



# PLASMALEAP

Technologies

ZERO-EMISSIONS eFUELS & CHEMICALS

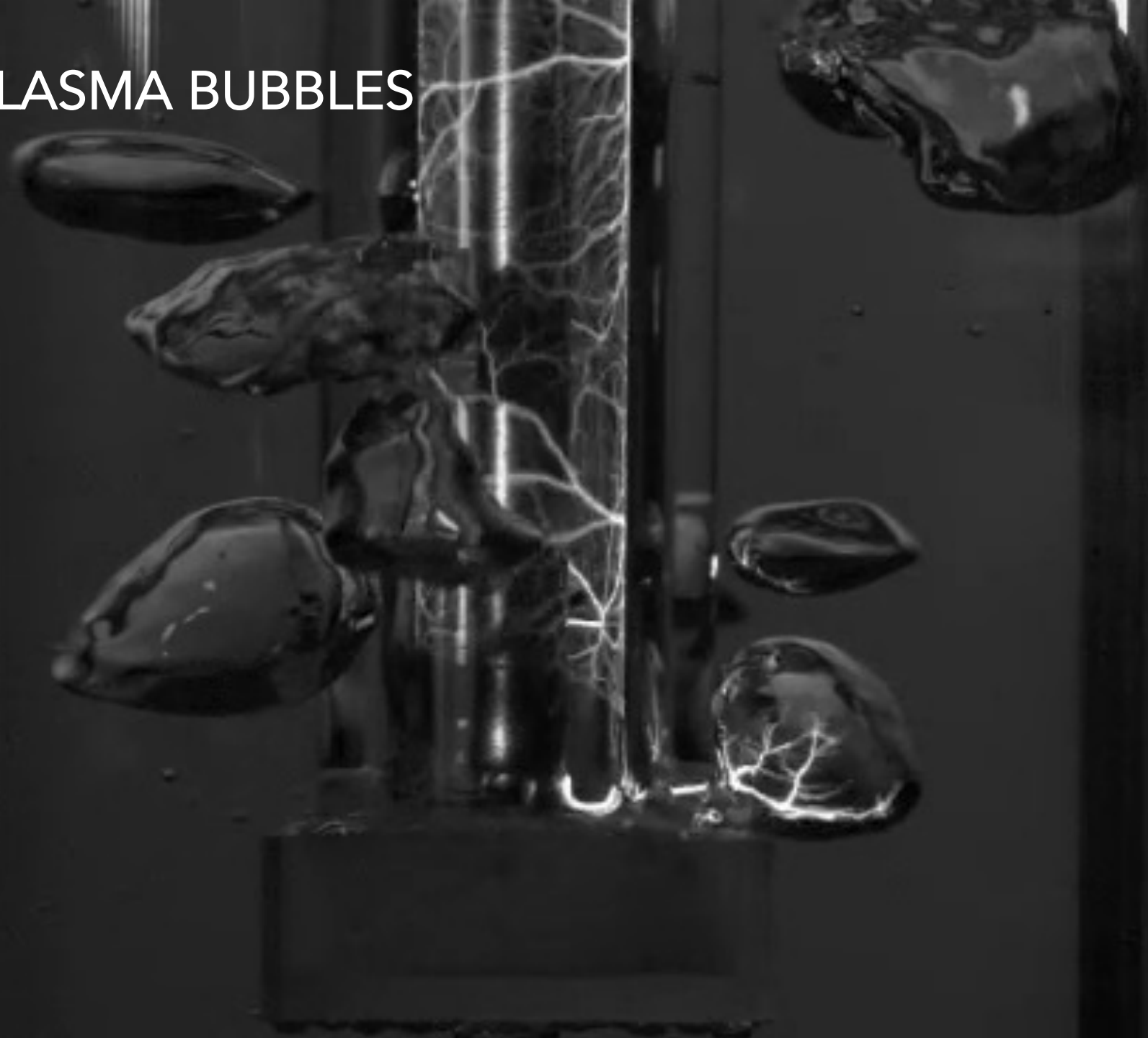
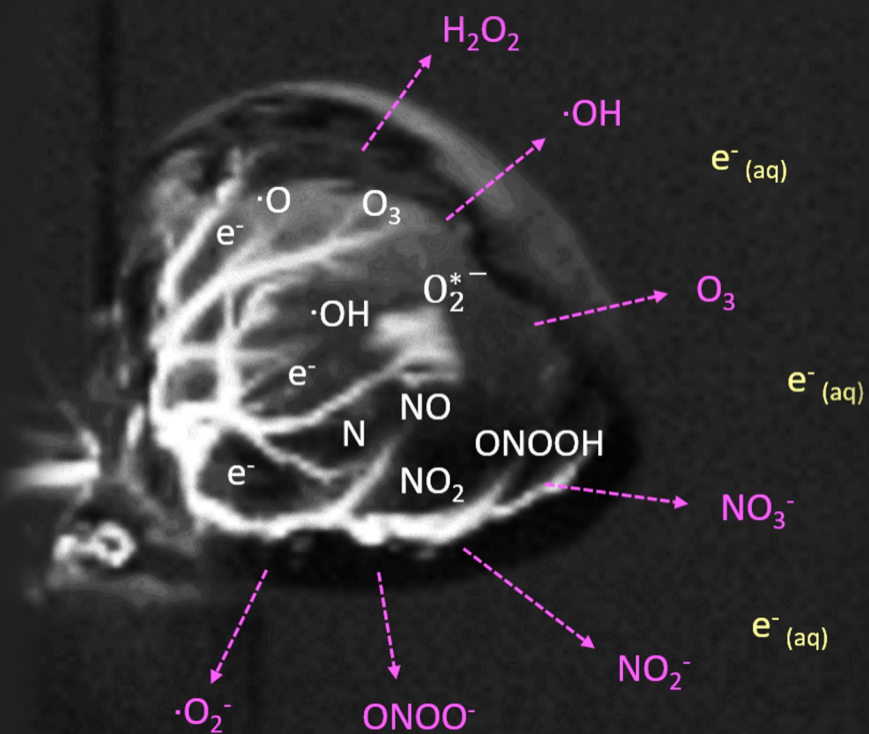
CONFIDENTIAL

# MISSION

**Build a sustainable world using  
green electrons.**



# OUR INNOVATION PLASMA BUBBLES



# TECHNOLOGY

Our reactors discharge at high-voltages to excite air and other gasses into plasma, and react this with water under atmospheric conditions



Image: PlasmaLeap Bubble Column Reactors

## Scalable

- Based on principles of fluid dynamics, the technology maintains performance and energy efficiency at scale.
- Operates at atmospheric conditions (temp & pressure)
- Vertically & Horizontally scalable

## Compatible

- High-energy electron approach to chemistry allows many applications via new reaction pathways
- Compatible with wide range of catalysts & electrochem systems

## Efficient

- Highly energy efficient for Ammonia synthesis
- Surpasses energy performance in other plasma-systems
- Out-performs energy efficiency frontiers of competing market technologies.

# PRODUCTS

PlasmaLeap has scaled its plasma reactor technology into world-leading products and industrial prototypes for zero-emission eFuels & chemicals synthesis

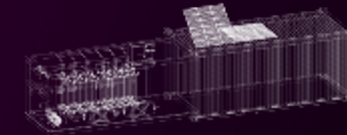
**Leap100**  
Laboratory-grade reactor



**Ammonia Synthesis**  
Ammonia Modular Base Unit



**eFuel Synthesis**  
Hydrocarbon Modular Base Unit



PRODUCT

APPLICATION

Multiple Applications

Direct fuel, hydrogen carrier,  
Fertiliser

Carbon neutral fuel for aviation & auto,  
feedstock for industrial manufacturing

INPUTS

Gasses + Liquids

Air + Water + Electricity

CO<sub>2</sub> + Water + Electricity

OUTPUTS

- Multiple synthesis pathways
- Multiple destruction pathways

- Nitrates
- Ammonia

- Methanol > Jet fuel
- Syngas > Fischer-Tropsch products

REVENUE MODEL

Unit Sales

\$/kg

\$/kg

TECHNOLOGY  
READINESS LEVEL

9 (In Market)

7 (In Pilot)

4 (In Lab)



# AMMONIA



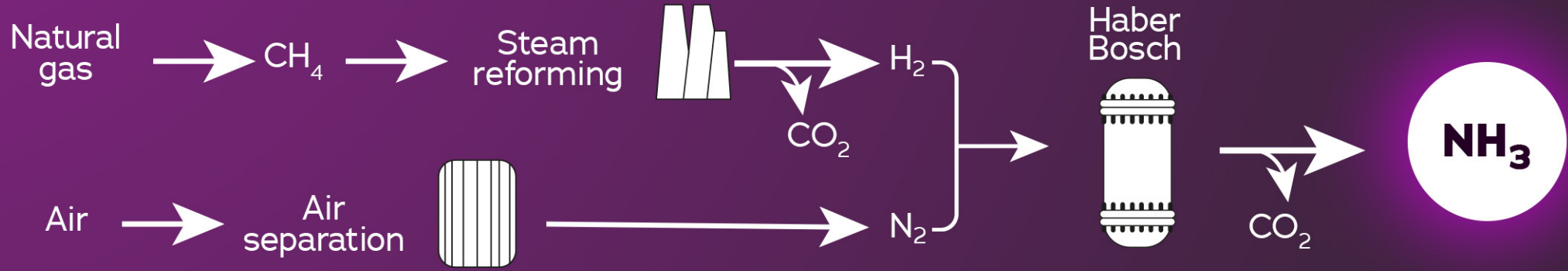


# HISTORY

Birkeland–Eyde (1903): used electrical arcs (thermal plasma) to react atmospheric nitrogen ( $N_2$ ) with oxygen ( $O_2$ ), ultimately producing nitric acid ( $HNO_3$ ) with water.

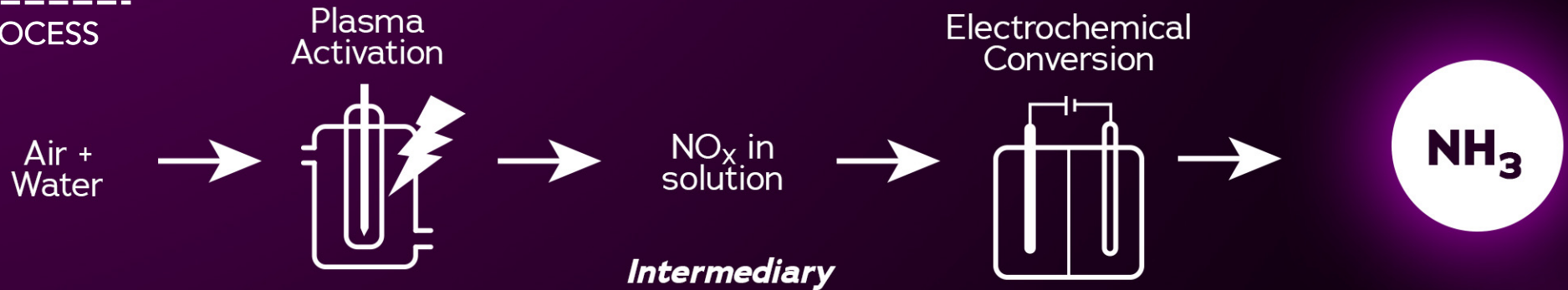
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# HABER-BOSCH GREY AMMONIA



# PLASMALEAP GREEN AMMONIA

## PLASMA BUBBLE PROCESS





# IN THE NEWS


**INTERESTING ENGINEERING** INNOVATION SCIENCE CULTURE HEALTH TRANSPORTATION VIDEOS DIY

SCIENCE

## Chemical Engineers Create Ammonia With New Green Method

The 100% renewable method can help drastically minimize carbon emissions.

By Fabienne Lang  
Jan 21, 2021



DHuss/iStock

**RENEW ECONOMY**  
Clean Energy News and Analysis

## Australian team makes green ammonia production breakthrough


Michael Mazengarb 22 January 2021 19



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**The New Zealand Institute of Agricultural & Horticultural Science Inc**

AGSCIENCE MAGAZINE HOME ABOUT MEMBERSHIP NEWS PLANT SCIENCE CENTRAL CO



## New eco-friendly way to make ammonia looks promising for agriculture

Chemical engineers at UNSW Sydney have found a way to make 'green' ammonia from air, water and renewable electricity without the need for the high temperatures, high pressure and huge infrastructure currently needed to produce this essential compound.

**PLASMA LEAP**

## Lightning In A Bottle Might Allow Farmers To Make Eco-Friendly Ammonia Fertilizer

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**HUAWEI**

## Smarter Energy for a Better Life

With Huawei's FusionSolar Residential Smart PV Solution

### Green ammonia breakthrough a potential boon for solar-powered exports

Scientists from the University of New South Wales and the University of Sydney have made a breakthrough in the development of green ammonia. Their findings could alter the global industry with the help of solar to produce green ammonia for export to countries like Japan and Germany, instead of straight hydrogen.

JANUARY 21, 2021 **BLAKE MATICH**

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**ELEMENTAL**


## Eco-friendly Way to Make Ammonia Could be Boon for Hydrogen, Agriculture

Monday, January 25, 2021

Chemical engineers at UNSW Sydney have found a way to make "green" ammonia from air, water and renewable electricity that does not require the high temperatures, high pressure and huge infrastructure currently needed to produce this essential compound.

The new production method, demonstrated in a laboratory-based proof of concept, has the potential to play a role in the global transition towards a hydrogen economy, where ammonia is increasingly seen as a solution to the problem of storing and transporting hydrogen energy.

In a paper published in *Energy and Environmental Science*, the authors from UNSW and University of Sydney say that ammonia synthesis was one of the critical achievements of the 20th century. When used in fertilisers that quadrupled the output of food crops, it enabled agriculture to sustain an ever-expanding global population.



**UNSW**  
SYDNEY

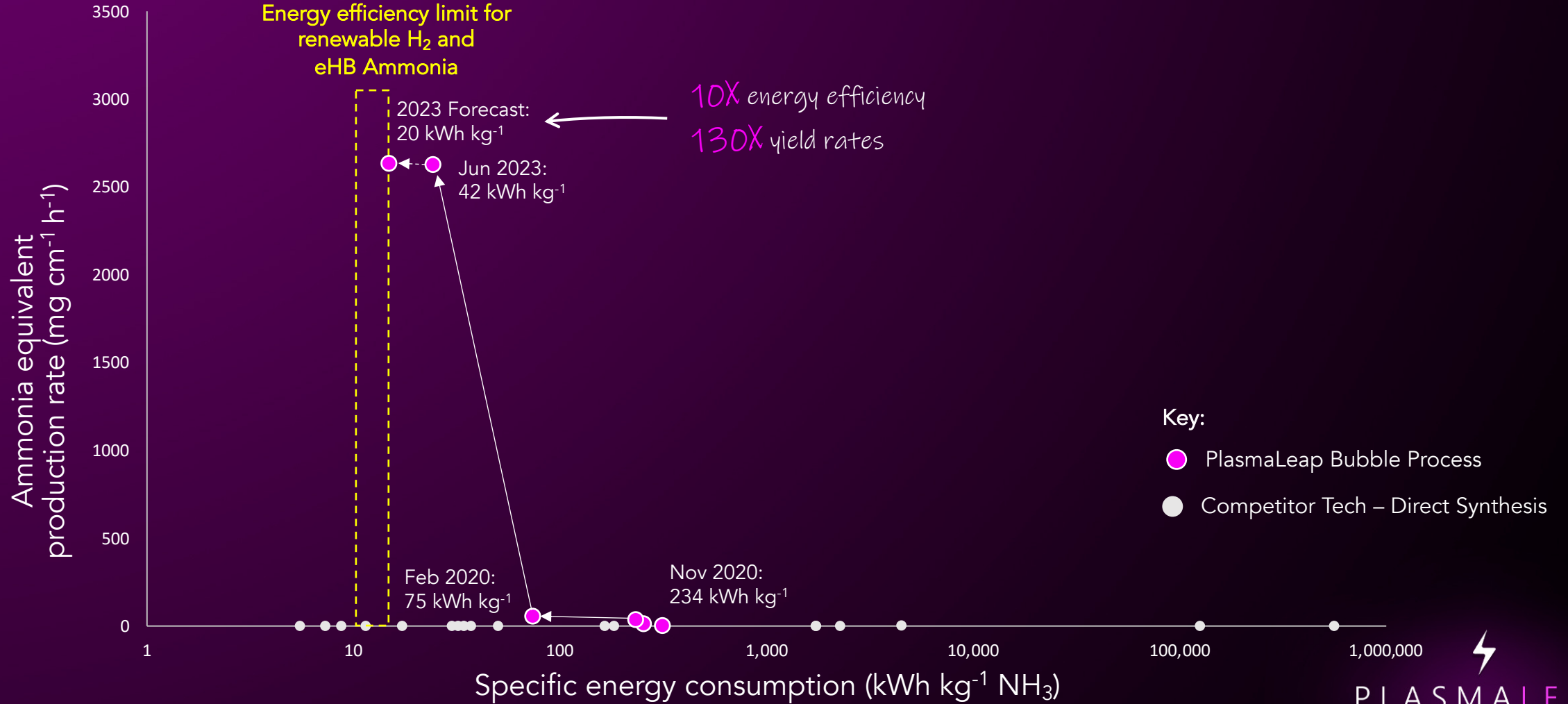


THE UNIVERSITY OF  
**SYDNEY**



# MARKET LEADING PERFORMANCE

We are on track to combining world leading energy efficiency & production rates



Graph: Zero-emission Direct Ammonia Synthesis Performance, Source: PlasmaLeap

# PLASMALEAP GREEN AMMONIA

We're leading the race in the development of viable solutions for green ammonia

	MARKET TECHNOLOGY				PLASMALEAP
	Haber-Bosch	Green Haber-Bosch	eNRR	Li intermediary	
<b>Temperature and Pressure</b>	150 – 250atm 400 – 500 °C	150 – 250atm 400 – 500 °C	Ambient	180°C	Ambient
<b>Feed requirements</b>	Pure Nitrogen Pure Hydrogen	Nitrogen water	Pure Nitrogen	Pure Nitrogen Pure Hydrogen	Air Water
<b>Moisture sensitivity</b>	Low	Low	High	Low	Low
<b>Stability</b>	High	High	High	Low (<1h)	High
<b>Compatibility with Renewables</b>	Low	Moderate	High	High	High
<b>CAPEX</b>	High	High	Low	Moderate	Low
<b>OPEX</b>	Low	Moderate	Moderate	Moderate	Low



# NITRATE & AMMONIA MODULAR BASE UNIT

## **Green.**

Synthesises Ammonia and Nitrates from atmospheric air, water, and renewable electricity.

## **Decentralised. Safe.**

Capable of deployment on farm, removing transport and supply chain. Reduces the risk of large-scale combustion or explosion.

## **Competitive. Cost-Effective.**

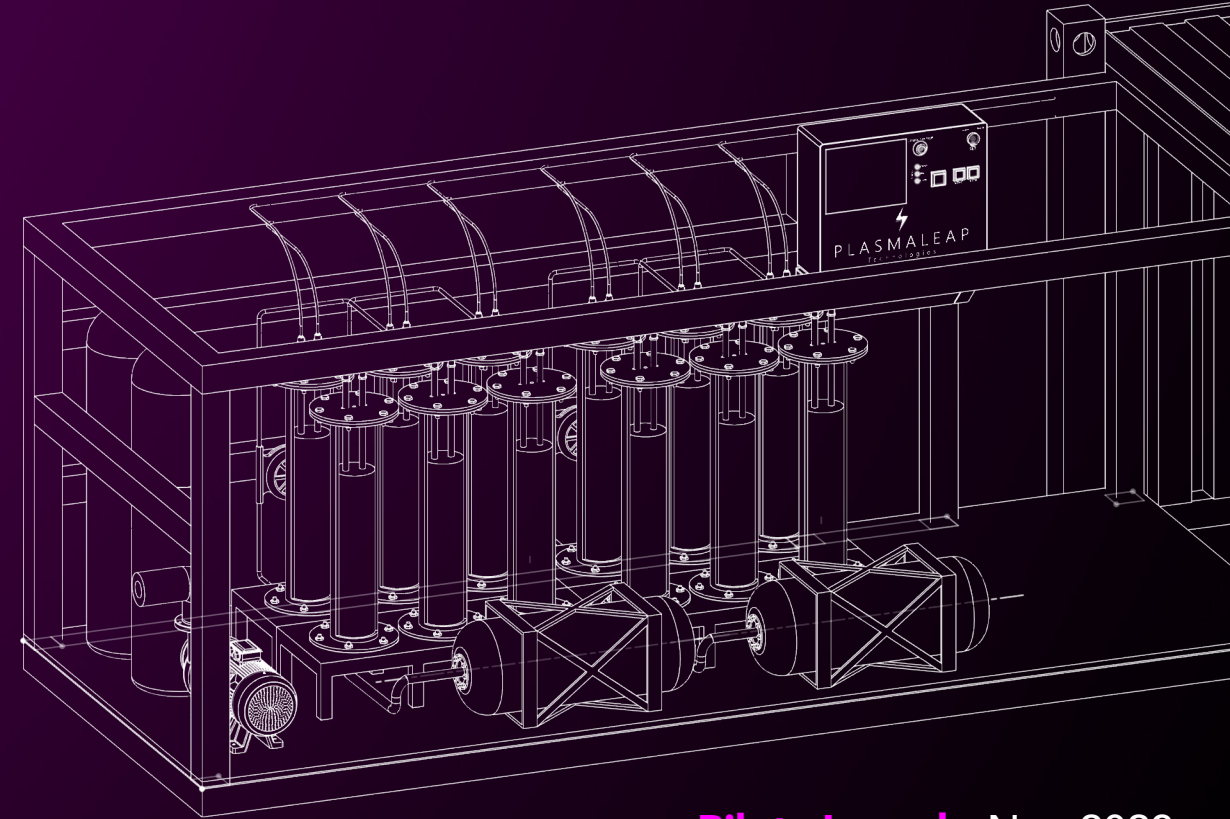
Market leading NH<sub>3</sub> production and energy consumption rates. 2023 Target 20kWh/kg. No transport and supply-chain costs.

## **Compatible.**

Compatible with variable renewable electricity.  
Deployable with established electrolyser technology.  
Modular for scale.

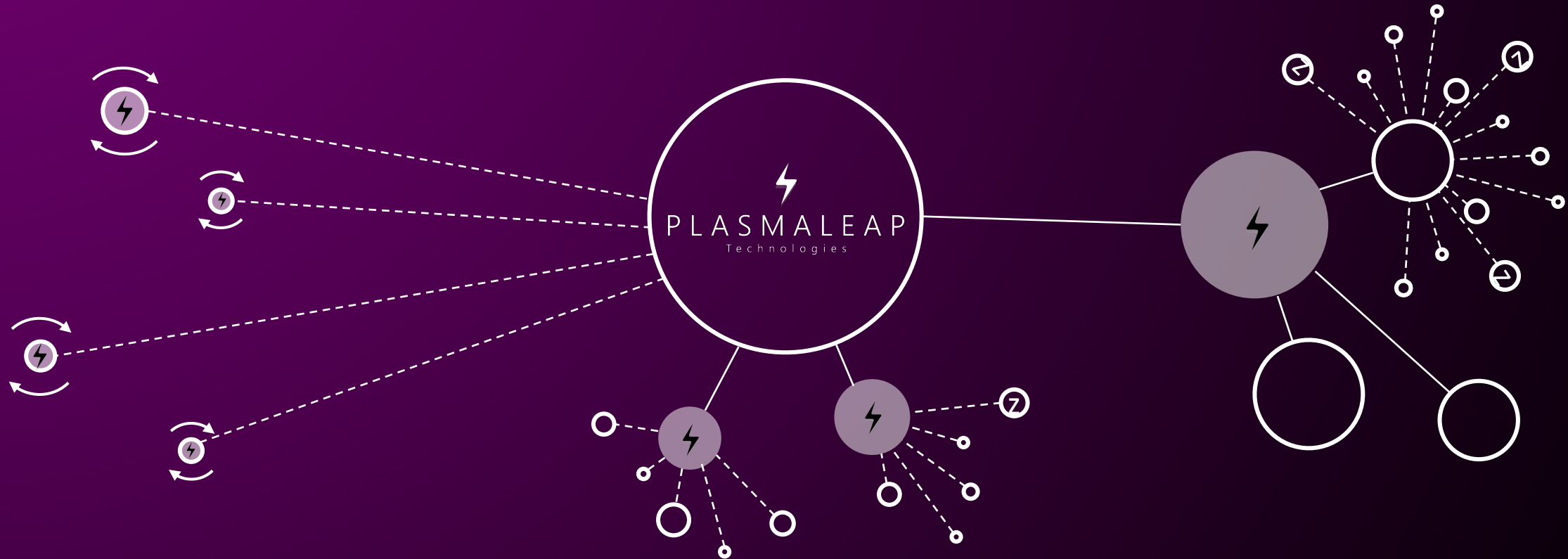
## **Smart & Connected.**

Units are monitored, sampled, and controlled remotely by PlasmaLeap's cloud infrastructure for efficiency and safety.



**Pilots Launch: Nov 2023**

# OUR COMMERCIAL ROADMAP



**2024**

**Decentralized Production**

On-Farm Nitrate Units  
100-200t p.a.



**2025**

**Semi-centralized Production**

Regional Ammonia Hubs  
1-5 Kt p.a.



**2027**

**Centralized Production**

Large-scale Ammonia Plants  
500kt - 1Mt+ p.a.





**THANK YOU**





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Technologies

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