoacoustic engines do not need high pressures or temperatures to be efficient, which allows them to use rubber and other engine materials that can lower production costs. Three manufacturers and three products were identified that met our inclusion criteria. As an emerging technology, however, there are currently no products that are commercially available, and therefore it is not recommended that this electrical generation technology be pursued at this time.	Not commercially available		-	https://www.etalim.com/solutions.html http://nirvana-es.com/technology.html	-	Not commercially available
▼	**4h Treatment & Conversion - Advanced Oxidation**								
	4h Treatment & Conversion - Advanced Oxidation	**Advanced Oxidation**	Hazardous organic waste, widely spread in water by industrial, military and domestic sources, is an emerging issue. Advanced Oxidation Processes (AOPs) are efficient methods to remove organic contamination not degradable by means of biological processes. AOPs are a set of processes involving the production of very reactive oxygen species able to destroy a wide range of organic compounds. AOPs are driven by external energy sources such as electric power, ultraviolet radiation (UV) or solar light, so these processes are often more expensive than conventional biological wastewater treatment. See: • Ozone • Ultraviolet • Ultrasonic • Ferrate • Electrolysis	-		-	-	-	Available
	4h Treatment & Conversion - Advanced Oxidation	**Pulsed electric field (PEF)**	Pulsed electric field (PEF) processing is an efficient non-thermal food processing technique using short, high voltage pulses. These pulses induce poration of plant, animal and microbial cells, leading to cell disintegration and microbial inactivation.	-		-	-	-	Research / Prototype
	4h Treatment & Conversion - Advanced Oxidation	**Semiconductor electrochemistry**	water treatment technology	Cal Tech			-		Research / Prototype
	4h Treatment & Conversion - Advanced Oxidation	**Semiconductor phototcatalysis**	water treatment technology	Cal Tech			-		Research / Prototype
	4h Treatment & Conversion - Advanced Oxidation	**Ultrasonic Irradiation**	water treatment technology	Cal Tech			-		Research / Prototype
	4h Treatment & Conversion - Advanced Oxidation	**Ferrate**	Ferrate is a supercharged iron molecule in which iron is in the plus 6 oxidation state; it is better known as Iron(VI). Ferrate is extremely powerful, can deliver multiple treatments from a single application, does not create disinfection by-products, is environmentally friendly, and solves difficult treatment challenges that other oxidants can't touch. Most importantly, Ferrate is often the least expensive and most effective treatment option. Ferrate can simultaneously perform as an oxidant, coagulant, and disinfectant. Ferrate is more powerful than other oxidants such as ozone and chlorine dioxide. It can replace coagulants such as ferric chloride, alum and polymers for the removal of metals, non-metals and humic acids. It outperforms other disinfectants such as UV, hydrogen peroxide, and chlorine and can kill many chlorine resistant organisms such as aerobic spore-formers and sulphite-reducing clostridia. Ferrate is a versatile, powerful, multi-use water and wastewater treatment technology. Recently evaluated by the U.S. E.P.A. and judged to be a very effective, sustainable, treatment chemical.	Ferrate Treatment Technologies			www.ferratetreatment.com	-	Available

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	4h Treatment & Conversion - Advanced Oxidation	**Chlorination**		Multiple		-	-	-	Available
	4h Treatment & Conversion - Advanced Oxidation	**Ozonation**	Ozonation (also referred to as ozonisation) is a chemical water treatment technique based on the infusion of ozone into water. Ozone is a gas composed of three oxygen atoms (O3), which is one of the most powerful oxidants. Ozonation is a type of advanced oxidation process, involving the production of very reactive oxygen species able to attack a wide range of organic compounds and all microorganisms. The treatment of water with ozone has a wide range of applications, as it is efficient for disinfection as well as for the degradation of organic and inorganic pollutants. Ozone is produced with the use of energy by subjecting oxygen (O2) to high electric voltage or to UV radiation. The required amounts of ozone can be produced at the point of use but the production requires a lot of energy and is therefore costly.	Multiple		-	-	-	Available
	4h Treatment & Conversion - Advanced Oxidation	**UV Lamps**	The bactericidal effect of concentrated ultraviolet (UV) light is used in many areas and in many set-ups. For drinking water treatment, simple, commercially available UV tubes can be used to kill pathogenic microorganisms in the drinking water. Such UV tube water disinfection devices are an effective, low-cost and simple mean for a very rapid disinfection. They generally consist of a pipe, through which water slowly flows, and in which an UV light bulb is installed, which can be run on electric or solar power. There are many ways to design UV tubes devices and they can be used at household, community or institutional level. Even though very effective, however, chemical or physical pollution (e.g. salinity, heavy metals turbidity) cannot be treated and in opposition to chlorine, there is no residual disinfection effect. The household design uses a UV bulb suspended inside a larger tube or covered trough. The water enters the tube at one end, flows through the tube under the UV bulb, and through the outlet at the other end of the tube. The UV bulb emits UV-C light, which kills microorganisms by damaging their genetic material (DNA). This makes the pathogens unable to reproduce.	Multiple		-	-	-	Available
	4h Treatment & Conversion - Advanced Oxidation	**UV LED**	See UV Lamps UV LED's (as opposed to gas-discharge type lamps) promise to be more reliable and less expensive but at the moment are less powerful.	Multiple		-	-	-	Approaching commercialization
	4h Treatment & Conversion - Advanced Oxidation	**Vortex Bioreactor**	The system currently uses copper powder embedded in a seaweed extract as the anti-bacterial agent.	Plymouth Marine Laboratories		Mike Allen	https://www.pml.ac.uk/News_and_media/News/Revolutionising_waste_water_treatment	BMGF	Concept
▼ **4i Treatment & Conversion - Dewatering**									
	4i Treatment & Conversion - Dewatering	**Dewatering - Centrifugation**		Multiple		-	-	-	Available
	4i Treatment & Conversion - Dewatering	**Dewatering - Dissolved Air Flotation**		Multiple		-	-	-	Available
	4i Treatment & Conversion - Dewatering	**Dewatering - Electro-coagulation Floculation**	ECF combines the production of metal flocculant and microbubbles in-situ, using a gas-generating cathode and a metal floc-generating sacrificial anode.	Multiple		-	-	-	Available
	4i Treatment & Conversion - Dewatering	**Dewatering - Foam Flotation**		Multiple		-	-	-	Available
	4i Treatment & Conversion - Dewatering	**Dewatering - Gravity Separation**		Multiple		-	-	-	Available
	4i Treatment & Conversion - Dewatering	**Dewatering - Mechanical**	Mechanical dewatering is normally associated with large wastewater treatment plants and is used to separate sludge (residual sludge from wastewater treatment plants or faecal sludge from on-site sanitation) into a liquid and a solid part. The principal methods are belt filter presses, centrifuges and chamber filter presses. These techniques are usually sophisticated and rarely cost-efficient for smaller systems to be implemented on community level. The process does not treat the sludge, it only separates solid from liquid parts. Both solid and liquid parts still contain pathogens and pollutants.	Multiple		-	-	-	Available
	4i Treatment & Conversion - Dewatering	**Electro Water Separation (EWS)**	Electro Water Separation™ (EWS) is a highly scalable, continuous breakthrough water cleanup technology that uses electricity in small, programmed doses to gather up oils and suspended solids. The removal of these suspended solids allows for easy mechanical raking off the surface of the water. This ultimately results in the recovery of large qualities of water that can then be reused.	Origin Clear			-	-	Available
▼ **4j Treatment & Conversion - Other**									
	4j Treatment & Conversion - Other	**Porous Reactive Concrete**	Porous concrete specifically formulated to remove target contaminants. It can be used to remove heavy metals, solvents, nitrogen, phosphates, and other chemical compounds. May be functionalized with metals, chemical compounds, graphene oxide, bacteria, etc. Use at the household level has not been researched in detail, nor have reliable models developed.	-		-	-	-	Available

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
▼	**5 Re(Use) & Disposal**								
	5 Re(Use) & Disposal	**Briquettes & Pellets**		Multiple				-	Available
	5 Re(Use) & Disposal	**Agriculture - Composted**		-				-	
	5 Re(Use) & Disposal	**Agriculture - Fertilizer from Solids**		-				-	
	5 Re(Use) & Disposal	**Agriculture - Food Source**		-				-	
	5 Re(Use) & Disposal	**Fuel - Gasseous**		-				-	
	5 Re(Use) & Disposal	**Fuel - Liquid**		-				-	
	5 Re(Use) & Disposal	**Fuel - Solid**		-				-	
	5 Re(Use) & Disposal	**Other - Ash in Concrete**		-				-	
	5 Re(Use) & Disposal	**Other - Paper**		-				-	
	5 Re(Use) & Disposal	**Recovery - Nitrogen**		-				-	
	5 Re(Use) & Disposal	**Recovery - Phosphorous**		-				-	
	5 Re(Use) & Disposal	**Recovery - Precious Metal**		-				-	
	5 Re(Use) & Disposal	**Recovery - Water**		-				-	
	5 Re(Use) & Disposal	**Urine as Fertilizer**		-				-	
▼	**Service Models**								
	Service Models	**3SI**		3SI	India				Available
	Service Models	**APPSANi**	APPSANI serves its target customers with a one-stop shop toilet purchasing process. A range of low cost standardized septic tank and toilet kit is offered to customers with flexible term of payment such	APPSANI	Indonesia	Koen Irianto E:sekretariat@appsan E:koenirianto09@gma	www.appsani.org		Available
	Service Models	**Arkin Creations**		Arkin Creations					
	Service Models	**BRAC WASH**		BRAC WASH	Banglades h				Available
	Service Models	**CATS (UNICEF)**		CATS (UNICEF)	Africa, Australasi a, Asia, Latin/ Central America				Available
	Service Models	**Clean Team Toilet**	Clean Team is a smart in-home toilet service that sees itself not only as a sanitation business, but also as a social business. The team consists of toilet experts with a passion for people as much as the product. A sanitation solution set on redefining the status quo. Clean Team aims to offer a better alternative to open defecation, a more affordable solution than building a permanent household latrine and a more convenient, cleaner and safer toilet experience.	Clean Team, IDEO	Ghana	info@cleanteamtoilet s.com	https://www.cleanteamtoilets.com		Available
	Service Models	**CLTS**	Community Led Total Sanitation (CLTS) is an innovative methodology for mobilising communities to completely eliminate open defecation (OD). Communities are facilitated to conduct their own appraisal and analysis of open defecation (OD) and take their own action to become ODF (open defecation free).At the heart of CLTS lies the recognition that merely providing toilets does not guarantee their use, nor result in improved sanitation and hygiene. Earlier approaches to sanitation prescribed high initial standards and offered subsidies as an incentive. But this often led to uneven adoption, problems with long-term sustainability and only partial use. It also created a culture of dependence on subsidies. Open defecation and the cycle of fecal–oral contamination continued to spread disease.In contrast, CLTS focuses on the behavioural change needed to ensure real and sustainable improvements – investing in community mobilisation instead of hardware, and shifting the focus from toilet construction for individual households to the creation of open defecation-free villages. By raising awareness that as long as even a minority continues to defecate in the open everyone is at risk of disease, CLTS triggers the community's desire for collective change, propels people into action and	Kamal Kar VERC (Village Education Resource Centre) WaterAid Bangladesh	Asia, Middle East, Africa, Latin/ Central America				Available
	Service Models	**Gram Vikas**		Gram Vikas	India, Africa				Available
	Service Models	**iDE**	Successful sanitation model for the urban and rural poor developed.	iDE			https://washmarkets.ideglobal.org/global-learning/model		Available
	Service Models	**LooWatt**	as cash, instalment, collective saving group mechanism, or loan.	LooWatt			https://www.loowatt.com		Available
	Service Models	**Pit Vidura**	Pit Vidura offers safe, affordable, and legal pit latrine emptying services to households in dense urban settlements. The waste that we excavate is transported by truck to Kigali's dumpsite operated b the City of Kigali.	Pit Vidura			https://www.pitvidura.com		Available

	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	Service Models	**Practica**	PRACTICA develops and disseminates sanitation products and solutions that support a technically and financially viable sanitation chain.	Practica Foundation			https://www.practica.org/expertises/sanitation/		Available
	Service Models	**Samagra**	Sanitation services for the urban poor	Samagra			www.samagra.co		Available
	Service Models	**Sanergy**	We franchise sanitation units to create a Fresh Life network across Nairobi's urban slums, offering an affordable and effective alternative to sewers. Sanergy has also built other sanitation products and services to serve any urban slum effectively. This includes Mtaa Fresh, our pit latrine emptying service, which works with current emptiers to provide cleaner and safer services both for the community and the emptier, as well as guarantees the safe treatment of waste.	Sanergy	Kenya		www.sanergy.org	Multiple	Available
	Service Models	**Sanitation Solutions Group**	Sanitation Solutions Group (SSG) is a market-based sanitation enterprise whose objective is to provide affordable sanitation products and services to households and communities in Uganda. SSG's initial focus was on three sanitation business models – pre-fabricated concrete latrine construction, latrine upgrading and business support to entrepreneurs in both latrine emptying and construction. SSG has now refined its operations and our current specialization is emptying on-site sanitation facilities including pit latrines and septic tanks under our Fresh Pit brand.	Sanitation Solutions Group			https://www.google.com/search?client=safari&rls=en&q=Sanitation+Solutions+Group&ie=UTF-8&oe=UTF-8		Available
	Service Models	**Scaling Up Rural Sanitation (WSP)**		Scaling Up Rural Sanitation (WSP) Selling Sanitation (IFC) Sulabh International	Asia, Africa				Available
	Service Models	**EkoLakay**		SOIL					Available
	Service Models	**WASH United**		WASH United WaterShed WSUP/ Wateraid SanPlat programme	Africa, India				Available
	Service Models	**WaterLife**		WaterLife					
	Service Models	**X-Runner**	X-Runner is a waste management service for low-income households seeking a sustainable and hygienic sanitation solution. A urine diverting dry toilet and waste collection service are provided for a monthly fee. X-Runner delivers and installs the toilet, while waste is collected weekly by the brand Family's. Collected waste is composted at an off-site facility and used to enrich soils.	X-Runner					
	Service Models	**Community Health Clubs**	Community health clubs (CHCs) also known as community hygiene clubs are voluntary community-based organizations in Africa dedicated to improving public health through the promotion of hygiene. CHCs are formed at the village level	Africa AHEAD	Africa, Asia, Caribbean				Available
	Service Models	**Ekutir Svadha**		Ekutir	India		http://www.ekutirsb.com/svadha.html		Available
	Service Models	**East Meets West**		Thrive Networks					
▼	**Other Resources**								
	Other Resources	**Engineering for Change**		Engineering for Change			https://www.engineeringforchange.org/solutions/products		
	Other Resources	**PATH Sanitation Technology Filtering Tool**	The Sanitation Technology Filtering Tools help users identify appropriate sanitation technologies for their specific use case	PATH	n/a	Adam Drolet	www.path.org/resources/sanitation-technology-filtering-tools/		
	Other Resources	**eCompendium**		SANDEC			www.sandec.ch/ecompendium		
	Other Resources	**SuSanA**		Sustainable Sanitation Alliance			www.susana.org		
	Other Resources	**Sustainable Sanitation and Water Management Toolbox**		Sustainable Sanitation and Water Management Toolbox			https://sswm.info/catalogue		
	Other Resources	**Toilet Board Coalition**		TBC			www.toiletboard.org		
	Other Resources	**Transformative Technology Directory**		STeP			techdirectory.stepsforsanitation.org/		
▼	**Software / Analytics**								
	Software / Analytics	**Business Model Assessment of Sewage Treatment Plants**		STeP			stepsforsanitation.org/2016/04/business-...ge-treatment-plants/		
	Software / Analytics	**Sanitation Solutions: Business Models for Access**					stepsforsanitation.org/2016/03/the-sanit...s-models-for-access/		
▼	**Tools**								

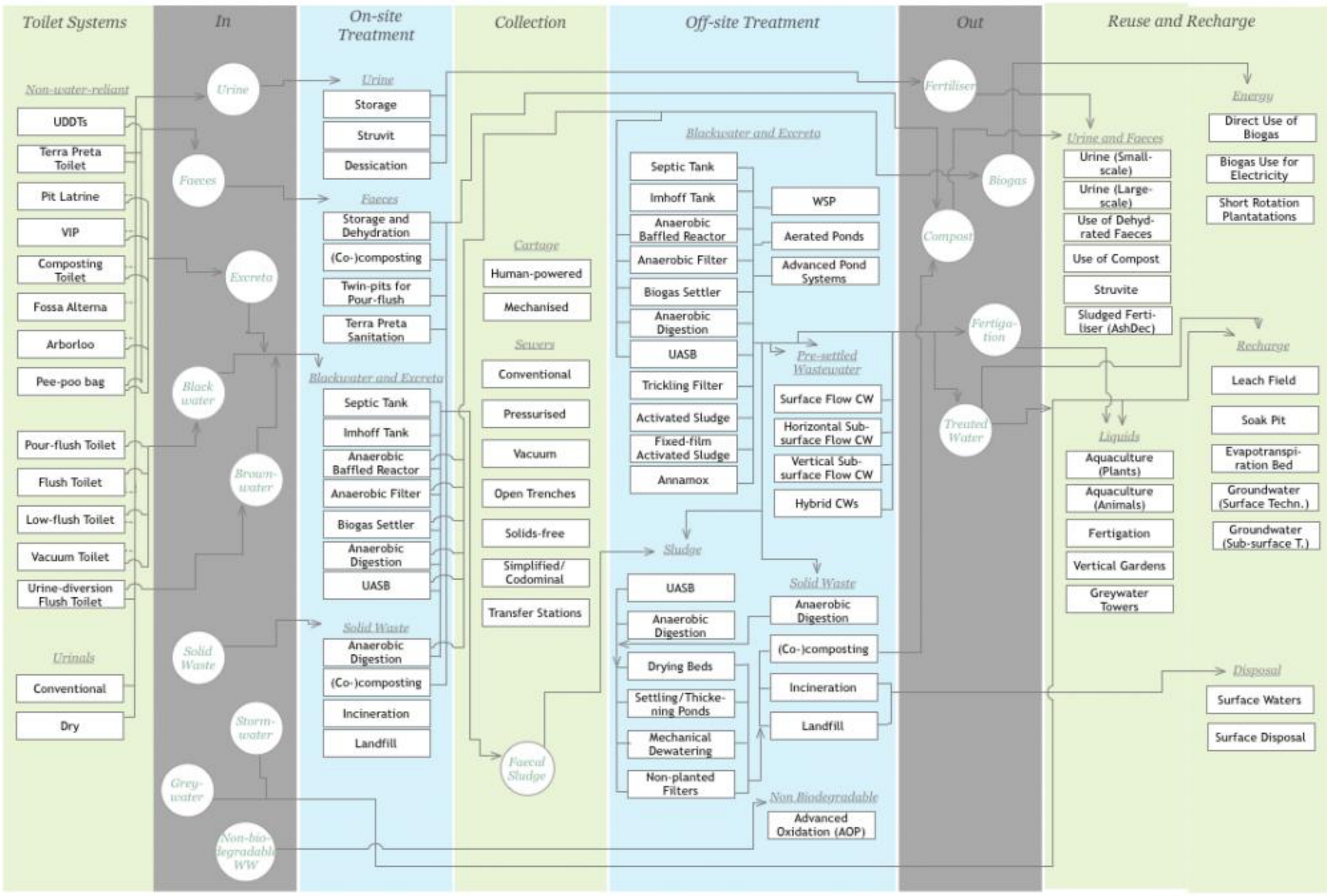
	Category	Name	Description	Organization	Region	Contact Info	URL	Funding Source	Status
	Tools	**Manual Cone Penetrometer**	Simple means to determine fecal sludge strength	Mott MacDonald, Mzuzu University, North Carolina State University					Available
▼	**Explanation**								
	Explanation	***New content / Revised**							
	Explanation	**HRS = High Resource Setting**							
	Explanation	**LRS = Low Resource Setting**							
►	**(blank)**								

Table 1

• Omni-Ingestor (Synapse)	https://docs.gatesfoundation.org/documents/Reinvent%20the%20Toilet%20Fair%20India%202014%20Technical%20Guide.pdf			
• 2 Plasma Gasifier (Delft)				
• 3 Biochar (Climate Foundation)				
• 4 Biological filter toilet (eawag)				
• 5 Sand smoldering (Toronto Univ.)				
• 6 Pyrolysis of mixed waste (Unilever)				
• 7 Solar dry/ biochar/fuel cell (Univ. Singapore)				
• 8 Solar portaloo (Santec)				
• 9 Sol-char toilet (Univ. Colorado Boulder)				
• 10 Nanomembrane Toilet (Cranfield Univ.)				
• 11 Supercritical Oxidation (Duke)				
• 12 Microbial fuel cell (and others) (Asian Inst. Technology)				
• 13 Hydrothermal Carbonisation HTC (Loughborough University)				
• 14 eToilet (ERAM)				
• 15 Waterless Toilet (RTI)				
• 16 PV Powered Domestic Toilet and Wastewater Treatment (Caltec)				
• 17 Omni-Processor, dryer/ incinerator (Janicki)				
• 18 Pour-flush toilets				
• 19 Flush toilets				
• 20 Urine diversion flush toilet				
• 21 Low-flush toilet				

• 22 Vacuum toilet				
23 Overhung latrine				
24 Flush urinals				
25 Waterless urinals				
26 Urine diversion components 27 Pit latrine				
28 Ventilated improved pit (VIP)				
29 Urine-diversion dehydration toilets (UDDT) 30 Composting toilet				
31 Fossa Alterna				
32 Terra Preta				
33 Peepoo				
34 Twin-pits				
35 Cesspit				
36 Urine storage				
37 Drying and storage of faeces				
38 Composting (small scale)				
39 Septic tanks				
40 Compost filter				
41 Anaerobic digestion (small scale)				
42 Imhoff tank				
43 Biogas settlers				
44 Anaerobic baffled reactor				
45 Anaerobic filter				
46 Septic tanks				
47 Upflow anaerobic sludge reactor				
48 Anaerobic digestion (large scale)				
49 Rotating biological contactors				
50 Trickling filters				
51 Aerated ponds				
52 Advanced integrated ponds				
53 Aquaculture (plants)				
54 Aquaculture (animals)				
55 Free-surface constructed wetland 56 Horizontal flow constructed wetland 57 Hybrid constructed wetland				
58 Non-planted filters (sand/ gravel)				
59 Activated sludge treatment				
60 Fixed film activated sludge				
61 Membrane bioreactor				
62 Membrane filtration				
63 Anammox				
64 Struvite				
65 Composting (large scale)				
66 Anaerobic digestion (general)				
67 Terra Preta Sanitation				
68 Drying beds				
69 Thinkening ponds				
70 Mechanical dewatering				
71 Advanced nutrient recovery 72 Incineration (small scale)				
73 Incineration (large scale)				
74 Landfill				
75 Simplified & condominal sewers				
76 Transfer and discharge stations				
77 Human powered emtying & transport				

78 Motorised emptying & transport				
79 Urine fertilisation (small scale)				
80 Urine fertilisation (large scale)				
81 Fertiliser from Urine (struvite)				
82 Fertiliser from sludge				
83 Use of dehydrated faeces				
84 Use of compost				
85 Arboloo				
86 Heat recovery from sludge				
87 Direct use of biogas				
88 Biogas electricity (small scale/large scale)				


Toilet Systems
In
On-site Treatment
Collection
Off-site Treatment
Out
Reuse and Recharge
Non-water-reliant
UDDTs
Terra Preta Toilet
Pit Latrine
VIP
Composting Toilet
Fossa Alterna
Arborloo
Pee-poo bag
Pour-flush Toilet
Flush Toilet
Low-flush Toilet
Vacuum Toilet
Urine-diversion Flush Toilet
Urinals
Conventional
Dry
Urine
Faeces
Excreta
Black water
Brown-water
Solid Waste
Storm-water
Grey-water
Non-bio-degradable WW
Urine
Storage
Struvit
Dessication
Faeces
Storage and Dehydration
(Co-)composting
Twin-pits for Pour-flush
Terra Preta Sanitation
Blackwater and Excreta
Septic Tank
Imhoff Tank
Anaerobic Baffled Reactor
Anaerobic Filter
Biogas Settler
Anaerobic Digestion
UASB
Solid Waste
Anaerobic Digestion
(Co-)composting
Incineration
Landfill
Cartage
Human-powered
Mechanised
Sewers
Conventional
Pressurised
Vacuum
Open Trenches
Solids-free
Simplified/ Codominal
Transfer Stations
Faecal Sludge
Blackwater and Excreta
Septic Tank
Imhoff Tank
Anaerobic Baffled Reactor
Anaerobic Filter
Biogas Settler
Anaerobic Digestion
UASB
Trickling Filter
Activated Sludge
Fixed-film Activated Sludge
Annamox
WSP
Aerated Ponds
Advanced Pond Systems
Pre-settled Wastewater
Surface Flow CW
Horizontal Sub-surface Flow CW
Vertical Sub-surface Flow CW
Hybrid CWs
Sludge
UASB
Anaerobic Digestion
Drying Beds
Settling/Thicke-ning Ponds
Mechanical Dewatering
Non-planted Filters
Solid Waste
Anaerobic Digestion
(Co-)composting
Incineration
Landfill
Non Biodegradable
Advanced Oxidation (AOP)
Fertiliser
Biogas
Compost
Fertiga-tion
Treated Water
Urine and Faeces
Urine (Small-scale)
Urine (Large-scale)
Use of Dehyd-rated Faeces
Use of Compost
Struvite
Sludged Ferti-liser (AshDec)
Liquids
Aquaculture (Plants)
Aquaculture (Animals)
Fertigation
Vertical Gardens
Greywater Towers
Energy
Direct Use of Biogas
Biogas Use for Electricity
Short Rotation Plantatations
Recharge
Leach Field
Soak Pit
Evapotranspi-ration Bed
Groundwater (Surface Techn.)
Groundwater (Sub-surface T.)
Disposal
Surface Waters
Surface Disposal