WHITE PAPER

Decarbonizing Thailand's Agri-Food Value Chain

A Verified Pathway from MOU to ISO Certification

Decarbonizing Thailand Partnership | JUMP+ Plan 2026–2028 | Net Zero 2050

Base Year: FY2025 | Standards: ISO 14064-1 · ISO 14067 · TGO CFO/CFP | Verifier: Bureau Veritas

THAI WAH PUBLIC COMPANY LIMITED

In Collaboration with PTT Consulting | Decarbonizing Thailand Partnership

Thai Wah's Decarbonization Journey: From MOU to ISO Certification

Thai Wah is one of the few Agri Food companies in Thailand to achieve both ISO 14064-1 corporate GHG verification and ISO 14067 Carbon Footprint of Product certification — building a **verified**, replicable decarbonization model with PTT Consulting as our methodology partner. This is a long-term competitive advantage delivering measurable business returns and Global market expansion

YEAR / MILESTONE	ACHIEVEMENT & SIGNIFICANCE
2020 - 2023 Internal GHG Tracking	Thai Wah begins collecting internal GHG data (Selected site) and identifies the strategic need for internationally recognized, third-party verified GHG accounting to meet rising customer, investor, and regulatory standards.
2024 GHG Methodology & Data Collection	Thai Wah completes its first full multi-site GHG inventory with support from PTT Consulting: organizational boundary definition, IPCC AR6/TGO emission factors, and data architecture across six Thai starch production facilities.
2025 MOU with PTT Consulting	Thai Wah signs a Memorandum of Understanding with PTT Consulting to co-design a verified GHG program aligned with ISO 14064-1, ISO 14067, and TGO standards, selecting PTT Consulting as our methodology partner.
FY2025 ISO 14064-1 Verification Achieved	Thai Wah achieves full Bureau Veritas independent verification of its Scope 1+2+3 GHG inventory at Limited Assurance, 5% materiality covering all six Thai starch production facilities.
Feb - July 2026 ISO 14067 CFP Certification	Thai Wah becomes Thailand's first Agri-Food company certified under both ISO 14064-1 and ISO 14067. Bureau Veritas certifies the Carbon Footprint of Product for 9 starch products (B2B Cradle-to-Gate).

Executive Summary

SITUATION	COMPLICATION	RESOLUTION
Thai Wah: 78 Years of Agri-Food Leadership Thai Wah has operated in agri-food for over 78 years with revenue of ฿9,296 M in FY2025, exporting to over 40 countries, and is one of the leading cassava producers in ASEAN In terms of energy, RE accounts for 65% of total energy consumption and is verified across ISO 14064-1 all Starch facilities in Thailand	**Regulatory & Market Pressures** EU CBAM (effective), Thailand ETS 2027 (2570), Climate Change Act 2026, ISO Scope 3 mandates. Companies without **verified** data face market access loss and capital cost penalties.	**Verified, Not Aspirational** Thai Wah has established a verified GHG base year with ISO 14064-1, ISO 14067 (9 products), and TGO CFO/CFP certifications JUMP+ Decarbonization Roadmap with verified GHG reduction targets Scope 1+2: −2% (2026), −3% (2027), −5% (2028) vs FY2025 base year. Expanding verification to Vietnam (2027) and Cambodia. Creating a replicable model for the ASEAN agri-food sector.

Key Figures — FY2025 Verified Base Year

187,530	65,694	65%	26%	9
tCO_2e Total S1+S2+S3	tCO_2e Scope 1+2	Renewable Energy Share	GHG Reduction vs 2021	ISO 14067 CFP Products

(Include Banglen, non-verified)

Executive Statements

"The certification of ISO 14064, ISO 14067, and TGO CFO/CFP is the clearest evidence that Thai Wah is not just making ESG commitments. We are delivering on them with independent, internationally recognized verification. This is the foundation of our Net Zero 2050 journey and our business competitiveness for the next decade."



— Mr. Phochara Luengrungroj, SAVP - Head of Starch Business at Thai Wah

"PTT is committed to being more than an energy company. We are a transition partner for Thai industry. Our collaboration with Thai Wah demonstrates that verified, science-based decarbonization is achievable and commercially compelling for the Agri-Food sector. We are ready to scale this model across ASEAN."



— Mr. Sompol Wairatpanich, Executive Vice President Natural Gas Retail and Engineering

CHAPTER 1

ESG Profile & Strategic Context

1.1 ESG Awards & Recognitions FY2025

Thai Wah has demonstrated consistent, multi-year progress across all major ESG ratings and certification frameworks. The FY2025 recognition profile reflects the cumulative impact of sustained investment in governance, climate action, and supply chain Sustainability.

CATEGORY	RECOGNITION / CERTIFICATION	STATUS / LEVEL
Governance	Excellence CG Scoring — Thai Institute of Directors	6th Consecutive Year
ESG Rating	SET ESG Rating — Stock Exchange of Thailand	A | 3rd Consecutive Year
ESG Scores	FTSE Russell — London Stock Exchange Group (LSEG)	3.8 / 5.0 (FY2024)
Climate	CDP Climate Change Disclosure 2025	B–
Water	CDP Water Security Disclosure 2025	B–
Forests	CDP Forests Disclosure 2025	C
Reporting	Sustainability Disclosure Recognition — Thaipat Institute	5th Consecutive Year
GHG	ISO 14064-1 — Bureau Veritas (All TH Starch Facilities)	FY2025 Verified
Carbon Product	ISO 14067 CFP — 9 Starch Products — Bureau Veritas	FY2025 Verified
Supply Chain	EcoVadis Sustainability Rating	Bronze Medal (FY2024)
Agriculture	SAI FSA Gold Standard — Cassava (TH + Cambodia)	First in the World

1.2 Decarbonization Embedded in TW2030 Business Strategy

Under the TW2030 vision "Strengthen our Core and Reinvest in Growth," decarbonization is not a separate Sustainability initiative. It is structurally embedded across all three Strategic Pillars, directly supporting the EBITDA and Net Profit targets under the JUMP+ plan by 2028.

PILLAR 1 Portfolio Transformation	PILLAR 2 Cost Excellence	PILLAR 3 New Growth Platform
CFP-certified HVA products give a premium margin in EU/US/JP markets. ISO 14067 Carbon Labels on CASSFLO and CASSTEX products enhance B2B competitiveness. Modified & Functional Starch positioned as low-carbon B2B inputs for global food manufacturers.	Energy efficiency reduces Scope 1+2 emissions and lowers energy costs: Hydrocyclone, Solar PV (7.26 MWp), biogas energy equivalent (136.2 GWh for both electricity and thermal energy), and biomass thermal energy support approximately ฿100M+ savings per year. GHG verification enables quantified energy productivity reporting to investors.	A verified GHG baseline could benefit Green Bond / SLL readiness. CFP portfolio enhances ASEAN expansion (TH → VN → KH). JUMP+ decarbonization plan linked directly to P&L targets.

CHAPTER 2

Verified GHG Baseline FY2025

2.1 Corporate GHG Inventory Summary — ISO 14064-1 Verified

Thai Wah's FY2025 GHG inventory was independently verified by Bureau Veritas Certification (Thailand) Ltd. under Limited Assurance, applying the ISO 14064-1:2018 standard with IPCC AR6 GWP100 values as mandated by Thailand's Greenhouse Gas Management Organization (TGO). The Operational Control approach covers all six Thai starch production facilities.

SCOPE	tCO_2e	SHARE (%)	PRIMARY SOURCES
Scope 1 (Direct Emissions)	21,632	11.5%	Biogas flare CH_4, stationary combustion, mobile sources, fugitive refrigerants (HFC-32, R-410A)
Scope 2 (Grid Electricity — Market-based)	44,062	23.5%	MEA/PEA grid electricity using EGAT emission factor (IPCC AR6). Self-generated solar and biogas electricity EF = 0
Scope 3 (Value Chain)	121,836	65%	Purchased goods & services: Cassava, Chemicals, packaging. Fuel & Energy Related Activities (GHG Protocol Category 3)
TOTAL BASE YEAR	**187,530**	**100%**	**ISO 14064-1 Verified | Bureau Veritas | Limited Assurance | 5% Materiality**
Biogenic Carbon (reported separately)	31,659	—	Biogas combustion + biomass thermal. Excluded from GHG totals per ISO 14064-1. Reported for transparency.

Scope 1+2 Intensity

0.2085

tCO_2e per tonne of product output | FY2025 Verified (Include Banglen, non verified)

Scope 1+2+3 Intensity

0.5950

tCO_2e per tonne of product output | Full value chain | FY2025 Verified (Include Banglen, non verified)

2.2 ISO 14067 Carbon Footprint of Product — 9 Certified

Thai Wah has achieved ISO 14067 CFP certification for nine starch products across three production entities, verified by Bureau Veritas in February–June 2026. The B2B Cradle-to-Gate system boundary includes all upstream cassava sourcing, processing energy, and packaging through the factory gate. Land Use Change (LUC) assessment for cassava feedstock was conducted per ISO 14067, 20-year look-back requirement.

PRODUCT (SKU)	CATEGORY	ENTITY	STATUS	CFP VALUE (tCO_2e/tonne)
CASSFLO 400 (25 kg)	Modified Starch	Tapioca Development Corp.	✔ Certified Apr 2026	1.324 tCO_2e/t
CASSFLO 500 (25 kg)	Modified Starch	Tapioca Development Corp.	✔ Certified Apr 2026	1.172 tCO_2e/t
CASSFLO 600 (25 kg)	Modified Starch	Tapioca Development Corp.	✔ Certified Apr 2026	1.268 tCO_2e/t
CASSFLO 800 (25 kg)	Modified Starch	Tapioca Development Corp.	✔ Certified Apr 2026	1.332 tCO_2e/t
CASSTEX 22 (25 kg)	Modified Starch	Tapioca Development Corp.	✔ Certified Apr 2026	0.96 tCO_2e/t
Native Cassava Starch (25 kg)	Native Starch	Thai Wah Fuji Nihon Co., Ltd.	✔ Certified Apr 2026	0.5 tCO_2e/t
Native Cassava Starch (850 kg)	Native Starch	Thai Wah Fuji Nihon Co., Ltd.	✔ Certified Apr 2026	0.496 tCO_2e/t
Native Cassava Starch (25 kg)	Native Starch	Thai Nam Tapioca Co., Ltd.	✔ Certified Jun 2026	0.48 tCO_2e/t
Native Cassava Starch (850 kg)	Native Starch	Thai Nam Tapioca Co., Ltd.	✔ Certified Jun 2026	0.412 tCO_2e/t

CFP values (tCO_2e/tonne, Cradle-to-Gate, ISO 14067:2018) reflect Bureau Veritas certification results, FY2025 production base year. Modified starch range 0.96 – 1.332 tCO_2e/t; Native starch 0.5 tCO_2e/t which is 23% below the global benchmark of 0.65–0.80 tCO_2e/t for fossil-fuel-intensive starch production, driven by Thai Wah's 65% renewable electricity. Thai Wah is now hold 9 certified products across 3 facilities — the most comprehensive Agri-Food CFP portfolio in Southeast Asia.

2.3 PTT Consulting as Strategic Partner for Corporate GHG and Product Carbon Footprint

Effective carbon accounting consultancy requires experts who can translate complex data into actionable business value. PTT Consulting, as Thai Wah's strategic consultant, supports foundational methodologies and the core skills needed to navigate corporate structures, secure stakeholder alignment, and drive net-zero transformation.

Core Strategic Expert for GHG Consultancy	
Stakeholder Engagement & Alignment	Bridging the gap between a company's procurement, supply chain, and finance teams to align accounting methods with decarbonization initiatives.
Change Management	Guiding executive leadership and employees through transitions, helping them view emissions data as a strategic advantage rather than just a reporting burden.
Translation & Storytelling	Simplifying complex environmental data into clear, actionable, and financially sound insights for board-level decision making.
Cross-functional Collaboration	Partnering with different departments to establish robust data governance and improve the quality of Scope 1, 2, and 3 emissions tracking.
Audit-Ready Methodologies	Building a defensible calculation engine that traces data from source to output, preparing your inventory for independent third-party verification.

Double counting occurs when a single emission reduction or carbon removal is counted more than once towards meeting climate targets. This inflates reported climate progress under strict carbon accounting rules like the GHG Protocol.

Mitigation and Prevention Strategies	
Enforce Exclusive Claims	Ensure all carbon credits are officially retired on behalf of your organization in a recognized, certified registry.
Align with international standard (GHG Protocol, ISO 14064)	Follow Corporate Net-Zero Standard, which prohibits the use of carbon credits for meeting near-term or long-term internal reduction targets, keeping offsetting separate from inventory reduction.

Thai Wah applies a disciplined carbon accounting approach by keeping corporate GHG inventory, product carbon footprint, biogenic carbon, renewable energy claims, and carbon credit claims clearly separated. Biogenic carbon is reported separately from total GHG emissions, renewable energy benefits are linked to actual energy use, and carbon credits are not counted as operational emission reductions unless formally retired and disclosed. This approach helps ensure Thai Wah's climate claims are transparent, audit-ready, and free from double counting.

2.4 PTT Consulting Expands GHG Methodology from Starch to Cassava-Based Bioplastics

Evaluating bioplastics within GHG accounting shifts the focus from fossil-fuel extraction to biological feedstocks and end-of-life dynamics. While bioplastics use plant-based biogenic carbon to lower fossil-carbon dependency, their carbon accounting requires clear system boundaries and careful claim management.

The Primary Advantage of Cassava-Based Bioplastics	
Carbon Absorption	During growth, cassava plants absorb atmospheric CO_2 through photosynthesis. Under GHG Protocol Standards, this absorbed carbon is credited as a negative emission entry at the start of the life cycle.
Fuel Displacement	Producing raw bioplastics generally saves around 50% to 66% of the fossil-energy inputs required to manufacture conventional polymers like Polyethylene (PE) or Polypropylene (PP).

Building on Thai Wah's ISO 14067-certified starch portfolio, PTT Consulting's expansion into bioplastics GHG consultancy can help Thai Wah move from verified food ingredients to verified renewable materials. Cassava-based bioplastics such as ROSECO can become a strategic low-carbon platform for packaging customers, supported by Thai Wah's cassava sourcing network, renewable energy use, and disciplined carbon accounting. The key value is not only lower-carbon material innovation, but credible, audit-ready product carbon footprint data that customers can use for packaging decarbonization, supplier reporting, and climate claims without double counting.

2.5 PTT Consulting's Role in Governing AI-Enabled GHG Accounting

In the future, AI and digitalization are revolutionizing Thai Wah GHG accounting by automating data ingestion, mapping complex supply chains, and ensuring compliance with frameworks like the GHG Protocol.

AI Transforms GHG Accounting	
Automated Data Extraction	AI models read unstructured data like supplier PDFs, utility bills, and NetSuite/ERP transactions to automatically calculate CO_2e values without manual CSV uploads.
Scope Classification & Mapping	Systems instantly categorize emissions into Scope 1, 2, and 3 based on transaction context, applying location- or market-based emission factors.
Anomaly Detection	AI cross-checks data against historical baselines, preventing double-counting and flagging errors before audits.
Real-Time Forecasting & Optimization	Platforms track emissions live, allowing AI agents to recommend verified carbon offsets and optimize reduction strategies.
Governance and audit controls	Defines methodology rules, emission factor hierarchy, data validation checks, and evidence trails so AI outputs remain verification-ready.

As Thai Wah moves toward AI-enabled GHG accounting, PTT Consulting can help define the governance rules behind the technology: data boundaries, emission factor selection, audit trails, double-counting controls, and verification readiness. This ensures AI does not become a black-box calculation tool, but a controlled system that supports ISO 14064-1, ISO 14067, TGO, and GHG Protocol requirements.

CHAPTER 3

Standards Crosswalk — 1 Investment, 8 Returns

The crosswalk below confirms that **Thai Wah**'s FY2025 Bureau Veritas-**verified** GHG data directly fulfils the material disclosure requirements across CDP, GRI, ISSB, FTSE Russell, EcoVadis, TGO, SET Thailand, and the GHG Protocol without duplicating effort.

DATA FIELD	ISO 14064-1	ISO 14067	GRI 305	CDP C6	ISSB S2	TGO CFO/CFP	SET TH	GHG Protocol
Scope 1 Direct (tCO_2e)	✔	✔	✔	✔	✔	✔	✔	✔
Scope 2 Indirect — Energy	✔	✔	✔	✔	✔	✔	✔	✔
Scope 3 Value Chain	✔	✔	✔	✔	✔	—	✔	✔
Carbon Intensity (tCO_2e/t)	✔	✔	✔	✔	✔	✔	✔	✔
Biogenic Carbon (separate)	✔	✔	✔	✔	✔	✔	—	✔
Product CFP (9 products)	—	✔	—	✔	✔	✔	—	—
Base Year + Recalculation Policy	✔	✔	✔	✔	✔	✔	✔	✔
3rd Party Verification	✔	✔	✔	✔	✔	✔	✔	✔
Organizational Boundary	✔	✔	✔	✔	✔	✔	✔	✔
GHG Reduction Targets (SMART)	✔	—	✔	✔	✔	✔	✔	✔
Renewable Energy % + Projects	—	—	✔	✔	✔	—	✔	—
ASEAN Expansion Roadmap (VN, KH)	✔	—	✔	✔	✔	—	—	✔

✔ = Fully Satisfied | — = Not applicable / partial | Source: ISO 14064-1 (BV verified), ISO 14067 (BV certified), SR2025, JUMP+ Plan 2026–2028

CHAPTER 4

Thai Wah ESG Framework Achievement & Score Uplift

Thai Wah's CDP Journey — Enabled by ISO Verification

Thai Wah's investment in ISO 14064-1 GHG verification with PTT Consulting as our methodology partner has directly elevated Thai Wah's performance across every major ESG rating platform. The CDP pathway from B− toward A− is a direct outcome of the verified data architecture Thai Wah built in FY2025.

Thai Wah + PTT Consulting — Methodology Design (2023–2024)	Thai Wah + PTT Consulting — Verification Support (2024–2025)
• Organizational boundary definition (Operational Control approach) • Emission factor selection: IPCC AR6 GWP100 + TGO + EGAT grid EF • Multi-site data architecture: 6 Starch Thai facilities, Fr-01 to Fr-05 forms • ISO 14067 LCA methodology + LUC assessment framework • Scope 3 materiality assessment — cassava feedstock, chemicals, packaging	• Bureau Veritas verification interface and audit preparation • ISO 14064-1:2018 compliance review across all Starch Thai sites • Verification statement documentation and reporting structure • JUMP+ roadmap consulting, SMART target setting • Scope 3 supplier engagement framework design

Outcomes — CDP Requirements Fulfilled in FY2025

CDP REQUIREMENT	ACTIONS COMPLETED (FY2025)	PTT CONSULTING ROLE	SCORE IMPACT
C6.1 — Scope 1, 2, 3 verified data	ISO 14064-1 verified (S1+S2+S3), Bureau Veritas	Methodology design + data collection support FY2024	Major uplift C→ B
C6.5 — Product-level CFP	ISO 14067 — 9 products (B2B, Cradle-to-Gate)	ISO 14067 LCA methodology	New capability C→ B+
C7 — Emissions breakdown	Fr-05: Full breakdown by facility (6 sites), scope, source	Multi-site data architecture	Strengthened
C9 — Scope 3 supplier engagement	JUMP+ Supplier Program — survey 2026, data 2027, CFP 2028	Scope 3 framework design	↻ In progress → A−
Forests C — Deforestation	Zero Deforestation policy + satellite monitoring + SAI FSA Silver	—	Partial → B

CHAPTER 5

JUMP+ Decarbonization Roadmap 2026–2028 → Net Zero 2050

5.1 GHG Reduction Trajectory — FY2025 Base Year → Net Zero 2050

YEAR	S1+S2 Baseline	TARGET (%)	REDUCTION (tCO_2e)	S1+S2 TARGET	KEY INITIATIVES	STATUS
2025	65,694	BASE YEAR	—	65,694	ISO 14064+14067 **Verified**	✅ Done
2028	65,694	−5%	−3,285	62,410	Solar + Biogas Efficiency + Machinery Upgrade	🎯 Target
2030	—	Carbon Neutral	S1+S2 **Net Zero**	~0	50% RE + Solar + Biogas + T-VER carbon credits (offsets) + PPA	🏁 Goal
2050	—	**Net Zero**	S1+S2+S3 **Net Zero**	Paris Aligned	Full value chain decarbonized	🌍 Vision

5.2 Renewable Energy Measures — FY2025 Actual Performance

MEASURE	FY2025 ACTUAL	2028 TARGET	GHG IMPACT	COST SAVINGS
Solar PV	7,578 MWh/yr (7.26 MWp installed)	+8,000 MWh/yr	3,600 tCO_2e/yr avoided	~฿27M/yr
Biogas Energy (Electricity + Thermal)	490,241 GJ/yr (9,314 MWh electricity + 456,711 GJ thermal)	Optimize annually for both electricity and thermal use	Scope 1 and Scope 2 benefit from both heat and electricity displacement	~฿37M/yr equivalent savings from mixed-use biogas
Coal → Biomass Transition	92% thermal from biomass	Subject to biomass price feasibility	GHG reduction vs coal baseline	Fuel cost reduction

5.3 ASEAN Verification Expansion

The JUMP+ Plan extends **Thai Wah**'s **verified** GHG program across its ASEAN manufacturing footprint, with PTT Consulting as the methodology partner for each country expansion.

TH THAILAND — 2025	VN VIETNAM — 2027	KH CAMBODIA — 2028	🌏 FULL ASEAN — 2028+
ISO 14064-1 + ISO 14067 ✅ COMPLETED 6 Starch Facilities **verified** Bureau Veritas Limited Assurance	ISO 14064-1 📅 PLANNED PTT model deployment	ISO 14064-1 📅 PLANNED Greenfield operations PTT model deployment	Full S1+S2+S3 **verified** 🌍 TARGET Supplier CFP programme PTT Consulting partner model

CHAPTER 6

Business Impact & Return on Investment

Evidence-based decarbonization is not a cost center — it is a revenue enabler and risk manager directly linked to TW2030 P&L targets.

6.1 Renewable Energy Investment Pipeline — 5 Options (TWPC Starch BU)

INITIATIVE	STAGE	EXPECTED RETURN / BENEFIT
Expand Solar (per 0.99 MW panel)	Ongoing	Generate 1.2 MWh/yr per MW | Reduce PEA grid dependency
EV Wheel-Loader Replacement	Ongoing	5-year lifetime savings ฿2M incl. CAPEX | Less diesel exposure | Supports Scope 1 reduction
Biogas Improvement (pond cover + efficiency)	Planning	Additional biogas for electricity + heating
Hydrolysis Pond (boost biogas from pulp)	Explore	Increase biogas yield from cassava pulp | Additional electricity generation 20 MW
Power Purchase Agreement (PPA)	Explore	Reduce PEA grid exposure | REC accounting for carbon footprint reduction | Hedge against electricity price changes

CHAPTER 7

Nature-Positive Strategy & 3T Framework

Traceability · Transition · Transformation

Thai Wah's decarbonization program is embedded within a broader Nature-Positive strategy, structured around three interdependent dimensions that connect verified GHG data to regenerative agriculture, circular economy, and biodiversity outcomes.

TRACEABILITY	TRANSITION	TRANSFORMATION
Verified GHG baseline FY2025 (S1+S2+S3) Expanding TH → VN → KH with assurance GHG multi-site data architecture	65% Renewable Energy (Solar + Biogas) 92% biomass thermal energy Operation (Hydro cyclone, new machine) efficiency	SAI FSA Gold — 1st in World (Cassava TH + Cambodia) TW8 Bio-stimulant ROSECO Bioplastics Zero Deforestation Policy

NATURE-POSITIVE INITIATIVE	ACHIEVEMENT FY2025	STANDARD	ESG IMPACT
Zero Deforestation Policy	100% sourcing areas covered | Satellite monitoring active	TNFD 2023 CDP Forests	CDP Forests, GRI 304
SAI FSA Gold — First in World	First in SEA for cassava (TH + Cambodia).	SAI FSA	GRI 302, CDP Supply Chain
TW8 Bio stimulant — Soil Carbon	50%+ organic matter improvement. Deployed >50% of Thai Wah farmers.	Internal	Scope 3 C1 reduction + soil carbon
ROSECO Biodegradable Bioplastics	80–90% carbon reduction vs fossil plastic.	ISO 14067, LCA	Circular economy + export premium
TNFD LEAP Approach*	Nature-related risk assessment across all production sites.	TNFD 2023	Investor confidence + TNFD disclosure

Thai Wah completed a TNFD LEAP (Locate–Evaluate–Assess–Prepare) assessment, covering Thai Wah's value chain

NATURE RISK	CATEGORY	HORIZON	IMPACT (Before mitigation)	STATUS
Deforestation-linked supply chain exclusion (EUDR)	Transition Regulatory	Near (2026–2028)	HIGH	Active monitoring; GPS farm mapping in progress
Water availability for starch processing	Physical Chronic	Medium (2030+)	HIGH	Water abstraction monitoring to be formalized
Cassava soil degradation from monoculture	Physical Chronic	Medium (2030+)	HIGH	Soil carbon baseline measurement starting 2027

***** Impacts are assessed in alignment with TCFD and TNFD, with mitigation actions implemented to reduce residual exposure to a minor risk level.

CHAPTER 8

Corporate Governance of Climate & ESG

Board-level oversight of climate risk and ESG performance is a material requirement under CDP Climate Change (C1), ISSB S2, GRI 2-12, and FTSE Russell governance scoring. **Thai Wah** has established a multi-tiered governance structure integrating climate data from the **verified** GHG inventory directly into Board reporting.

GOVERNANCE LEVEL	RESPONSIBILITIES	FREQUENCY	FRAMEWORK ALIGNMENT
Board of Directors	Approves **Net Zero** 2050 strategy, JUMP+ targets, and ESG risk appetite. Receives annual GHG verification report and ESG ratings update.	Annual	CDP C1, ISSB S2, GRI 2-12
Audit & Risk Committee	Reviews material ESG risks including regulatory exposure (ETS, CBAM), verifies internal controls over GHG data quality.	Bi-Quarterly	CDP C2, TCFD Risk
ESG / Sustainability Committee	Monitors JUMP+ KPI progress, ISO verification schedule, CDP/FTSE/EcoVadis action plans.	Quarterly	CDP C4, GRI 2-14
Sustainability & Innovation Division	Manages GHG data collection, verification interface with Bureau Veritas, and stakeholder disclosure (CDP, Ecovadis, SR2025).	Bi-Monthly	ISO 14064-1, GRI 305

Climate Risk & Opportunity Register

TYPE	RISK / OPPORTUNITY	DESCRIPTION	TIMEFRAME	FINANCIAL IMPACT (estimated)*
Transition Risk	Thailand ETS 2027	Phase 1 mandatory carbon market. Un**verified** companies face permit costs.	Medium-term	฿6-15M before mitigation
Transition Risk	EU CBAM	Carbon border adjustment. ISO 14067 CFP is the compliance evidence.	Medium-term	Under assessment
Physical Risk	Water Stress	Cassava regions face increasing water scarcity.	Medium-term	฿94-144M before mitigation
Physical Risk	Cassava Yield Decline	Heat and drought risk across all Thailand starch sites (IPCC SSP1-2.6 scenario).	Short-term	฿80-120M before mitigation
Opportunity	Green Finance	SLL / Green Bond access contingent on **verified** GHG baseline.	Short-term	Under assessment
Opportunity	Export Premium	Carbon-labelled HVA starch commands premium in EU/US/JP.	Short-term	+3–8% margin on HVA revenue
Opportunity	Internal Carbon Price (ICP)	ICP mechanism applied. Drives internal capex decisions and abatement prioritization.	Short-term	Implied internal carbon cost

* Financial impacts are assessed in alignment with TCFD and TNFD, with mitigation actions implemented to reduce residual exposure to a minor risk level.

CHAPTER 9

From Thai Wah Proof Point to ASEAN Decarbonization Journey

" **Aspiration to Verification** " — Thai Wah has built a verified decarbonization model that demonstrates that ISO 14064-1 + ISO 14067 certification is commercially compelling, regulator-ready, and replicable across ASEAN.

Connect with Thai Wah and PTT — Start Your Decarbonization Journey

Thai Wah's verified decarbonization framework is a replicable model for Agri-Food companies across ASEAN.

Connect with us to learn how this approach can be applied to your organization.

THAI WAH PUBLIC COMPANY LIMITED	METHODOLOGY PARTNER
Sustainability & Innovation Division • GHG Inventory & ISO 14064-1 Verification • ISO 14067 Carbon Footprint of Product • ESG Framework Disclosure (CDP, GRI, ISSB, TNFD, TCFD, FTSE) • Nature-Positive & 3T Strategy **Contact: sd@thaiwah.com**	**PTT Consulting** PTT Consulting serves as **Thai Wah**'s GHG methodology partner, supporting ISO 14064-1 design and verification readiness as part of the Decarbonizing Thailand Partnership. **Contact:** worayut.s@pttplc.com

PTT Decarbonization Services

ISO 14064-1 GHG Inventory · ISO 14067 Carbon Footprint of Product · Decarbonization Roadmap · ESG Framework · International standard Verification

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