Greenhouse Gas Reduction Project in Agriculture

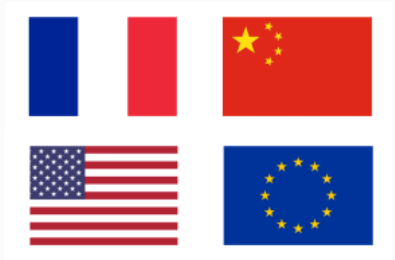
GREENERY

GHG Reduction in the Agricultural Sector is recognized as One of the Four Major Sources for GHG emission

2050 Carbon Neutrality Declaration

- **2050 Carbon Neutrality Declaration by 196 Countries**
  - The declaration of carbon neutrality by various countries around the world in response to global climate change.
- **As an interim target, the NDC(Nationally Determined Contributes) for 2030 has been established**

Intensification of GHG Reduction Demands on Enterprises



- **Global regulations such as EU's CBAM (Carbon Border Adjustment Mechanism) and the imposition of carbon prices are being strengthened**
- **Pressure to reduce emissions is increasing due to regulations like the EU Battery Regulation and ESG disclosures**

Agricultural GHG emission reduction is crucial, recognized as one of major source of emissions.

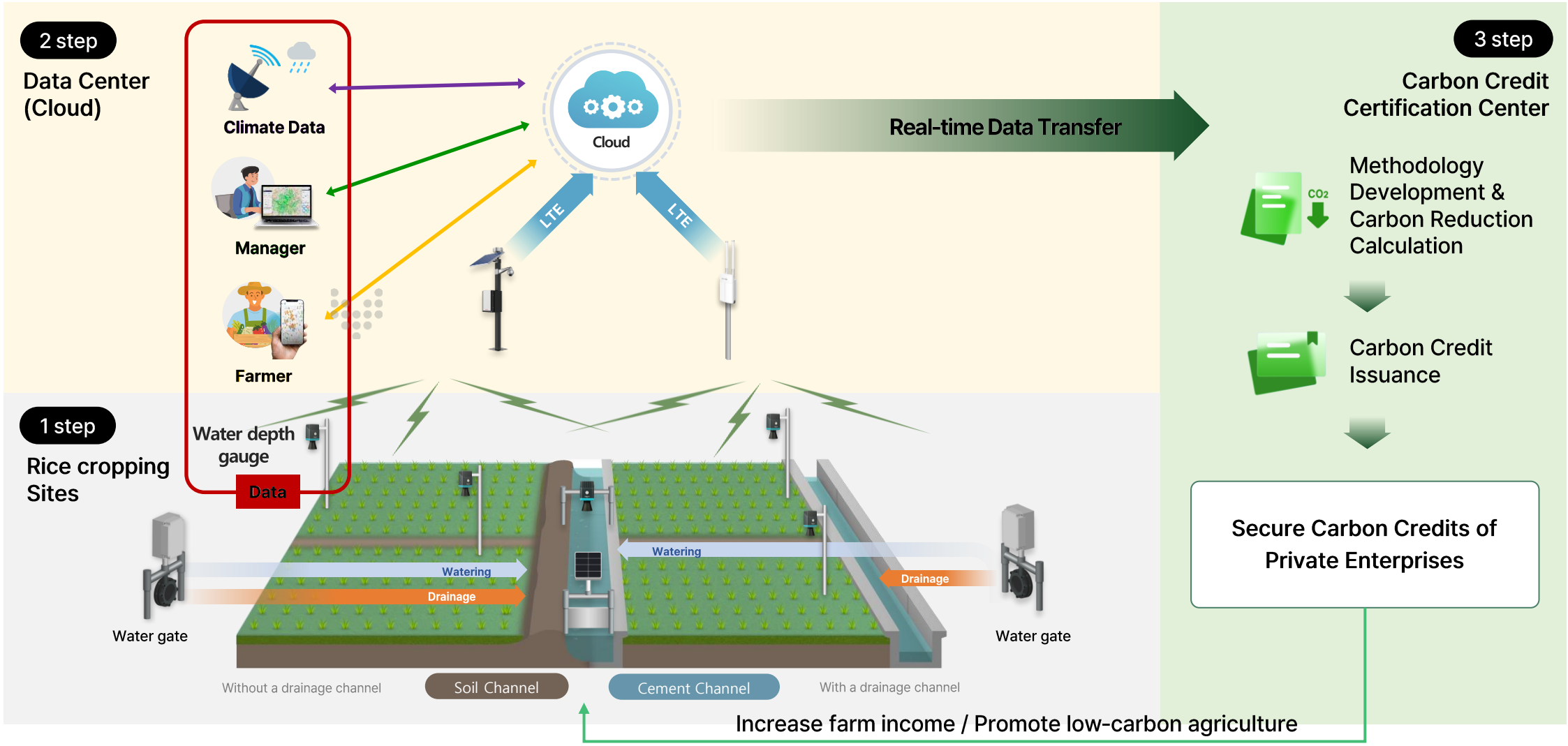
- **Rice farming holds significant amount of methane emissions contributions**
  - Methane has over 28 times the warming impact compared to carbon dioxide.
- **30% reduction is needed by 2030**
  - Government are committed to a 30% reduction by 2030 by joining the Global Methane Pledge

To achieve low carbon agriculture, systematic approach (e.g. Data collection) is critical

- **Agriculture industry in general has a weak digital infrastructure**, with insufficient systems in place to effectively use data-driven methods for reducing inefficiencies.
- Traditional **farming methods demand labor-intensive** efforts from farmers, which hampers the speed of GHG initiative and creates challenges in accurately measuring their impact.

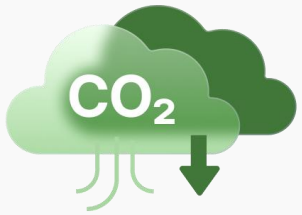
- ✓ **An urgent need for a system to effectively harness and manage the dispersed and fluctuating agricultural data available.**
- ✓ **An innovative operational model/structure is required for low-carbon agriculture through private company-farmer collaboration, enabling carbon neutrality for both government and companies**

Systematic approach to Calculate Carbon Reductions using Real-time Data from Rice Paddy fields



Implementation of Economic Cycle for Greenhouse Gas Reduction through Data-Driven Solutions

Greenhouse Gas Reduction Effect

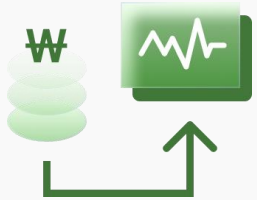


- ✓ Reduction of Approximately 1.9 Tons of Greenhouse Gases per Hectare.

Agricultural Practices to Respond to Climate Changes and 30% Water Savings

- ✓ Flexible Paddy Water Management using Integrated Data on Water Levels, Weather, and Soil
- ✓ 30% Water Savings with Additional Water Saving from Intermittent Drainage

Expanding the Cooperative Structure / Model between Enterprises and Farmers



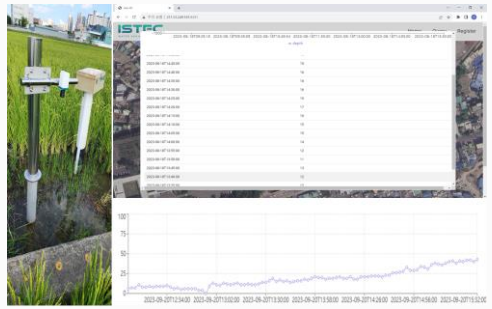
- ✓ Sell Issued Carbon Credits in Partnership with Companies
- ✓ Revenue from credit sales are Allocated to Farmers, Expanding Their Income

Data structure to ensure the Accuracy and Reliability of Carbon Reduction Calculations

List of Data Collection and Application

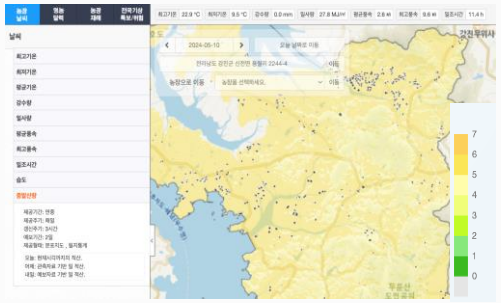
Water depth measurement data

- ✓ The water level in rice paddies affects methane production by microbes and creates an anaerobic environment



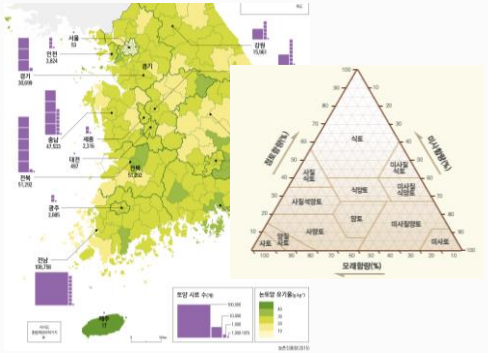
Climate data

- ✓ Temperature, rainfall, solar radiation, and evaporation affect rice paddy water levels



Soil data

- ✓ Complex effects on soil organic matter, moisture, and microbial activity

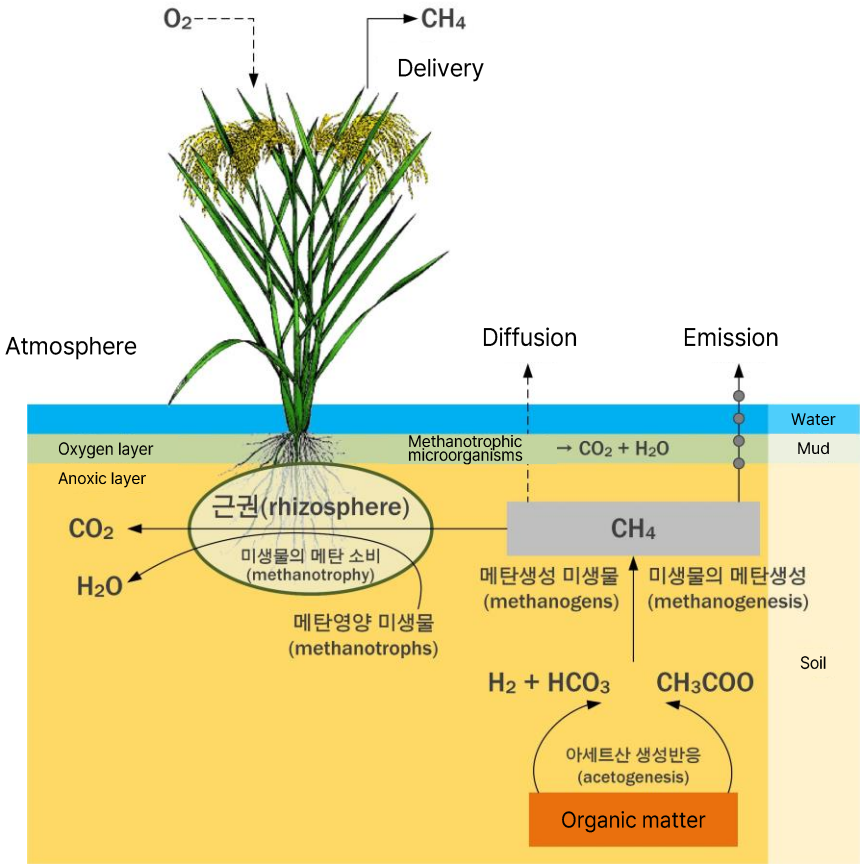


Farming data

- ✓ Water depth influenced by irrigation/drainage
- ✓ Microbial ecosystem affected by straw application, fertilizers, and pesticides.

Data for a GHG Emission Model Reflecting Methane Generation in Rice Cultivation

Methane Generation Mechanism



GHG Emission Calculation Model

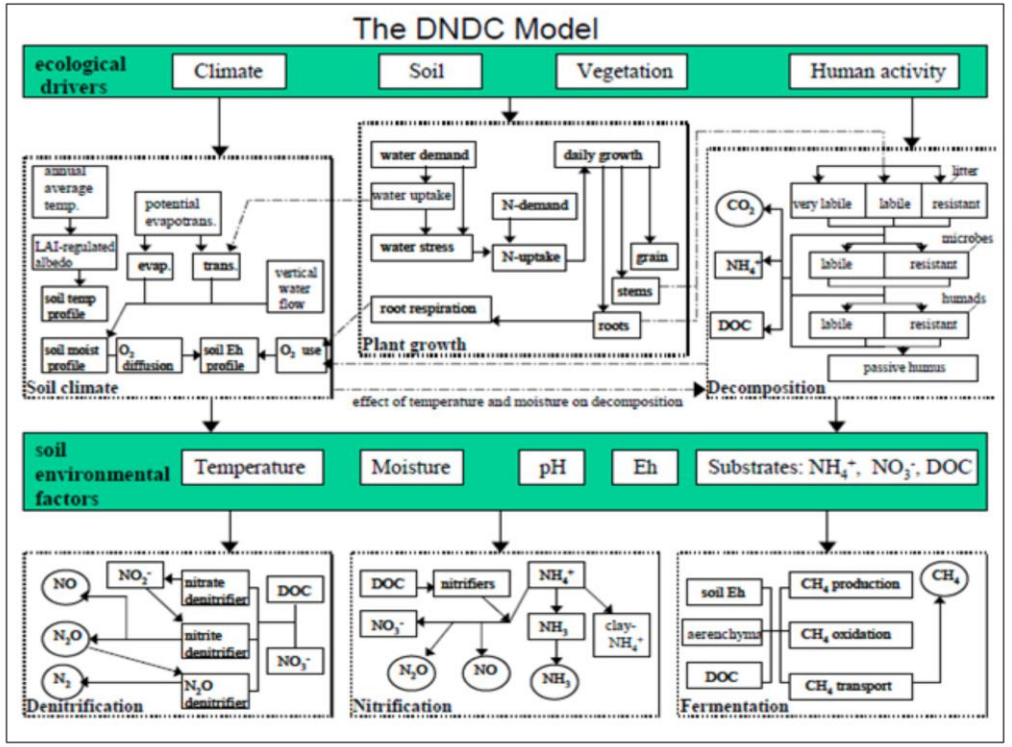
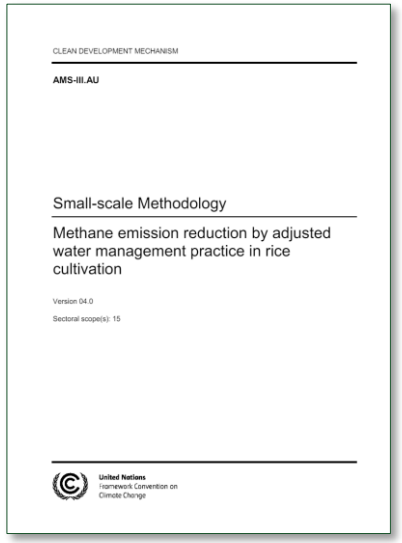


Fig. 1. Structure of the DNDC model (http://www.dndc.sr.unh.edu).

Introduction of International Paddy Water Management Methodology Based on Biogeochemical model and Tier 3 data parameters

Reference Methodology


CLEAN DEVELOPMENT MECHANISM

AMS-III.AU

Small-scale Methodology

Methane emission reduction by adjusted water management practice in rice cultivation

Version 04.0

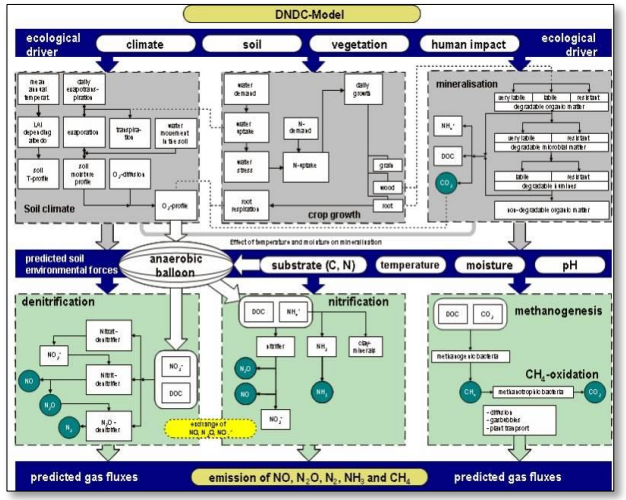
Sectoral scope(s): 15

United Nations Framework Convention on Climate Change

CDM[AMS-III.AU]

Methodology designed based on Tier 1 data, utilizing IPCC default factors

Biogeochemical Model



A biogeochemical model centered on Tier 3 to forecast GHG emissions

Methodology Development

1 Methodology Idea Note

- Baseline scenario
- Analyze Tier factors
- Methodology application and additionality

2 Methodology Development

- Verify scenario and data suitability
- Process for data collection and management
- Optimal monitoring methods (QA/QC)

3 Methodology Proposal & Evaluation

- Establish baseline scenario
- Identify and present GHG emission source
- Development of reductions calculation formula including Tier 3 data
- Definition, purpose, management plan for each parameter
- Third-party review and evaluation by experts

* Methodology: A document describing the standards, assumptions, calculation methods, and procedures applied to calculate and monitor GHG reductions or removals

Establish Baseline and Project Scenario Criteria for Methodology

Total Reductions
= ① Baseline Emission – ② Project Emission

① Baseline Emission (BE)

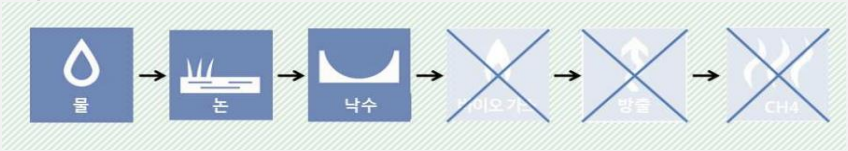
Methane emissions before changing agricultural practices (continuous flooding or intermittent flooding)

② Project Emission (PE)

Methane emissions after changing agricultural practices and emissions resulting from additional activities performed for the change

AS-IS

TO-BE



Key points of the water management methodology	
Scope	• **Rice farms that change the water regime during the cultivation period** from continuously to intermittent flooded conditions and/or a shortened period of flooded conditions • **Alternate wetting and drying method** and aerobic rice cultivation methods
Applicability	• **Applicable regardless of scale**, but data level (Tier) is determined based on scale • Excludes upland soils, rainfed areas, and deep water cultivation • **Applicable to sites with irrigation and drainage facilities** • **Should not affect rice yield** • No additional land use changes for the project • Provide farmers with sufficient education about the project • **Compliance with regulations of the local government** or authorities governing the agricultural area
Additionality	• Must not violate **national, local, or international laws or regulations** • Economic additionality assessment is mandatory if emissions exceed 60,000 tons

Automated Data Collection from Farm Sensors, Carbon Reduction Calculation, Visualization, to Carbon Credit Issuance

Sensor → **Data Sources** → **Collection & Storage** → **Analysis & Visualization** → **Application**

Climate/water level Sensor Installation

System Registration

Sensor data

- Water Depth Data
- Soil Moisture
- Soil Temperature
- Soil Humidity

Soil data

- Soil Carbon Content [kgC/kg]
- Clay Content
- Soil pH (Acidity)
- Bulk Density [g/cm³]
- Soil Salinity
- Soil Texture

Farming data

- Crop Type
- Latitude/Longitude
- Cultivation Area, Fertilizer Application Methods, etc

external **Weather center**

- Daily Average, Maximum and Minimum Temperature (°C)
- Daily Precipitation (cm)
- Relative Humidity (%)

API

Water level

Soil

Farming

Area

DB

Location

...

Climate

Analysis

Data preprocessing
Data link

Automatic Generation of Input Data for the DNDC Model

Greenhouse Gas Emission Simulation

Visualization

Farmer

Manager

Reductions Calculation

Carbon Credit Issuance

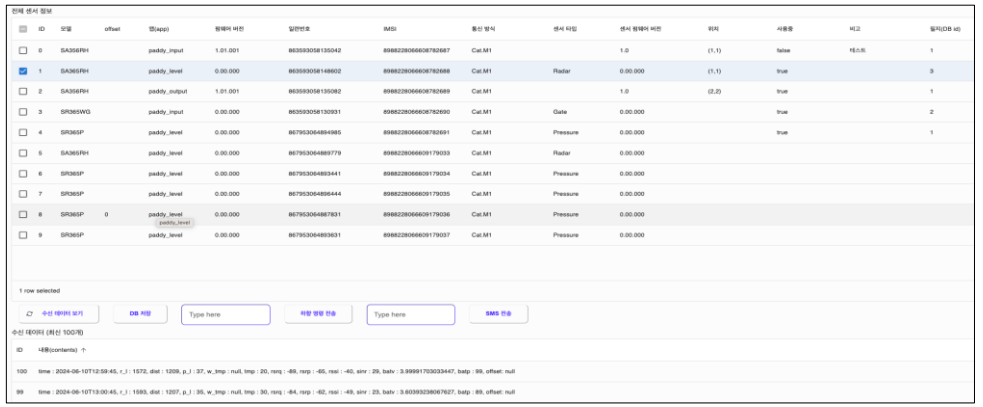
Increase in Carbon Reduction Performance in the Agricultural Sector

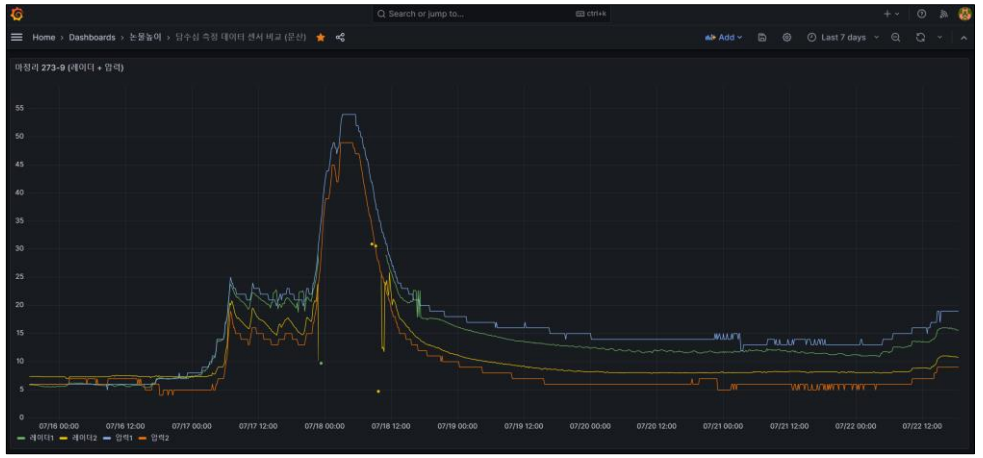
Increase farm income

Installation of Water Depth Sensors and Data Collection in Rice Paddy fields

Installation of Water Depth Sensors and Automated Water Gate System

Real-time Monitoring of Paddy Water Data





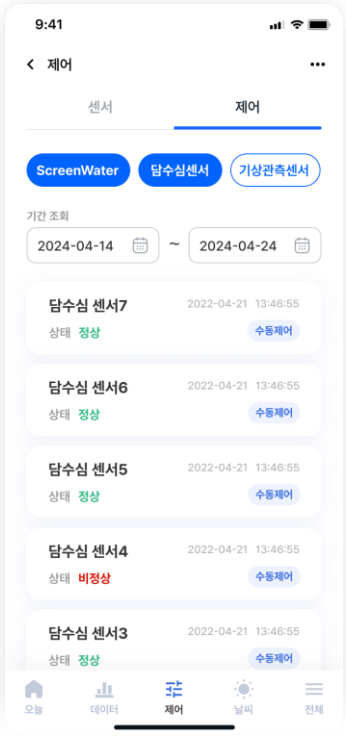
Real-time based Data Monitoring (via Dashboard)and Data Analysis

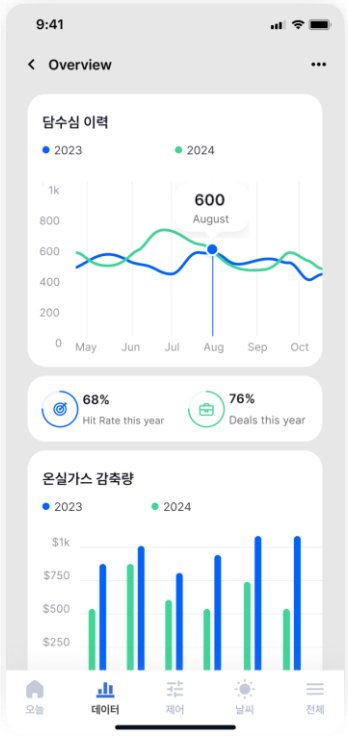
Web Interface for Managers

Check Collection Status

Monitor history of water level sensing and GHG reductions

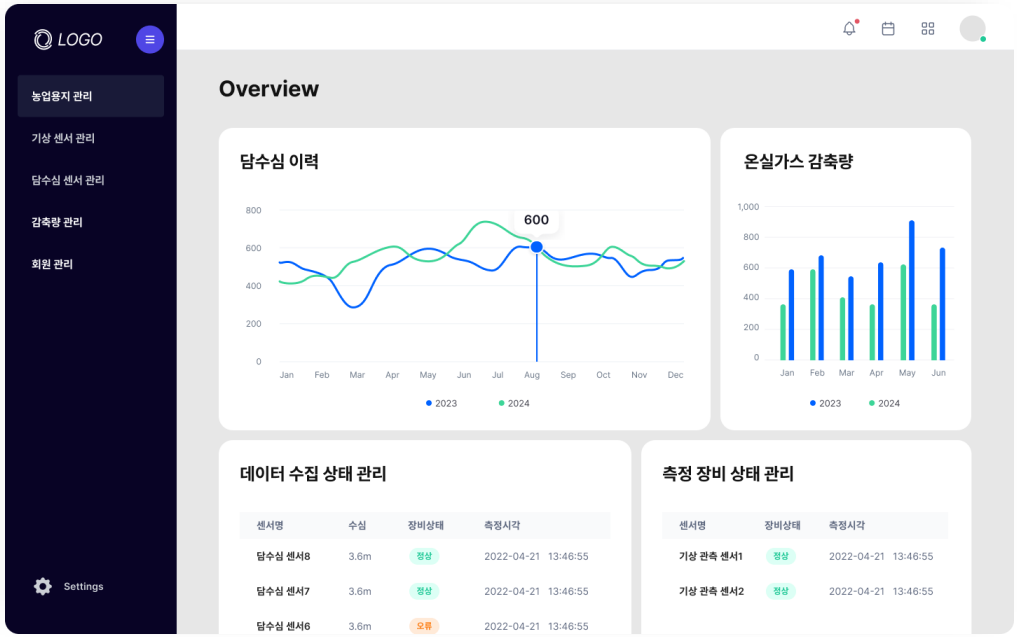
Current Weather Conditions Near the Cultivation Area





App Interface for Users

- Check Flood Depth Status and Greenhouse Gas Reduction Amount for Registered Farms and Provide Charts
- Alert for Abnormal Conditions of Remote Sensing Equipment and Remote Control



Achieving Sustainable Development Goals along with GHG Reduction in Agriculture

SDGs, Sustainable Development Goals

ZERO HUNGER

Promoting Sustainable Agricultural Revitalization through Low-Carbon Agriculture

GOOD HEALTH AND WELL-BEING

Improving Food Security

CLEAN WATER AND SANITATION

Ensuring Water Use Efficiency and Improving Water Management through Automation Technologies

CLIMATE ACTION

Contributing to Climate Change Mitigation through Greenhouse Gas Reduction

Collaborating with Water Solution Companies and Research Institutions to Issue International-Standard Carbon Credits

Project Leading Company

GREENERY

Climate Related Solution Development

- Conducting C**arbon Emission Monitoring and Carbon Reduction Consultation** for Companies
- LCA and Development of Methodologies for Carbon Reduction Assessment

Development of Automation Technologies for the Carbon Market

- Technologies for Automatic Calculation of Carbon Reduction Amounts and Automation of Carbon Credit Purchases

Partner Organizations

Ministry of Agriculture, Food and Rural Affairs

Support for **Expanding Low-Carbon Agricultural Activities and Quantification of Reduction Amounts**, Policy Development, and Assistance for International Expansion of Carbon Credit Issuance Services

National Information Society Agency

Agency leading South Korea's digitalization **funded project**. Policy advancements with multiple government ministries

ISTEC, ltd.

Delivery and Installation of **Water Depth Sensors** by a Water Management and Sensor Specialist Company

Seoul National University, College of Agriculture and Life Science

Consulting on the **Development of GHG Reduction Methodologies** and Analysis of Water Savings Effects in Water Management

Korea Agriculture Technology Promotion Agency

Collaboration on **Developing Optimization Technologies** for Paddy Water Management


Thank you
GREENERY