something cool sounding LABS

Making Sustainable Fuels Economically Inevitable

The Premise

Synthetic fuels are not a hard problem. They are an *expensive* one.

The chemistry has existed for over a century:

- **Methane** — Sabatier reaction: $CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$
- **Ammonia** — Haber-Bosch process: $N_2 + 3H_2 \rightarrow 2NH_3$

Both are simple, well-understood, industrially proven reactions. Methane is one of the world's most versatile fuels. Ammonia is both a critical industrial chemical and a viable carbon-free fuel. Neither is hard to make.

What's hard, and what has kept green versions of these fuels a rounding error in global production, is the energy math. Less than 5% of hydrogen produced today is green, not because we don't know how to make it, but because doing so affordably is a different problem entirely.

Where the Efficiency (and the Money) Is Actually Lost

Green production of methane and ammonia requires green electricity and green hydrogen. But our two best sources of clean energy, solar and nuclear, are being converted into usable power at a fraction of what they deliver:

Source	Typical conversion efficiency
Solar (PV)	~22%
Nuclear (heat → electricity)	~33%

The rest, the majority of the energy these sources actually produce, is lost in the conversion step before it ever reaches a chemical reaction.

The Insight

Sabatier, Haber-Bosch, and hydrogen production (via the Cu-Cl cycle) are all fundamentally **heat-driven** processes. Today, we generate heat and electricity from solar and nuclear sources, convert it to electricity, lose most of it in that conversion, and then often convert it back to heat to run these reactions.

LABS is built on a simpler path: skip the lossy middle step.

For solar, initially:

- **Optical concentrators** can capture up to ~90% of incident solar energy, compared to ~22% through conventional PV.
- Driving Sabatier, Haber-Bosch, and Cu-Cl directly from concentrated heat, rather than from electricity generated at a fraction of source efficiency, closes most of the efficiency gap in one move.

This isn't a new chemical process. It's a redesign of how energy reaches the process that already works.

And when small nuclear reactors become available privately, LABS will already have the process proven and ready to run directly on that heat too.

Why This Is the Unlock

Every input cost in green fuel production is downstream of energy cost. Close the efficiency gap between energy captured and energy usable, and the cost curve for green methane and green ammonia doesn't bend, it collapses.

That collapse is the difference between green fuels as a subsidized alternative and green fuels as the economically obvious choice.

Why It Matters

Energy is the foundation everything else is built on. Its cost sets the cost of food production, construction, manufacturing, mining, transportation, and ultimately, the standard of living available to everyone downstream of it.

Large-scale desalination. Carbon-neutral aviation. Green steel and cement. Synthetic fuels. Bioplastics replacing petroleum-based plastics outright. Autonomous drone logistics. The gap between where we are and a future of genuine abundance isn't a technology gap, it's an energy cost gap.