Chapter 5: Case Studies

The SUI in practice — Becaps (Argentina) and MubOn (Colombia), plus a sector generalisation guide.

- Becaps (Argentina) — Chemical Displacement per Hectare
- MubOn (Colombia) — kWh Delivered per Charging Point
- Applying SUI Across Sectors

Becaps (Argentina) — Chemical Displacement per Hectare

Becaps (Argentina) — Chemical Displacement per Hectare

> **SUI Statement:** One application of Becaps microbial biostimulant to one hectare of cultivated land displaces **102.4 kg CO?e** of synthetic chemical inputs, net of counterfactual, verified against a three-tier SSOT pipeline (±12%, 95% CI).

Company Overview

Becaps is an Argentine agri-biotech company that has developed a proprietary microencapsulation technology for soil microorganisms. The core product delivers high-viability microbial consortia — primarily nitrogen-fixing bacteria and phosphate-solubilising fungi — to agricultural soils in a formulation that survives harsh field conditions and achieves root-zone colonisation at commercially meaningful rates.

Technology differentiation:

- Microbial viability at application: ?10^{11} CFU per gram (Colony Forming Units)
- Synthetic Displacement Ratio: 1.3:1 — for every 1 kg of Becaps product applied, 1.3 kg equivalent of synthetic nitrogen or phosphate fertiliser is displaced
- Field persistence: active colonisation confirmed at 90-day post-application in field trials
- Crop compatibility: validated for soy, maize, wheat, sunflower, and vegetable cultivation

The SUI: Chemical Displacement per Hectare

Parameter Set

Parameter	Value

SUI Name	Chemical Displacement per Hectare
Outcome Domain	Climate — GHG Emissions Avoided
IRIS+ Code	PI5765 (GHG Emissions Avoided by Investees)
Application Event	Application of 1 kg Becaps biostimulant to 1 hectare of cultivated land
Baseline	220 kg N/ha synthetic nitrogen application (INDEC 2023, Argentina national average)
Observed	85 kg N/ha (average across 120 trial plots, 2022–2024, certified by INTA)
Net Displacement	135 kg N/ha
CO?e Conversion	135 × 0.758 CO?e/kg N (IPCC AR6, Tier 1 emission factor for synthetic N production)
SUI Magnitude	102.4 kg CO?e per hectare per growing season
Uncertainty	±12.3 kg CO?e (±12%, 95% CI, based on plot-level variance across 120 trials)
Verification Protocol	Annual LCA audit by certified GHG verifier; SSOT ingest from ERP batch records + INTA lab reports

The Becaps SSOT Architecture

Tier 1: Ingest

- **Source 1:** ERP production records — batch ID, quantity produced (kg), production date, microbial viability QC result (CFU/g)
- **Source 2:** Logistics records — delivery date, customer ID, delivery location (GPS), quantity delivered (kg)
- **Source 3:** Customer application records — hectares treated per batch delivery (customer-reported, validated against land registry data for customers >50 ha)
- **Source 4:** INTA lab reports — soil nitrogen content pre/post application for monitored plots (12 per 500 ha treated, stratified sampling)

Tier 2: Digital Twin

- Model: Python-based LCA model (version-controlled in Becaps GitLab)
- Emission factors: IPCC AR6, INDEC regional agricultural statistics (updated annually)
- Baseline model: INDEC 2023 national average, disaggregated by province and crop type
- Uncertainty propagation: Monte Carlo simulation, 10,000 iterations per batch

Tier 3: Conversion

- IRIS+ PI5765 report: monthly update to GIIN platform
- SUI Ledger: append-only PostgreSQL table with one row per application event
- Auditor export: quarterly CSV package with full calculation audit log

- Blended finance dashboard: cumulative CO?e displaced vs. milestone thresholds (real-time)

Blended Finance Structure

Becaps secured a blended finance structure in Q3 2024 using the SUI as trigger metric:

- **First-loss provider:** IDB Lab (via DGGF intermediary), $800K guarantee
- **Commercial co-investor:** Latin American agri-tech VC, $2.4M equity
- **Leverage ratio:** 3:1 commercial to concessional
- **Milestone 1 trigger:** 500 tonnes CO?e displaced (verified) ? $200K of guarantee converts to grant, interest rate on commercial debt reduces 75 bps
- **Milestone 2 trigger:** 2,000 tonnes CO?e displaced ? Full guarantee conversion, green revenue note eligibility

Key Lessons for Other AgTech Companies

1. **The INTA partnership was decisive.** Having national agricultural research institute validation of field trial data gave the LCA model credibility that self-collected data alone could not. For CTH portfolio companies, identifying the equivalent national research institute in their country early is critical.
2. **Crop-specific baseline disaggregation mattered.** Becaps initially used a single national nitrogen average — investors challenged this. Disaggregating the baseline by crop and province improved accuracy and defensibility.
3. **The viability specification (10^{11} CFU/g) became a product standard.** Defining the minimum viable SUI trigger (a product lot must meet this viability threshold to count as an application event) forced quality discipline in production that improved product performance.
4. **Customers became data partners.** Integrating data collection into the customer relationship (land registry verification, application reporting) initially faced resistance. Framing it as "your data helps us show the financial system what you're doing" shifted the conversation.

Next: MubOn (Colombia) — kWh Delivered per Charging Point

MubOn (Colombia) — kWh Delivered per Charging Point

MubOn (Colombia) — kWh Delivered per Charging Point

> **SUI Statement:** One kWh delivered through one MubOn-managed shared EV charging point enables **approximately 6.5 km of electric driving**, displacing approximately **1.12 kg CO?e** of emissions from the equivalent internal combustion engine trip — verified monthly against SSOT IoT data (±8%, 95% CI). Alternatively expressed as: one MubOn charging point delivers **320,000 kWh per year** (system aggregate, 2025), serving **22,000 charging sessions** at 25–40% utilisation vs. <15% for traditional charging infrastructure.

Company Overview

MubOn is a Colombian cleantech company building shared, IoT-connected EV charging infrastructure for residential buildings, commercial properties, and public spaces in Latin American cities. Its platform solves the critical "apartment building problem" of EV adoption: residents of multi-unit buildings cannot install private home chargers, creating a range-anxiety barrier that suppresses EV uptake even when residents want to switch.

Business model innovation:

- Shared charging points installed in building parking facilities (shared among multiple residents)
- Smart scheduling algorithm optimises charging across users, avoiding peak grid demand
- IoT-enabled: real-time data on energy delivered, session duration, grid draw, user identity
- Revenue: per-session charging fees split between MubOn and building management
- Infrastructure cost: amortised across multiple users, reducing capex per EV owner by 60–70% vs. private charger

The SUI: kWh Delivered per Charging Point per Month

Primary SUI: Energy Displacement

Parameter	Value
SUI Name	kWh Delivered per Charging Point per Month
Outcome Domain	Climate — GHG Emissions Avoided (transport sector)
IRIS+ Codes	PI7685 (Clean Energy Generated), OI1284 (GHG Emissions Avoided)
SDGs	SDG 7 (Affordable Clean Energy), SDG 11 (Sustainable Cities), SDG 13 (Climate Action)
Application Event	One completed EV charging session through one MubOn-managed charging point
Baseline	Equivalent km driven by ICE vehicle: Colombian grid average emission factor (0.172 kg CO?e/kWh, UPME 2024)
Counterfactual	Same trip driven in gasoline vehicle: 2.31 kg CO?e/km (IDEAM 2024 Colombian light vehicle fleet average)
Observed Efficiency	0.154 kWh/km (EV fleet average in MubOn network, 2025)
Net Emission Factor	Grid sourced kWh: 0.172 kg CO?e/kWh; ICE equivalent: 2.31/6.5 = 0.355 kg CO?e/km ? per kWh delivered: 0.355/0.154 ? 0.172 = 2.31 ? 0.172 = 1.12 kg CO?e net avoided per kWh
SUI Magnitude	1.12 kg CO?e avoided per kWh delivered (or 6.5 km of electric driving per kWh)
Uncertainty	±0.09 kg CO?e (±8%, 95% CI — driven by grid emission factor uncertainty)
Verification Protocol	Monthly third-party audit of IoT session logs against billing data; annual LCA review

Secondary SUI: Infrastructure Utilisation

MubOn also defines a secondary SUI that captures its infrastructure efficiency innovation:

Parameter	Value
SUI Name	Charging Point Utilisation Rate
Baseline	<15% utilisation for traditional single-user charging points (ANDEMOS 2024)
Observed	25–40% utilisation for MubOn shared points
SUI Magnitude	+10 to +25 percentage points utilisation uplift per shared charging point
Financial Significance	Higher utilisation ? faster payback on charging infrastructure capex ? enables deployment at lower subsidy requirement

2025 Impact Results

MubOn's verified impact for calendar year 2025:

- **Total kWh delivered:** 320,000 kWh across all managed charging points
- **Total charging sessions:** 22,000 sessions
- **GHG avoided:** 358,400 kg CO?e (0.358 tonnes CO?e, or approximately 358 tonnes)
- **Infrastructure utilisation:** 31% average across all points (vs. 15% baseline)
- **Average session energy:** 14.5 kWh per session
- **Cities operating:** Bogotá, Medellín, Cali

SSOT Architecture: IoT-Native Pipeline

MubOn's SSOT is built on its IoT infrastructure, giving it a significant advantage over companies that must construct their data collection system from scratch:

Tier 1: Ingest

- IoT charging controller: real-time session data (start time, end time, kWh delivered, charger ID, user token)
- Grid metering: utility meter readings for each installed charging point (independent verification of IoT readings)
- UPME grid emission factor API: automatic monthly update from Colombian energy authority

Tier 2: Digital Twin

- Real-time calculation engine running on MubOn's cloud platform
- Per-session CO?e avoided calculation (kWh × net emission factor)
- Uncertainty propagation from grid emission factor monthly updates
- Daily aggregation to the SUI Ledger

Tier 3: Conversion

- Monthly impact report: kWh delivered + CO?e avoided, by city and property type
- IRIS+ PI7685 report for investor reporting
- SDG contribution statement (SDGs 7, 11, 13)
- Auditor export: session-level CSV with IoT raw data links

Pathway to Blended Finance

MubOn's verified SUI positions it for several financing structures unavailable to unverified EV infrastructure companies:

- **Green Revenue Note:** Financing secured against projected kWh delivery revenue, with coupon linked to verified impact milestones
- **Municipal co-investment:** Bogotá's Secretaría de Movilidad has indicated willingness to co-invest in public charging infrastructure that can demonstrate verified utilisation and emission impact data
- **NAMA Facility alignment:** Colombia's NAMA for urban mobility requires verified emission reductions — MubOn's SSOT makes it eligible

Next: Applying SUI Across Sectors — a generalisation guide for other industries.

Applying SUI Across Sectors

Applying SUI Across Sectors

The SUI framework is sector-agnostic. Any enterprise whose product or service produces a measurable, attributable environmental or social outcome can define a SUI. This page provides a generalisation guide across the major cleantech and impact sectors relevant to the CleantechHUB portfolio.

Sector-by-Sector SUI Templates

Agriculture and Food Systems

Sub-sector	Application Event	SUI Name	Unit	Key Baseline Challenge
Bio-inputs / Biostimulants	1 kg product applied per hectare	Chemical Displacement per Hectare	kg CO?e / ha	Regional synthetic input averages vary widely; disaggregate by crop and region
Precision irrigation	1 irrigation event per hectare	Water Saved per Irrigation Event	m³ water / ha	Counterfactual irrigation volume from regional water authority statistics
Food waste reduction	1 kg food waste diverted from landfill	Landfill Diversion per kg	kg CO?e / kg food	National landfill emission factors from EPA/environment ministry
Regenerative agriculture platform	1 hectare enrolled and verified per season	Soil Carbon per Hectare	tCO?e / ha / year	Requires soil sampling; LCA scope 3 often controversial — document boundary carefully

Energy and Mobility

Sub-sector	Application Event	SUI Name	Unit	Key Baseline Challenge
EV Charging	1 kWh delivered through managed charger	kWh Delivered per Session	kg CO?e avoided / kWh	Grid emission factor must be updated as grid decarbonises — a diminishing SUI over time

Sub-sector	Application Event	SUI Name	Unit	Key Baseline Challenge
Distributed solar (C&I)	1 kWh generated by installed system	Clean kWh Generated per Month	kg CO?e / kWh	Grid displacement assumes system substitutes grid power, not additional consumption
Electric two-wheelers (fleet)	1 km driven by fleet vehicle	Clean km per Vehicle	kg CO?e / km	Fleet average ICE equivalent; leakage if displaced drivers switch to ICE alternatives
Energy efficiency (buildings)	1 month of occupancy in certified efficient building	Energy Intensity Reduction per m²	kWh / m² / month	Baseline energy intensity from building energy audit; weather-normalisation required

Water and Sanitation

Sub-sector	Application Event	SUI Name	Unit	Key Baseline Challenge
Water purification (household)	1 litre purified and delivered	Safe Water per Litre	DALY avoided / 1000 litres	WHO DALY factors for waterborne disease; counterfactual water source quality data
Industrial water recycling	1 m³ water recycled vs. discharged	Water Recycled per m³	m³ freshwater saved	Industrial water withdrawal baseline from watershed authority
Wastewater treatment	1 m³ wastewater treated to standard	Pollution Load Removed per m³	kg BOD removed / m³	Effluent quality standard (discharge permit defines counterfactual)

Circular Economy and Waste

Sub-sector	Application Event	SUI Name	Unit	Key Baseline Challenge
Plastic recycling	1 kg plastic collected and processed	Plastic Diverted per kg	kg CO?e / kg plastic	Emission factor depends on plastic type and alternative disposal method
Electronics refurbishment	1 device refurbished and resold	Device Life Extension	kg CO?e / device	Avoided manufacturing emissions require LCA of new device equivalent
Industrial symbiosis platform	1 kg waste matched between producer and consumer	Waste-to-Resource Match per kg	kg CO?e / kg material	Complex: must account for transport emissions of rerouted material

Biodiversity and Land Use

Sub-sector	Application Event	SUI Name	Unit	Key Baseline Challenge

Forest conservation (REDD+)	1 ha protected for 1 year	Deforestation Avoided per Hectare	tCO?e / ha / year	FREL (Forest Reference Emission Level) required; jurisdictional baseline complex
Ecosystem restoration	1 ha restored to target condition	Biodiversity Units Restored per Hectare	BNG units / ha (UK metric) or equivalent	Baseline habitat condition assessment; TNFD metrics preferred
Sustainable aquaculture	1 tonne of certified product harvested	Wild Fish Substitution per Tonne	tonne wild harvest avoided / tonne farmed	Feed conversion ratio and wild fish equivalent calculation required

Five Cross-Sector Principles

1. **Outcome over output:** Always define the SUI at the outcome level (CO?e avoided, m³ water saved, DALY avoided) not the output level (units sold, installations completed). Investors and MDBs will push to the outcome level in due diligence — define it proactively.
2. **Net not gross:** The SUI is always net of counterfactual. A solar installation that adds capacity to an already-decarbonising grid has a smaller net SUI than an equivalent installation displacing coal. Acknowledge this honestly — it demonstrates credibility.
3. **Scope boundaries must be stated:** Scope 1 (direct), Scope 2 (energy), Scope 3 (value chain) boundaries must be explicit. For most cleantech products, the most impactful emissions are Scope 3 avoided — but these are also the hardest to verify. Be precise about which scopes your SUI covers.
4. **Diminishing SUIs are acceptable:** A grid-connected clean energy SUI will naturally decline as the grid decarbonises. Document this explicitly and include a projection of how the SUI evolves under different grid decarbonisation scenarios. This demonstrates sophistication rather than hiding a risk.
5. **Negative SUIs must be disclosed:** If your product produces some environmental harm alongside its primary benefit (e.g., mining impacts for battery metals, land use change for bioenergy crops), these must be disclosed and ideally included in a net SUI calculation. DNSH (Do No Significant Harm) compliance requires this — don't wait for an auditor to find it.

SUI Readiness Checklist by Sector

Before claiming a SUI in any sector, confirm:

- [ ] Outcome domain mapped to IRIS+, TNFD, or GRI indicator
- [ ] Application event defined (trigger condition, unit boundary)
- [ ] Counterfactual baseline identified with peer-reviewed or official source
- [ ] Measurement protocol exists for the outcome variable at the point of application
- [ ] Scope boundaries explicitly documented (Scope 1/2/3)
- [ ] Uncertainty range estimated (even if rough at first)
- [ ] Independent verifier identified (even if not yet engaged)
- [ ] SSOT architecture planned (even if not yet built)

Continue to Chapter 6: The CTH VRF Integration — how SUI fits into the Venture Readiness Framework.