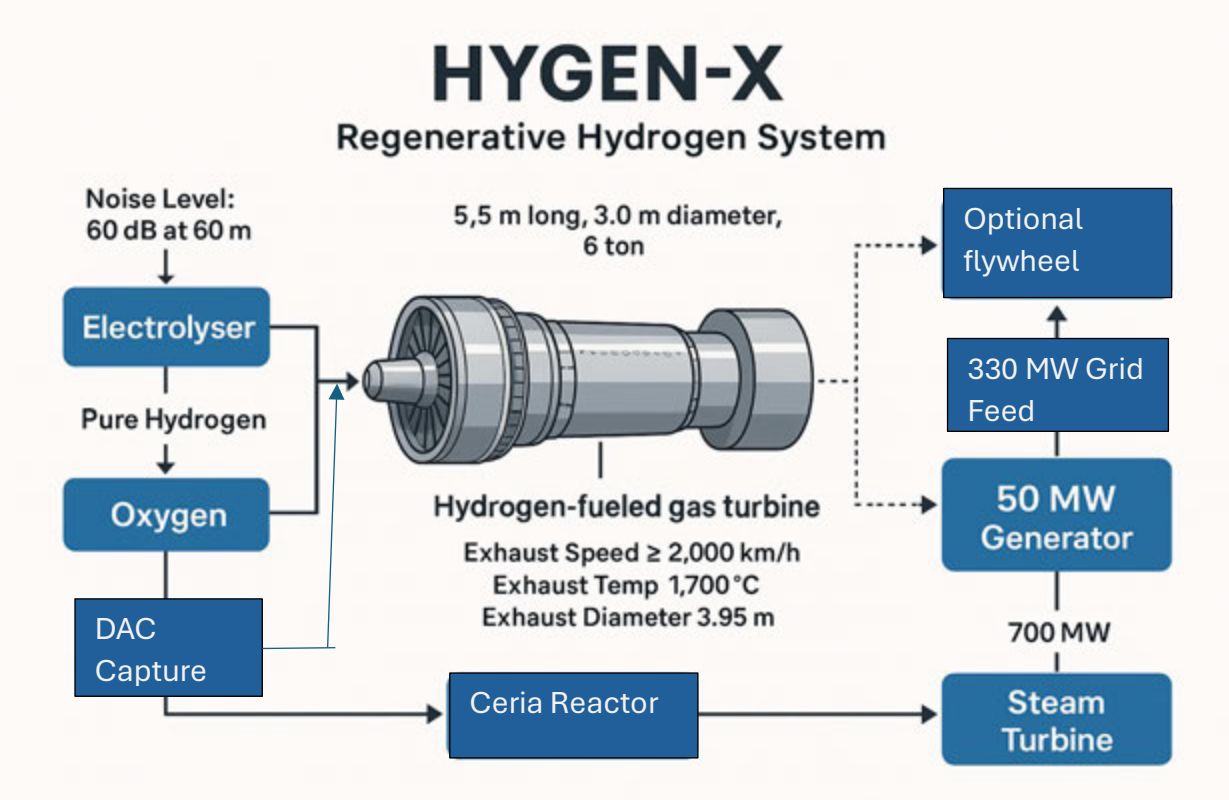
Productivity Commission Submission August 2025

In response to the Commission's inquiry into accelerating affordable, low-emission technologies, HYGEN-X offers a national-scale solution that is zero-emission, grid-stabilizing, and policy-aligned.

Investing in cheaper, cleaner energy and the net zero transformation.

HYGEN-X, addresses the shortcomings of renewables, fossil fuel and Nuclear. It is a regenerative hydrogen energy system built to deliver deep grid decarbonization, scalable sustainable aviation fuel production, and engineered carbon capture aligned with policy-backed credit markets.

HYGEN-X Summary: Regenerative Hydrogen System for Clean Base Load Energy



HYGEN-X is a aviation-grade hydrogen energy platform integrating a high-efficiency gas turbine with DAC-enabled co-generation and multi-modal energy recovery. HYGEN-X achieves clean hydrogen generation without reliance on traditional electrolytic 'green hydrogen' infrastructure, minimizing system lag and grid dependence. HYGEN-X is unique as it achieves **multi-modal regenerative amplification**.

- *"HYGEN-X harvests layered outputs—mechanical, thermal, and atmospheric—exceeding initial turbine input through integrated recovery pathways."*
- *"Where traditional energy systems dissipate heat and exhaust, HYGEN-X reclaims and amplifies every vector."*

The designs Architecture uses off the shelf available equipment for minimal spatial impact and maximum regenerative return. The system transforms a football field-sized footprint into a full-spectrum clean energy hub.

🔧 **Core Specs**

- **Generating Turbine**: 86MW hydrogen-fuelled, multi-fuel enabled, 5.5m long × 3.0m diameter, 6t mass, one moving part.
- **Noise Level**: 60 dB at 60m—quieter than wind assets.
- **Hydrogen Generator Drive**: 50MW operating 75% efficient electrolyser.
- **Hydrogen Output**: 1 kg/sec of pure H_2 + 1 Kg/sec O_2 from 9 L of recoverable water.
- **Fuel Consumption**: 0.36 kg/sec of H_2, reduced to 0.21 kg/sec with precooled O_2 catalyst.
- **Jet thrust turbine:** 330Mw at 50Hz grid energy feed.

"HYGEN-X's jet stream architecture reclaims exhaust energy across temperature, pressure, and velocity—converting waste into active grid and synfuel outputs."

🌪️ **Jet Stream Dynamics**

Function	
Exhaust Speed	Drives jet thrust energy capture
Exhaust Temp	Enables heat recapture & synfuel synthesis
Exhaust Pressure	Used for induction energy transfer
Air Intake	Captures 4% atmospheric carbon for syngas synthesis

♻️ **Modular Energy Recovery**

- **Jet Thrust Turbine**: Dampens power band, feeds 330MW into grid to stabilize load.
- **Optional Steam Turbine**: Harnesses bypass heat (~585°C) for 700MW output
- **Optional Flywheel Storage**: 330MW unit powered by regulated induction motors; scalable in series
- **Optional Ceria Reactor**: Uses 1,500°C bypass heat + reclaimed water + CO_2 to synthesize 4,000 L/hr of carbon-neutral aviation fuel.

AU Deployment Potential

- 65 HYGEN-X units ("Noads" compact modular deployments designed for retrofit into hydro infrastructure) retrofitted to any of Australia's 125 hydro schemes based on 2023 energy consumption would power **100% of the nation's 50Hz base load** carbon free.
- A FOAK deployment of 330 MW costs AU $86 million—delivering grid-ready hydrogen energy at a cost well below comparative battery or nuclear assets."

Tackles closed-loop hydro inefficiencies by replacing costly gravity-pumped systems with on-demand energy dispatch—no reliance on grid power or green hydrogen input.

*Snowy 2.0, once coming online, will require approximately **1.7 times more energy input** than it delivers during its 172-hour gravity-fed*

generation cycle. This reflects the energy cost of restoring its 2,000 MW closed-loop capacity via pumped hydro — a process dependent on off-peak electricity pricing and grid arbitrage.

*According to Snowy Hydro's published business case, the **annual income potential from this arbitrage strategy is estimated at A$580 million**, based on differential pricing between low-cost pumping and high-value dispatch.*

🧭 **Policy & Market Fit**

- Aligns with tech-neutral market incentives
- Generates offset-eligible DAC and synfuel
- Reduces infrastructure approval lag via modular, low-footprint design
- Ideal for regional deployment where grid stress and energy pricing diverge

The **International Court of Justice (ICJ)** issued a landmark advisory opinion on **July 23, 2025**, declaring that states have binding obligations under international law to **reduce greenhouse gas emissions in line with the best available science** and to **regulate fossil fuel industries to prevent environmental harm**2.

🌍 ICJ Decision: Climate Obligations of States

🔹 Key Findings

- States must **prevent significant environmental harm** from emissions, even if cumulative or diffuse in origin.
- There is a **duty of due diligence** to regulate fossil fuel production and consumption.
- Climate treaties (UNFCCC, Kyoto, Paris) are reinforced by **customary international law**, including human rights and environmental protection principles.
- The ruling applies to **present and future generations**, elevating intergenerational equity to a legal standard.

🔗 Relevance to HYGEN-X

HYGEN-X isn't just technically advanced—it's **legally aligned** with the ICJ's climate mandate:

ICJ Obligation	HYGEN-X Response
Reduce emissions in line with science	HYGEN-X replaces fossil fuels with hydrogen, DAC, and synfuel
Regulate fossil fuel industries	Offers a scalable alternative to coal/gas base load
Prevent environmental harm	Closed-loop water recovery, low noise, minimal land impact
Protect future generations	Modular deployment across hydro schemes ensures long-term resilience

ICJ Obligation	HYGEN-X Response
Enable carbon capture and offset	Integrated DAC and ceria reactor produce offset-eligible aviation fuel

This ruling gives HYGEN-X a **policy tailwind**—not just as a clean energy solution, but as a **compliance-ready infrastructure** that anticipates regulatory shifts.

Australia's energy future must now meet both scientific and legal thresholds. HYGEN-X is engineered to exceed both.