



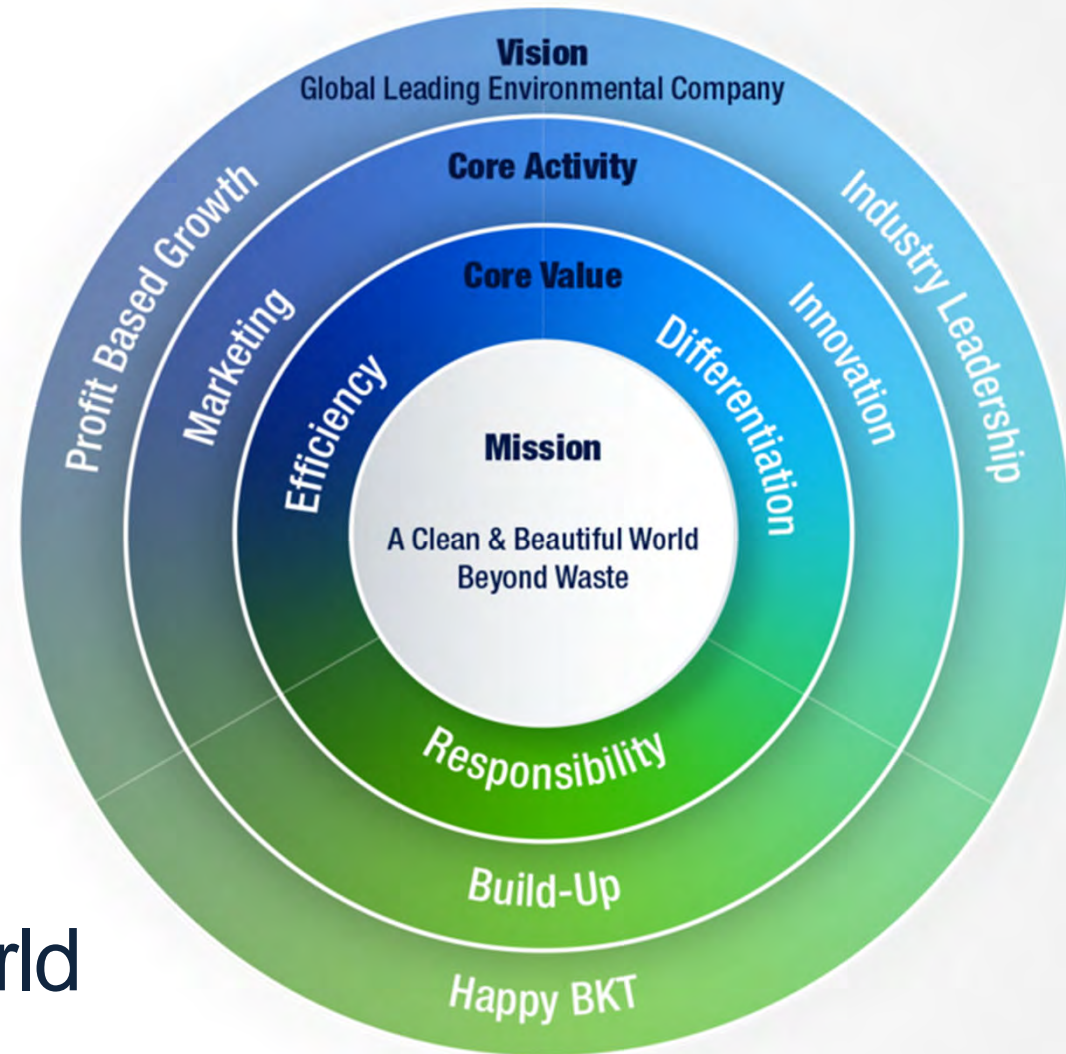
About Us

November 5, 2019

I. Introduction

I. Introduction – BKT Way

BKT Way



“ A Clean & Beautiful World
Beyond Waste ”

BKT Presence

I. Introduction – BKT Presence



1995 BKT Co. Korea

Daejeon, South Korea
*R&D and Engineering
Corporate Headquarters*

**2008 Tomorrow Water
DBA BKT United**

Anaheim, California, USA
*Global Sales & Marketing
Headquarters*

2014 BKT Vietnam

Hanoi, Vietnam
Manufacturing

Intellectual Resources

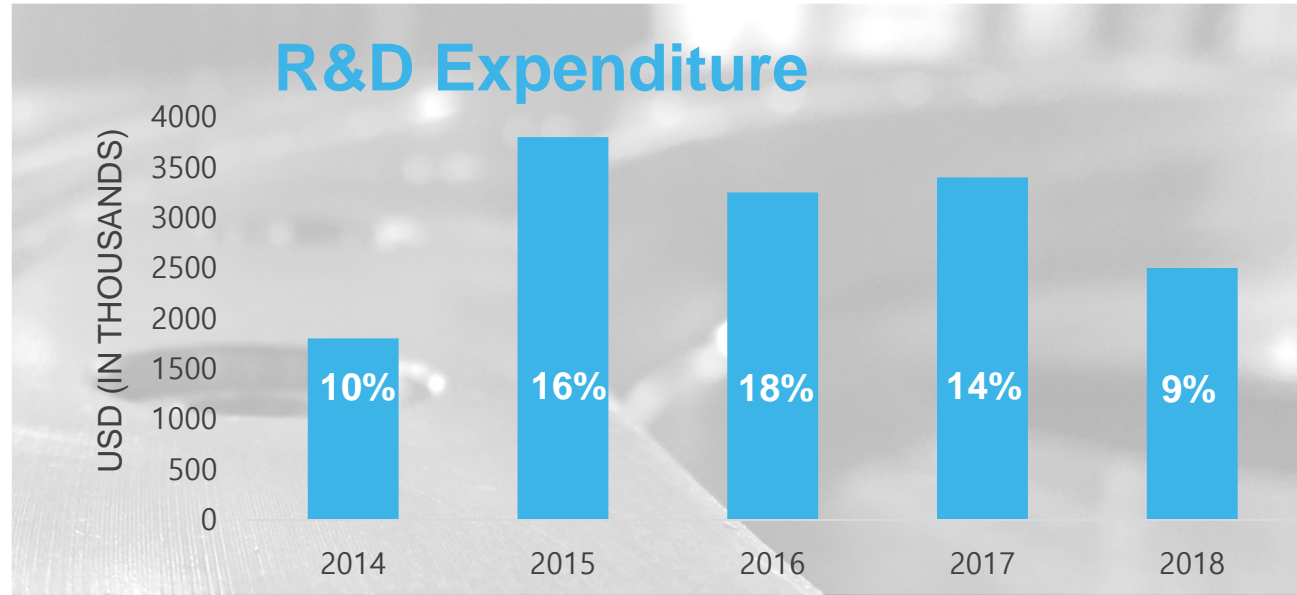
I. Introduction – Intellectual Resources

143 Registered Patents

40+ Government Funded R&D Projects

13% R&D Spending of Total Budget (5-year average)

Over **40%** Hold a Masters or PhD (of 109 employees)



SRI International



Dozens of Awards (Korean Top Tech Co, Best Workplace, Etc.)

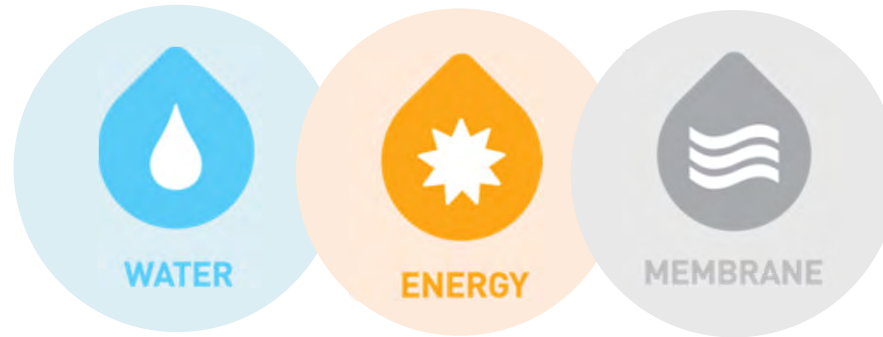
Organizational Structure

Team
Tomorrow



Team
Today

Business Portfolio



Today

Municipal | Livestock | Industrial Wastewater

Energy Production | Savings | Recovery

Biogas Plant | Energy Optimization Solutions, Turbo Blower
Organic Waste, Thermal Hydrolysis

Manufacturing Process (Membrane System)

Bio, Chemical, Food & Beverage

Tomorrow

Tomorrow Water

From Cost Stream To Profit Stream

Smart Water City

Water Adds Value to Cities

Water AI

AI for Sustainable Water Infrastructure

Go Together Project

Sustainability for the Livestock Industry

I. Introduction – Business Portfolio



II .Tomorrow Business

4 Core Strategy Initiatives



Tomorrow
Water Process

**From Cost Stream to
Profit Stream**



Smart Water
City

**Water Adds
Value to Cities**



Water AI

**AI for Sustainable
Water Infrastructure**

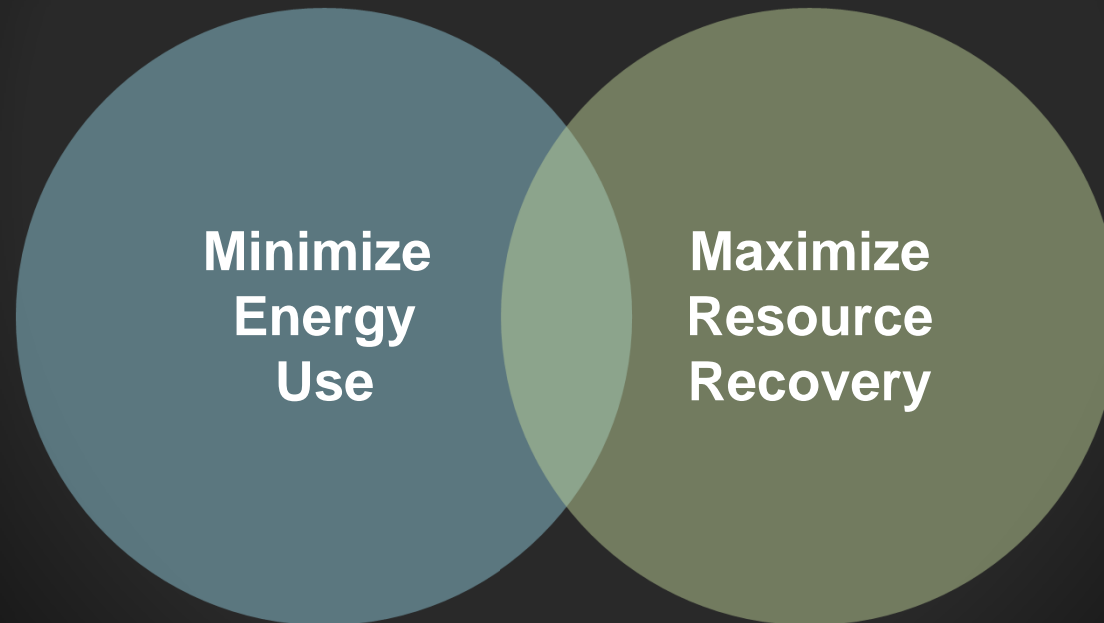


Go Together
Project

**Sustainability for the
Livestock Industry**

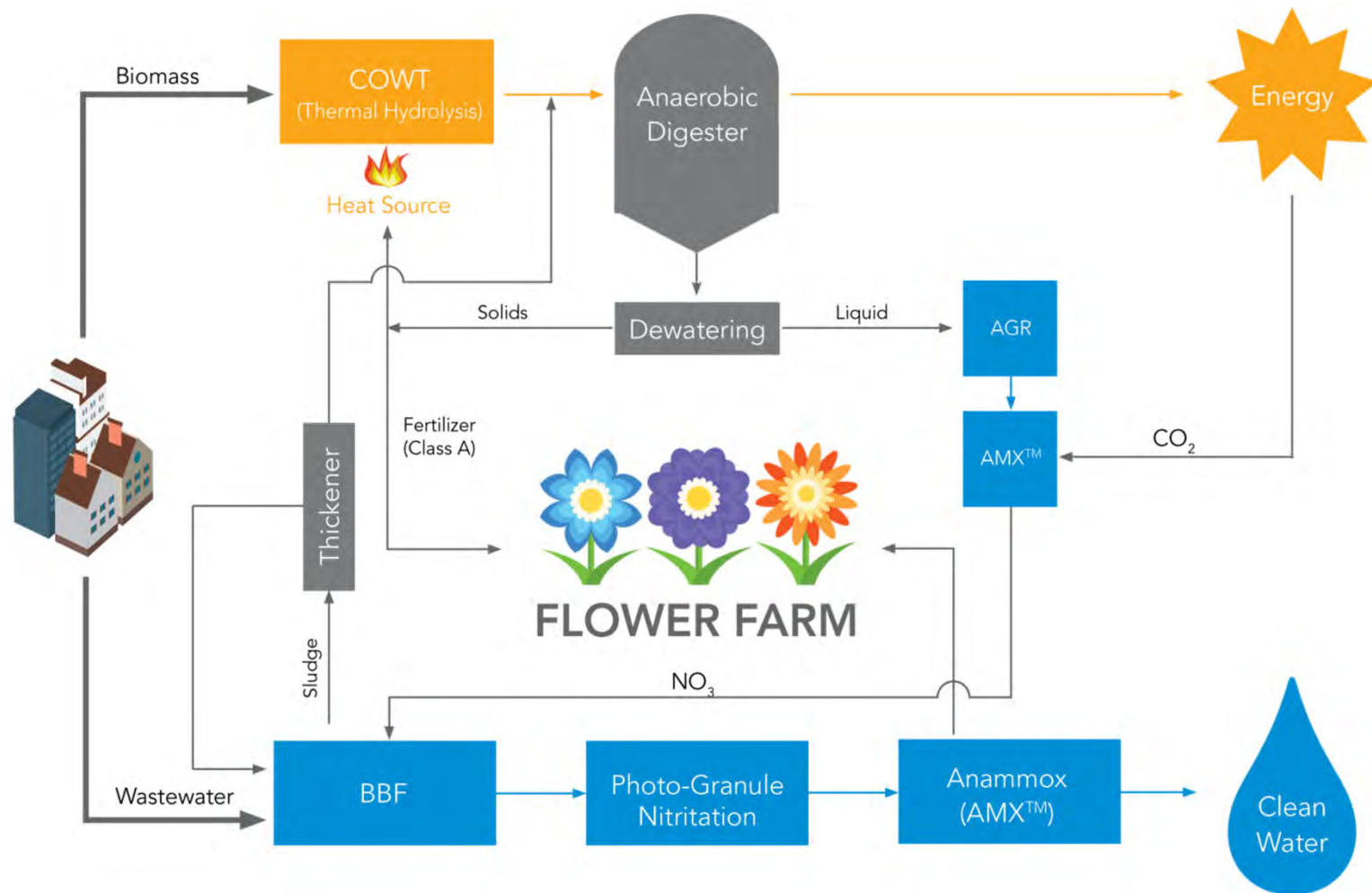
Tomorrow Water Process

From Cost Stream to Profit Stream



Tomorrow Water Process

II. Tomorrow Business – TWP



Tomorrow Water Process

II. Tomorrow Business – TWP



Officially registered as the [Tomorrow Water Initiative #12177](#)

UN Partnership for the SDGs Platform

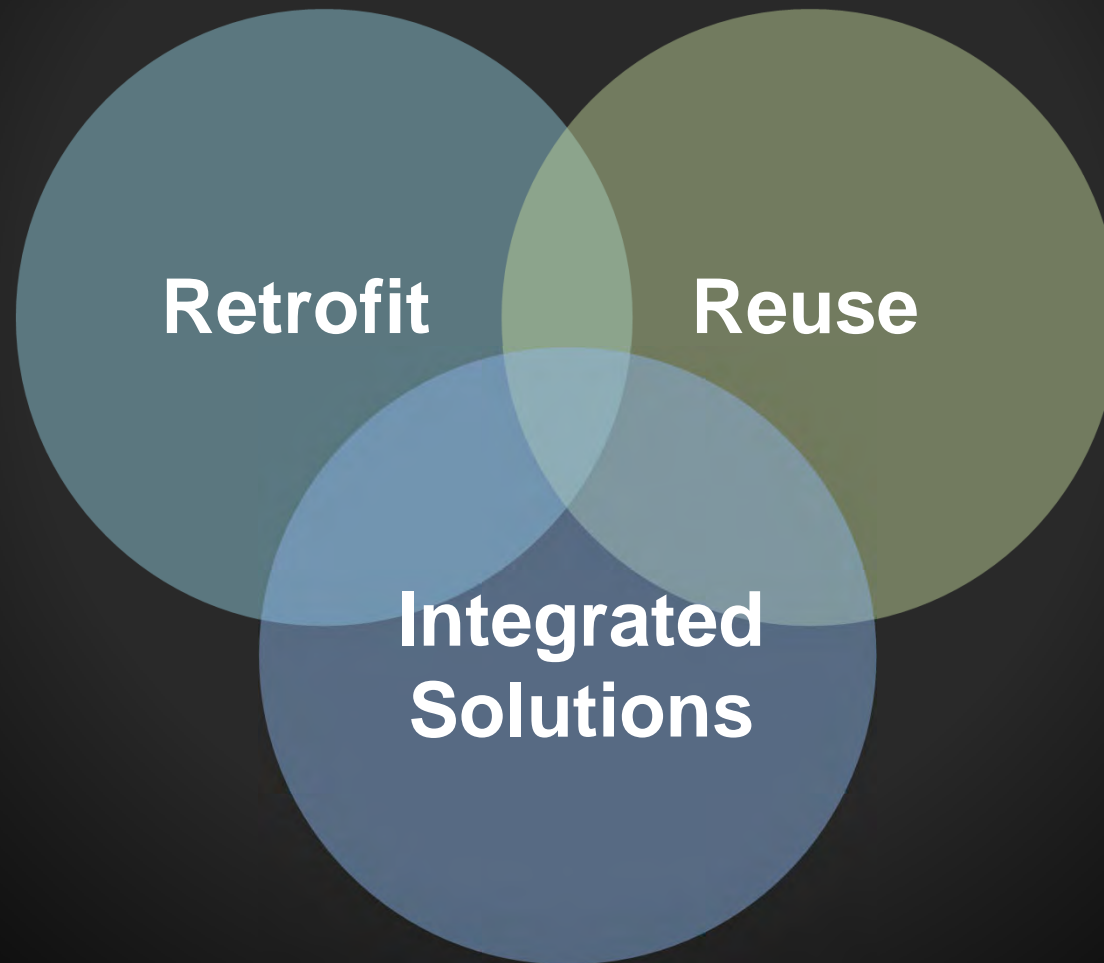


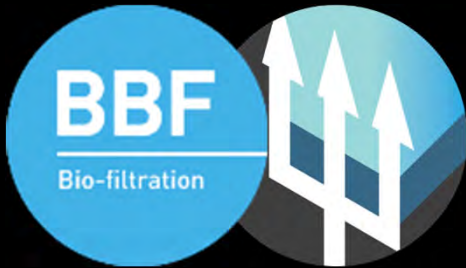
Accepted 2016 UN ECOSOC
High-Level Segment



Smart Water City

Water Adds Value to Cities





85%

Retrofitting the world's aging water infrastructure for resource recovery to save energy, land and water.

**Unlock Hidden Space
by Replacing Existing Primary Clarifiers**

Water Reuse & Revitalization

II. Tomorrow Business – Smart Water City

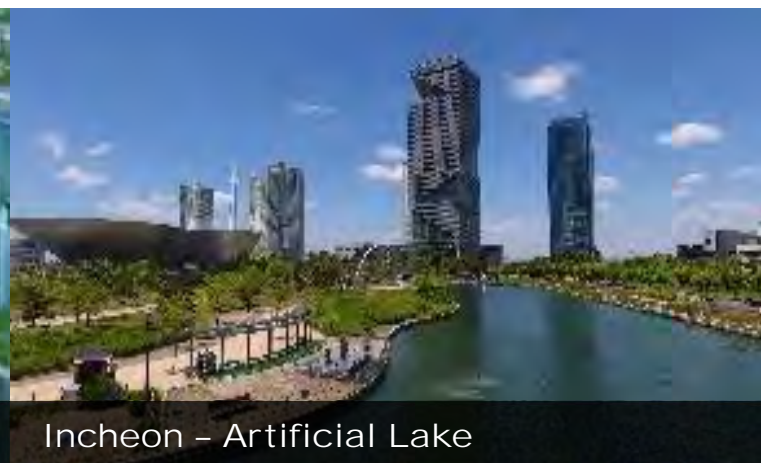
Using treated wastewater for mandmade lakes, streams, and services



- Property Values
- Recreation & Amenities
- Energy Savings
- Irrigation Management
- Green Spaces
- More Wildlife



- Heat Island Effect
- Air Pollution & Fine Dust



Water AI

AI For Sustainable Water Infrastructure

Proposal & Design

IoT
Big Data
AI

Construction

3D Printing

Operation

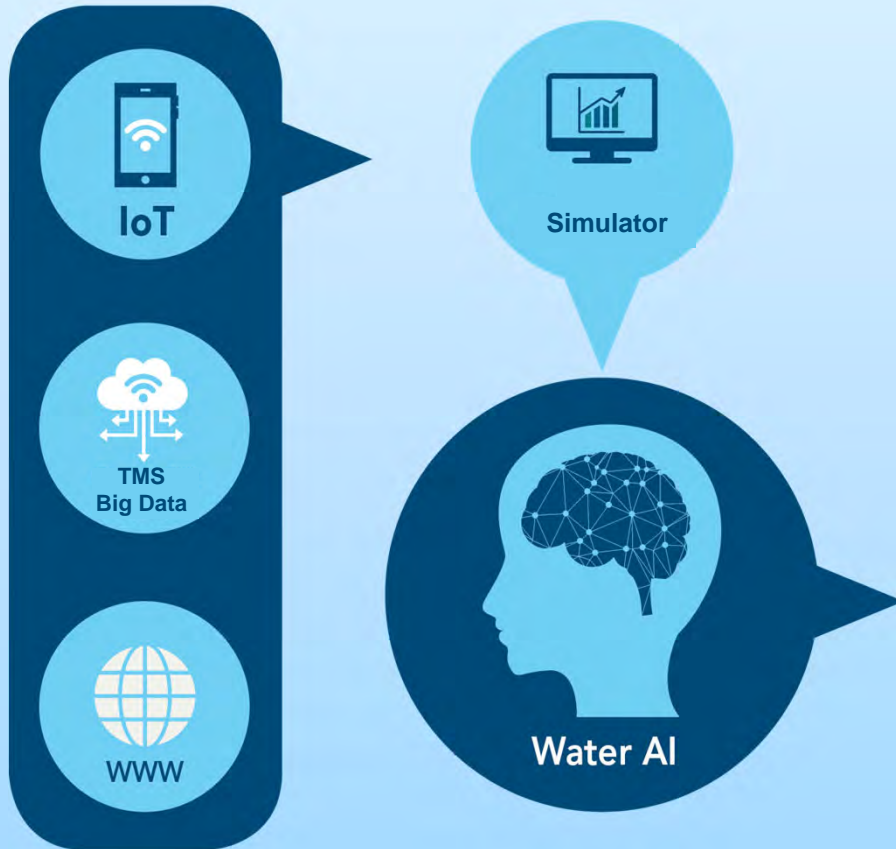
Digital Twin



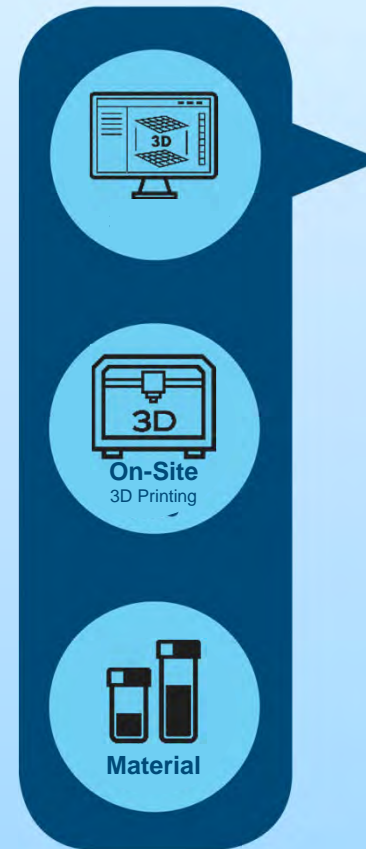
Water Industry 4.0

II. Tomorrow Business – Water AI

Proposal & Design



Construction

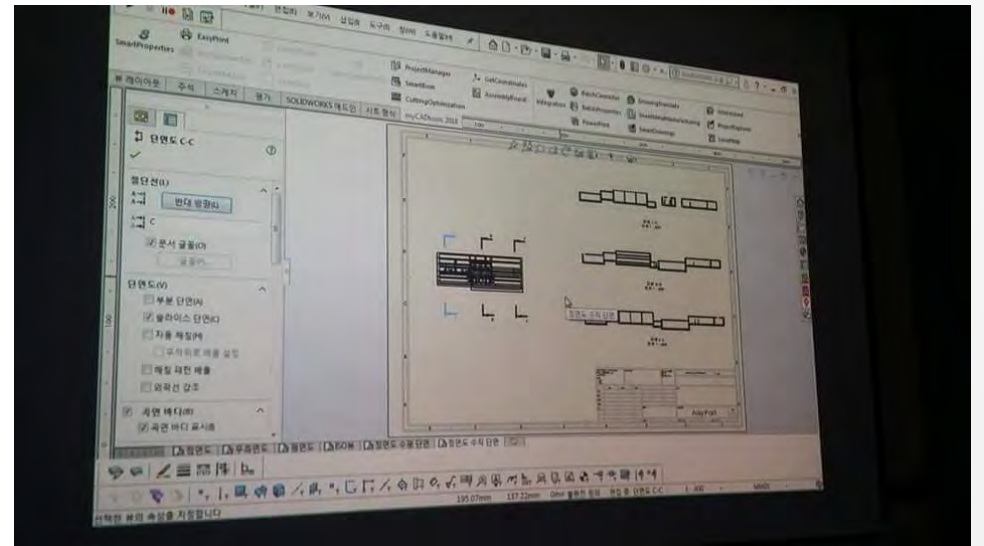
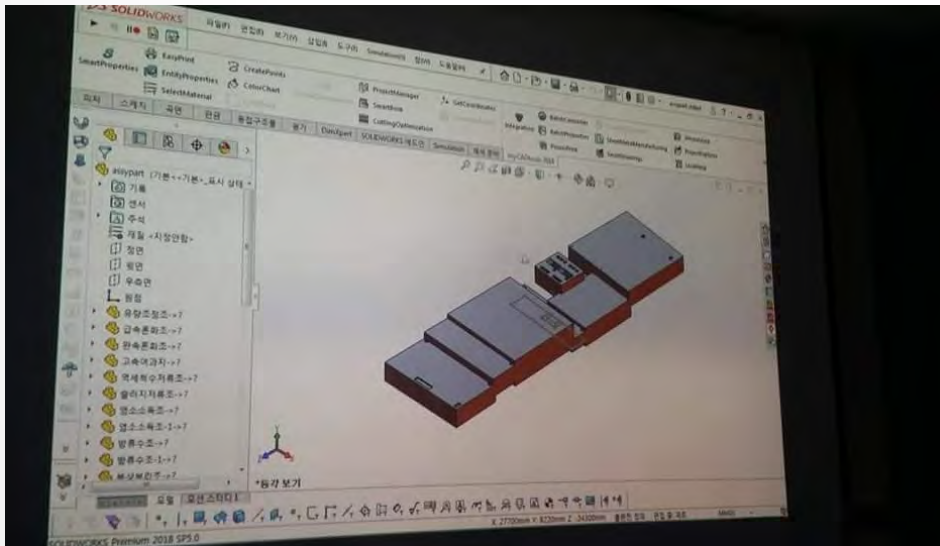
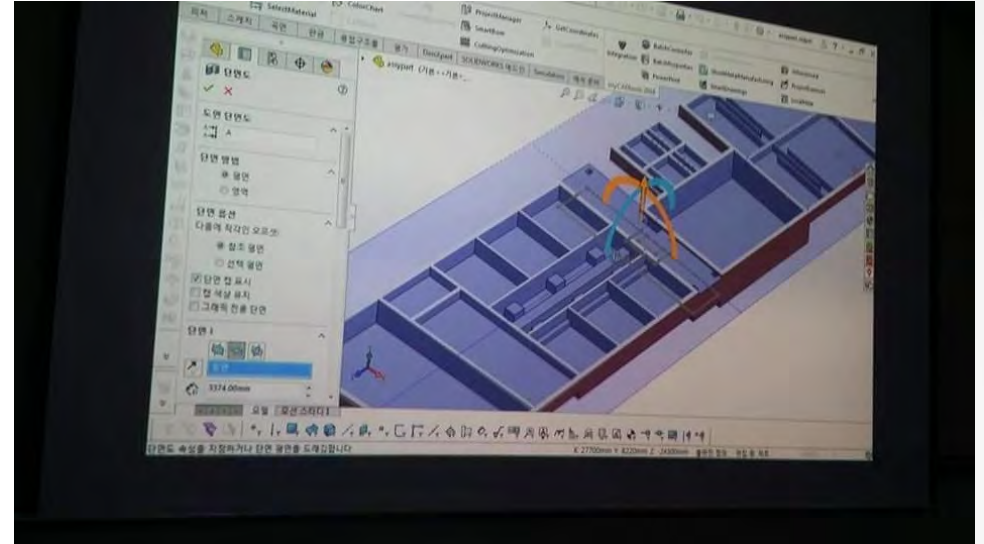
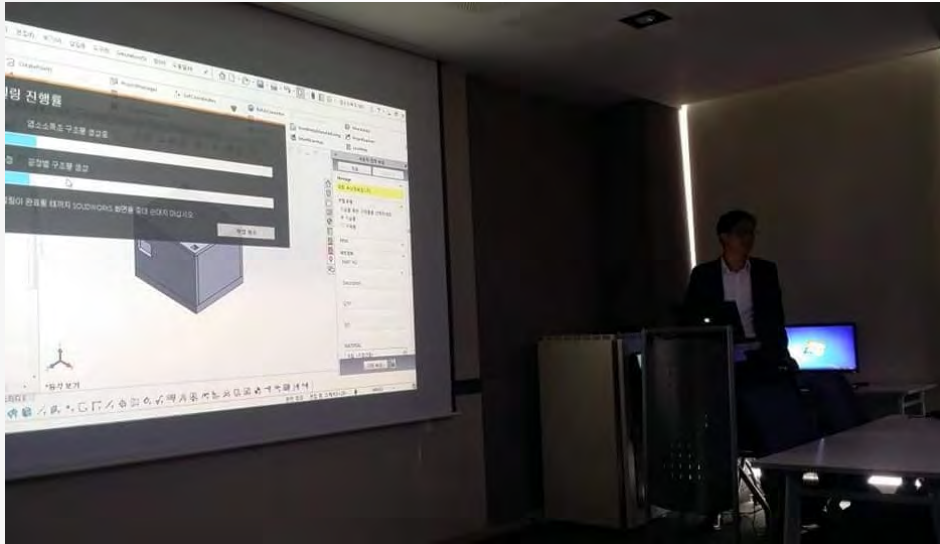


Operation



Water AI

II. Tomorrow Business – Water AI



Sustainability for the Livestock Industry

Go Together Project



II. Tomorrow Business - GTP

Would you throw it out
if it was **PureGold?**



The Stark Reality of the Livestock Industry

II. Tomorrow Business - GTP

Wastewater

**Manure with
Concentrated Nitrogen
and Phosphorus**

Contamination of
surface water and
ground water

Waste

**Slaughter Waste
Hair
Toenails**

Odor & Air Pollution

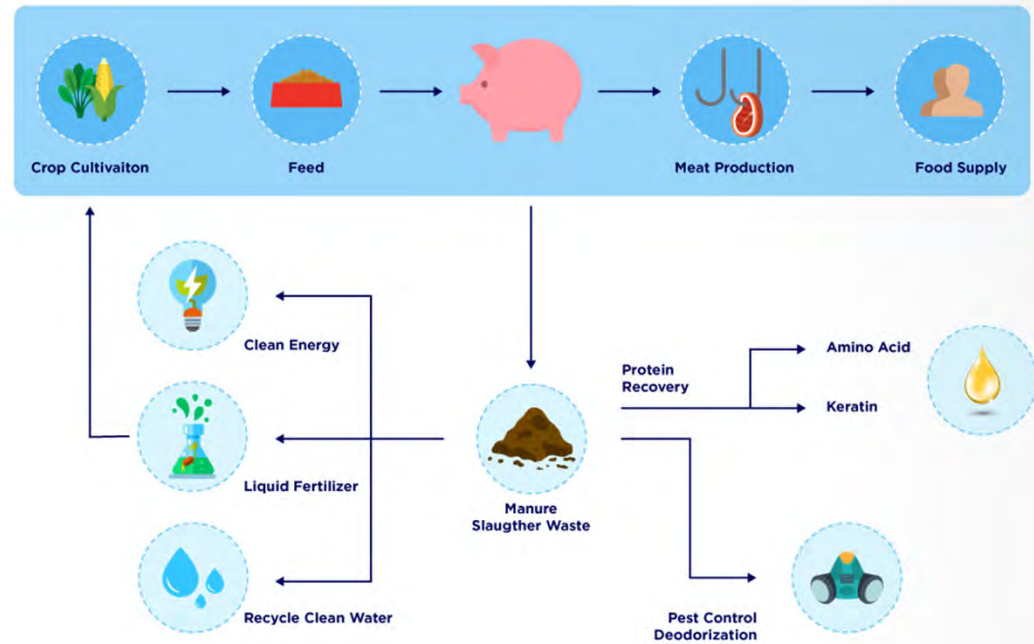
**Odor
Greenhouse Gas
Fine Particulate Dust**

GTP

Sustainable livestock production in the circular economy

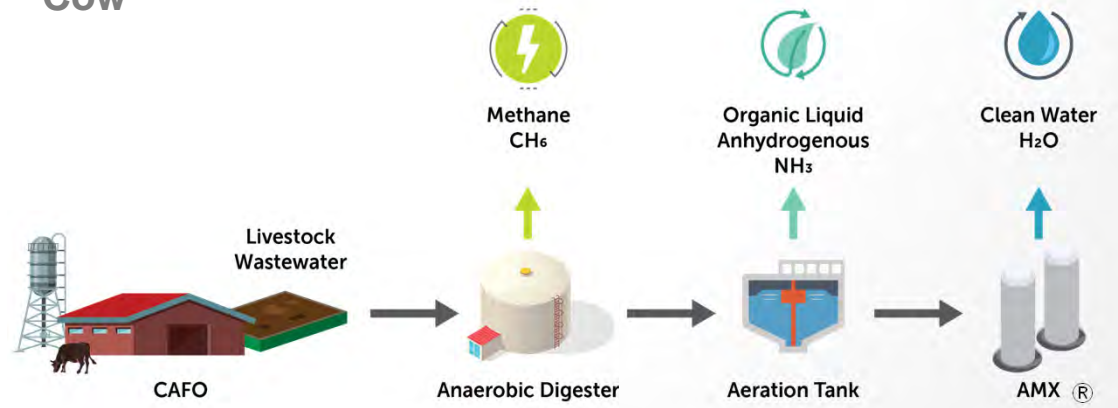


Hog



II. Tomorrow Business - GTP

Cow



GTP

Develop high-value co-products
(Amino Acid, Keratin)

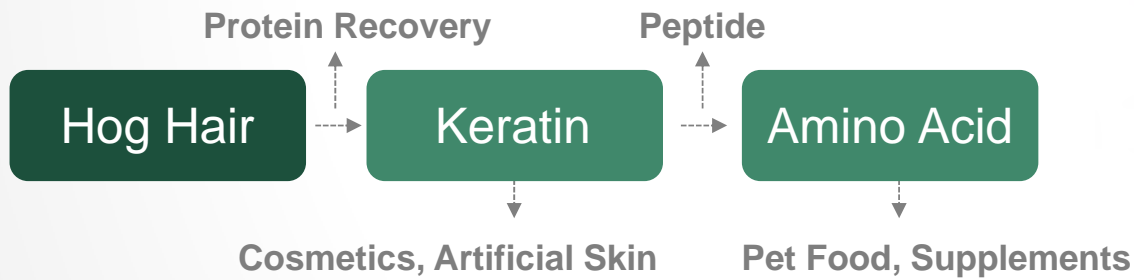


Figure 1 Dose Response Curve for 19-0228/19-0229

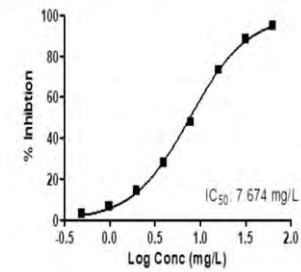
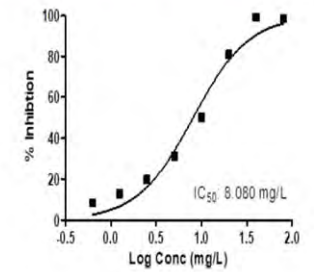


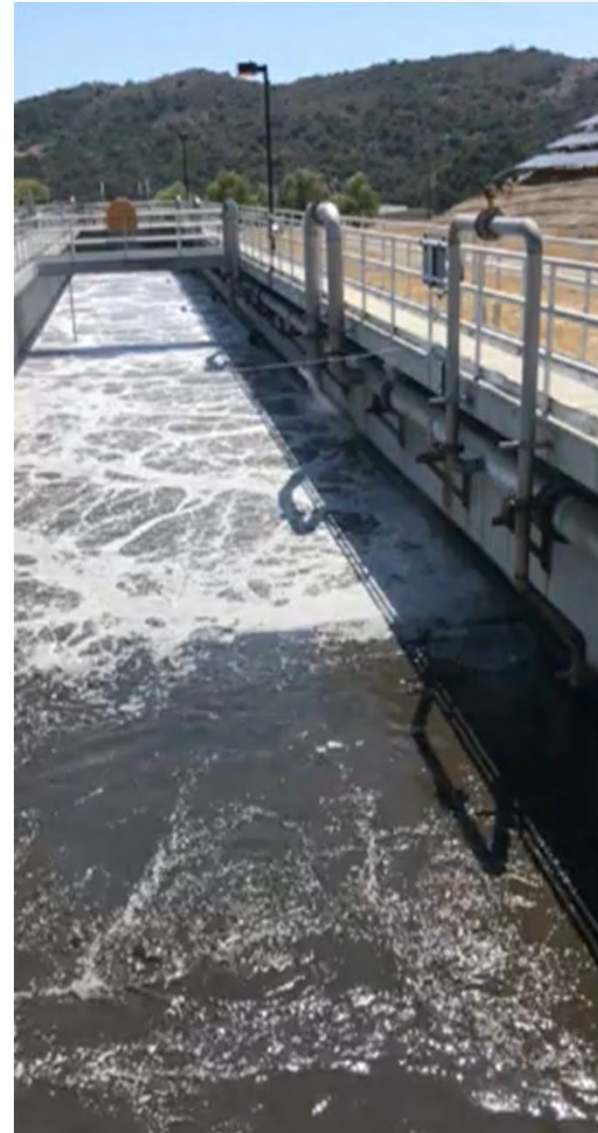
Figure 2 Dose Response Curve for Trolox



IC₅₀: The half maximal inhibitory concentration.

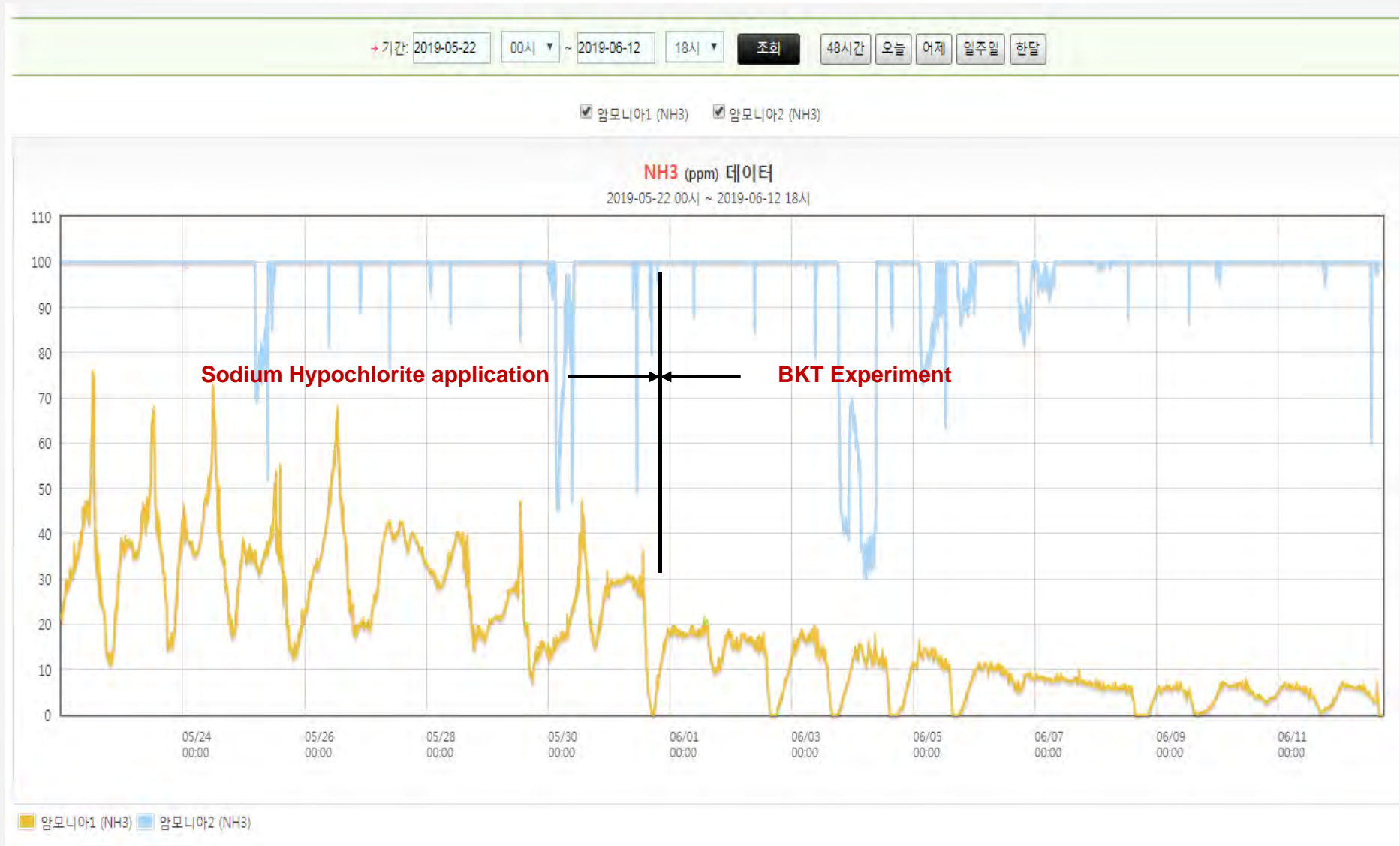
Proven & Safe Odor Control

II. Tomorrow Business - GTP



Odor Control Outcome

II. Tomorrow Business - GTP



III . Today Business

Technology Portfolio

III. Today Business

BBF

Bio-filtration

vDAF

Vortex Dissolved
Air Flotation

FMX

Anti-Fouling
Membrane

COWTT

Organic Waste
Thermal Treatment

AAD

Activated Anaerobic
Digestion

AMX

Anammox



Primary Filtration & Bio-Filtration

Proven & Versatile Solutions for Municipalities

III. Today Business



PRIMARY

- Wet Weather flow
- Carbon Diversion

Jungnang Water Reclamation Center
Seoul, Korea

132 MGD (Wet Weather)
66 MGD (Primary + Secondary)

SECONDARY

- Main Treatment
BOD, SS, and Nitrogen

TERTIARY

- Retrofit
- Reuse

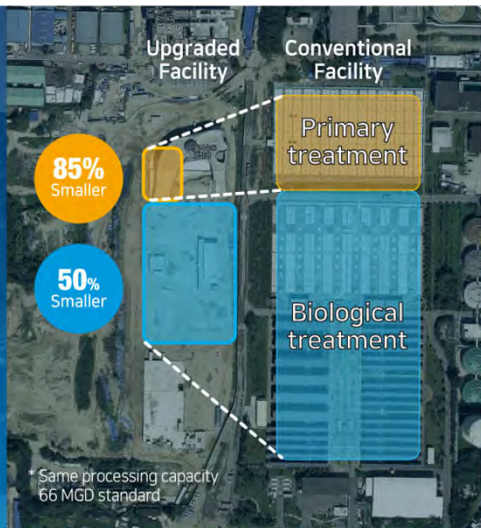
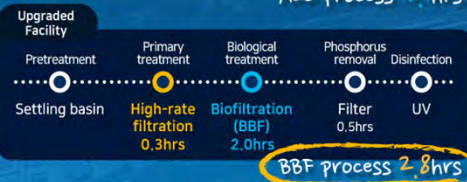


TITLE 22

High-Rate Filtration Technology

Small footprint innovation

Reduce processing time compared to A2O process



Wet Weather Flow

III. Today Business



Genesee County Drain Commissioner

High Rate Solids Removal

- **Small Footprint, Rapid Startup (reduces EQ required)**
- **Consistent TSS output**
 - Reduces chlorine demand & contact time
 - Less chlorine dosing swings, less violations

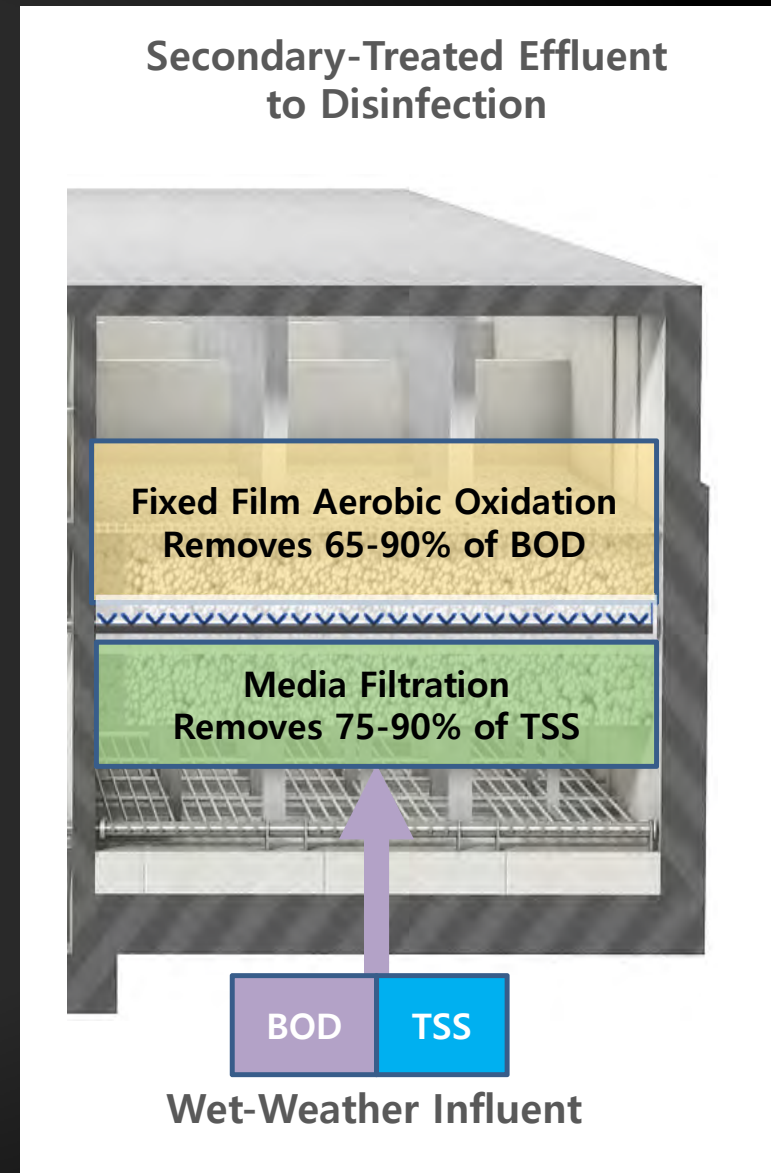
Rapid Biological Treatment:

- **Short HRT, Small footprint:**
Filtration + Biological in 15-30min EBCT

Soluble BOD removal 50-90%

Maximum peak flow flexibility

- Peaks of 4X design flow can still be filtered to achieve TSS & total BOD removal



Groundwater Treatment

III. Today Business

BBF
Bio-filtration

Groundwater Remediation Project *City of Barstow, CA*

- Simultaneous removal of Nitrate, Perchlorate, and Dissolved Organics
- Energy-efficient biological filtration
- No brine disposal required



Media

Expanded Polypropylene (EPP) Media

- Cost-Effective
- Long Lifespan (>100yr)

Primary Filtration

- Patented Cross-shaped Media Design
- Maximizes Void Ratio
- High Solids Loading Rate
- Minimizes Head Loss
- Easy Backwashing, Low Attrition (3%)

Secondary & Tertiary Biofiltration

- Maximizes Surface Area for Biofilm Development
- Simultaneous Oxidation, N/DN and Filtration



BBF Reference Sites Worldwide

III. Today Business



APPLICATION	CLIENT	CAPACITY (m ³ /d)	CAPACITY (MGD)
Livestock Wastewater Treatment	Pocheon LWWT	120	0.032
Livestock Wastewater Treatment	Boryung LWWT	80	0.021
Tertiary (TMDL control)	Docheok WWTP	4,000	1.1
Tertiary (Polishing)	Pyeongchang WWTP	200	-
WW Treatment	Mitan WWTP	200	-
Tertiary (Water reuse)	Qufu WWTP (China)	40,000	10.6
Livestock Wastewater Treatment	Boeun LWWT	80	0.021
Tertiary (TMDL control)	Ohpo WWTP	14,000	3.7
Tertiary (TMDL control)	Boryung WWTP	30,000	7.9
Livestock Wastewater Treatment	Yeongam LWWT	70	0.019
Livestock Wastewater Treatment	Sacheon LWWT	40	0.011
Tertiary (TMDL control)	Gwangju WWTP	25,000	6.6
Tertiary (Polishing)	Munmak WWTP	200	-
Livestock Wastewater Treatment	Seongju LWWT	80	0.021
Livestock Wastewater Treatment	Imsil LWWT	130	0.034
Livestock Wastewater Treatment	Iksan LWWT	700	0.185
Tertiary (TMDL control)	Jeungpyung WWTP	25,000	6.6
Livestock Wastewater Treatment	Dangjin LWWT	95	0.025
Tertiary (Advanced WWT)	Deajuk WWTP	12,000	3.2
Livestock Wastewater Treatment	Hwaseong LWWT	190	0.05
Livestock Wastewater Treatment	Gimje LWWT	100	0.026
Livestock Wastewater Treatment	Gimhae LWWT	200	0.053
Livestock Wastewater Treatment	Goryeong LWWT	150	0.04
Livestock Wastewater Treatment	Gochang LWWT	95	0.025
Livestock Wastewater Treatment	Yecheon LWWT	80	0.021
Livestock Wastewater Treatment	Changyeong LWWT	98	0.026
Tertiary (Advanced WWT)	Chungbuk WWTP	15,200	4
WW Treatment	Haman Pasu WWTP	300	-

BBF Reference Sites Worldwide

III. Today Business



APPLICATION	CLIENT	CAPACITY (m ³ /d)	CAPACITY (MGD)
Tertiary (Polishing)	Pohang WWTP	9,000	2.4
Secondary BNR	Samri WWTP	5,000	1
Tertiary (Water reuse)	Dangjin WWTP	30,000	7.9
Tertiary (Water reuse)	Songdo WRP	20,000	5.3
Secondary BNR	Julpo WWTP	1,600	0
Secondary BNR	Gwangju WWTP	20,000	5
Tertiary (Advanced WWT)	Pocheon WWTP	24,000	6.3
Livestock Wastewater Treatment	Deunggok LWWT	105	0.028
Water Reuse	Okjung WWTP	22,000	5.8
CSO/SSO control	Hado WWTP	62,000	16.4
Tertiary (Water reuse)	Seonam magok WRP	20,000	5.3
Livestock Wastewater Treatment	Cheongwon LWWT	140	0.037
Livestock Wastewater Treatment	Dangjin LWWT	130	0.034
Primary	Jungnang WWTP	250,000	66.0
Secondary BNR	Jungnang WWTP	250,000	66
CSO/SSO control	Jungnang WWTP	500,000	132
Secondary BNR (Concentrate Treatment)	Pajoo WWTP	17,000	4.5
Secondary BNR	JinGun WWTP	63,000	16.6
Tertiary (Advanced WWT)	Geomdan WWTP	40,000	10.6
Livestock Wastewater Treatment	Boryung LWWT	150	0.04
Livestock Wastewater Treatment	Jincheon LWWT	150	0.04
Livestock Wastewater Treatment	Kyungju LWWT	150	0.04
Polishing & Tertiary	Other 16 LSWWTPs	40~700	-
Tertiary (Advanced WWT)	Ohsan WWTP	57,000	15.1
Tertiary (Advanced WWT)	Eonyang WWTP	45,000	11.9
Tertiary (Advanced WWT)	Bookhang WWTP	35,000	9.3
Primary	Seonam WWTP	360,000	95
CSO/SSO control	Seonam WWTP	720,000	190



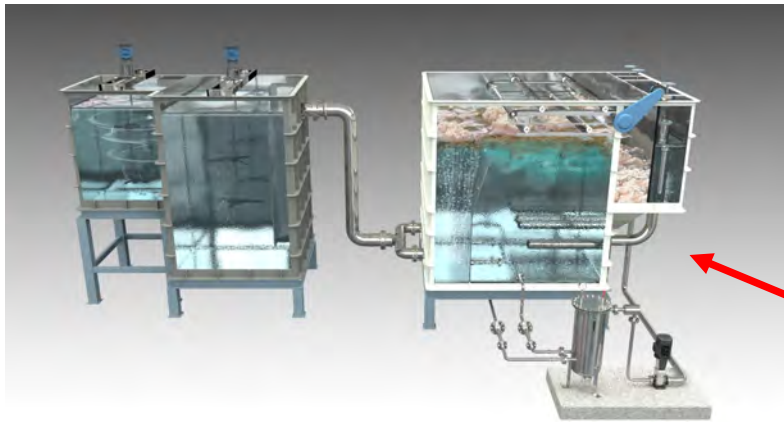
Vortex Dissolved Air Flotation



High-efficiency dissolved air flotation with the help of vGEN and vMIXER.

Compact size => Minimized footprint

III. Today Business



Applications

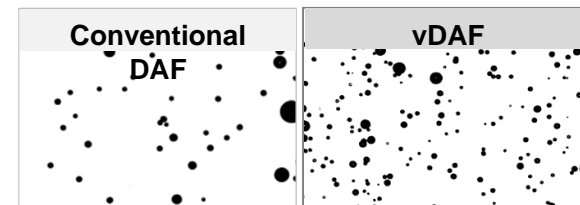
- DAF (Retrofit)
- Seawater Desalination
- Livestock Manure Treatment/Concentration
- Primary/Secondary/Tertiary Treatment
- O3 Dissolve: removal of NBDCOD
- CO2 dissolve: pH adjustment (substitute for sulfur), Re-mineralization
- Agriculture, Farming



Generates fine bubbles with impact plate & vMIXER

Fine bubbles (10-60µm bubble diameter)

Bubble Density: More than 120,000 bubbles/ml

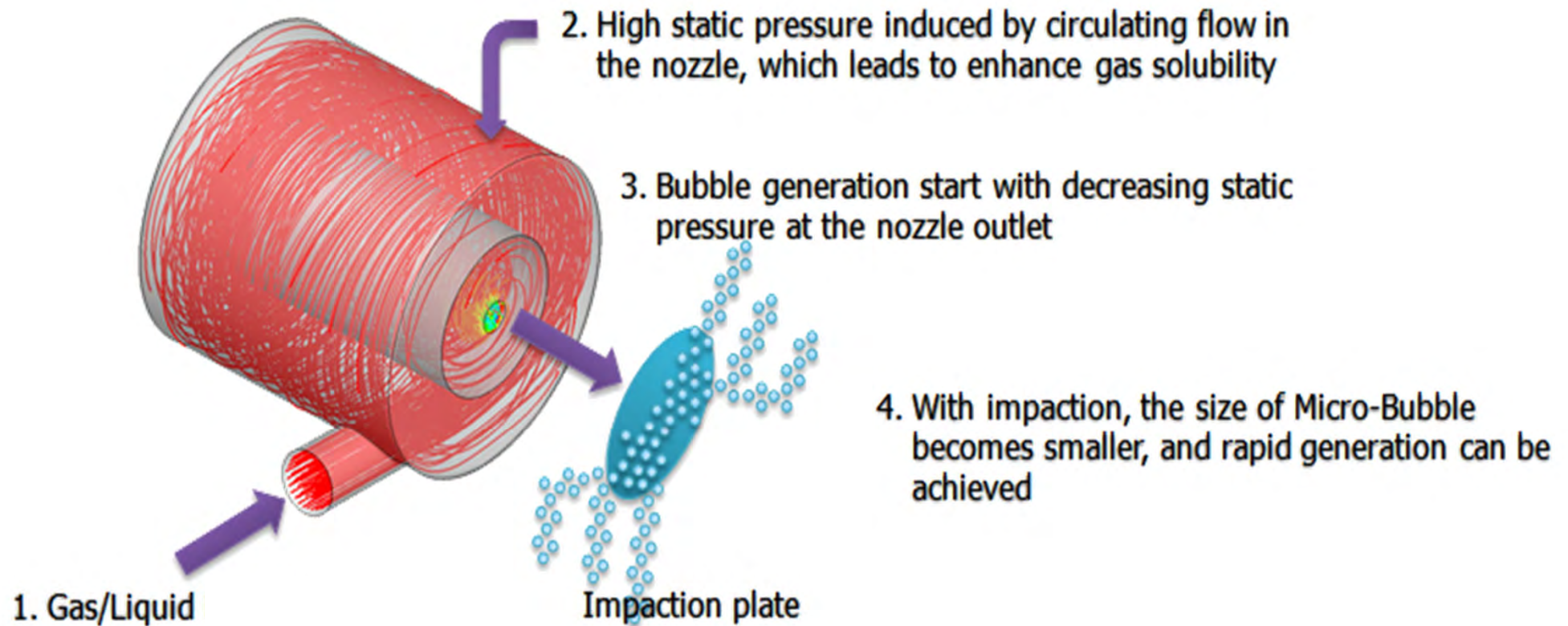


Mixes gas into liquid

Applicable to various kinds of gases

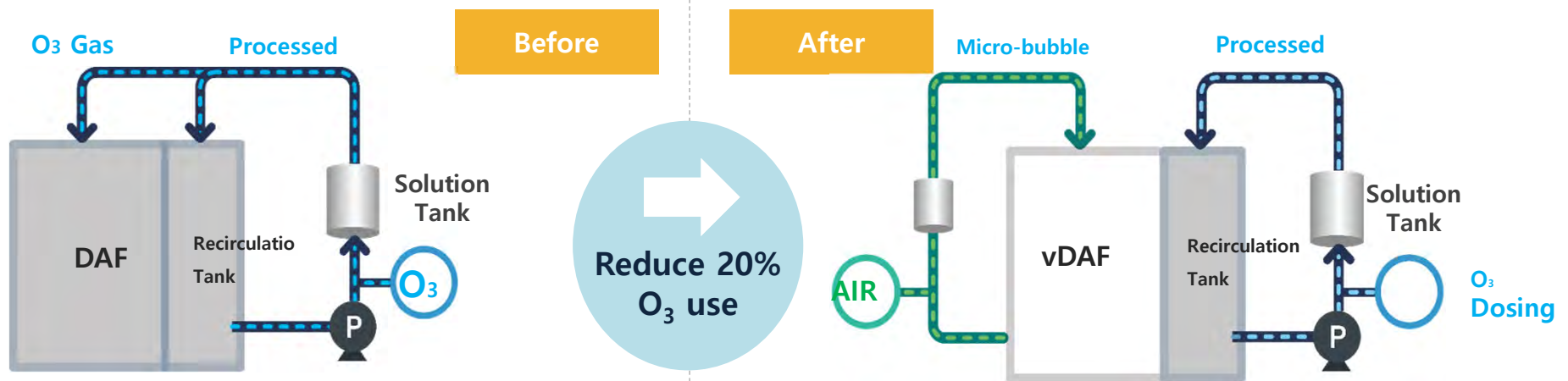
Generating Fine Bubbles

III. Today Business



* [Patented 10-1284266 in Korea] Fine bubble generator based on spiral flow unit

Combining Ozone (O₃) Generator With vDAF



- Large O₃ bubbles mean low ozone contact time reduced separation efficiency
- Inconvenient O&M due to closed cover

Issues

- Unstable bubble pattern
- Chemical & ozone overdoses
- Mechanical corrosion by ozone



- Higher **SS removal** rates
- Higher **ozone contact** time
- Easy **O&M**: open cover

Improvement

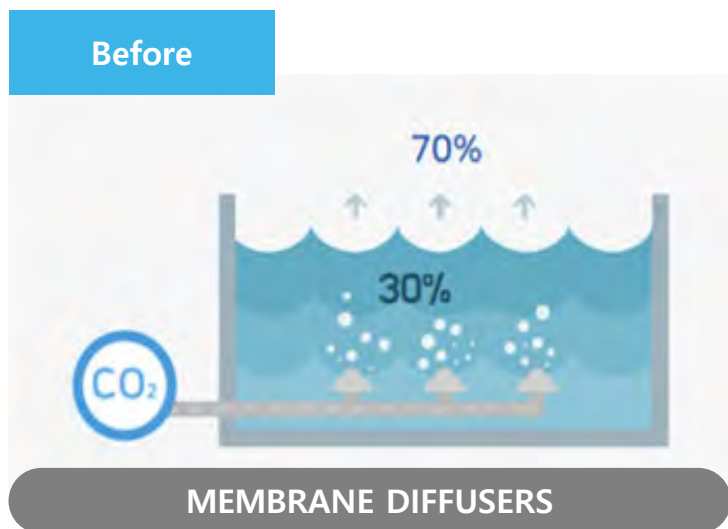
- Increased process capacity (x1.5)
- O&M cost saving (50% less polymer, 20% less ozone)

Case Study: pH Control

III. Today Business



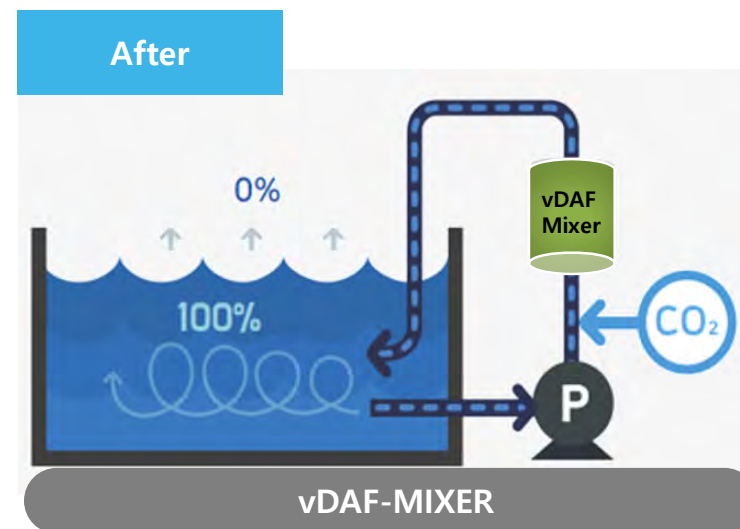
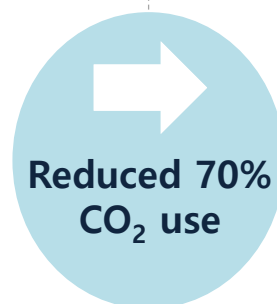
Steel Mill (vDAF-Mixer)



Low CO₂ solubility

Issues

- Wasted 70% of total CO₂ applied to the system
- High O&M cost
- Short pH tenacity (less than a day)



Complete mix emits 0% CO₂

Improvement

- Achieve 0% CO₂ emission
- Save CO₂ use by 70%
- Longer pH tenacity (more than two days)

vMIXER Reference Sites

III. Today Business



**Dangjin
Livestock Manure Treatment Facility
(DAF Retrofit)**



**Boeun-gun
Livestock Manure Treatment Facility
(Secondary Treatment)**



**Steel Mill in Korea
Treatment of Industrial wastewater
(Replacing Sulfur)**



Anti-Fouling Membrane

FMX Technology Overview

III. Today Business

FMX
Anti-Fouling
Membrane

Anti-Fouling Membrane Filtration

FMX is an anti-fouling membrane filtration system specialized for difficult applications beyond the capability of conventional systems.

Pre-treatment for Down
stream Processes

Anti-Fouling

Anti-Scaling

Volume Reduction

Modular System
Easily scalable, easy
maintenance

MF, UF, NF Capable
For filtration of a wide range of
particle size needs as well as
TDS



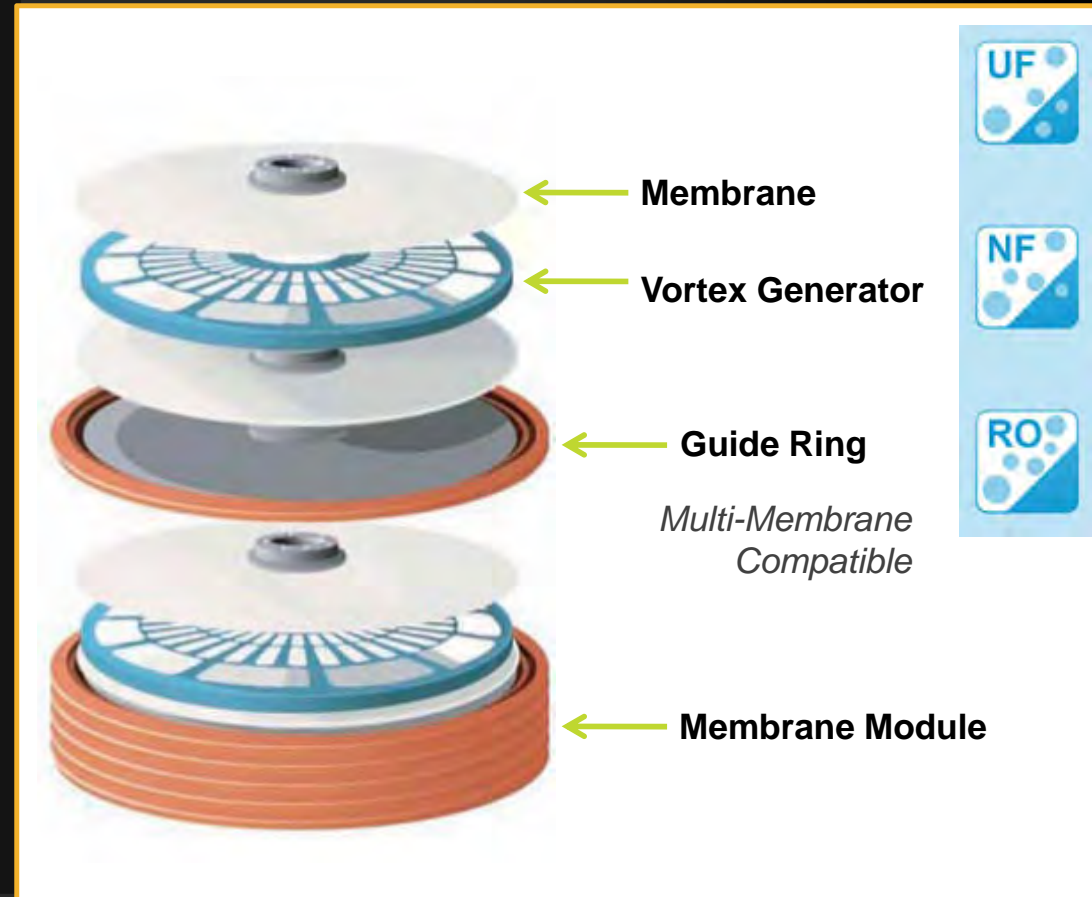
FMX Technology Overview

III. Today Business



FMX Membrane Filtration Technology allows for:

- HIGHER scale tolerance
- GREATER recoveries
- HIGHER salt rejection
- HIGHER permeate flux
- ANY flat-sheet membrane



FMX in Wastewater Treatment

III. Today Business



Digestate Treatment

Nutrient Recovery & Treatment

The FMX system recovers valuable nutrients, transforming waste streams into profit streams.



Flue Gas Desulfurization WWT

Emission Regulation Compliance

Using nanofiltration membranes, the FMX system can pretreat FGD wastewater to remove all contaminant ions (TDS) simultaneously.

*** Funded by U.S. Dept. of Energy. Both projects have been successfully completed.**

FMX in Manufacturing

III. Today Business

FMX
Anti-Fouling
Membrane

FMX Technology improves recovery for the chemical, biochemical, and hi-tech industries.

FMX maximizes concentration, while minimizing clogging, scaling, and fouling. It can filter the thickest of fluids.

FMX simplifies production processes and optimizes treatment trains, making them less energy and water intensive.

FMX is used in:

- Colloidal particle concentration
- Fermentation broth filtration
- Probiotics concentration & separation
- Amino acid concentration
- Diafiltration



CAEBIGEN Inc.
CHEMISTRY · BIOLOGY · GENOMICS



Dongkook
PHARMACEUTICAL

SK bioland

SAMSUNG

LOTTE
FINE CHEMICAL

DU PONT

BIFIDO
Probiotics World Best

NALCO
An Ecolab Company

FMX Anti-Fouling Membrane

III. Today Business



Waste Oil Filtration



Simplified Production Processes

(Chemical sedimentation + Centrifugal Separation → FMX)

Higher Quality + Greater Recovery



FMX Reference Sites Worldwide

III. Today Business



Sector		Product	Process	Model (Qty)
Chemical	MP	Methyl Cellulose	Methyl Cellulose Concentration	S-100(7)
Chemical	MP	Silica	Colloidal Silica Concentration	S-100(1)
Chemical	MP	Chemical Process	Chemical Process R&D	B(1)
Chemical	MP	Water Reuse	Optical Film Production	P(2)
Chemical	MP	Nano-material	Nano-material	B5(1)
Chemical	MP	Refined fuel	Waste Oil Refining	E(1)
Biotech	MP	2,3-BDO	2,3-BDO Separation/Concentration	E(1)(MF), E(2)(UF)
Biotech	MP	Micro Algae	Micro Algae Separation/Concentration	B(1), B5(1)
Biotech	MP	Chinese Medicine	Chinese Medicine R&D	B(1)
Biotech	MP	Antibiotics	Antibiotics R&D	B5(1)
Biotech	MP	Natural Extracts	Natural extract purification process	E20(1)
Biotech	MP	Muconic acid	Biorefinery R&D	B5(1)
Biotech	MP	PDO	PDO Separation/Concentration	P(1)
Biotech	MP	Amino Acid	L-Methionine Concentration(DF)	S-100(2)
Biotech	MP	Probiotics	Probiotics Separation/Concentration	E(1), P40(1)
Biotech	MP	Enzyme	Enzyme Separation/Concentration	E(1)
Biotech	MP	β -Glucan	β -Glucan Separation/Concentration	E(1)

FMX Reference Sites Worldwide

III. Today Business



Sector		Product	Process	Model (Qty)
Biotech	MP	Cell separation	Bio R&D-Cell separation	B5(1)
Biotech	MP/UF	Functional sugars	Protein separation/concentration	B5(1)
Biotech	MP	Bio-Cosmetic	Bio-Cosmetic	B5(1)
Biotech	MP	Bio-Cosmetic	Bio-Cosmetic	B5(1)
Biotech	MP	Antibiotics	Antibiotics	PP(1)
Biotech	MP	Protein	Protein separation/concentration	E(1)
Biotech	MP	R&D	Bio R&D-Cell separation	B(1)
Biotech	MP	Tryptophan	Tryptophan	S(3)
Livestock	WW	Liquid Fertilizer	Liquid Fertilizer Production	S-20(1)
Livestock	WW	Liquid Fertilizer	Liquid Fertilizer Production	S-30(1)
Livestock	WW	Liquid Fertilizer	Liquid Fertilizer Production	S-70(1)
Livestock	WW	Liquid Fertilizer	Liquid Fertilizer Production	S-60(1)
Livestock	WW	Liquid Fertilizer	Liquid Fertilizer Production	S-40(1)
Digestate		BGP	BGP	S-80(3)
Digestate		BGP	Digestate Liquid/Solid Separation	E5(1)
Energy & Mining	WW	Produced Water	Produced Water Reuse	S-20(1)
FGD	WW	FGD	FGD Wastewater Treatment	P-10(1)
R & D	WW	WWT	R & D	B(1)
R & D	WW	WWT	R & D	B(1)
R & D	WW	WWT	WWT	P(1)



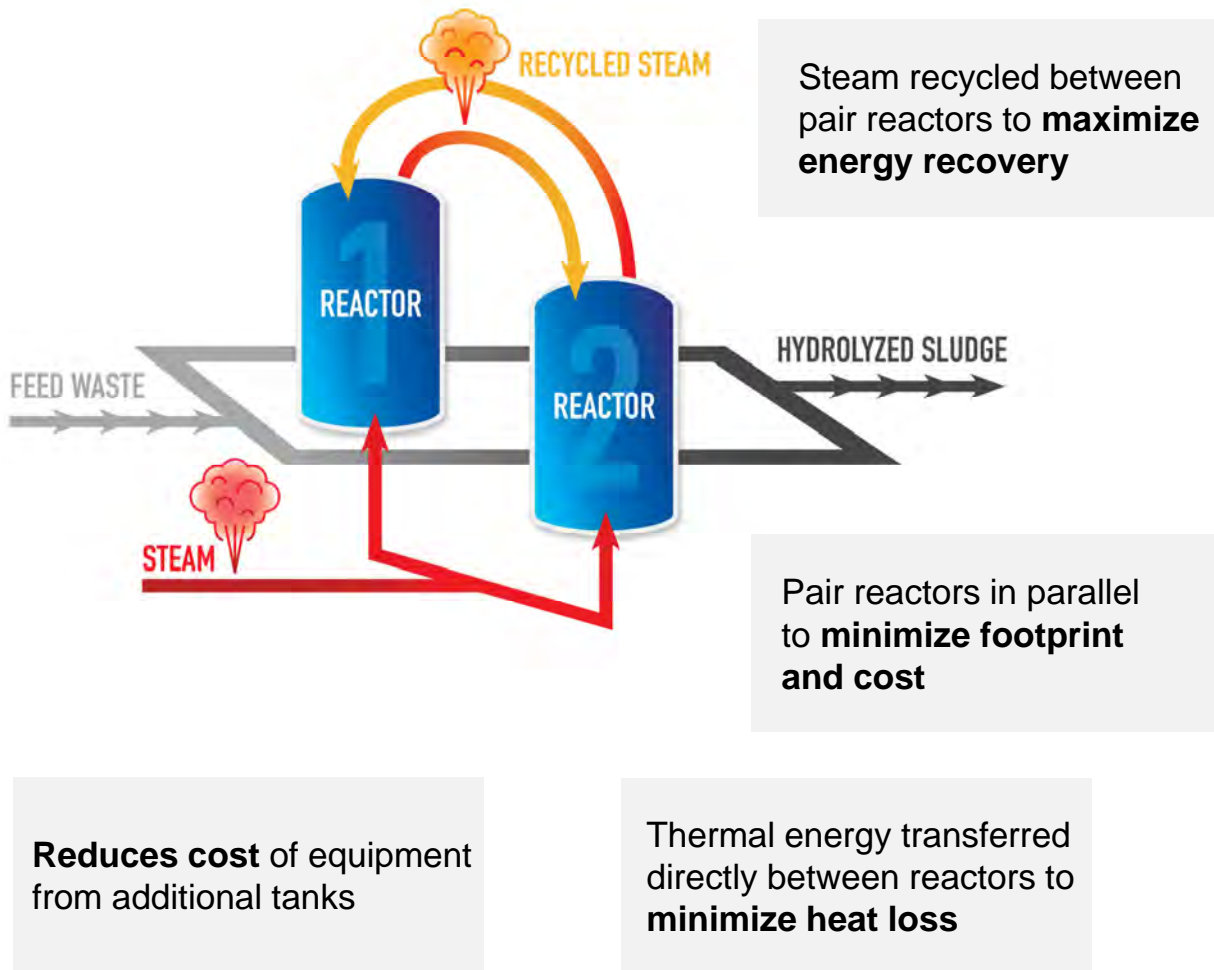
Cyclic Organic Waste Thermal Treatment

Energy Production

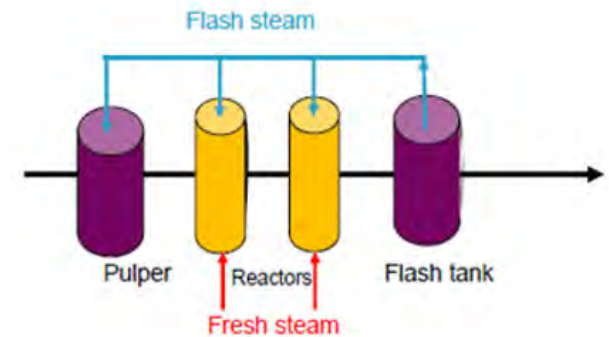
III. Today Business



BKT's Thermal Hydrolysis (THP) Solution: Cyclic Organic Waste Thermal Treatment Process



Conventional THP



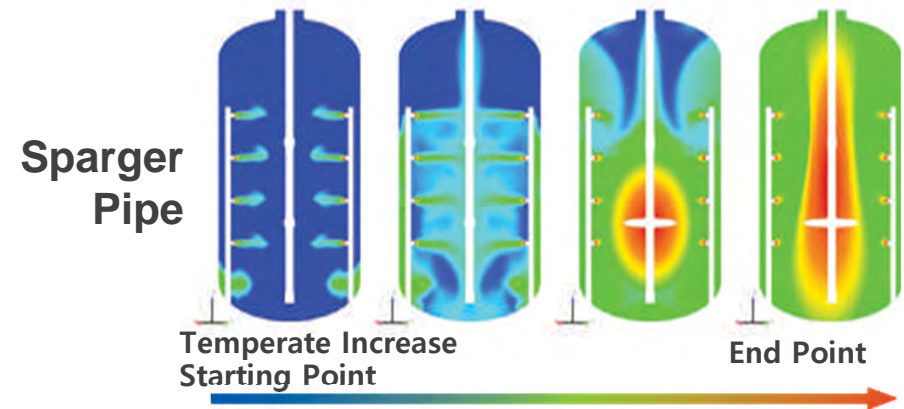
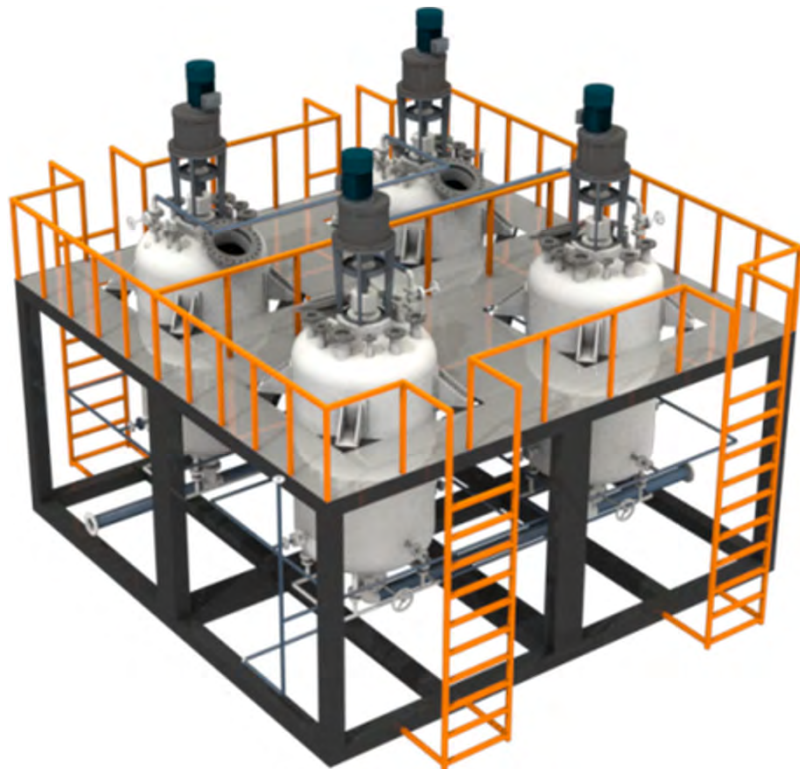
Energy Production

III. Today Business



Direct heat transfer using patented *multipoint spargers* and patented mixing systems

Unique equipment design allows processing of high-solids feed stocks (TS=25%), allowing for more cost-effective and efficient installations.



**Pukyong Nonghyup
Organic Waste Treatment**



**Icheon Organic Waste
Treatment Pilot**

Thermal Hydrolysis System used for organic waste treatment, including sludge and animal remains.

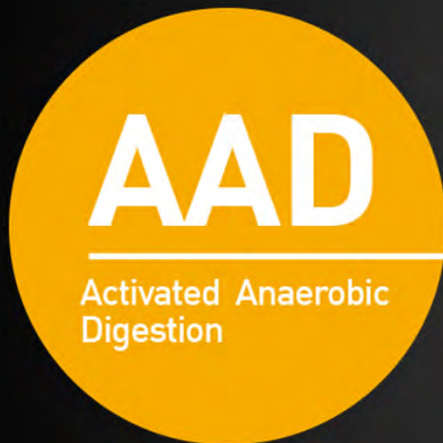
COWTT Reference Sites Worldwide

III. Today Business



Site Location	Feed Material	Capacity (dry ton/y)	Process Objectives	Installation Year
Guri, S. Korea	Municipal sludge	9,125	Biogas Class A cake	<i>In Design</i> (2018)
Icheon, S. Korea	Animal remains	1,460	Volume reduction Disposal	2016
Dangjin, S. Korea	Municipal sludge	1,460	Demonstration	2015





Activated Anaerobic Digestion

Activated Anaerobic Digestion

III. Today Business



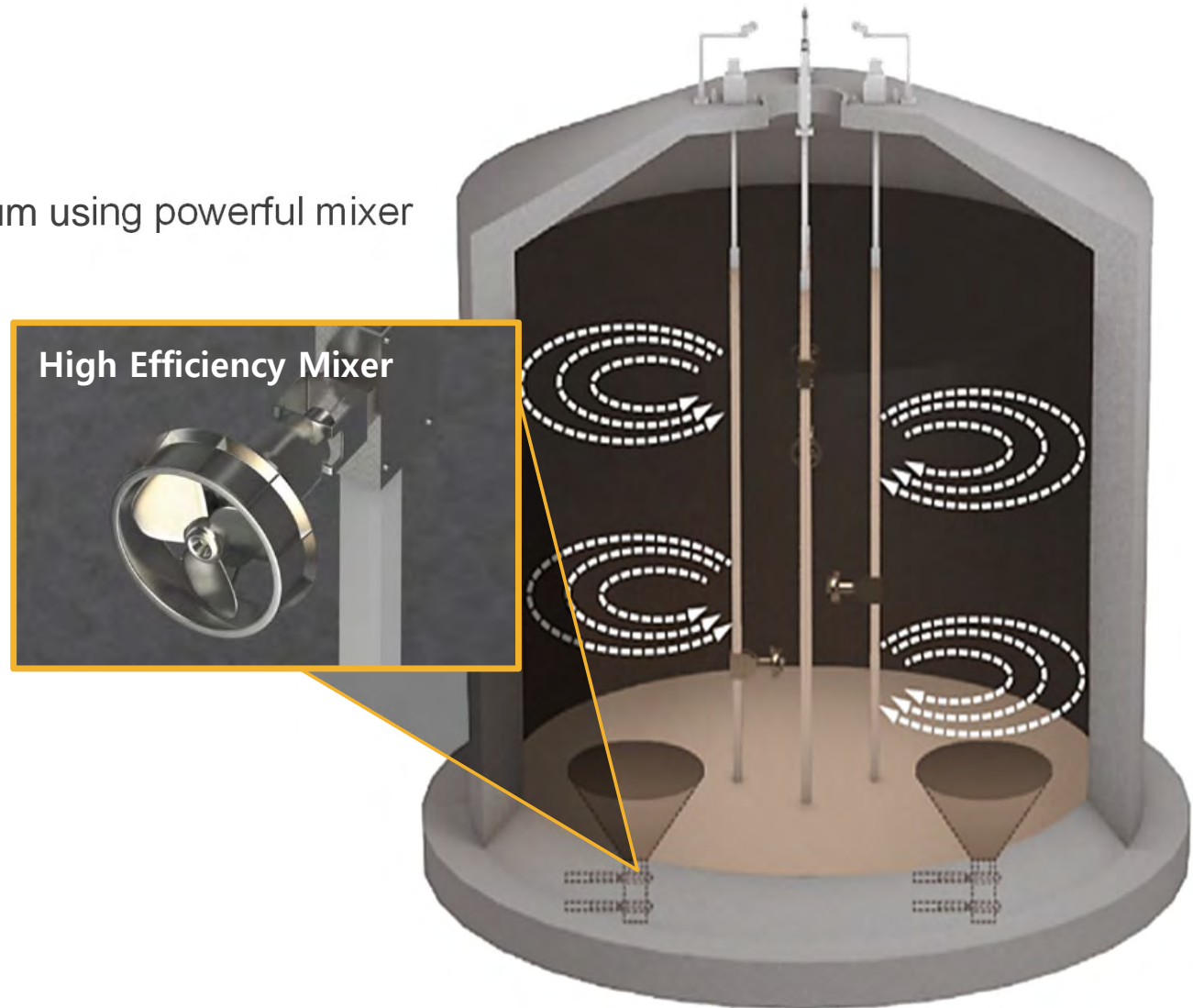
Highly efficient mixer and sediment discharge system

Advantage

- Eliminate dead space and scum using powerful mixer
- Minimize maintenance costs

References in South Korea

- Hongcheon
- Miryang
- Gimhae
- Uljin
- Jinju



AAD Reference Sites

III. Today Business



Application	Client	Capacity (m ³ /d)	Capacity (MGD)
Organic Waste Treatment (Livestock Manure)	GWANGJU WWTP	30	0.01
Organic Waste Treatment (Livestock Manure)	ULJIN WWTP	60	0.02
Organic Waste Treatment (Sewage Sludge)	JINJU WWTP	755	0.20
Organic Waste Treatment (Livestock Manure + Food Waste)	NONSAN WWTP	150	0.04
Organic Waste Treatment (Livestock Manure + Food Waste)	MILYANG WWTP	100	0.03
Organic Waste Treatment (Livestock Manure + Food Waste)	HONGCHEON WWTP	100	0.03
Organic Waste Treatment (Livestock manure + Food Waste)	GIMHAE WWTP	200	0.05



**Hongcheon
Eco-friendly Town**



**Gimhae
Livestock Wastewater Treatment Plant**



**Junju
Sewage Wastewater Treatment Plant**



COWTT

Organic Waste
Thermal Treatment

Well-balanced & Well-organized Energy Production Process



AAD

Activated Anaerobic
Digestion

Safeguard Your System
The Most Resilient Anammox Process In The World



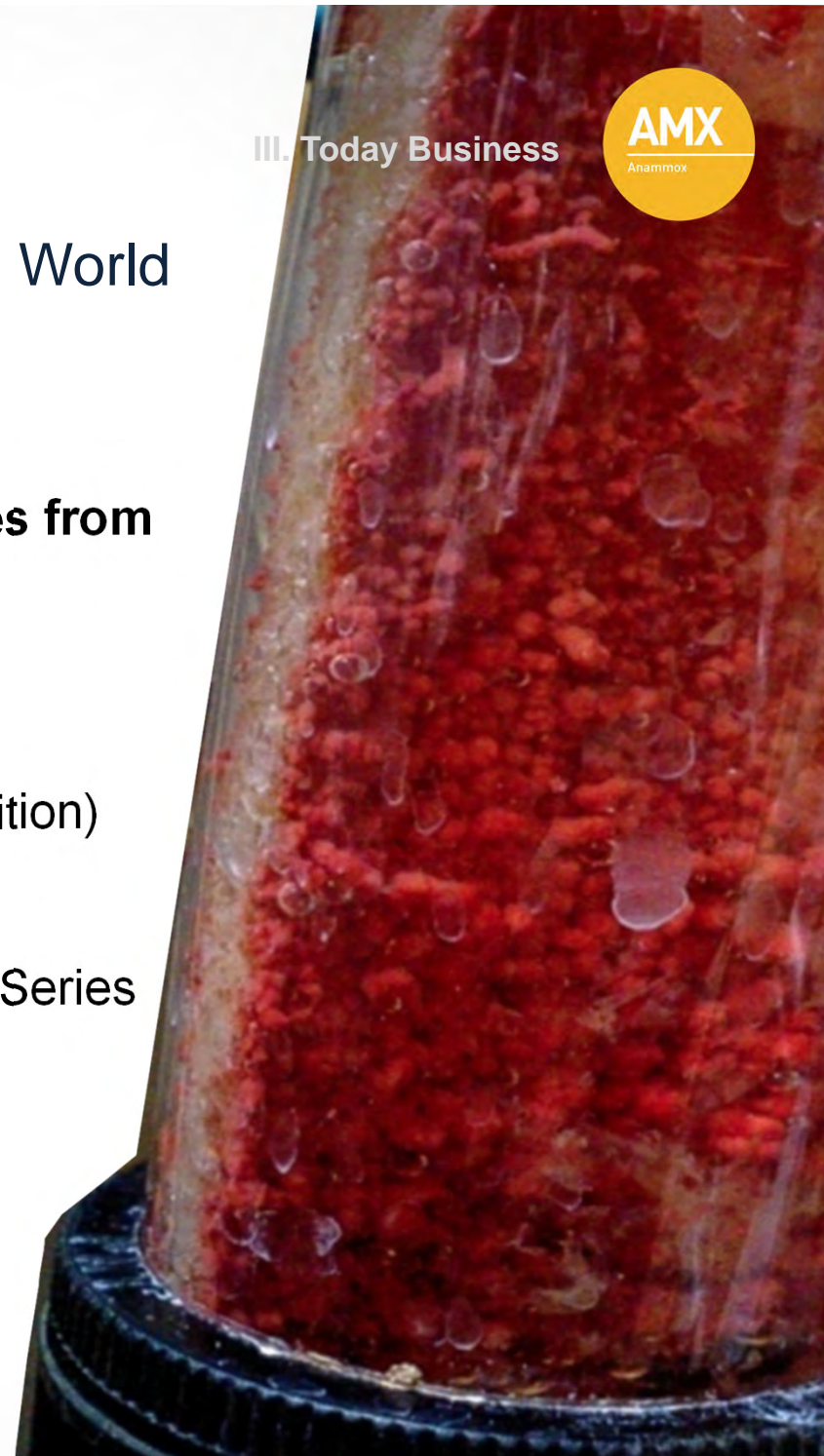
Two-Stage AMX[®]

Two-Stage AMX[®]

The Most Resilient Anammox Process in the World

- ✓ **Avoid the risk of catastrophes caused by spikes from High TSS and High COD**
- ✓ **Highest Removal Rates:**
Up to 2.5 kg N/m³d (>50% higher than the competition)
- ✓ **Unique, Super-Efficient Anammox Strain: OBA Series**
- ✓ **Use both suspended and attached growth**

III. Today Business



AMX Reference Sites Worldwide

III. Today Business



Project Classification		Site	Capacity	Comments
Korea	Side-stream (Digester Centrate)	Noksan STP (Busan)	780 m ³ /d	Under construction. Seeding planned for Oct 2019
		Daejon STP	220 m ³ /d	Operational full-scale
		Gangbyeon STP (Busan)	70 m ³ /d	Anammox farm. In operation till at least Noksan is operational.
	Livestock/food waste digestate	Hongcheon	2 m ³ /d	Operational pilot plant. Will run for at least 7-8 months
	Landfill Leachate	Sudokwon Landfill (Incheon)	2 m ³ /d	Operational pilot plant. Possible extension for 6-12 months
USA	Main-stream	JWPCP (California)	40 m ³ /d	Completed demo plant
		Hyperion Water Reclamation Plant (California)	40 m ³ /d	Demo plant. Starting Q4 2019
	Side-stream (Digester Centrate)	Hyperion Water Reclamation Plant (California)	1 m ³ /d	Operational pilot plant
	Livestock digestate	Bos Dairy Farm (Indiana)	1 m ³ /d	Completed pilot plant

Two-Stage AMX[®] Reference Sites

III. Today Business



Noksan WWTP in Korea - Side-Stream AMX (780 ton/day)



Hyperion Main/Side Stream AMX



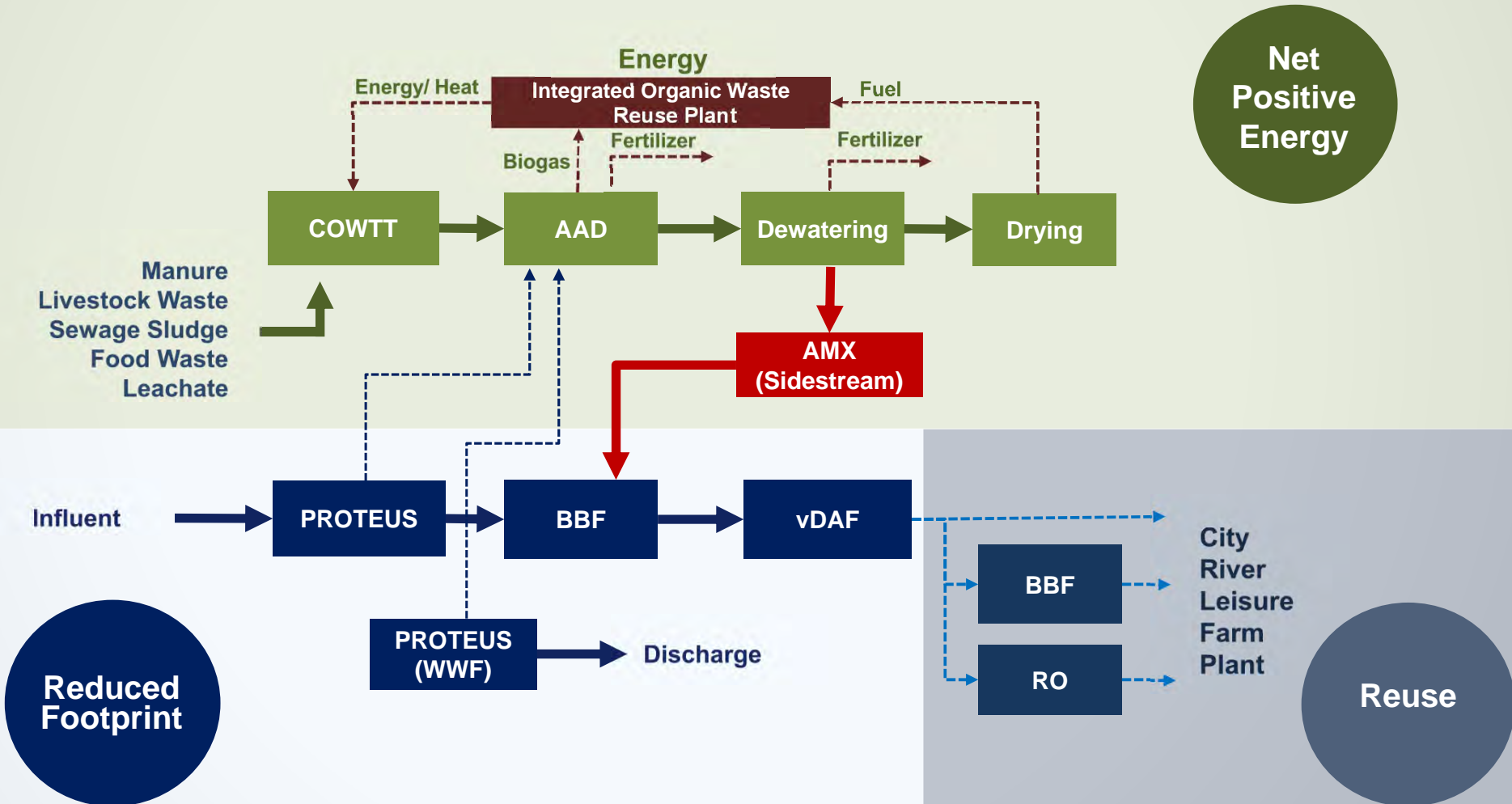
Daejeon WWTP - AMX Incubating facility (220 ton/day)



Indiana Project (livestock manure treatment in dairy farm) - AMX pilot

Total Solutions

III. Today Business



Thank You!

A Clean and Beautiful World
Beyond Waste



www.bkt21.com
www.tomorrowwater.com

