# Recycle of Rainwater and Greywater (RERain and REGrey) for Green Building


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# Content

- Introduction of Working Organization
- Green Building Criteria
- RERain
- REGrey

# ERD Strategic Framework

## PTT-InI Vision

"Accelerating Future Energy and Beyond with Innovative Solutions"

**ERD Vision** | **Innovative Climate Solutions for PTT Business and Sustainability**

**Positioning** | Tech Partner for BCG business | Innovation Center for Net Zero and ESG

| Carbon Capture Utilization and Storage Technology | Circular Carbon Technology | Carbon Assessment and Certification | Pollution Treatment Technology |
|---|---|---|---|
|   |  |   |  |
| Driving CCUS Tech and accelerate toward Carbon Neutrality and Net Zero | Innovating Circular Technology to move forward Resource Sustainability and Business | Offering Beyond Carbon Emission and Strategy for Carbon Neutrality and Net Zero | Transforming Treatment Processes to reduce Carbon Emissions |

POLLUTION TREATMENT TECHNOLOGY

# Environmental Innovation and Carbon Solutions Dept.

**Mission :** Transforming Treatment Processes to reduce Carbon Emissions

## Water Business

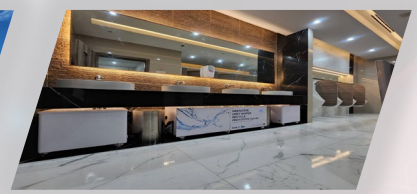
- Tech Due Diligence: Env. Technology and Engineering support
- Proof of Concept, Process & Product testing for Benchmarking

## Water Treatment Technology

- Desalination
- Water/Wastewater Recycle
- Zero Liquid Discharge(ZLD)

**RERain**
Rainwater Treatment for Cooling Tower

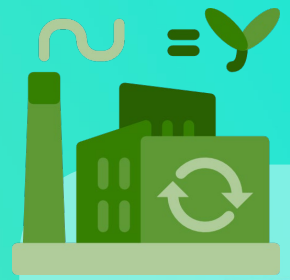
**REGrey**
Greywater Recycle for toilet flushing



## Air Treatment Technology

- Biofilter
- VOCs adsorbent filter
- Air modelling
- PM 2.5 Removal

# Green Building



**The buildings that lessen the environmental impacts through**

- Water Conservation/Efficiency
- Energy & Atmosphere
- Indoor Environment
- Materials & Resources
- Site & Landscape
- (Green) Innovation
- Building Management
- Environmental Protection
- Location and Transport
- Regional Priority

## Most widely used Certification in Thailand

| | No. of Certified Project in Thailand |
|---|---|
| Leadership in Energy and Environmental Design (LEED) | 113 Projects |
| Green Marks | 3 Projects |
| Thai's Rating of Energy and Environmental Sustainability (TREES) | 12 Projects |

# Green Building

## Water Conservation/Efficiency (6 Points in TREES)

### 2 Alternatives

1

- Use water saving closet and urinal flushing
- Use Water Saving Faucet or Metering faucet
- Install sub-meter for water in the project
- **Install rainwater tank to collect and use**

2

- **Reduce water use consumption from baseline**

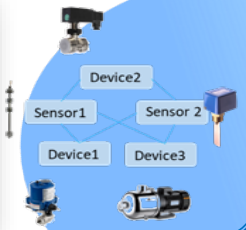
# RERain

**RERain** : Innovative system used to harvest rainwater and treat for reuse purposes such as Water Cooling feed, Boiler Water, Tap water, Industrial water, etc.

**Benefits :**

- Reduce freshwater intake or tap water consumption
- Prolong Water Blowdown Cycle in water cooling system
- CO2 emission reduction
- Wastewater Cost Reduction


## Innovative Technology Integration Platform




## Innovative IOT Platform

**RERain Prototype Capacity 136 $m^3$/y harvedted from 300 $m^2$* Roof Area**

* Data in 2566 (Elninino Effect) at PTT Head Office.

**25% water cooling saving & Prolonging Blowdown Cycle**

**Reduce wastewater treatment cost**

**$CO_2$ Reduction 0.44 $tCO_2eq$/year ()**

**Petty Patent Filling**

**Easy Control and Operate through IoT**

**Safety Operation (Alarm & Remote Control)**

**No Chemicals Storage**

## The Quality of RERain Water is 3-5 times better than Tap Water

| Parameter | Tap Water | RERain water |
|---|---|---|
| pH | 5-9 | 6-8 |
| Turbidity (NTU) | <5 | 0.3-0.7 |
| TDS (mg/L) | <500 | 36-88 |
| BOD (mg/L) | - | <2 |
| Hardness (mg/L) | 300 | 10-70 |
| Alkalinity (mg/L) | - | 10-93 |
| Fe (mg/L) | 0.5 | <0.003 |
| **Legionella** / Total Coliform** | ND* (Total Coliform) | ND* / ND* |

*ND = Not Detected

# Background of RERain

ประกาศ
เรื่อง ยุทธศาสตร์ชาติ (พ.ศ. ๒๕๖๑ - ๒๕๘๐)

บัญญัติเรื่อง **'พัฒนาความมั่นคงน้ำ พลังงาน และเกษตรที่เป็นมิตรต่อสิ่งแวดล้อม'**

## E Environment

PTT has developed sustainable Management Master plan and determined target of Water Withdrawals Intensity in Office

- Long Term Target: in 2573 water reduction **10%** comparing to 2556
- Short Term Target: < **144 Litre/cap/day**

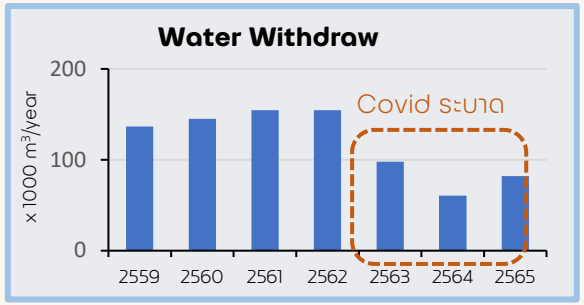
*Corresponding to PTT Group Environmental Master Plan (2564-2573)*

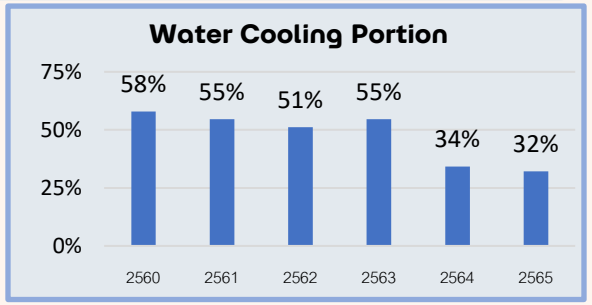
## S Social

- Water Shortage problem GDP $_{2566}$ ↓ **0.1%**
- GDP$_{2567-2568}$ ↓ **0.3%** (Estimated)
- National Agriculture Big Data Center forecast Agricultural Impact in 2567-2568 : **21 – 56 Billion Baht**

## Q Quality

- **Water Cooling: 50-60% of total consumption**




## C Cost

- Tap Water Cost for Cooling: **2-3 MB/year**

# Option Selection for Water Withdrawals Intensity Reduction in Building

| | | | | | | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|---|---|---|
| Solution | Objective | Option | Target | %Water Reduction | Current Status | Water Reduction Gap for improvement | Implement ability | Investment | สรุปการคัดเลือก |
| 1 Reduce consump-tion | Cooling | 1.1 Drift Eliminator for Cooling | ลดการใช้น้ำ 10% เทียบปี 2016 | 0.7% | 0.7% | 0% ✗ | - | - | ✗ |
| | | 1.2 Control Evaporation Loss | | 25% | - | 25% | No: Tech Not Readiness ✗ | - | ✗ |
| | Toilet | 1.3 สุขภัณฑ์ประหยัดน้ำ | | 5% | 1% | 4% | Yes | 11 MB | ✗ |
| 2 Water Recycle | Cooling | 2.1 Recycle Water Cooling Blowdown for Cooling | | 0.19% | - | 0.19% | No: System will be used only 4 times/year ✗ | - | ✗ |
| | Toilet | 2.2 Greywater Recycle | | 5% | 0.5% | 4.5% | Yes | 10 MB | ✗ |
| 3 New Fresh Water Source | Cooling/Toilet | 3.1 Rainwater Harvesting | | 10% | 0 | 10% | Yes | 1.5 MB | ✓ |

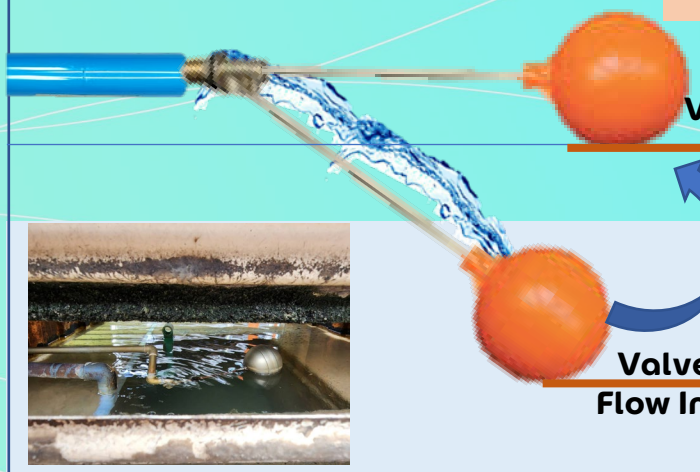
**Option Selection** Based on 3 criteria, Rainwater Harvesting is the most proper option to reduce Water Withdrawals Intensity in office

# Laboratory Testing

# Level Sensor Selection

**Target** The Proper Level Sensor to Fill in water in the Cooling Water Basin

**Floating Ball** | ท่อ Overflow | **Float Level Switch**



Valve Close

Valve Open 40%
Flow Inlet 60 L/min

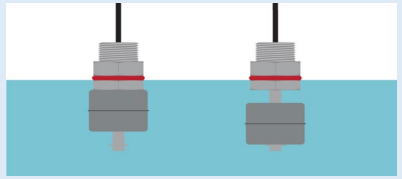
Valve Open 100%
Flow Inlet 150 L/min

19 cm

4 cm

Pump Close

Pump Open 100%
Flow Inlet 80 L/min



**การทำงาน** ระดับสูงสุดของวาล์วลูกลอยอยู่ที่ท่อ Overflow จะปิดวาล์วน้ำเมื่อน้ำเต็ม อัตราการเติมน้ำสูงขึ้นเมื่อระดับลูกลอยต่ำลง และสูงสุดเมื่อต่ำกว่าระดับ Overflow 8 cm

**การทำงาน** ปั๊มจะสูบน้ำเข้าระบบ เมื่อระดับน้ำต่ำกว่า Overflow 4 cm

| Option | Criteria | | |
|---|---|---|---|
| | Water Flow | Constant and Continuous water flow | Ease of installation |
| 1. Floating Ball | 60 L/min | No | No |
| 2.Float Level Switch | 80 L/min ✓ | Yes ✓ | Yes ✓ |

**Conclusion** **Float Level Switch** is proper to Fill in water in the Cooling Water Basin

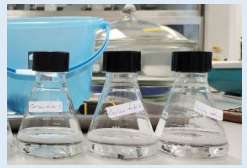
# Laboratory Testing

# Treatment Technology

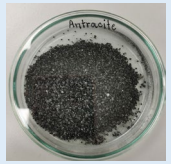
## Target

**Proper Treatment Technology**

### Lab Testing

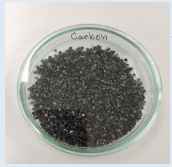


1. Evaluate Properties of Media




Media A

Alkalinity, pH TDS




Media B

Alkalinity, pH TDS


Media C

$Fe^{3+}$

pH

2. Media Portion Test (by Weight)

1 : 1 : 1

X : Y : Z

I : J : K

Water Quality follow the criteria

3. Surface Load Rate Test for Design ($m^3/m^2.h$)

xx

yy

Lowest time of Treatment

### Pilot Testing




4. Testing of the selected Media at proper portion with proper Surface Load Rate

## Pilot Test Result

| Parameter | เกณฑ์ RERain | น้ำฝน | น้ำฝนหลัง MMF |
|---|---|---|---|
| Turbidity* (NTU) | 1.5 | 5 | <1 |
| pH | 6-8 | 7.4 | 7.8 |
| TDS (mg/L) | <150 | 28 | 32 |
| BOD (mg/L) | - | <2 | <2 |
| Hardness (mg/L) | <100 | <1 | 3 |
| Alkalinity (mg/L) | <150 | 3 | 35 |
| Fe (mg/L) | 0.15 | 0.2 | <0.02 |
| **Legionella** (CFU/mL)** | **ND** | **ND** | **ND** |

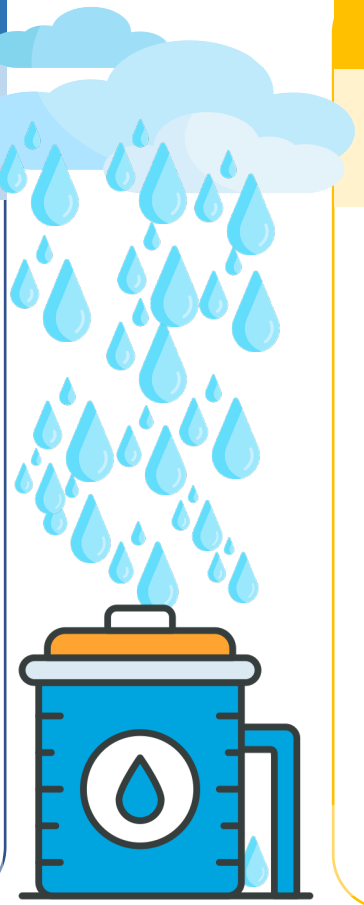
## Conclusion

**Multimedia Filter (MMF) is comprised with** Media A, B และ C in proper ratio **could improve water quality to achieve RERain Criteria**

# Rainwater Treatment for Cooling Tower (RERain)

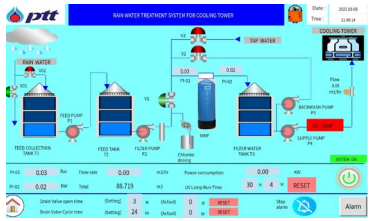
## RERain Hardware

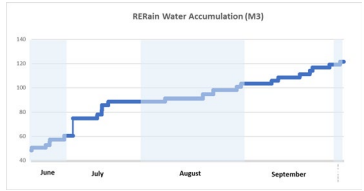
Prototype capacity **10 m³/d at Rooftop**
**PTT Head Office 3rd Building**

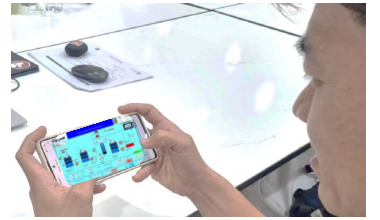


## RERain IoT

Remote Monitor and Control System through
**Mobile Application**




**SMART** (High Performance, Stability และ User Friendly)

# RERain Prototype Performance

## 2023 Testing

Prototype produce water to Water Cooling **136 $m^3$** (Last raining 08/11/2023) with energy consumption 99 kwh

**Water Quality** of RERain **achieved Cooling Water Quality** and **better Than Tap Water 3- 5 times**

**Petty Patent** (Filing No. 2303002341)

Easy Control and Operate through **IoT platform**

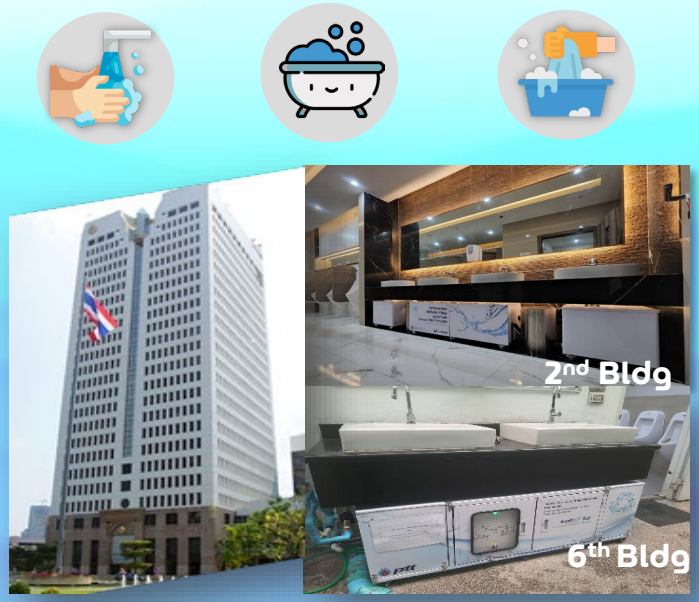
**Safety** Operation (Alarm & Remote Control)

$CO_2$ Reduction **0.44 $tCO_2eq/yr$**

# REGrey

**REGrey** : Innovative System to Treat Greywater, Handwash, Laundry, Dish Cleaning etc. to reuse for Urinal Flushing It's aimed to reduce freshwater withdrawal intensity and encourage employee awareness about valuable resource


- System Capacity : **365 m³/year**
- Tap Water Reduction : **1-2 L/cap.day**
- Urinal Flushing : **100%**
- Capacity : **1000 L/day**




2nd and 6th Building PTT Head Office

**Water saving 30%**

**Compact System & Easy to install**

**Petty Patent Filling**

## Water Quality of REGrey achieved USEPA Guideline for Toilet Flushing

### REGrey Performance

| Parameter | USEPA Guideline (Toilet Flushing) | Our performance |
|---|---|---|
| pH | 6-9 | **7.3-7.6** |
| BOD (mg/L) | <10 | **3-10** |
| Turbidity (NTU) | <2 | **<2** |
| Fecal Coliform (MPN/ 100 mL) | ND* | **ND*** |
| Public concern (color, odor) | - | **Clear, No Smell** |

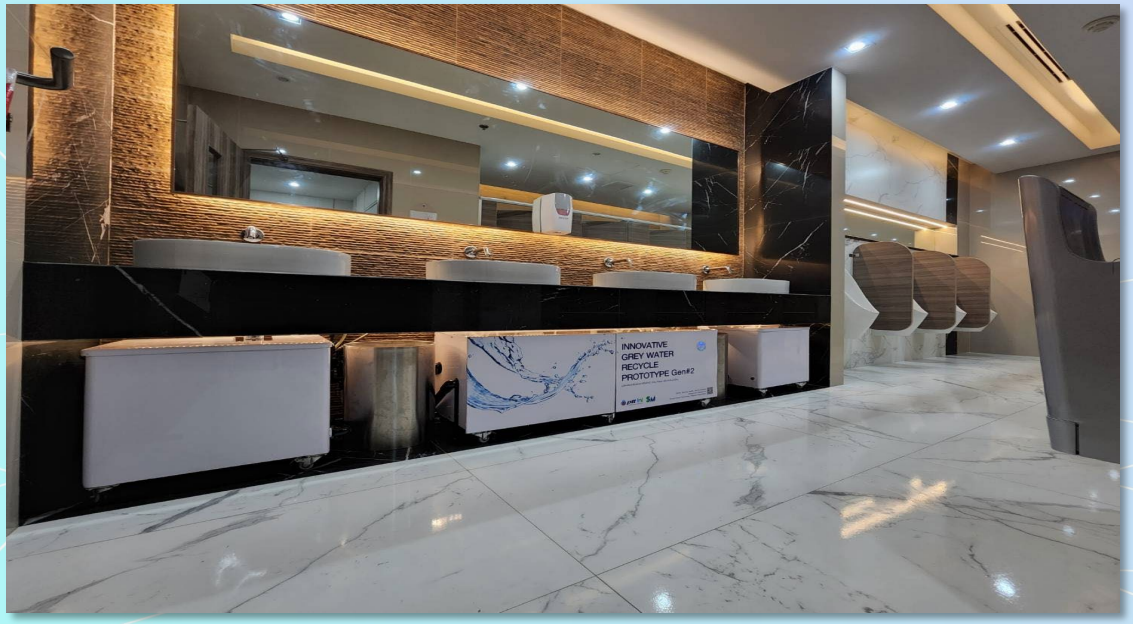
*ND = Not Detected

# REGrey Performance


Grey water


Grey water REGrey Water


Grey water REGrey Water




| Parameter | Grey water quality (Influent) | Final Performance Testing (Treated Water ) | US EPA Guideline (Toilet Flushing) | Pass |
|---|---|---|---|---|
| pH | 7.2-7.5 | 7.3-7.6 | 6-9 | OK |
| BOD (mg/L) | 6-109 | 3-10 | <10 | OK |
| Turbidity (NTU) | 45-330 | < 2 | <2 | OK |
| Fecal Coliform (MPN/ 100 mL) | 3300-330,000 | Not Detected | ND | OK |
| Public concern (color,odor) | Black-Brown-Yellow, Smell | Clear, No Smell | - | OK |
| Other Pathogens | Yes | No | - | OK |

| | |
|---|---|
| **Recycle Water** | **365 $m^3$/yr** |
| **Urinal Flushing** | **100%** |
| **Freshwater Withdrawal Intensity Reduction** | **1-2 L/cap.day** |
| **% Freshwater Reduction เทียบเป้าหมาย** | **~20%** |

Note: Petty Pattern (Filling No.) 2103003637

# About us

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