



Forum for Approaches to Air Pollution and Climate Action



Feasibility Study Project to Replace Coal Fuel with Biomass Solid Fuel Made from Agricultural Waste in Vietnam

17 February 2026, Tokyo, Japan

Dr. Ken Yamashita, ACAP
Dr. Le Ngoc Cau, IMHEMS

Project Organization Structure

Ministry of Environment, Japan (MOEJ)
- Overall Project Lead-



Asia Center for Air Pollution Research (ACAP)

- Overall coordination of the project with relevant organizations
- Scientific research related to air pollution
- Financial management
- Overall Progress/Project Report

INNOVARE

- Coordination of the project with ACAP
 - Social research related to bio solid fuel management
- ↓ Support for Overall Progress/Project Reporting of ACAP

TROMSO

- Test and evaluation of creating bio solid fuel with agricultural residues

IMHEMS (Vietnam: sub-contractor)

- **Coordination with MAE and local stakeholders**
- **Support for local survey and meeting/workshop**
- **Joint study on co-benefits (air pollution control and GHG reduction)**
- **Assist for research output**

Japanese Embassy in Vietnam, JICA
• information sharing and possible cooperation

Background & Rationale

The Problem

Open burning of agricultural residues, specifically rice straw, is a primary driver of PM2.5 air pollution across Vietnam.

The Challenge

Industrial sectors remain heavily reliant on coal, contributing significantly to national GHG emissions.

The Solution

Solid biomass fuel derived from agricultural residues provides a practical, carbon-neutral alternative to solve both issues simultaneously.



Project Objectives

Feasibility Study

Conduct a comprehensive Feasibility Study (FS) focused on replacing coal with solid biomass fuel in industrial applications.

Evaluate technical, economic, and institutional feasibility specifically under the Joint Crediting Mechanism (JCM) framework.

Quantify & Replicate

Rigorously quantify the reduction in GHG emissions and the co-benefits related to air pollution improvement.

Develop a robust, replicable JCM project model that can be scaled across Vietnam and other Asian nations.

Target Area & Study Scope

Geographic Focus

- ✓ Ho Chi Minh City and surrounding industrial zones.
- ✓ Mekong Delta region, the agricultural heartland of Vietnam.

Biomass Resources

- ✓ Primary: Rice straw (abundant and currently burned).
- ✓ Secondary: Coffee husk, bagasse, and cassava stems.

Target Users

- ✓ Industrial boilers and manufacturing facilities currently dependent on coal.



Key Survey & Research Activities



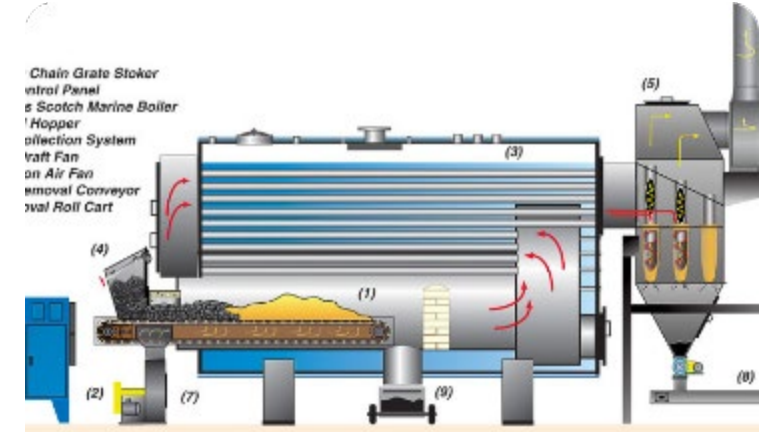
Resource Survey

Assessing biomass availability, seasonal generation patterns, and the feasibility of large -scale collection.



Tech & Supply Chain

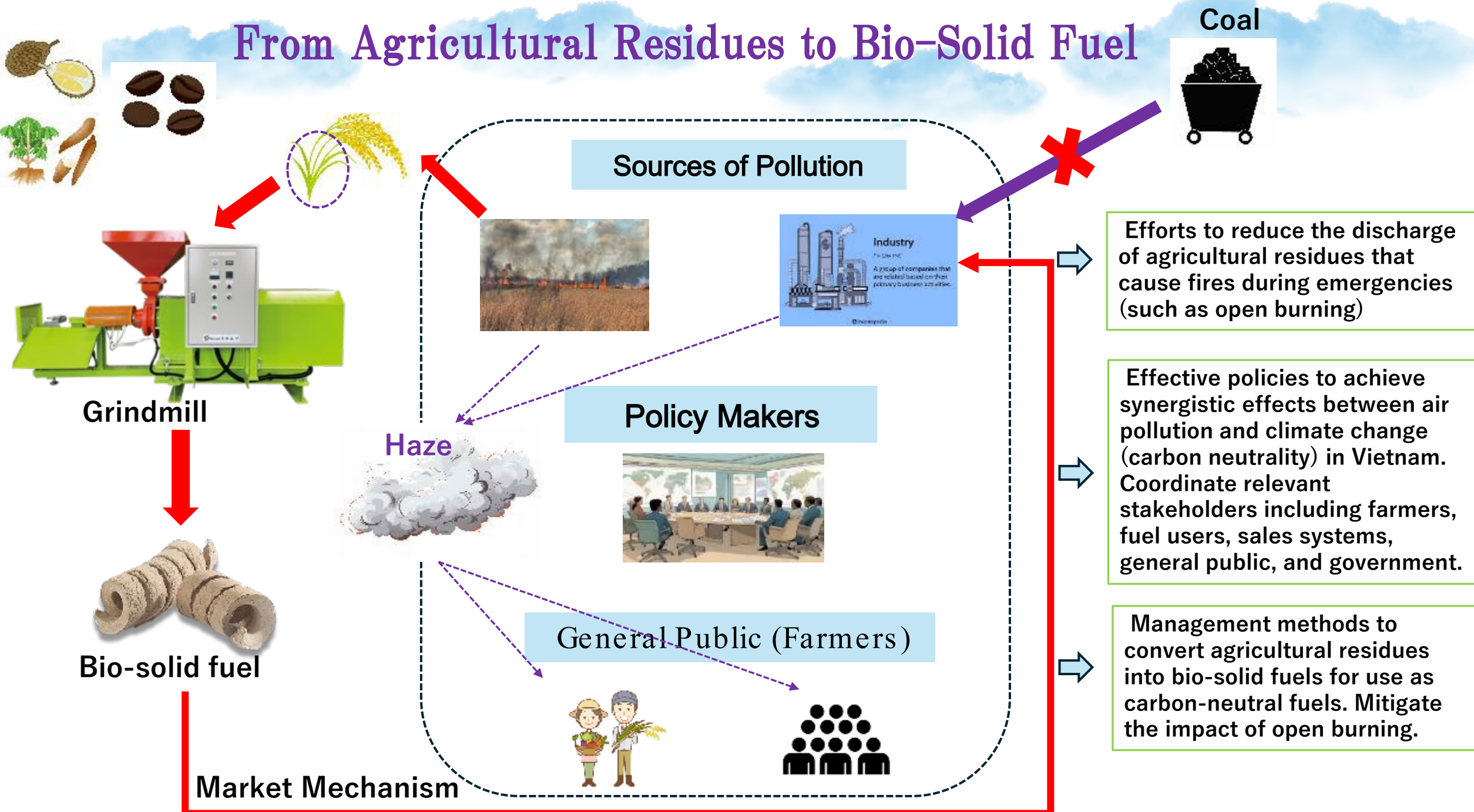
Evaluating solid biomass fuel production technologies and analyzing local supply chain structures and costs.



Demand Survey

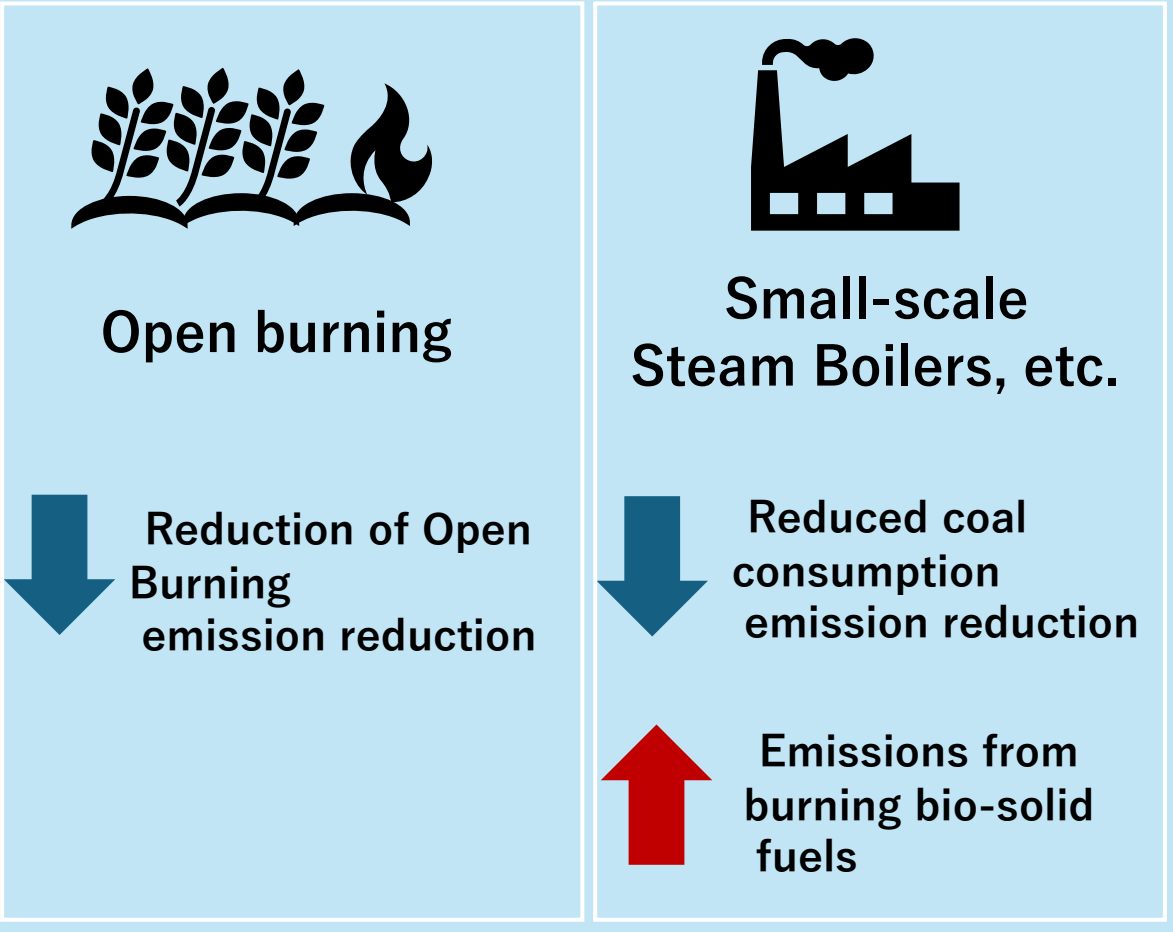
Determining fuel demand, technical compatibility with existing boilers, and comparative costs against coal.

From Agricultural Residues to Bio-Solid Fuel

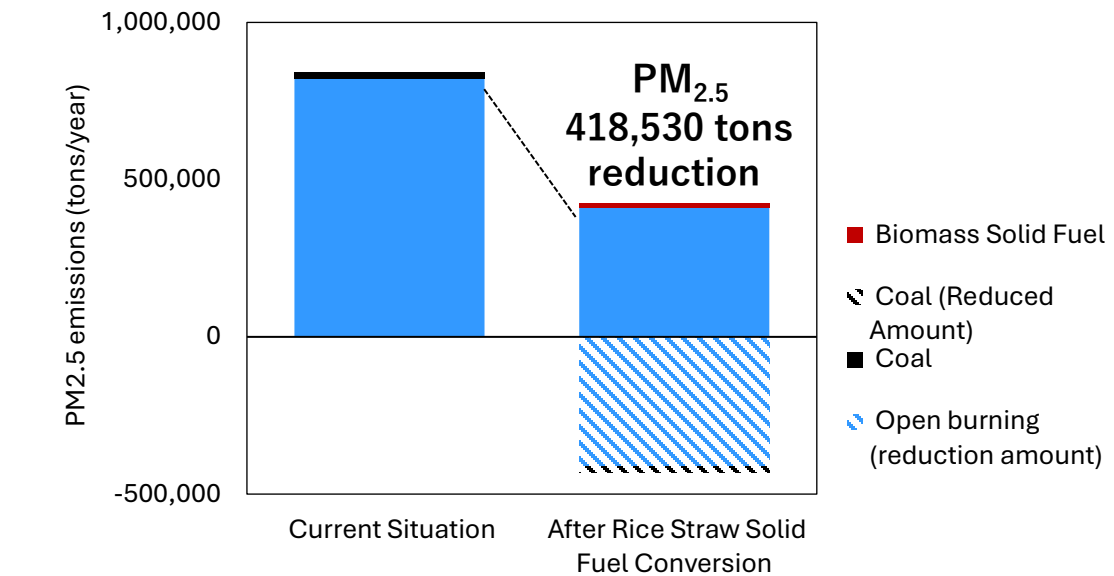
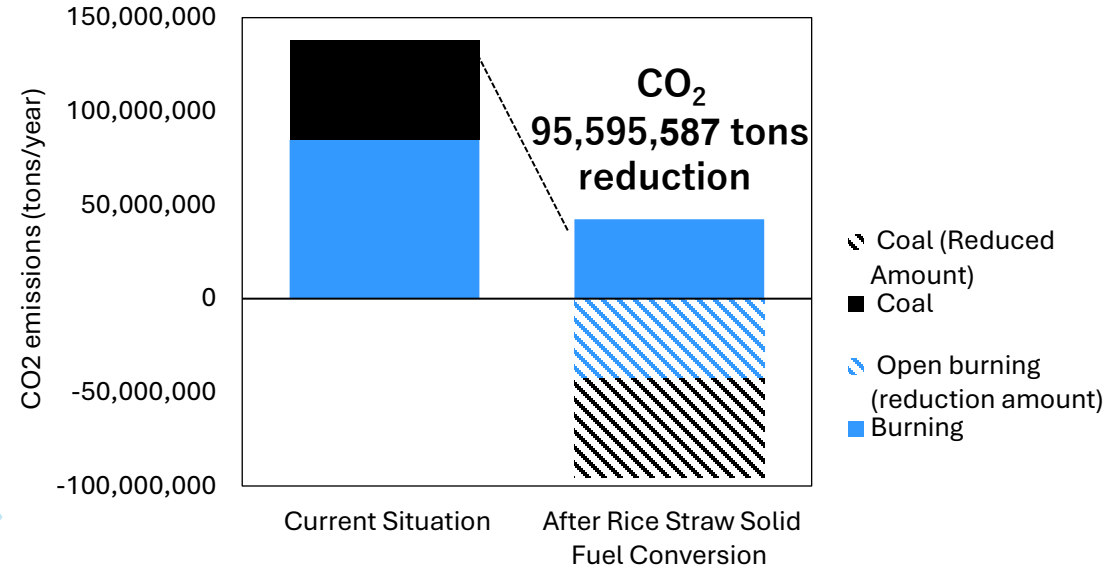


Estimated Reduction Effects of CO₂ , and PM2.5 from Biomass Solid Fuel Conversion

Conversion of 50% of rice straw subject to open burning converted into biomass solid fuel, Changes in CO₂ , and PM2.5 Sources



Reduction Effect in the Mekong Region



Machinery Introduction for Sample Test

- **Solidification Unit**



Grind Mill TRM-200CR

Specialized machine for spiral-shaped solidification of rice husks

【Specifications】

Model / TRM-200CR

Processing Capacity / Approx. 200 kg/h (Rice Husk Curl Chip Production)

Unit Dimensions / Approx. Width 2,197 × Depth 1,095 × Height 1,480 (mm)

Unit Weight / Approx. 985 kg

Power Supply / AC-200V 3φ 50/60Hz · AC400V

- **Crusher (Engine-Powered)**

【Application】 Crushing raw materials requiring high torque

【Features】 No power source required; suitable for outdoor work

【Specifications】

Dimensions (L × W × H): 1970 × 660 × 900 mm

Dry Unit Weight: 140 kg

Maximum Processing Diameter: 45 mm

Processing Capacity: 1 m³/h

Engine Model: GX200

Maximum Engine Output: 4.8 kW

Number of Knives: 2 Spiral Blades



- ▶ **Crusher (Electric)**

【Application】 Grinding to uniform particle size

【Features】 Continuous operation possible with stable rotation speed

【Specifications】

Maximum engine output: 3kW

Crushing capacity: 400kg/h



Results

Cassava Branches (Moisture Content 11.68%)



Rubber Shells (Moisture Content 7.07%)



Rice Straw (Moisture Content 11.42%)



【Cassava Branches】
Produced with the input material in a pulverized state

【Rubber Shells】
Produced with the input material in a pulverized state

【Rice Straw】

- Confirmed stable molded bodies
- Good shape retention

【Rice Husk】

- Confirmed stable molded form
- Good shape retention

JCM Project Details: Verification of Coal Replacement Model

Technical Specifications and Assumptions

Item	Specifications/Conditions
Production Equipment	Tromso Grind Mill (200 kg/h)
Fuel Quality	Calorific Value: 3,500 kcal/kg
Annual Production Capacity	250 t/unit (1,250 operating hours/year)
Co-firing Rate	10-20% (phased introduction)
Target Boilers	Coal-fired industrial boilers
Estimated Usage	1,000 t/year per site

Economic Evaluation (Annual Cash Flow)

Item	Amount (million VND/year)
Incremental Fuel Cost	-432
JCM Credit Revenue	+121
Annual balance	-311

[Conclusion] Difficult to justify economically

Calorific Value Unit Price: Rice Straw 430 VND/1,000kcal vs Coal 300 VND/1,000kcal

Conditions for economic viability

Viability Conditions	Current Situation	Required Level	Feasibility
Rising Carbon Prices	Current \$15/tCO ₂	Required \$50/tCO ₂ or higher	Feasible in the medium term
Increase in coal prices	Current: 5,000 VND/kg	Required: 8,000 VND/kg or more	Uncertain
ESG compliance demand	Voluntary Initiatives	Regulatory compliance and customer requirements	Potential in the short term
Increase in Equipment Subsidy Rate	Current: 50%	Required: 70% or higher	System revision required

Business models that are not JCM-eligible but are self-sustaining

[Key Discovery] Identified a model that is economically viable without JCM support

Model ①: Rice Husk Substitution (Demand Side)

Prerequisites

Target Companies	Companies using rice husk boilers (rice mills, etc.)
Current Fuel	Rice husks (1,700 VND/kg)
Alternative Fuel	Rice straw solid fuel (1,500 VND/kg)
Usage	1,000 t/year

Economic Impact

Annual Fuel Cost Savings: +242 million VND/year

Model ②: Farmer Community Operation (Supply Side)

Prerequisites

Operating Entity	Farmers' Community (50-100 farmers)
Equipment	1 grinding mill per site
Raw Material Procurement	Self-supplied rice straw (zero raw material cost)
Annual Production	250 tons/year

Economic Impact

Annual Revenue: +111 million VND/year
Payback period: 4.2 years

Why is it not JCM-eligible?

- The JCM targets GHG reductions through "fossil fuel substitution." Rice husks → rice straw constitutes "substitution between biomass fuels," making it ineligible for credits
- However, the project is likely economically viable without JCM support due to its self-sustaining nature



Decentralized "Green Energy Service Hubs"

Based on Tromso's compact compression technology and the logistics constraints (weak bridges/narrow roads) of the Mekong Delta.

1. Core Proposal: Establish decentralized rice straw collection and compression hubs directly at key **Agricultural Cooperatives (ACs)** within the "**1-Million Hectare High-Quality Rice Project**" zones.

2. Operational Workflow:

Collection: Cooperatives gather fresh rice straw post-harvest.

Pre-processing: Natural/Mechanical drying to reach **moisture content <20%** (meeting Japanese technical standards).

Compression: Utilizing compact 1-phase grind mills to produce **high-density biomass briquettes/pellets**.

3. Addressing Infrastructure "Bottlenecks":

Accessibility: Small-scale, 1-phase machinery allows installation in remote areas without upgrading power grids.

Logistics Optimization: Compressed briquettes reduce volume significantly, enabling easy transport via narrow inland roads and low-capacity bridges.

4. Value Creation:

For Enterprises: Ensures a **stable, year-round supply** of high-quality biomass fuel.

For Farmers: Generates **additional income** from agricultural residues that were previously wasted or burned.

Conclusion: Unlocking Sustainable Energy in Vietnam

Feasibility & Prospects

Rice straw biomass shows technical fit and market potential.

Triple -Win Impact

Advances energy security, reduces emissions, and boosts local incomes.

Enablers for Success

Leverages existing infrastructure and sustainable feedstock supply.

Next Steps

Sustain support and innovate to scale clean energy benefits.