

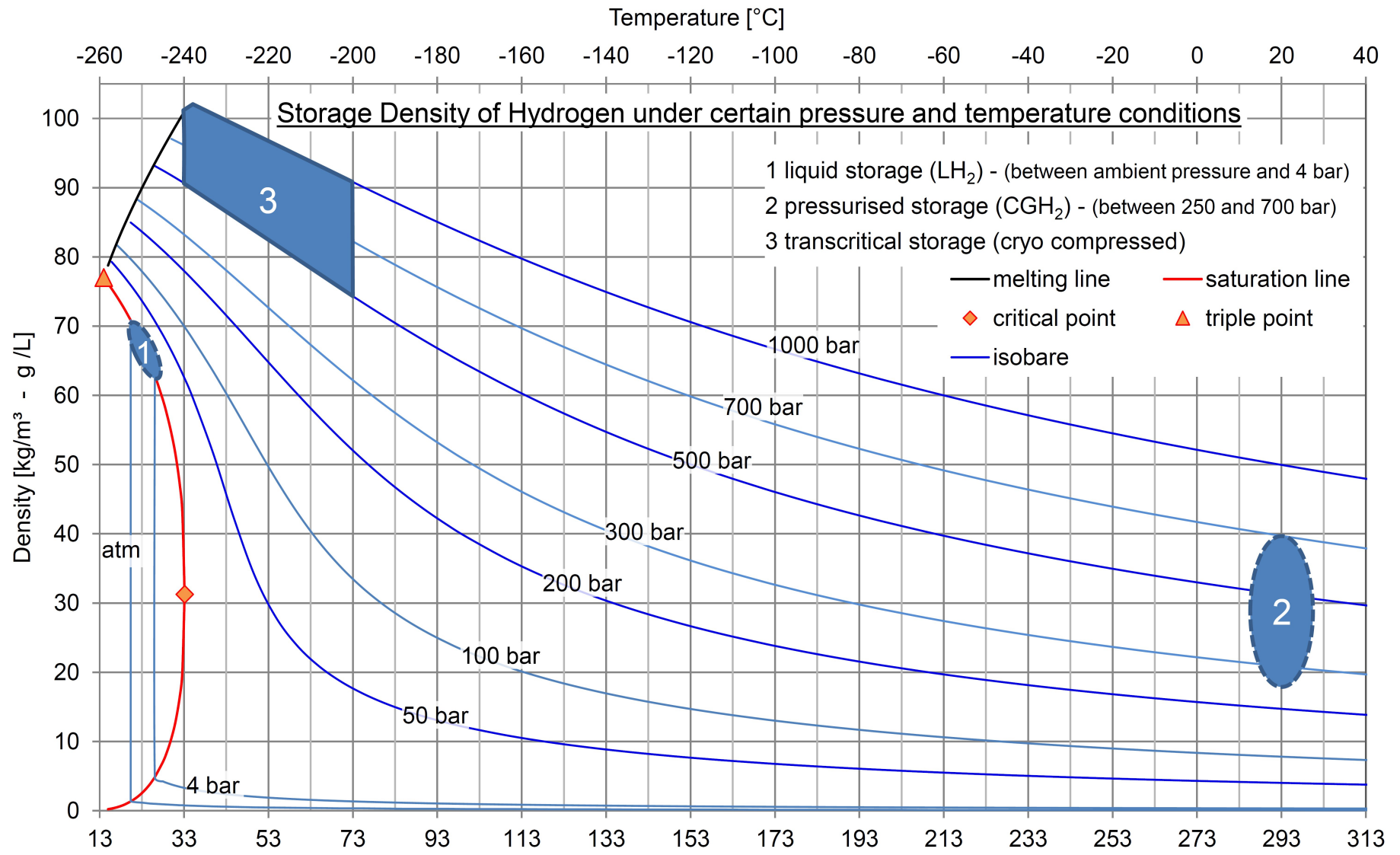
# VCCH

Expansion Energy LLC's Comprehensive H<sub>2</sub> System for Storing and Dispensing Energy

- H<sub>2</sub> Energy Storage = Battery;
- Requiring Multiple Steps Between “Charging” and “Discharging”;
- Resulting in end-use power that is now ≈ 5-times more costly\* than LNG-produced power;
- But, with zero emissions if the H<sub>2</sub> is “green”.

**\* VCCH significantly reduces that multiplier, while maintaining zero emissions.**

**Instead of LH2, VCCH is a 4<sup>th</sup> Phase of H<sub>2</sub> at Metacritical\* Conditions**  
**\*Colder than H<sub>2</sub>'s Critical Temperature, Above its Critical Pressure**



# A Comprehensive VCCH Plan, From Energy Storage to Release

## (A) PRODUCTION:

Produce “green” H<sub>2</sub> from water by electrolysis with renewable energy, yielding a **low density** vapor state of H<sub>2</sub>.

## (B) DENSIFICATION:

- Proprietary balance of compression + chilling = optimal density (**75 kg/m<sup>3</sup> or 4.68 lbs/ft<sup>3</sup>**);
- With the least energy input per density achieved;
- Yielding **lower CAPEX and OPEX** than other densification options, including LH<sub>2</sub>.

## (C) STORAGE AND NON-PIPELINE TRANSPORT:

- Proprietary VCCH vessels store and deliver H<sub>2</sub> by road, rail or container ship;
- With **zero boil-off** (BOG) over extend periods, yielding an extended “shelf life”;
- Allowing nearly **three-times the H<sub>2</sub> mass** per vessel than standard ISO containers;
- Substantially reducing transportation costs.

## (D) ENERGY RELEASE:

- Recover the potential energy in the H<sub>2</sub> (in fuel cells or heat engines), and
- Recover the pressure and “cold energy” in a proprietary **Combined Cycle**.

## **SUMMARY**

- **VCCH is an “energy dense” form of H<sub>2</sub>**
- **The comprehensive \$/kWH will be less for VCCH than for standard H<sub>2</sub> “batteries”;**
- **Lower \$/kWH improves the economic viability of H<sub>2</sub> storage and release;**
- **Advancing the “Hydrogen Economy”.**

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