

Reinvented Toilets Opportunity Overview



ALL LIVES HAVE EQUAL VALUE

An introduction to the Bill & Melinda Gates Foundation



BMGF/WSH Transformative Technology Development and Commercialization

BMGF has prioritized the transformation of sanitation for over 10 years

Catalytic event

Technology deployment



BMGF launches the “Reinvent the Toilet” Challenge, awarding grants to 16 researchers to design a new NSS solution



UN Sustainable Development Goals (SDG) are adopted, incl. 6.2 which prioritizes access to safe sanitation for all



Reinvented Toilet Expo, hosted in Beijing, announces RT products and funding commitments to drive adoption of RTs



CRTs demonstrations live in China and South Africa



HRT testing units deployed in US, India, France, and South Africa

2011

Reinvent the Toilet Challenge: China, \$5M committed

2014

Reinvent the Toilet Challenge: India, partnered with India’s Ministry of Science and technology

2017



First omni-processor demonstrated in Senegal

2020



Omni-processor Live operation in WuHe, China, with Beijing Feb. 7, CO., Ltd.

Today

2023

Omni-processor to be deployed in Rohingya Refugee Camp

South Africa, Sanitation Appropriate for School - SAFE

India’s Swachh Bharat Mission and ongoing implementation

China’s Toilet Revolution

Transformative Technology Commercialization

DEVELOP SUPPLY:

Develop compelling products and validate their commercial application to create a supply of NSS solutions

REDUCE RISK:

For new sanitation technologies, reduce the risk of market entry for commercial partners

STIMULATE EARLY MARKET

Stimulate the growth of a market ecosystem that drives demand for non-sewered sanitation industries in Launch countries early adopters' market

We try to be thoughtful about the role of philanthropy – and one of the things we're best placed to do is lower barriers and risk for the private sector and for governments to adopt new solutions to solve big problems.

Bill Gates, RTE, Beijing, Nov. 6, 2018

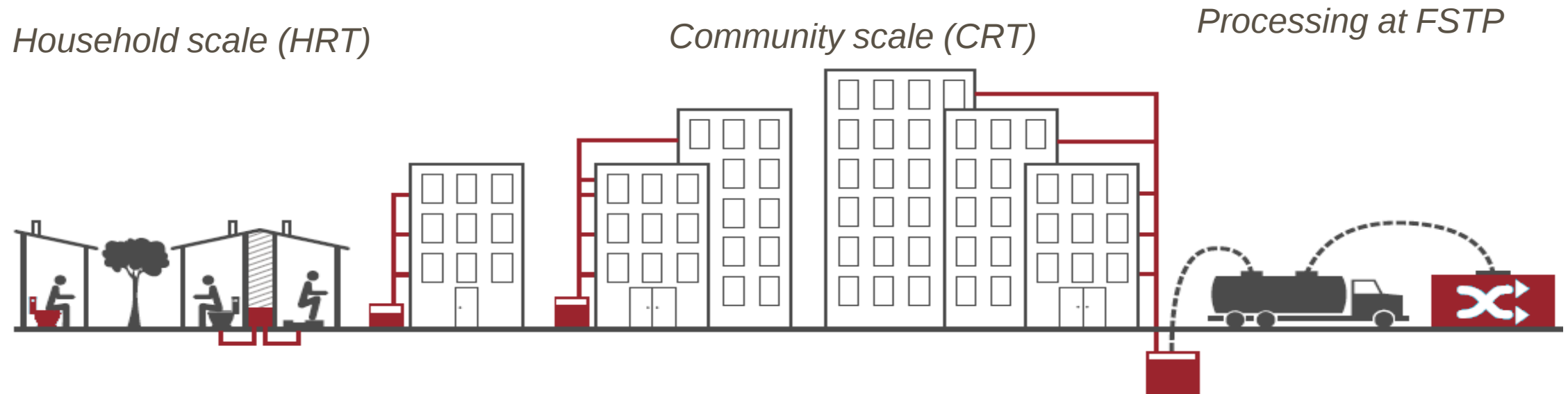




Our Transformative Technology Portfolio

REINVENTED TOILET

OMNI PROCESSOR



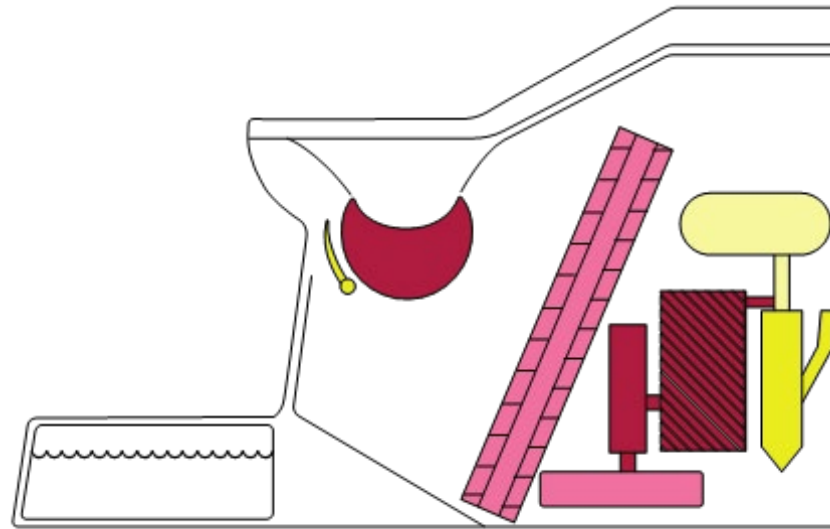
The Reinvented Toilet program is designed to address each of today's limitations

Eliminate pathogens

- Eliminate safety concerns via handling
- Reduce disease burden
- Improve environmental safety

Convey low life-cycle costs

- Reduce need for pit emptying
- Ensure a sustainable business model, including maintenance via service providers



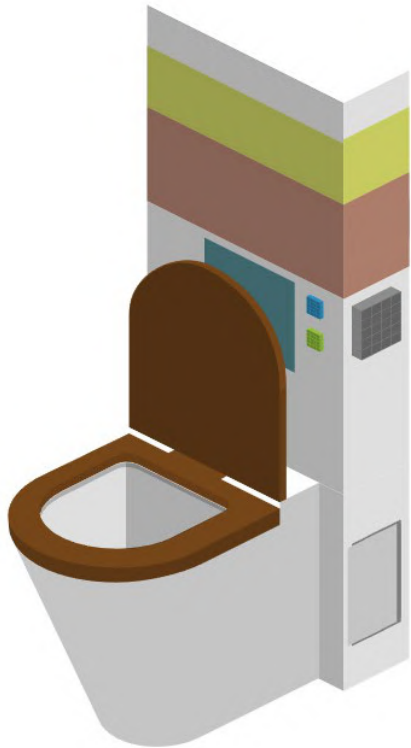
Operate off grid

- Eliminate need for external inputs such as water and energy
- Make portable and easy to install

Present modular, attractive interface

- Reduce / eliminate construction costs
- Provide clean and dignified product
- Eliminate odors and waste

BMGF has invested in the Reinvented Toilet (RT) as part of its commitment to improve sanitation globally



RTs are a new generation of toilets that treat waste and kill pathogens without the need for connections to sewers, treatment plants, water supply, or continuous electricity



These new sanitation solutions use a variety of innovative technologies to break down human waste and eliminate dangerous pathogens, leaving behind clean water and solids that won't harm people or the environment



Reinvented toilets can be used by individual households (Household RT or "HRT") or in multiple stall facilities serving local communities, schools, apartment buildings, and commercial facilities (Community RT or "CRT")



These systems all treat blackwater. In the future, certain systems may also treat greywater or offer solids or liquids-only treatment for specific scenarios (e.g., solids-free sewers, transportation vehicles)



RT design goals:

- 1 kWh of electricity
- \$450 capex and \$0.15/day opex
- Requires no plumbing or sewerage
- Safely recycles water for flushing
- Operation requires no behavioral change for users and accommodates squatting or sitting preferences
- **Can be adapted to cold and dry climate**



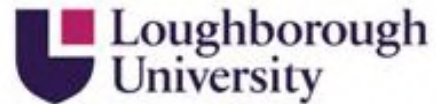
Our core RT processing technologies

Electrochemical



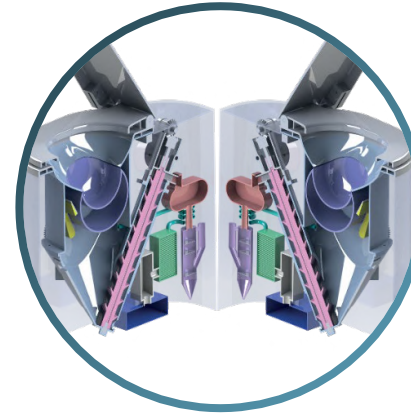
Caltech

Wet oxidation



eawag
aquatic research ooo

Dry combustion

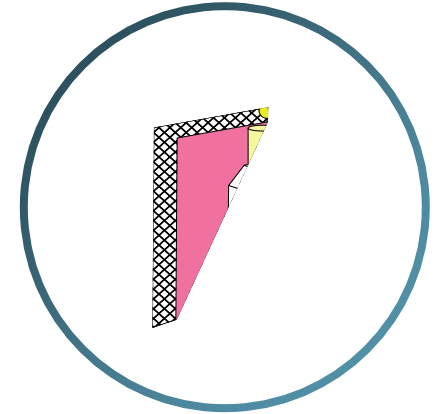


Cranfield
UNIVERSITY



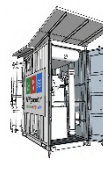
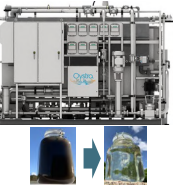
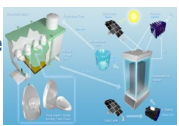
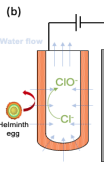
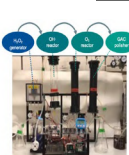
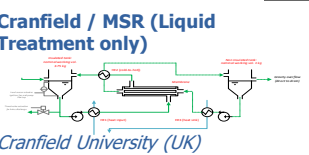
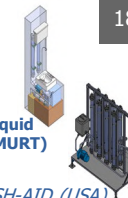
JANICKI BIOENERGY

Biological



Overview of opportunities

- MORE THAN 19 ADVANCED TECHNOLOGIES ARE LOOKING FOR COMMERCIAL PARTNERS.
- 24 LICENSES SIGNED SINCE 2019

Single-Use Reinvented Toilet HTClean Helbling (Switzerland) helbling 	Single-Use Reinvented Toilet Firelight Toilet Sedron Technologies (USA) SEDRON TECHNOLOGIES 	Multiple-Use Reinvented Toilet Integrated Unit Back End Yinxing Eco-Sanitary (China) Eco-san 	Multiple-Use Reinvented Toilet NEW generator 100/1000 University of South Florida (USA) USF UNIVERSITY OF SOUTH FLORIDA 	Multiple-Use Reinvented Toilet TT-1, TT-3, TT-5B TT-6 Clear Technology (China) CLEAR 
Omni Ingestor (OI) Oystra® Crane Engineering (USA) CRANE ENGINEERING 	Omni Processor (OP) Large OP- JOP JOP/ OP CS50 Processor CRRC / Beijing Feb. 7th Locomotive Industry (China) 27 	Omni Processor (OP) Large OP- SCWO Supercritical Water Oxidation Sys. (SCWO) Duke University (USA) Duke UNIVERSITY 	Omni Processor (OP) Small OP- POP 5 Biogenic Refinery Models Biomass Controls PBC (USA) BIOMASS CONTROLS INC 	
Components Entrustech ETEST (plate electrode) Yinxing Entrustech (China) 恩创环保 Caltech (USA) Caltech 	Components Reactive Electrochemical Membrane (REM) Caltech (USA) Caltech 	Components Seva Self-diagnosis and smart maintenance solution Caltech (USA) Caltech 	Components Trash Excluder North Carolina State University (USA) NC STATE UNIVERSITY 	Components Front-end Cranfield / MSR (Front End) Module Cranfield University (UK) in partnership with MSR CascadeDesigns Cranfield UNIVERSITY 
Interface Urine Trap EOOS (Austria) EOOS 	Liquid only CalTech Electrochemical Reactor - Ultron Liquid Treatment System Caltech (USA) Caltech 	Liquid only Cranfield / MSR (Liquid Treatment only) Cranfield University (UK) Cranfield UNIVERSITY 	Liquid only Reclaimer Liquid Treatment Module (SURT), Reclaimer (SURT), Reclaimer Liquid Treatment Module (MURT) Duke Center for WaSH-AID (USA) Duke WaSH-AID 	Liquid only UWE Pee Power - Microbial fuel Cell (MFC) technology that turning urine into electrical power Bristol BioEnergy Centre, University of the West of England (UWE) UWE BRISTOL 

Households Reinvented Toilets Products/Technologies in the pipeline

All systems use combustion for solids processing, recycle water for flushing, and can fit indoor bathroom, or configured to have the treatment systems outside, in cold or dry climate.



Designed by Georgia Tech
Tech transfer/licensing in process



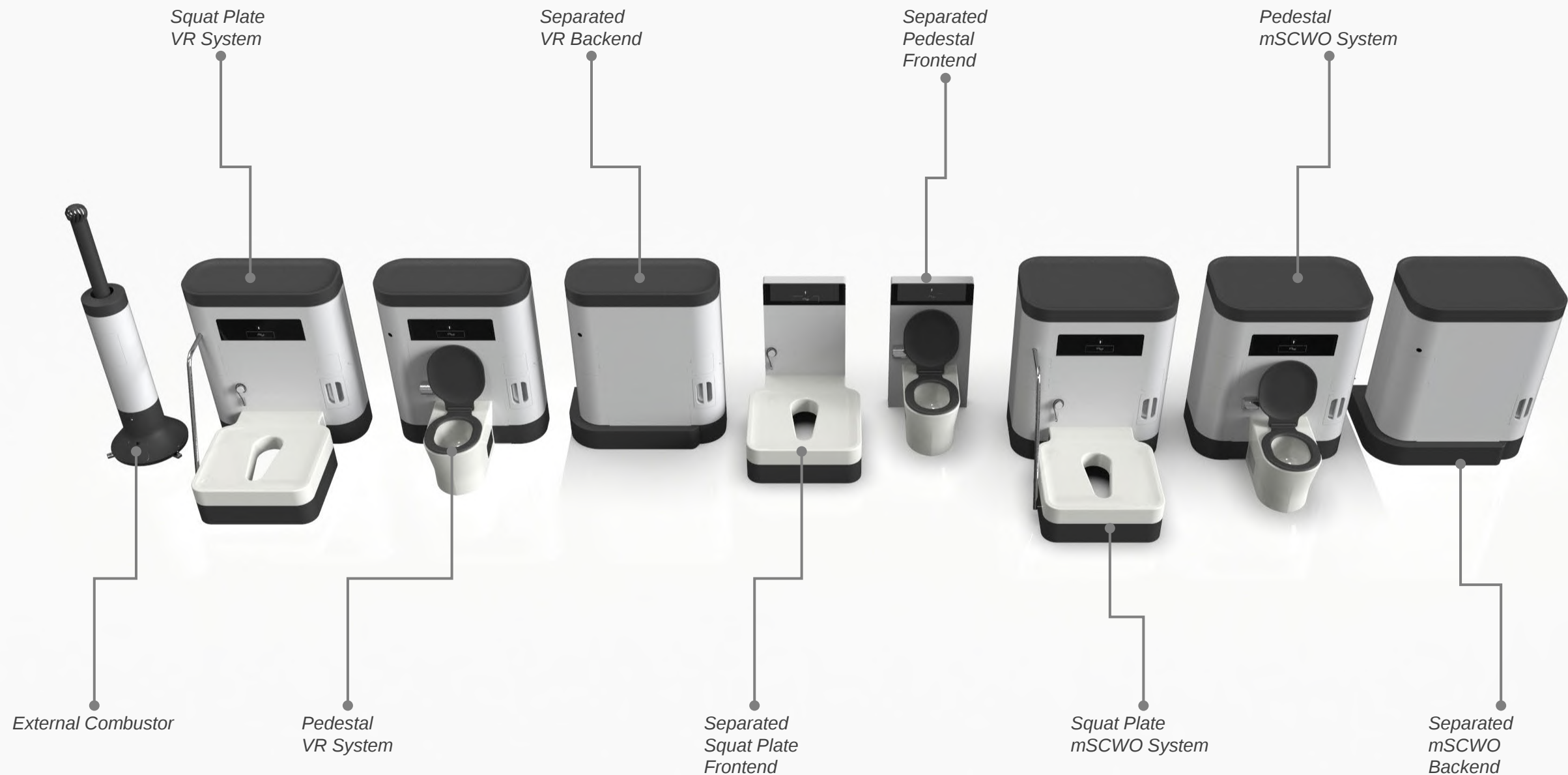
Designed by Cranfield University,
licensed by Huatie and JOMOO



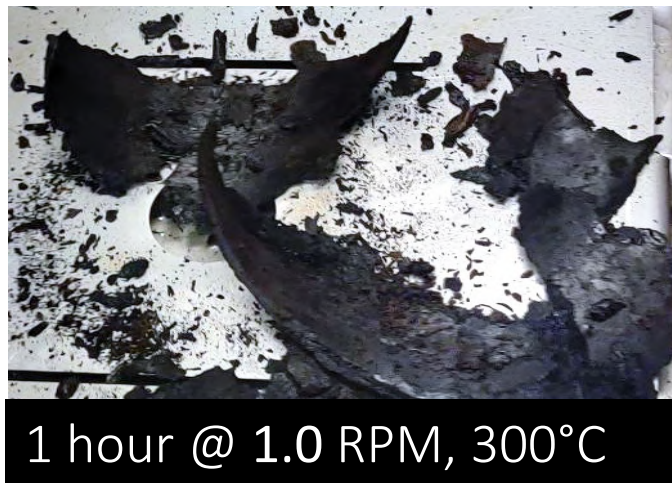
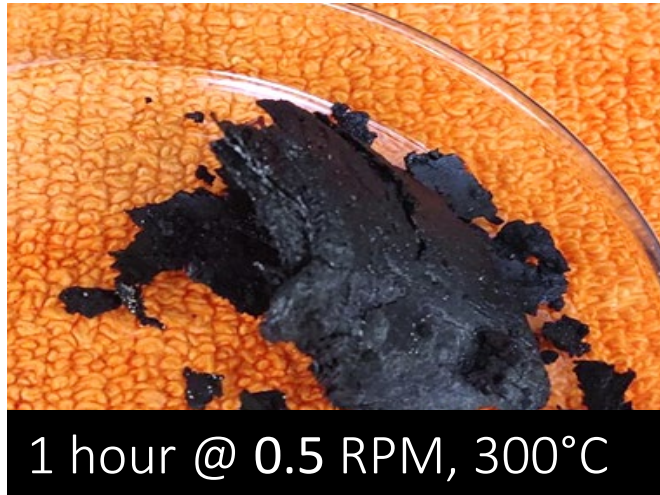
Designed by Samsung /
SAIT tech
transfer/licensing in process



Georgia Tech RT Product Portfolio



Example of solids output for safe discharge



- No pathogens
- Treated to meet ISO 30500 specs
- Safe to discharge in waste bin or garden/plants
- Safe to recycle water for flushing

Example of liquid output for safe reuse for flushing



Liquid
Waste
Feed

Cold Tank at
Start (Tap Water)

Distillate from
Overflow Weir

Distillate from
Carbon Filter

ISO 30500 Standard

Adopted in 29 countries including: USA, Canada, France, South Africa, Senegal, China (soon), Brazil, etc.



TÜV SÜD Water Services| Certification for ISO 30500

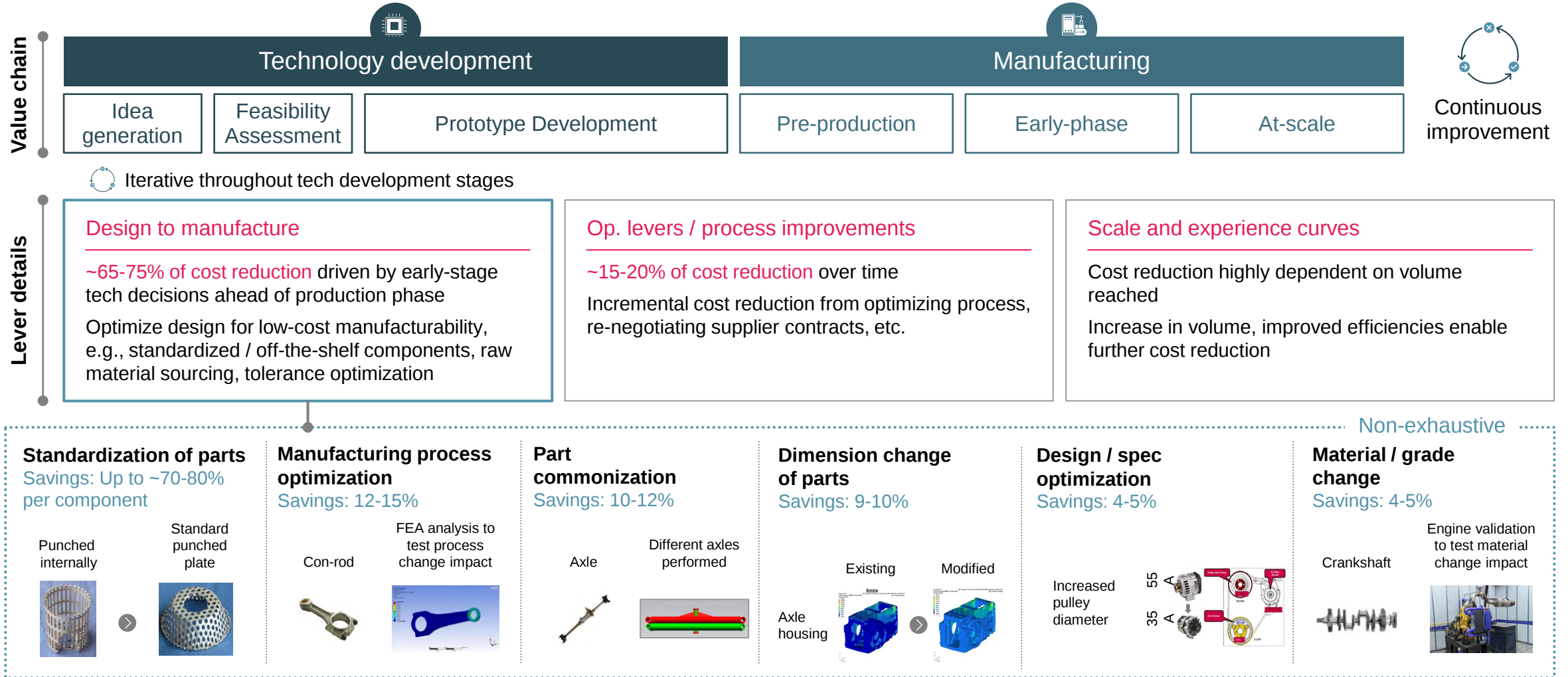
The image shows a sample certificate template for TÜV SÜD ISO 30500 certification. The certificate is titled "CERTIFICATE" and includes the following fields:

- No. [#CERT_NO#]
- Holder of Certificate: [#CERT_HOLDER#]
- Production Facility(ies): [#FACTORY#]
- Certification Mark: [Certification Mark]
- Product: [#PRD_TERM#] [#ADD_PRD_TERM#]
- Model(s): [#MODEL#]
- Parameters: [#PARAMETERS#]
- Brand Name: [#BRAND_NAME_T#]
- Tested according to: [#TEST_REQ#]
- Test report no.: [#ORDER_NO#]
- Valid until: [#VALID_UNTIL#]
- Date, [#ISSUE_DATE#] [#TC_NAME#]

The certificate also includes a disclaimer: "The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf."

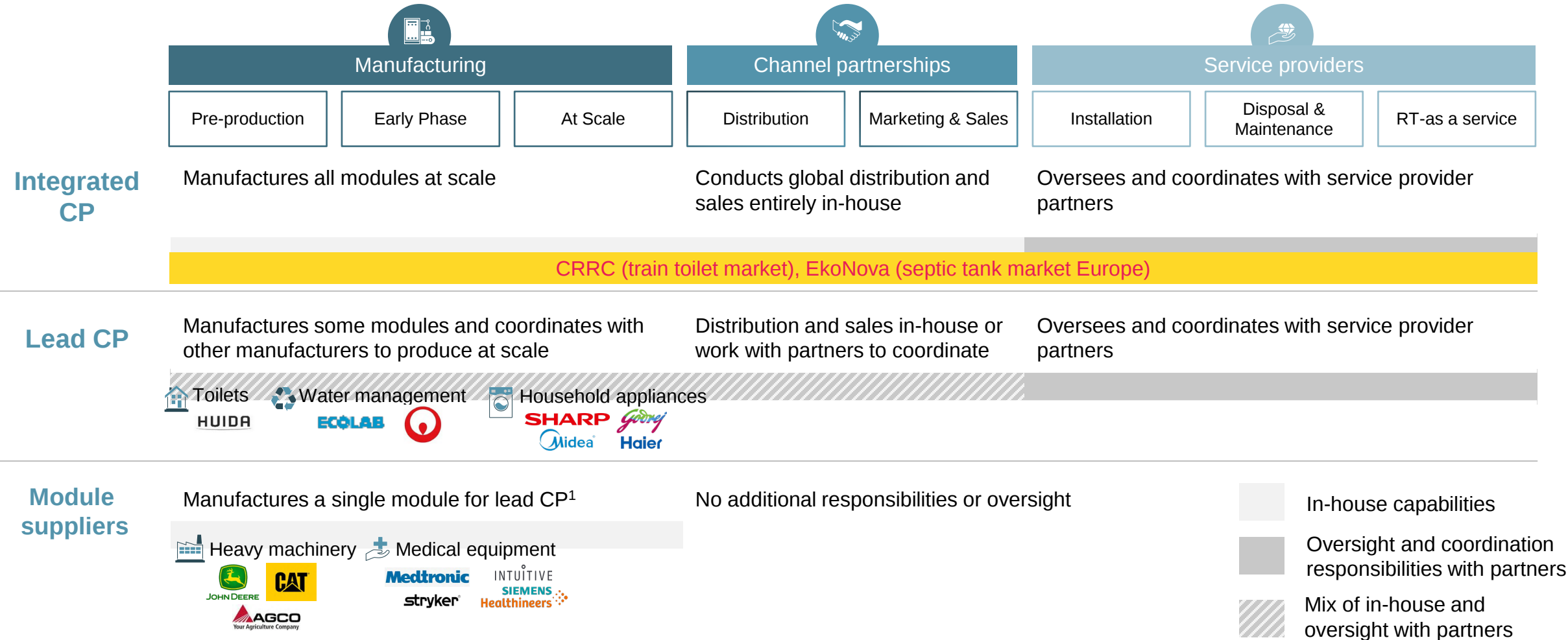
The certificate is signed by TÜV SÜD Product Service GmbH, Certification Body, located at Ridlerstraße 65, 80339 Munich, Germany. The page is labeled "Page 1 of 1".

Supply | Three key supply-side levers to drive down RT manufacturing costs over time, majority of which should be reduced before initiating production



EP starter list for engagement provided in the Appendix with expertise and priority

CP ecosystem analyses identified several potential archetypes which inform how to potential roles for different CPs



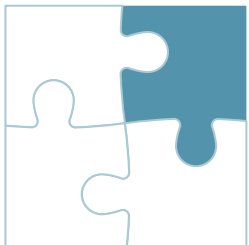
Anticipated configuration comprised of a lead CP, several module CPs, and other channel and service provider partners

We are looking for commercial partners that bring expertise along the RT value chain and anticipate two key roles - lead CP and module supplier



Lead CP

Manufactures some modules and coordinates with other manufacturers to produce at scale



Module Supplier

Manufactures a single module for the lead CP e.g., back-end solid or liquid processing units

Value Chain Category	Expected capabilities	Lead	Module
Manufacturing	Experience manufacturing consumable products	✓	
	Targeted technology expertise relevant to RT modules		✓
	Experience manufacturing multiple product lines	✓	
	Significant in-house production capacity to produce RTs at scale	✓	✓
	High quality and safety assurances	✓	✓
	Ability to modify design based on regional or local preferences	✓	✓
Partnerships (channel and service providers)	Strong existing presence or partnerships in consumable products	✓	
	Existing geographic footprint across target markets (including India, Indonesia, South Africa, Nigeria, and China)	✓	
	Experience managing service and repair providers	✓	
	Experience collaborating with multiple manufacturing stakeholders	✓	✓

Capabilities and potential synergies specific to the CP's industry

Industry	Current capabilities (to keep in mind during discussion)	New synergies (for slide 14 updates)
Waste and Water Management	• Working with and deep knowledge of sanitation systems • Using or developing chemicals for water cleaning and hygiene • Integrating different products, from chemicals to large-scale machinery	• Develop new sanitation chemicals or methods that meet the strictest ISO standards at a household level • Become market leader and disruptor in an industry ripe for innovation
Toilets	• Designing, manufacturing and selling traditional toilet and sanitation technology • Marketing brand directly to customers	• Increase brand recognition and expanded distribution channels in growing markets • Become market leader and disruptor in the industry, which is ripe for innovation
Household Appliances	• Overseeing maintenance and repair services for households • Designing and manufacturing different household goods • Marketing brand directly to customers	• Increase brand recognition and expanded distribution channels in growing markets • Expand product line into RT and hygiene markets
Heavy Machinery	• Overseeing maintenance and repair services • Manufacturing and assembling many parts of complex products • Navigating government contracts and regulations	• Develop new sanitation chemicals or methods that might be marketable beyond RTs • Expand distribution channels in growing global markets
Medical Equipment	• Understanding of human health and hygiene • Manufacturing and assembling many parts of complex products • Navigating government contracts and regulations	• Develop new sanitation chemicals or methods that may be marketable beyond RTs • Expand distribution channels in growing global markets



RT configuration / use cases