

Second Generation Ethanol (E2G) :

Technology, Initiatives, and Policy Proposals for ASEAN

About Us: Nippon Steel Engineering Co. Ltd., (NSE)



NIPPON STEEL
ENGINEERING

NIPPON STEEL ENGINEERING CO., LTD. (NSE*) is the engineering company representing the NIPPON STEEL Group.

NSE started its engineering business in 1974 by utilizing its plant equipment technologies and steel utilization technologies which have been amassed in the steel manufacturing industry to promote social and industrial infrastructure projects.

Today NSE provides optimal solutions to a wide range of sectors, such as **environment & energy business including carbon neutral**, building & infrastructures and industrial services, **with its capabilities in engineering, procurement, and construction, as well as operation and maintenance.**

Who We Are

An Engineering Company with a
Long History and Extensive
Experience



Head office: Tokyo, Japan
Capital: ¥ 15 billion
Sales: ¥ 400 billion
(FY2024; consolidated)



Steelmaking and steel fabrication



NIPPON STEEL Chemical & Material
Chemicals, materials



Energy Solutions



Waste to Energy



Oil and Gas



Pipelines



Building Construction and
Steel Structures

*In the following slides, the term 'NSE' is used solely as an abbreviation for our company, and not in a trademark sense.

NSE's Carbon Neutral Business & Technologies

- ✓ NSE offers a wide range of decarbonization solutions. In this forum, we will focus on introducing our technologies and initiatives in biofuels (E2G), along with our proposals for ASEAN.

Offshore wind farm



NSE has a lot of experiences as EPCI contractor for offshore project and will provide total solution for offshore wind farm development.

Waste to energy



NSE has and operates 35 waste treatment facilities in Japan, which generate power from waste.

Biomass power plant (75MW, the largest class in Japan)



Nippon Steel Group owns and operates a variety of power generation facilities in Japan, and has established a system to supply power not only to private demand but also to local communities. NSE is also engaged in the construction and operation of biomass power plants.

Geothermal steam production facility



(Domestic market share: 50% or more)
Since the 1980s, NSE has designed, procured, and constructed steam production facilities for geothermal power plants. In 2016, NSE also started selling binary power plant.

CO₂ recovery, ESCAP™



ESCAP is an energy-saving CO₂ absorption process that enables the separation and recovery of high-purity CO₂ from effluent gases.

FT Synthesis Fuel Technology (GTL, e-fuel)



Converts CO and H₂ into clean liquid fuels, applicable to GTL, e-fuel.

Sewage sludge fuelization, J-COMBI™



J-COMBI can process sewage sludge into granular dry fuel without damaging its own calorific value. The fuel is usable as a coal alternative in a power plant.

Biofuel and biomaterial technologies



NSE has production technologies of **bioethanol (CellEtha™, CellEzyme™)** and biomass charcoal.

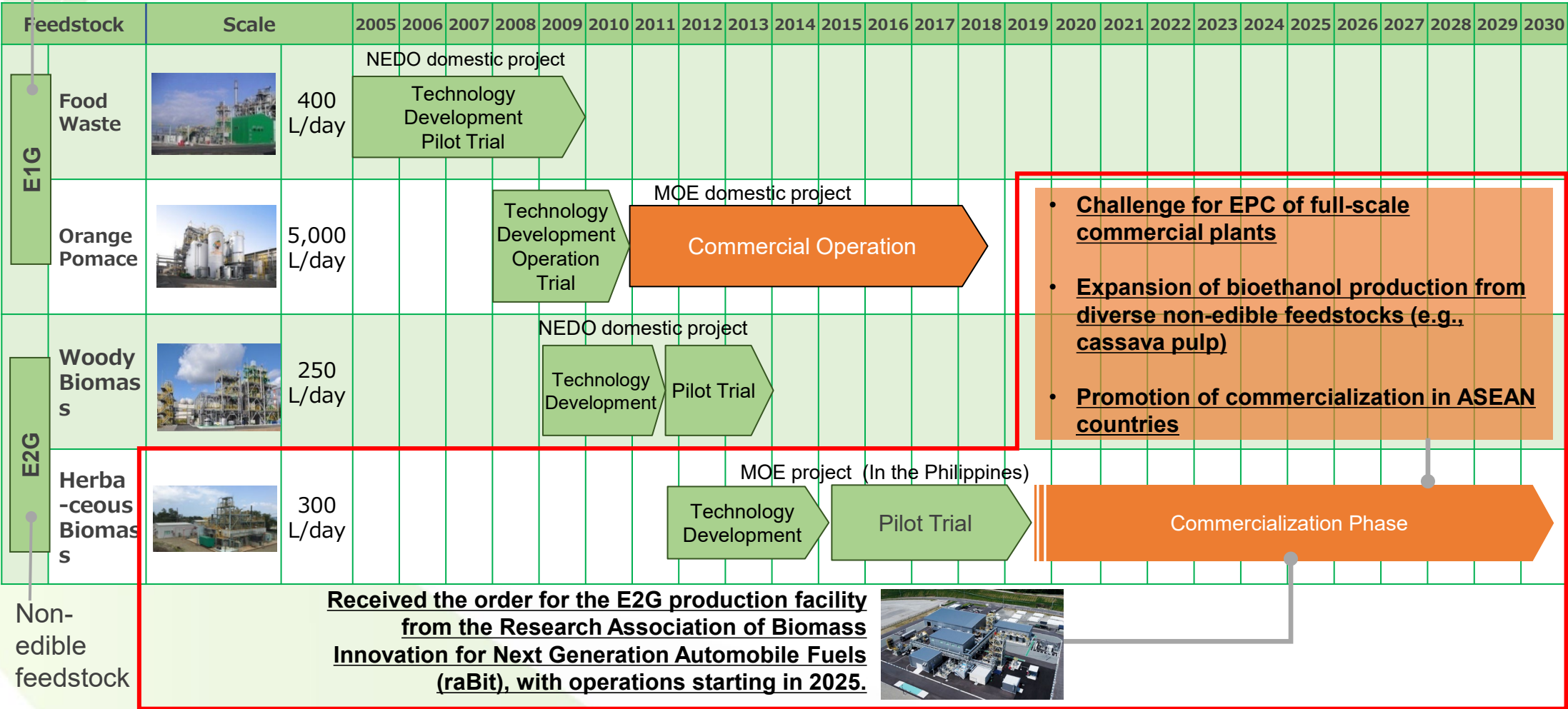
CO₂ utilization technologies

NSE is conducting development of carbon recycle technologies, which are methanation, e-Methanol Synthesis etc.

History and Current Project of NSE's Various Biomass Ethanol Technologies

NSE has developed technologies to produce ethanol from a variety of feedstocks and has established a technology for producing bioethanol from cellulosic biomass and cassava pulp (non-edible).

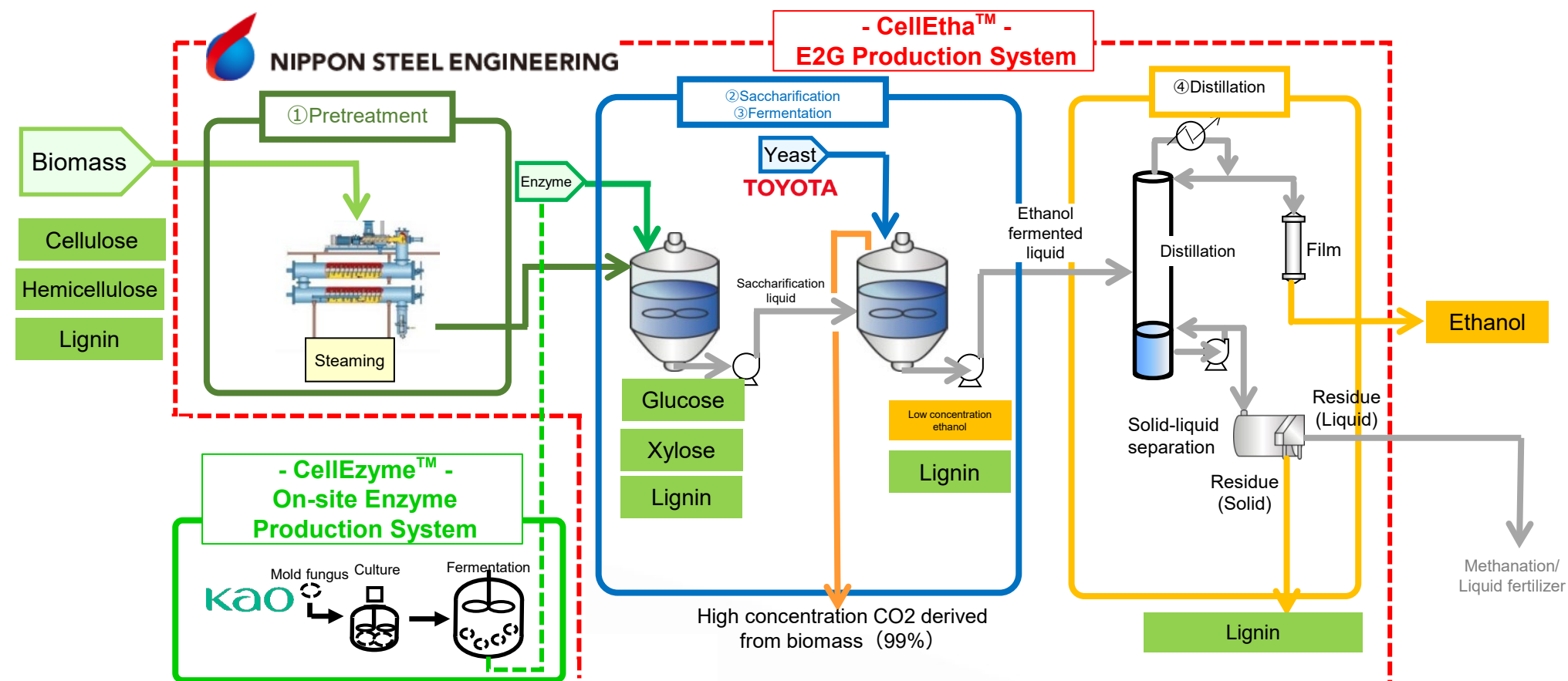
Edible feedstock



Non-edible feedstock

NSE's Integrated E2G Production System - CellEtha™ -

- ✓ E2G Production System (**CellEtha™**) achieved the World's Highest Ethanol Yield - 250 to 300 liters per dry ton of biomass
- ✓ The On-site Enzyme Production System (**CellEzyme™**), integrating Kao Corporation (Kao)'s enzyme technology with our engineering expertise, reduces enzyme costs compared to procuring enzymes from the market.
- ✓ High-Efficiency Fermentation Process jointly developed with TOYOTA MOTOR CORPORATION (TOYOTA), using yeast developed by TOYOTA
- ✓ Further economic efficiency is achieved through the utilization of ethanol residues (lignin).



NSE's on-site enzyme production technology - CellEzyme™ -

- ✓ High enzyme costs remain a barrier to the wider adoption of E2G.
- ✓ On-site Enzyme Production System (**CellEzyme™**), integrating Kao's enzyme technology with our engineering expertise, reduces enzyme costs compared to procuring enzymes from the market.

Off-site Supply

Purification and Formulation



Enzyme Factory

Transportation



Utilization



Biorefinery Factory

On-site Supply

Production



Enzyme
Production System
(CellEzyme™)

Utilization



Biorefinery Factory

Direct !

Advantage

- Cost reduction
- Mitigation of CO₂ emissions
- Supply chain resilience

Introduction of the E2G Pilot Scale Plant in the Philippines

Cellulosic Ethanol Pilot Plant - Supported by Japan's Low-Carbon Initiative -

- ✓ Developed technologies for producing cellulosic ethanol from various biomass sources, such as sugarcane bagasse, Napier grass, and Sugarcane trash , successfully demonstrating flexibility and high yield performance across different feedstocks.
- ✓ Demonstration conducted with an integrated cellulosic ethanol production system in the Philippines.
- ✓ Achieved ethanol yields of **250–300 liters per dry ton of bagasse** — among the highest in the world.



Cultivation- Harvesting



Stable feedstock supply



Cellulosic Ethanol Pilot Trial Plant

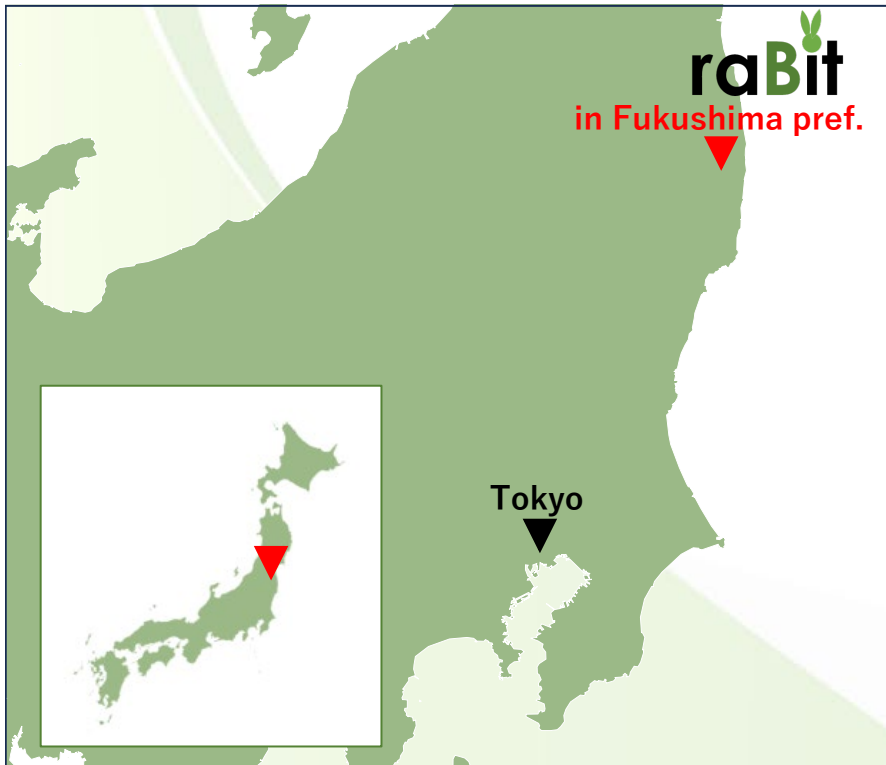


Fully Integrated Cellulosic Ethanol Producing System

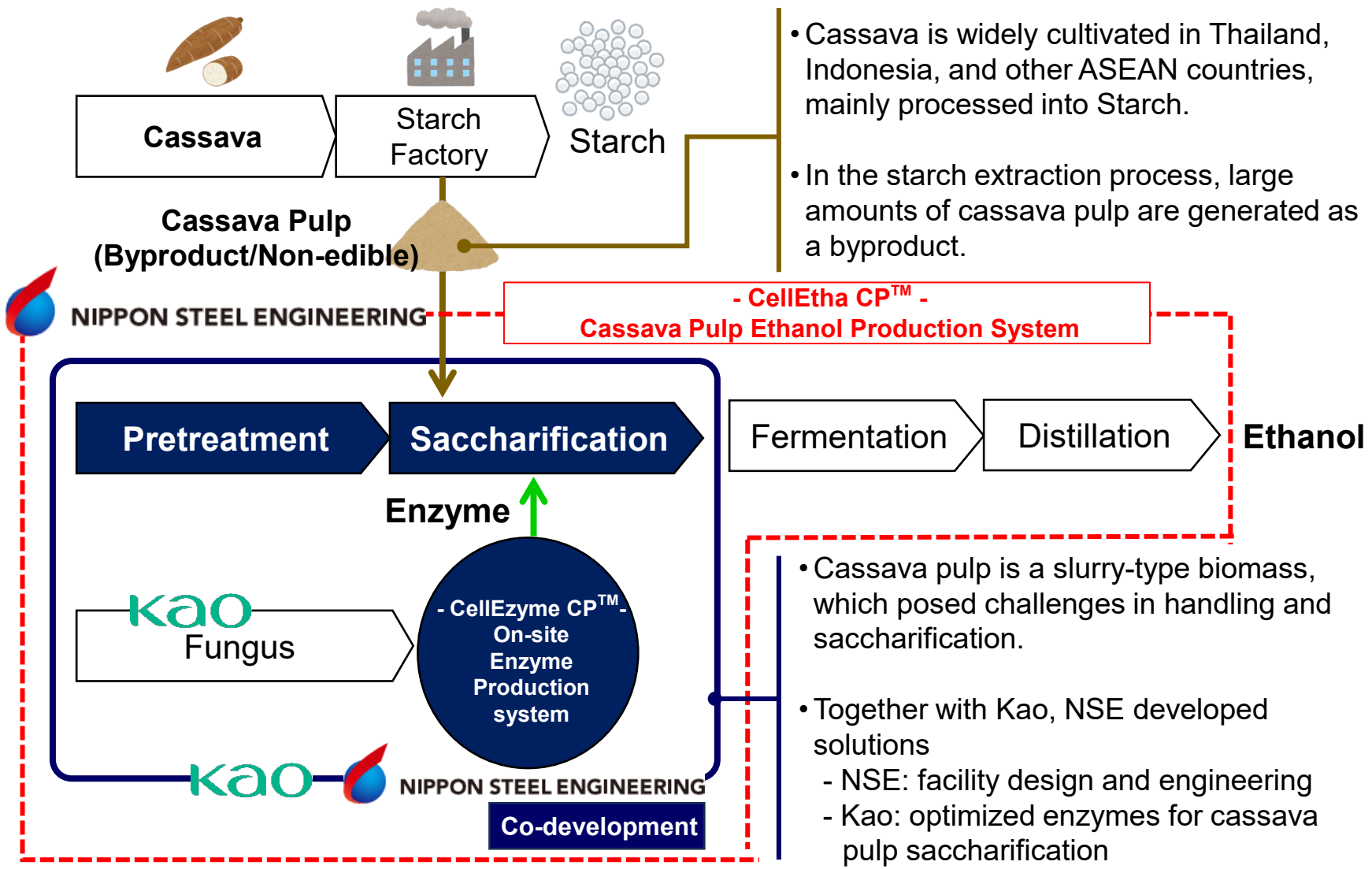


NSE's Proven Track Record in E2G Engineering & Construction

- Plant owner: Research Association of Biomass Innovation for Next Generation Automobile Fuel (raBit)
(raBit was established by Daihatsu Motor Co., Ltd., ENEOS Corporation, Mazda Motor Corporation, SUBARU CORPORATION, SUZUKI MOTOR CORPORATION, TOYOTA MOTOR CORPORATION, and Toyota Tsusho Corporation for technology research of bioethanol for automobile.)
- Contractor: Nippon Steel Engineering Co.,Ltd.
- Site: Fukushima Prefecture, Japan
- Capacity: approx. 60,000 Liters/year
- Feedstock: Sorghum (stalk and leaf)
- Beginning of operation: In 2025



Our Ongoing Initiatives in ASEAN - The Case of Cassava Pulp -



- As a result, NSE and Kao confirmed low-cost and high-yield ethanol conversion from cassava pulp.
- Upon scale-up, costs are expected to reach a cost-competitive level close to first-generation ethanol (E1G).

Proposal for ASEAN: Lessons from Successful E2G Models in the EU

Critical factors for the realization of E2G		EU	ASEAN
Policy		RED III - Advanced biofuel blending obligation - E2G are subject to double counting. - Penalty avoidance under blending mandates.	Institutional framework needs to be established* *The Philippines has preferential policies for domestically produced first-generation (E1G) ethanol.
Economic Viability		Premium pricing accepted by market	Market development is essential to drive the E2G sector
Production Technology		Commercialization of E2G technology is not yet domestic, but relies on proven large-scale projects overseas, while policy frameworks create strong market demand	Enabled by NSE's role as both EPC contractor and technology provider
Feedstock		Limited domestic feedstocks; E2G is imported	Rich potential in agricultural residues and other biomass (Ex. Thailand / Indonesia / Vietnam → Cassava Pulp, Philippines → Bagasse).

- ASEAN can complete the E2G value chain domestically with NSE's technology and abundant feedstocks.
- With policies and markets in place, ASEAN can take the lead in driving E2G.

Solutions for the Future



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