PlasmaLeap: Generating Ammonia and Nitrate with just Air, Water and Electricity

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- PlasmaLeap was recently announced as a recipient of funding through the Hort Innovation Venture Fund
- Launched in late 2024, the Venture Fund, delivered in partnership with Artesian Venture Partners, was created to accelerate innovation across the horticulture sector by investing in early-stage, high-growth startups
- Their eNFix system can generate high-concentration liquid fertiliser on your farm using air, water and electricity

PlasmaLeap's eNFix system is a zero-emissions nitrogen production technology that synthesises ammonia and nitrate fertilisers using only air, water and renewable electricity (Figure 1). The patented plasma-based process bypasses the need for natural gas inputs, as used in traditional Haber-Bosch grey ammonia systems, and is engineered for high energy efficiency and compatibility with variable renewable power (Figure 2).

eNFix produces high-concentration liquid fertiliser suitable for protected cropping and fertigation environments

The eNFix system is containerised and scalable, offering growers a stable, secure, and flexible approach to accessing nitrogen on-farm or in regional 'nutrient hubs' where clusters of interested growers are located. Nutrient hubs are planned for construction in Tasmania and regional New South Wales, where the shared model will be tested.

It is hoped that this technology will not only reduce the carbon footprint of nitrogen fertiliser inputs but also reduce exposure to transport bottlenecks, volatile global markets, storage risks and risks associated with long-distance freight and long global supply chains.

PlasmaLeap's eNFix system deployed at Green Camel farm in Cobbitty, NSW where it was tested on baby cucumbers. Low-concentration nitric acid (HNO_3) was dosed straight into the Priva system.
Photos credit: PlasmaLeap

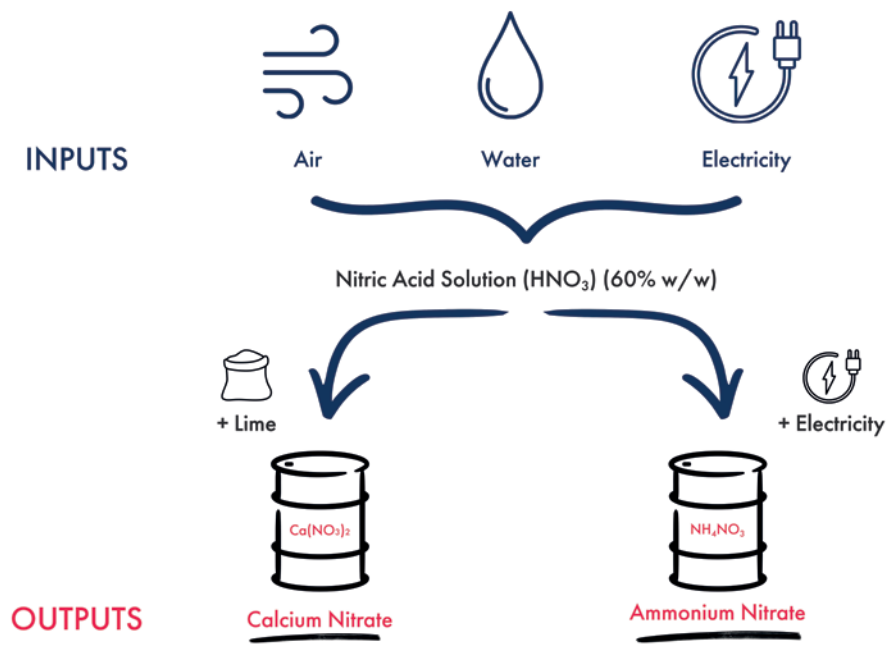

Figure 1. Inputs and outputs of PlasmaLeap's eNFix system

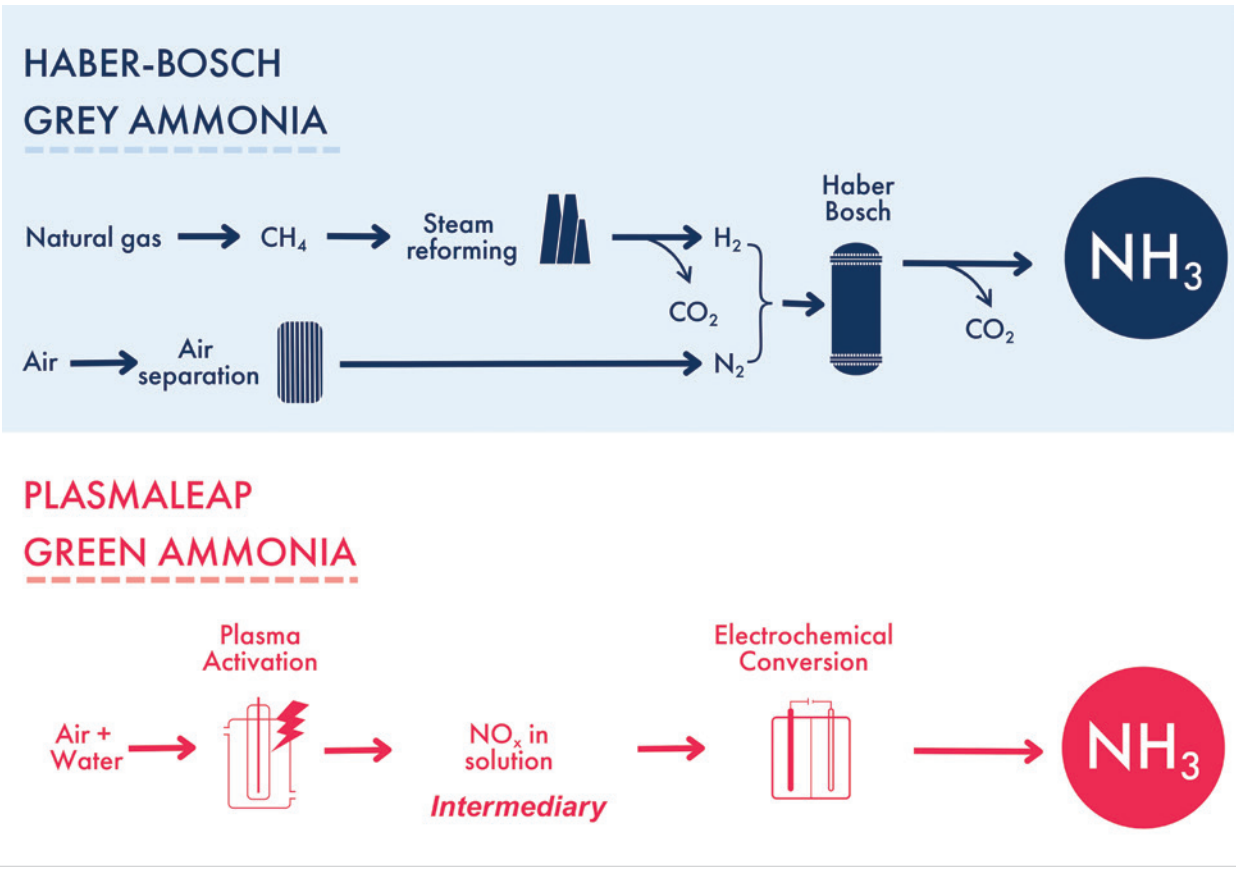

Figure 2. Comparison between traditional Haber-Bosch ammonia generation systems and the PlasmaLeap eNFix system

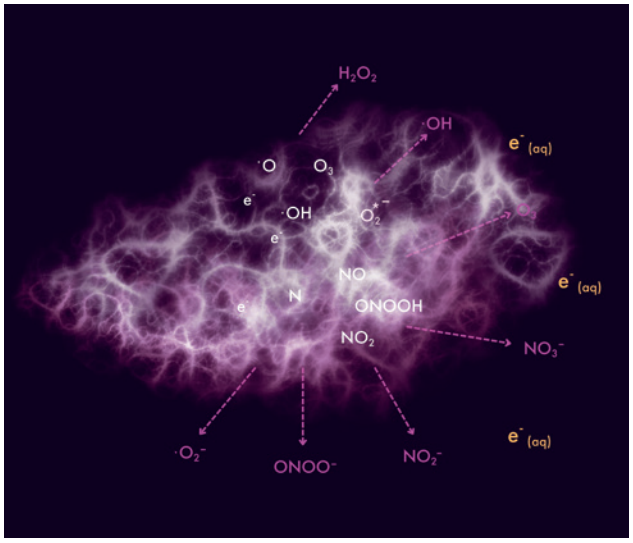

Figure 3. Plasma activation in action: primary chemical species generated by the plasma activation are shown in white. These rearrange themselves, attaching to other free molecules to form other chemical species shown in pink.

How plasma makes nitrogen fertiliser from air

Plasma is the fourth state of matter, distinct from solids, liquids and gasses. It's generated when energy, in the form of heat, pressure or electricity, is applied to a gas, causing ionisation where electrons separate from their atoms.

The air we breathe is made up of around 78% nitrogen gas (N_2). The two atoms in the nitrogen molecule are held together very tightly and are not easily separated.

Like a lightning bolt during a storm, the eNFix system applies enough energy to break apart the triple bond of the Nitrogen atoms. Once split, the nitrogen atoms quickly bond to oxygen in the atmosphere, forming nitrogen dioxide (NO_2) and other chemical species.

When water is added, like rainfall in a storm, the nitrogen dioxide dissolves, creating nitric acid (HNO_3), which forms nitrates (NO_3) (Figure 3). Lime can be added to this solution to create calcium nitrate ($CaNO_3$).

As an alternative pH buffer to lime, a further electrochemistry step can reduce part of the HNO_3 to generate Ammonium Nitrate (NH_4NO_3).

Beyond horticulture

While horticulture represents the natural early market, PlasmaLeap's plasma-based platform extends into broader agricultural applications, industrial, and emerging energy sectors.

Its zero-emission ammonia production is relevant to the rapidly expanding hydrogen and eFuel industries, providing additional commercial pathways that support the company's growth and the ongoing refinement of the technology.

More information

The Hort Innovation Venture Fund invests in technologies with the potential to materially strengthen the capability, resilience, and sustainability of Australian horticulture. PlasmaLeap aligns with this objective by offering a pathway to more sovereign, emissions aligned fertiliser production – an area of strategic vulnerability for growers.

Hort Innovation Venture Fund:
www.frontiers.au/startups

PlasmaLeap:
www.plasmaleap.com

Hort Innovation Frontiers

PLASMALEAP Technologies

WANT TO TEST THIS IN YOUR BERRIES?

PlasmaLeap is actively seeking pilot or trial participants who are willing to provide feedback to the business after using a representative amount of the fertiliser products over a crop growth cycle.

Previous trials have covered potatoes, berries, field tomatoes, sorghum, rye grass, wheat and cotton.

If you would be interested in hearing more, scan this QR code or visit bit.ly/ABJ-PL

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