

DEUTERIUM²

COMPANY DESCRIPTION

OPEX

With 15 years of experience, OPEX is positioned as the first zero-emission hydrogen producer in Colombia, spearheading the country's energy transition and establishing new benchmarks for global producers. Its business model positions it at the forefront of the LATAM hydrogen industry, with a primary role in the upstream value chain.

Company description

OPEX is the project developer, founded in 2011 and currently holding 100% of Deuterium's shares. For over six years, OPEX has been leading Colombia's green hydrogen value chain through its initiative Hevolución, dedicated to producing zero-emission hydrogen and its derivatives — including green ammonia and fertilizers — powered by non-conventional renewable sources such as small hydropower plants (SHPP). Through Hevolución, OPEX developed the country's first industrial-scale green ammonia facility, Protium, with a capacity of 1,800 tons per year — proof of concept for scaling the model into e-fertilizer production at Deuterium.

OPEX brings over fifteen years of experience as a pioneer of Colombia's industrial energy transition, having built and financed clean energy infrastructure for more than 55 of the country's leading companies. That track record in structuring, financing, and operating distributed energy assets at scale is the direct foundation for OPEX's expansion into green hydrogen, ammonia, and fertilizer production.

15 years

Experience as an energy transition solutions provider in Colombia

+55 Companies

Leading Colombian companies served across clean energy projects

+6 years

Leading Colombia's green hydrogen value chain

OPEX key Projects



1st zero-emission hydrogen refueling station in Colombia for vehicles, equipped with an electrolyzer capable of producing 4 kilograms per day of 99.999% pure hydrogen.



1st operational zero-emission hydrogen-based vehicle in Colombia and Latin America, with over 30,000 km traveled.



Dualization of Grupo Familia's cargo truck through diesel and hydrogen blending, resulting in a 22% reduction in CO2 emissions.



Development of the 1st industrial plant for green ammonia production, resulting in a total production capacity of 1.800 tons/year.

PROYECTO 01 · PRIMER FID INDUSTRIAL EN COLOMBIA

Protium — Planta piloto de amoniaco verde

OPERATIVO DESDE 2026

Descripción

Fase 1 del Hidrógeno Andino Macroproject, liderado por OPEX S.A.S. y Hevolución S.A.S. La planta de 2.3 MW está alimentada por una pequeña central hidroeléctrica y produce 5 toneladas de amoniaco verde por día. Toda la producción está comprometida con compradores locales mediante un APA (Ammonia Purchase Agreement) a 10 años, reemplazando amoniaco importado de origen fósil.

Localización: Sabaneta, Colombia

Rol OPEX: Estructuración, gestión técnica, operación

Financiador: 100% equity privado — USD 6M+

Duración: 2022–2025



2.3 MW

Electrólisis alcalina

2.7 MW

PPA hidro (10 años)

1,800 t/año

Amoniaco verde

4,140 tCO_2e/año

Reducción emisiones

35

Empleos directos técnicos

USD 6M+

Capital levantado

Cumple RFNBO y RED III (EU) · Apto para exportación a mercados europeos

Video : https://youtu.be/pMqoozsxFrk

Factibilidad H_2 + movilidad FCEV Nexo

COMPLETADO 2023

Descripción

Proyecto integral de estructuración del negocio H_2 en Colombia: estudio de mercado nacional, modelos de negocio para off-takers, identificación de sitios PCH, modelos financieros con captura de incentivos tributarios, y piloto de movilidad sostenible con vehículo de pila de combustible Hyundai NEXO (33,000 km de pruebas en campo).

Localización: Medellín, Colombia

Financiador: 100% equity privado

Duración: 2021–2023

Rol OPEX: Organización líder



7 kW
Electrólisis alcalina

21 kW
Energía solar

1.3 t/año
H_2 limpio

25 tCO_2/año
Reducción emisiones

33,000 km
Pruebas campo NEXO

250 kg
H_2 verde consumido

Primera estación de recarga H_2 a 350 bar en LATAM · Primer FCEV importado en Colombia

PROYECTO 03 · MOVILIDAD SOSTENIBLE — DUAL-FUEL DIESEL + H_2

Piloto dual-fuel diesel + H_2 para vehículos de carga (EPM)

COMPLETADO 2025

Descripción

Conversión dual-fuel de dos vehículos de carga para operar con mezcla diesel + H_2. Los vehículos fueron equipados con sistemas periféricos de inyección controlada de hidrógeno desde tanques de alta presión integrados. Se implementó una estación de recarga H_2 a 6,000 psi. Proyecto financiado por Empresas Públicas de Medellín (EPM).

Localización: Bello, Antioquia, Colombia

Financiador: Empresas Públicas de Medellín (EPM)

Duración: 2024–2025

Rol OPEX: Organización líder



7 kW
Electrólisis alcalina

7 kW
Generación biogás

1.3 t/año
H_2 limpio

14 tCO_2/año
Reducción emisiones

17%
Sustitución H_2/diesel

6 personas
Empleos directos

Estación H_2 y conversión dual-fuel para vehículo de carga — Essity

COMPLETADO 2024

Descripción

Suministro, instalación y operación de una estación de generación, compresión, almacenamiento y recarga de hidrógeno, junto con la conversión de un vehículo de carga para operar con mezclas diesel + H_2. El proyecto fue financiado por la empresa multinacional Essity como parte de su estrategia de descarbonización industrial.

Localización: Girardota, Antioquia, Colombia

Financiador: Essity (multinacional)

Duración: 2024

Rol OPEX: Organización líder



7 kW
Electrólisis alcalina

7 kW
Energía solar

1.3 t/año
H_2 limpio

7 tCO_2/año
Reducción emisiones

17%
Sustitución H_2/diesel

3 personas
Empleos directos

PROYECTO 05 · ALIANZA ESTRATÉGICA CON ECOPETROL

Proyecto Movilidad Dual — Infraestructura de recarga H_2 con CENIT

EN EJECUCIÓN

Descripción

Iniciativa conjunta entre CENIT y OPEX S.A.S. para el desarrollo de soluciones de movilidad sostenible basadas en hidrógeno de bajas emisiones. Busca construir y operar un sistema de recarga H_2 para vehículos livianos y pesados en el Hub de Movilidad Sostenible de Cundinamarca, dentro de la estrategia de descarbonización de CENIT.

Financiador: CENIT y Terpel

Rol OPEX: Organización líder

Duración: 6 meses (fase factibilidad)

Estado: Ejecución

7 kW
Electrólisis alcalina

7 kW
Energía solar

1.3 t/año
H_2 limpio

~7 tCO_2/año
Reducción emisiones

10%
Sustitución H_2/diesel

6 personas
Empleos directos

H_2 verde solar — Universidad de Antioquia + SGR

EN CURSO 2023–2026

Descripción

Proyecto de generación de conocimiento e infraestructura para producción, almacenamiento, transformación y uso de H_2 limpio a escala laboratorio. Financiado por el Sistema General de Regalías (SGR). Incluye seis estrategias de diseminación en 23 ciudades de Colombia — escuelas, industria y público general.





6.1 kW
Electrólisis

10.7 kW
Energía solar

46 kg/año
H_2 limpio producido

1,864 kgCO_2/año
Reducción emisiones

56 personas
Empleos directos

23 ciudades
Divulgación nacional

El hidrógeno como Proyecto País

Por qué el H_2 es distinto a cualquier otro activo de energía

El **hidrógeno de bajas emisiones** es fundamental para un futuro limpio y requiere infraestructura, políticas y cooperación global

Las puertas que abre

¿Por qué importa?

Oportunidad estratégica para reindustrializar a Colombia, al ser el punto de encuentro entre la producción de energía limpia y la creación de una nueva cadena de valor industrial.

Generación de nuevos empleos con proyecciones de hasta 15.000 empleos directos e indirectos para 2030.

Potencial de sustituir importaciones por más de 500 millones de dólares al años en sectores clave como el agro y los biocombustibles, impulsando la economía local.

¡Todos ganan!

Creación de hasta 15.000 empleos a 2030.

Desarrollo de industria nacional y nuevas cadenas de valor.



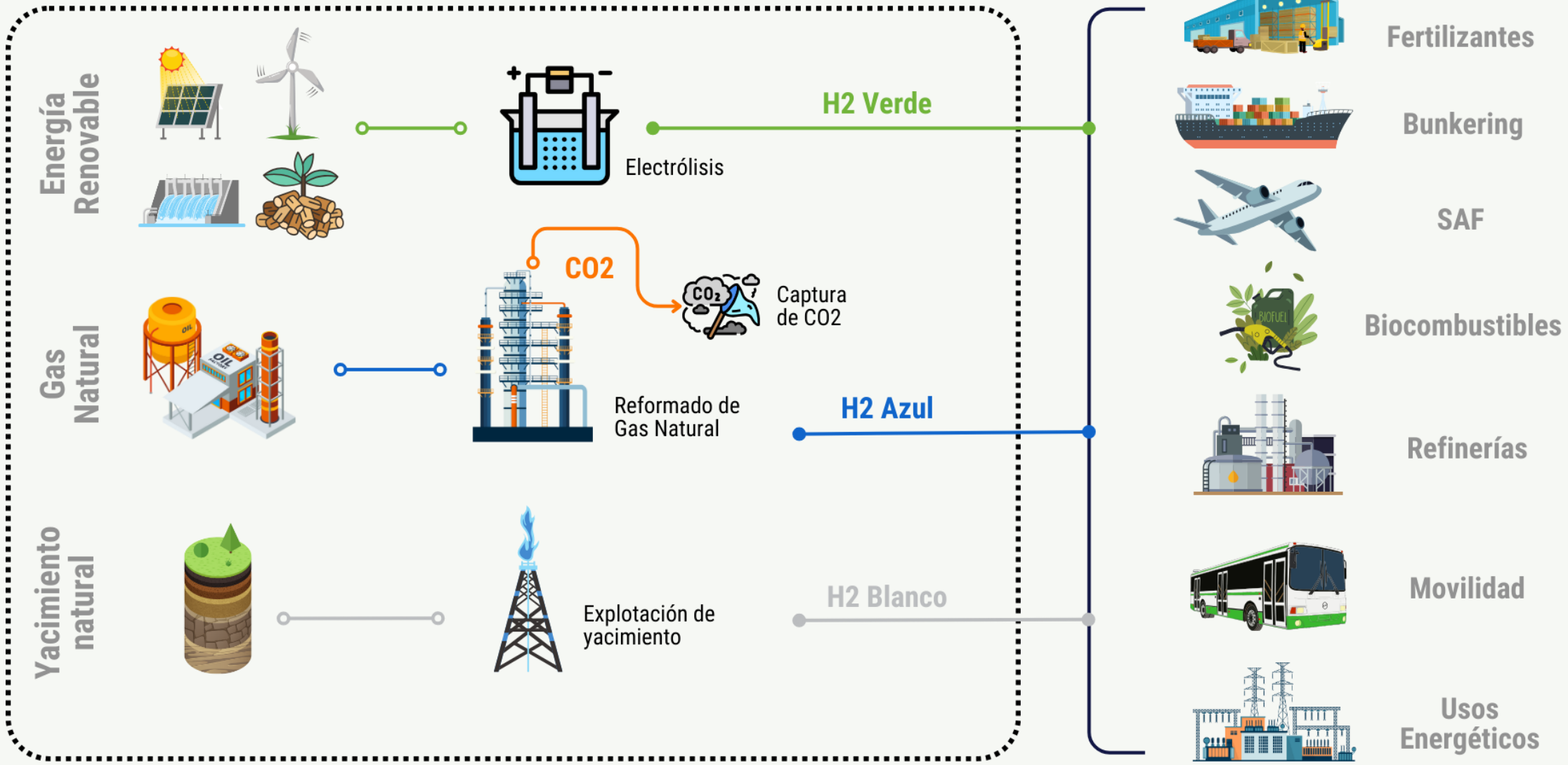
Potencial de 6 BCOP de inversión a 2030

La Cadena de valor del hidrógeno

Origen
Materia prima

Obtención
Método de producción

Cadenas de valor
En qué se puede usar



El sector agrícola guarda un potencial importante



14,1%
Población Ocupada



47%
Del crecimiento del PIB 2024



Productos Premium para mercados de exportación

CONTEXTO DEL MERCADO DE FERTILIZANTES

100% imported

Colombia doesn't produce its own fertilizers and farmers pay for it every time the world is in crisis.

High exposure to global price volatility, embedded fossil-based carbon footprint, limited domestic value capture, and structural agricultural input insecurity — all because the country depends almost entirely on external supply.

1.4M tons imported · 2024

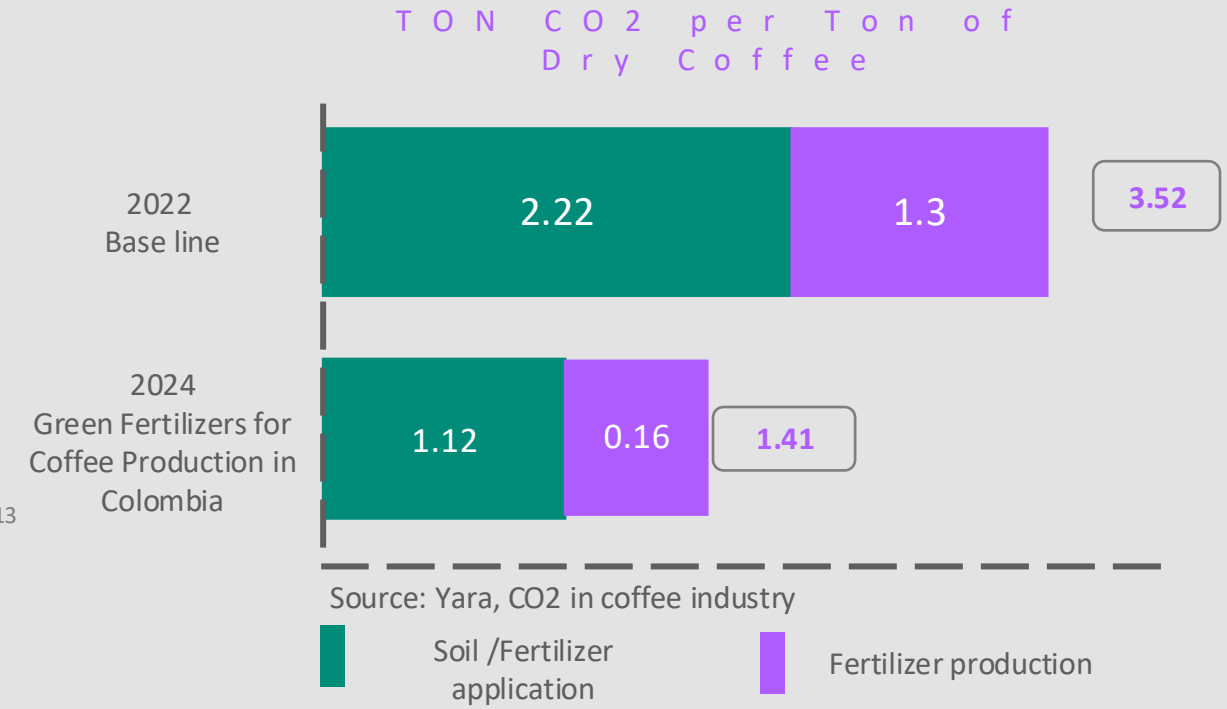
A multi-hundred-million USD market with no local producer.

Colombia's fertilizer import bill keeps growing. Deuterium is the first project positioned to replace a meaningful share with domestically produced, lower-carbon inputs.

70% of crop emissions

Fertilization drives most of the carbon footprint in agriculture and green fertilizers cut it by 60%.

Transitioning from conventional to green nitrogen fertilizers delivers up to a 60% reduction in Scope 1 and Scope 2 fertilizer-related emissions, turning a climate liability into a competitive advantage for Colombian exports.



Switching to green fertilizers reduces total carbon intensity from 3.52 to 1.41 tCO_2 per TDC, while cutting final fertilizer cost for farmers

- 60% CO_2 intensity

- 10% Final cost

Annual addressable fertilizer market, no domestic producer exists today. Deuterium enters first.

USD 100M+

La Cadena de valor del hidrógeno

Los principals costos asociados a estos productos



20 – 25%

Source: WIKA

DESCRIPTION OF THE PROJECT

MAIN COMPETITIVE ADVANTAGE



Raw material: (Renewable Energy, water and Air)

Products: Low carbon chemicals for fertilizer industry, and fertilizers for farming and food.

Cheap, captive energy

Own SHPP at ~40 USD/MWh — up to 50% below grid PPAs. Energy is a core asset, not a variable cost.

Proximity to customer

Less logistics, fewer intermediaries, products tailored to specific soils and crops — impossible for competitors in Russia or the Gulf.

Agricultural value uplift

Green fertilizers enable farmers to certify lower-carbon crops — unlocking premium prices in European and US specialty markets where buyers pay for verified sustainability.

Carbon regulation shield

Green process opens premium export markets and protects against carbon border taxes already raising costs for conventional competitors.

Source: international PtXhub

DESCRIPTION OF THE PROJECT

HYDROPOWER PLANTS READY TO BUILD

SHPP PROJECT PIPELINE · BY GENERATION CAPACITY



- Small (2 -10 MW)
- Medium (20 -40 MW)
- Large (150 -200 MW)

As part of the project's Conceptual phase in 2024, a first study was financed in partnership with the IDB and Colombia's Ministry of Mines and Energy, through FENOGE, to identify potential hydropower projects suitable for developing Deuterium and other future expansions. The study identified 1,5 GW of unbuilt hydropower capacity in Colombia, with projects already at an advanced stage of development and holding secured environmental licenses.

DEPLOYABLE AT THREE SCALES

SMALL · PILOT
2–10 MW
Demonstration scale
Protium model

MEDIUM · COMMERCIAL
30–40 MW
Deuterium model
60 kt/year of CAN 21 Capacity

INDUSTRIAL · EXPORT
150–200 MW
Tritium model · 235 kton/yr fertilizer · regional export capacity

This pipeline is the strategic moat.

1 GW without grid access — stranded renewable energy that no one else is converting into green fertilizers. Deuterium integrates these assets into green hydrogen hubs across the Coffee Axis, making the model replicable at scale across Latin America.

DESCRIPTION OF THE PROJECT

PROOF OF CONCEPT OF THE BUSINESS MODEL



Key metrics

6 MMUSD
CAPEX

150 tons
of fertilizers for direct proofs on coffee crops

360 tons/year
green hydrogen

1.800 tons/year
of **ammonia** for industrial applications

The model works. Here is the evidence:

Protium is the first industrial-scale green hydrogen and ammonia plant powered by small hydropower in LATAM, built, commissioned, and operating in Medellín. It de-risks Deuterium on every dimension that matters to investors. Building on this track record, and with EUR 1.5 million in non-reimboursable resources backing from KfW (Germany's national development bank), Deuterium is running a 3-year field trial on coffee plots with SKN Caribecafé, applying 150 tons of the specific CAN 21 fertilizer formulation to validate agronomic performance directly with an anchor customer ahead of commercial scale-up.

WHAT PROTIUM IS VALIDATING

Technical model proven

SHPP + electrolyzer + Haber-Bosch integration operating at industrial scale in Colombia.

Fertilizer trials in crops

With Protium capacity the proofs of concept for the CAN 21 fertilizer are being developed. This allow to get real information of its performance and facilitates the access to regulatory permissions for its commercialization.

De-Risked by Design

Protium proves that Deuterium's core technology stack (SHPP, electrolysis, and Haber-Bosch integration) already runs successfully at industrial scale in Colombia, having also navigated the country's full regulatory and permitting pathway for a first-of-its-kind green hydrogen and ammonia plant.

DESCRIPTION OF THE PROJECT

FARMERS LOYALTY STRATEGY

A closed value loop

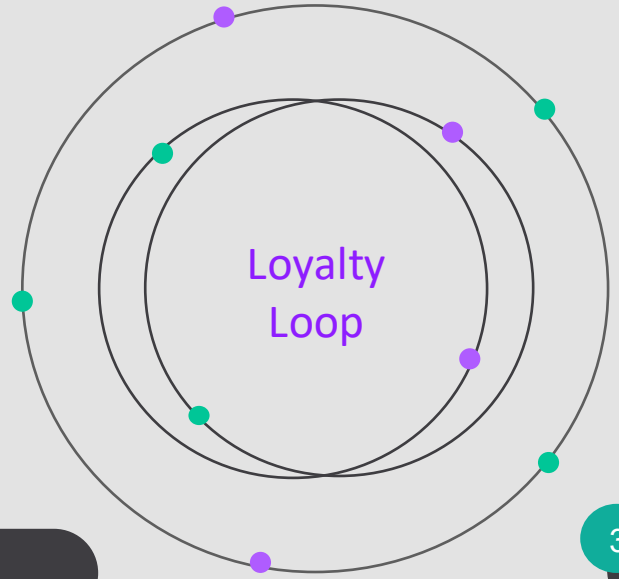
Fertilizer and technical support flow to farmers through SKN Caribecafé, premium coffee sales flow back as higher income, renewing the relationship season after season.

Partnering with:

SKN Caribecafé

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Investment	Farmers Involved	Total fertilizer
1,5 Million	6.000	150
Euros As a grant of the German Government	**Coffee farmers families** Impacted as part of the pilot in development	**Tonnes of fertilizer** Directly delivered to farmers in 3 years.



1 FERTILIZERS DELIVERY

CAN 21 Fertilizer is delivered to farmers through SKN Caribecafé.

2 TECHNICAL ASSISTANCE

Farmers receive technical assistance to develop better production practices.

3 COFFEE DELIVERY

Farmers deliver their coffee harvest to SKN.

4 PREMIUM COMMERCIALIZATION

SKN Commercializes the coffee in premium markets with better pay

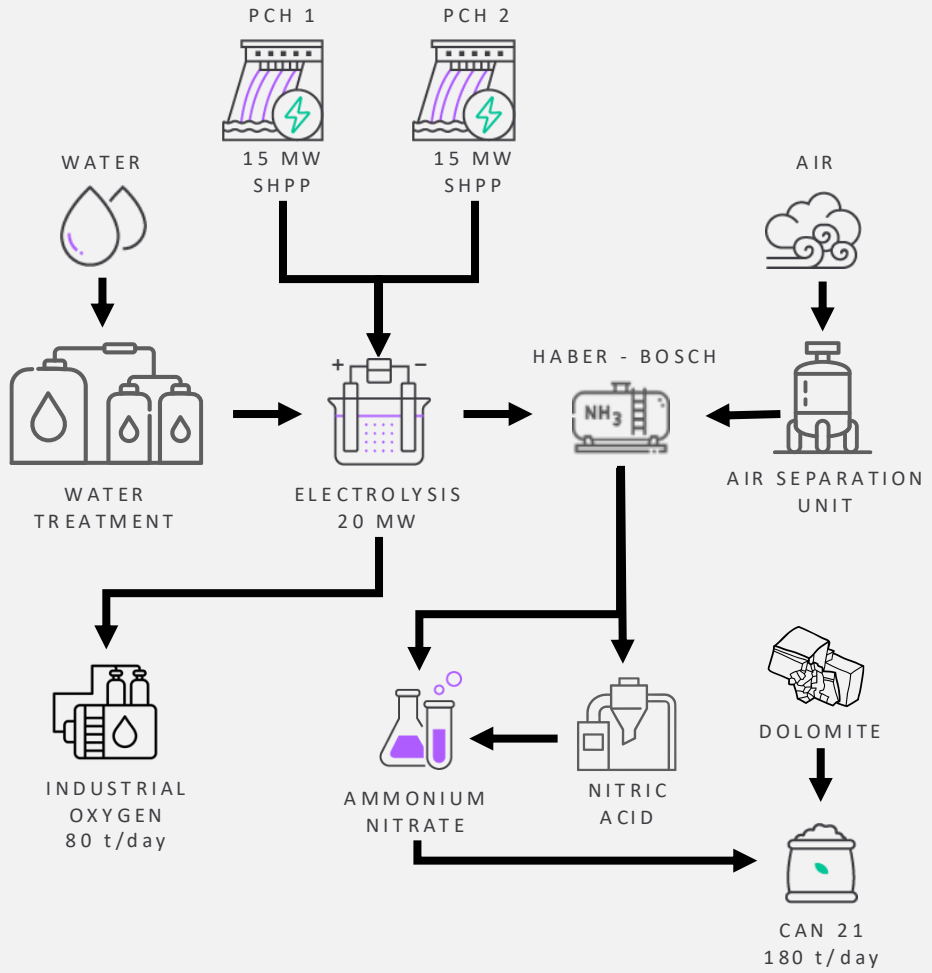
5 HIGHER FARMER INCOME

Farmers receive better pay, as their coffee sells at a higher price.

PROJECT DESCRIPTION

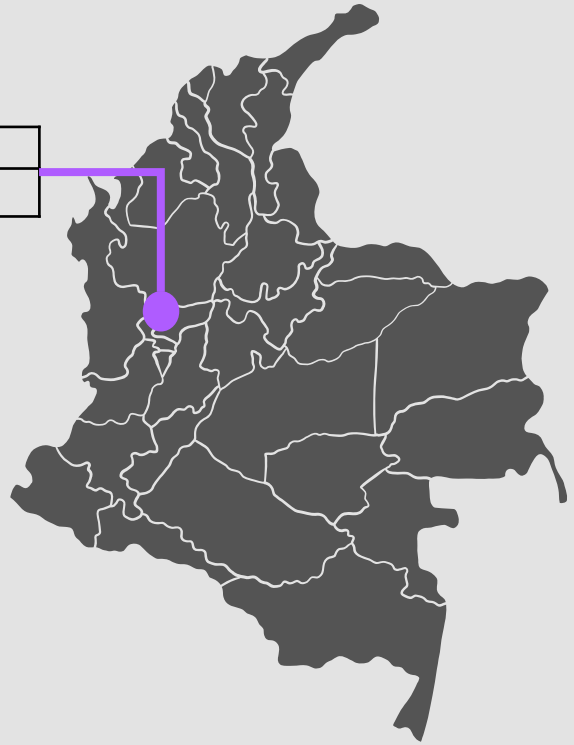
DEUTERIUM

Deuterium project description



Location of the Project

Coffee Axis of Colombia



Why this location

- **Water security**: Direct access to river provides process water for the plant, avoiding dependency on grid power or trucked-in water.
- **Logistics corridor**: sits on a strategic road corridor connecting the coffee axis to the country's central agricultural markets.
- **Proximity to demand**: Located within reach of the crop regions anchoring Deuterium's demand tesis, coffee, sugarcane, and others export crops, shortening the distribution chain from plant to farmer.

Key project facts

220 MMUSD

CAPEX for the development of the whole complex

60 KTons/year of CAN21[1]

Primarily intended for the provision of the local market.

Competitive

CAN 21 selling price in a medium-scale plant.

Proven

Replicable model and proven technology, this reflects a low-risk profile for early movers.

CAN21[1]: Calcium Ammonium Nitrate (21% of nitrogen)

DEUTERIUM · DEVELOPMENT PROCESS

COMPLETED · IN PROGRESS · UPCOMING

2024 DECISION POINT	2025 DECISION POINT	Q3 2026 DECISION POINT	Q3 2027 – Q1 2028 FINAL INVESTMENT DECISION	Q2 2030 COD

CONCEPT	PRE-FEASIBILITY	FEASIBILITY	FRONT END ENGINEERING DESIGN	ENGINEERING, PROCUREMENT & CONSTRUCTION	OPERATIONS & MAINTENANCE
• Market analysis • Product, feedstock & inputs • Environmental Scan • Incentives, financing & support mechanism options • Policy and regulation evaluation • Costs and profitability estimate • Socio-economic benefits	• Project configuration options • Site options (incl. land access) • Environmental Screening • Permitting and license requirements • Techno-economic assessment (1st) • Offtakers engagement and Letters of Intent (LOIs)	• Site selection • Land acquisition or lease • Initial project design • Techno-economic assessment with CAPEX Refinement Class 5 • Technology licensors short list • Environmental Impact Assessment • Initiate permit applications • Project communication and stakeholder engagement	• Technology licensor selection • Techno-economic assessment with CAPEX Refinement Class 3 • Engineering design • Finalise permitting • Construction schedule and budget • Product proof of concept • Business plan and offtake contracts negotiation • Environmental Management and Monitoring • Project Due Diligence	• Operationalise Special Purpose Vehicle • Engineering, Procurement, Construction Management activities • Engineering, Procurement, Construction commissioning	• Plant operations and maintenance • Performance monitoring and reporting • Decommissioning (beyond current project scope)

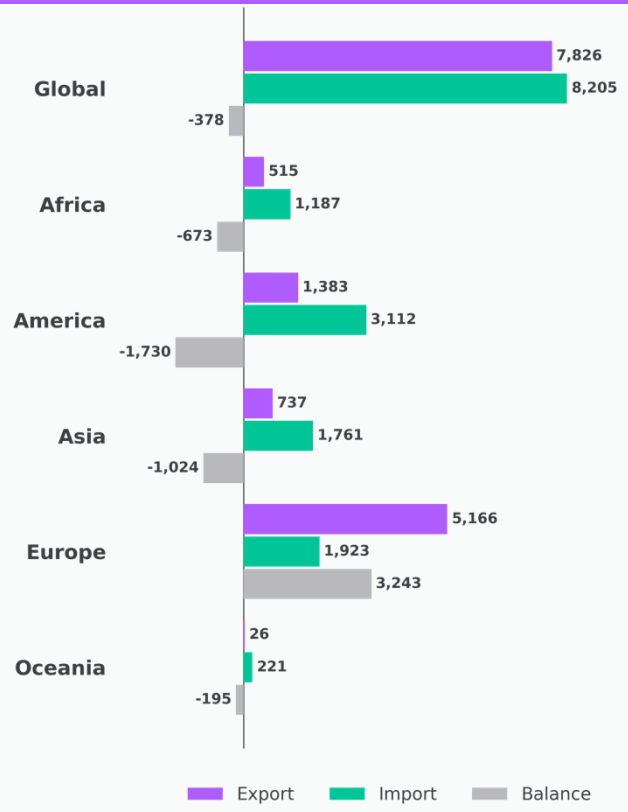
SUPPORTING ENTITIES

BID Invest · FDN Financiera de Desarrollo Nacional · BID · THE WORLD BANK · KFW · FENOGE · GGGI

MARKET POTENTIAL

GLOBAL MARKET CONTEXT

AN Trade Balance (thousand tonnes)



Global CAN Market Size

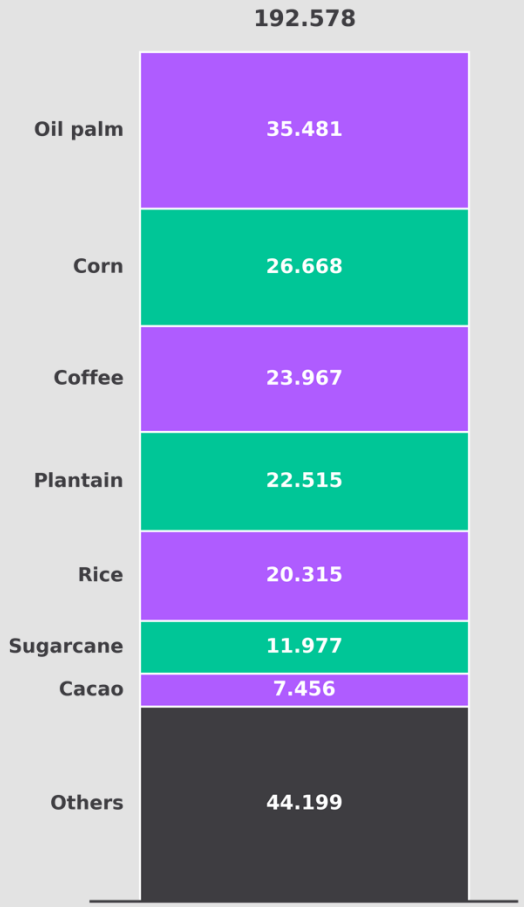


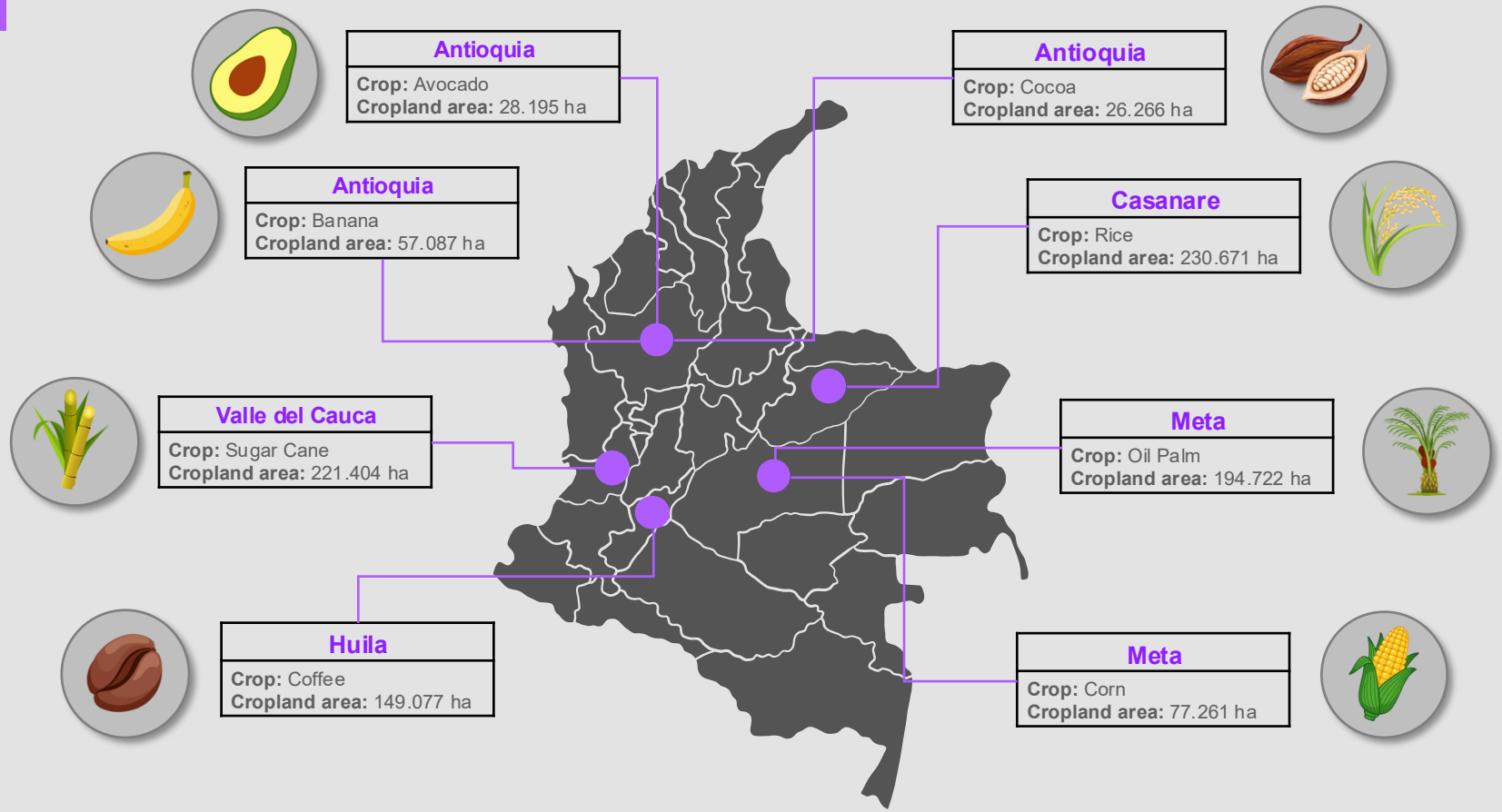
Sources: Market research..

MARKET POTENTIAL

LOCAL MARKET POTENTIAL

Local Addressable Market (tons)





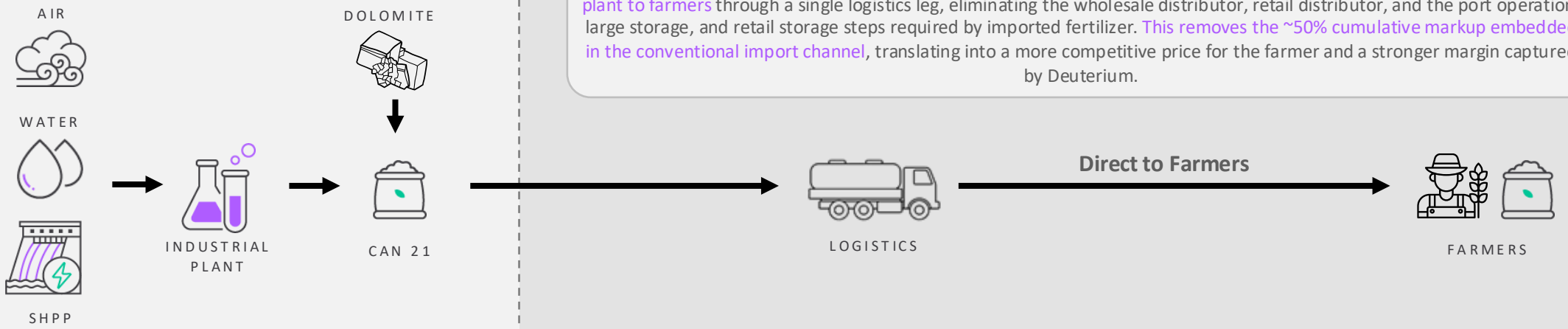
Sources: Market research.

MARKET POTENTIAL

DEUTERIUM'S BUSINESS MODEL

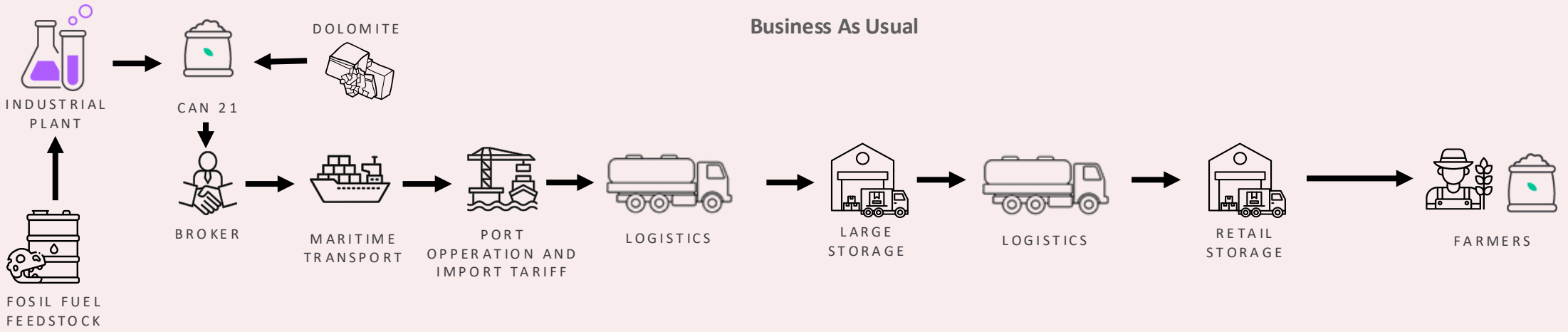
Production | Wholesale Distributor | Retail Distributor | Farmers

Deuterium's current business model



By producing CAN21 domestically and locating the plant near its target crops, Deuterium ships directly from the industrial plant to farmers through a single logistics leg, eliminating the wholesale distributor, retail distributor, and the port operation, large storage, and retail storage steps required by imported fertilizer. This removes the ~50% cumulative markup embedded in the conventional import channel, translating into a more competitive price for the farmer and a stronger margin captured by Deuterium.

Business As Usual



PRODUCTION OFF-TAKERS

DEMAND LANDSCAPE

Market Capture

3 – 5%

Of the total fertilizers market
Based on the plant capacity of 60 kt/year of CAN 21

Import Dependency

100%

Of Colombia's nitrogen fertilizer supply
No domestic CAN21 production exists today

Urea Concentration

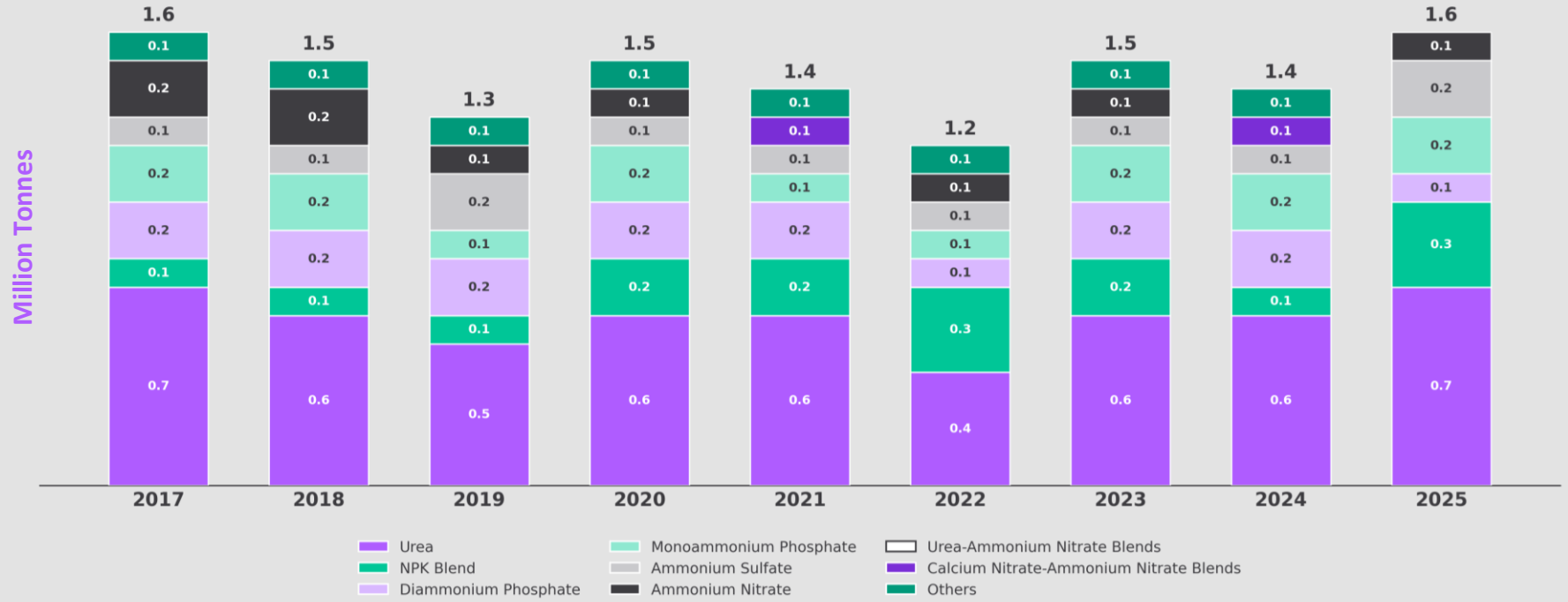
40-45%

Is urea
The single largest, highest-volatilization-loss segment, CAN21's substitution target.

Current CAN Segment

1%

Of imports classified as CAN-type blends
The gap is a supply gap, not a lack of agronomic demand.



Sources: Market research developed by IDOM consulting for the Project.

THE ROAD AHEAD

BUILT ON PROVED EXPERIENCE

Protium
(Demonstrative plant)

NH_3

1800 ton/yr

Key Investment Highlights

- **Current state**: Commissioned
- **Product:** Ammonia and e-fertilizers
- **CAPEX:** USD 6 Million
- **Offtake:** 10 Year PA Signed
- **Know how:** Expertise in developing PtX projects in Colombia.

Deuterium
(Current fundraising round)

60000 ton/yr

31 MW

Key Investment Highlights

- **Current status:** FEED studies
- **Product:** E-fertilizers (CAN 21)
- **Current investment**: USD 3 million
- **CAPEX**: USD 220 million including SHPP
- **Offtake:** Under negotiation
- **FID: Q3 2027 – Q1 2028**

Tritium
(Future expansion)

235 kton/yr

174 MW

Key Investment Highlights

- **Current status:** Feasibility
- **Product:** E-fertilizers (CAN 21)
- **CAPEX:** USD 1,250 million
- **Offtake:** Under negotiation
- **FID: 2028**


opex