



# Cold Storage of Fuel Gases

## → higher storage densities

### Customized cryosystems

- Cryostats (metal, glass/carbon fiber reinforced resin)
- Cooling and liquefaction systems
- Cryogenic actuators, sensors and pumps
- Energy storing systems (H<sub>2</sub>, CH<sub>4</sub>, ...)
- LNG technology
- Sensor calibration
- Customized electronics
- Individual software and visualization
- Engineering, calculation and simulation
- Heat to Power
- Thermal cycle and material tests ( $\lambda$ ,  $\alpha$ ,  $c$ ,  $P$ , ...)
- Cryobiology – Life Sciences

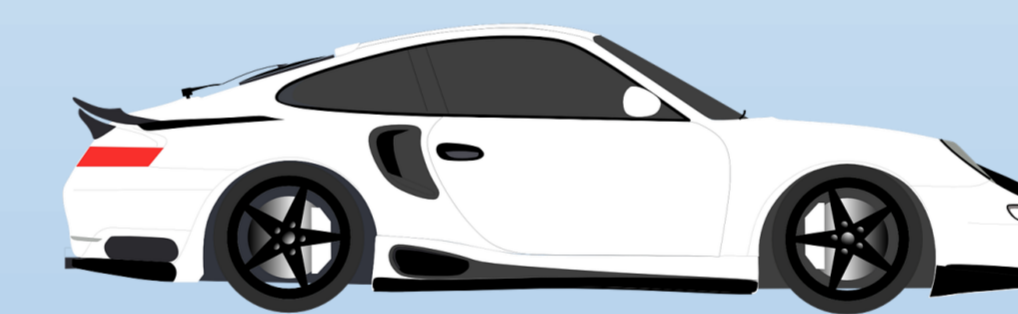
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Certificate in accordance  
 with the requirements of the  
 Pressure Equipment Directive  
 DGRL 97/23/EG, Modul A1  
 for cryostats  
 Ident-No. CE 0525



Natural Gas: 400 km 



“cold” Natural Gas: 800 – 900 km 



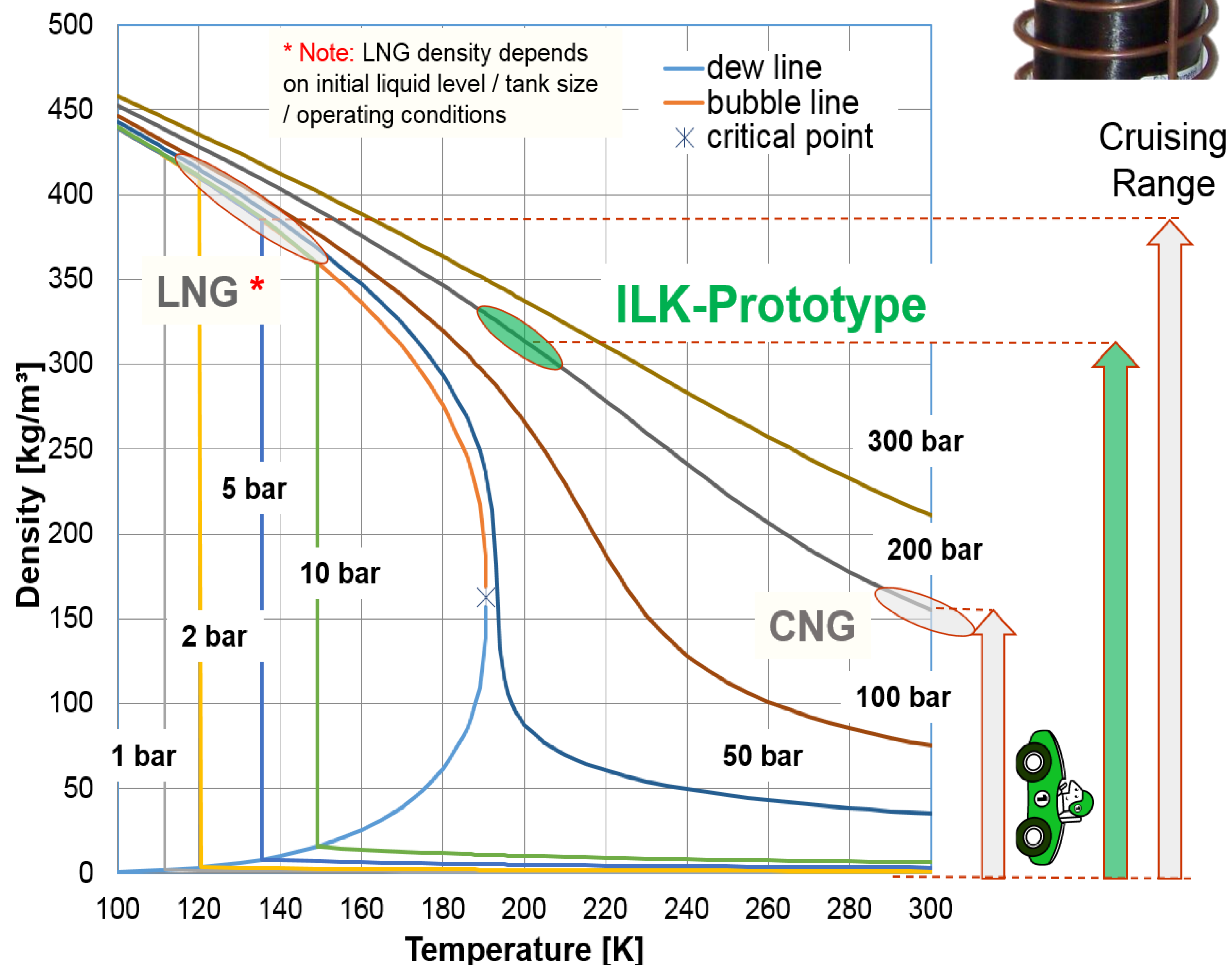


# Cold Storage of Natural Gas

High pressure **PLUS** low temperature (but higher as the critical point) **OFFERS** significant higher storage densities.

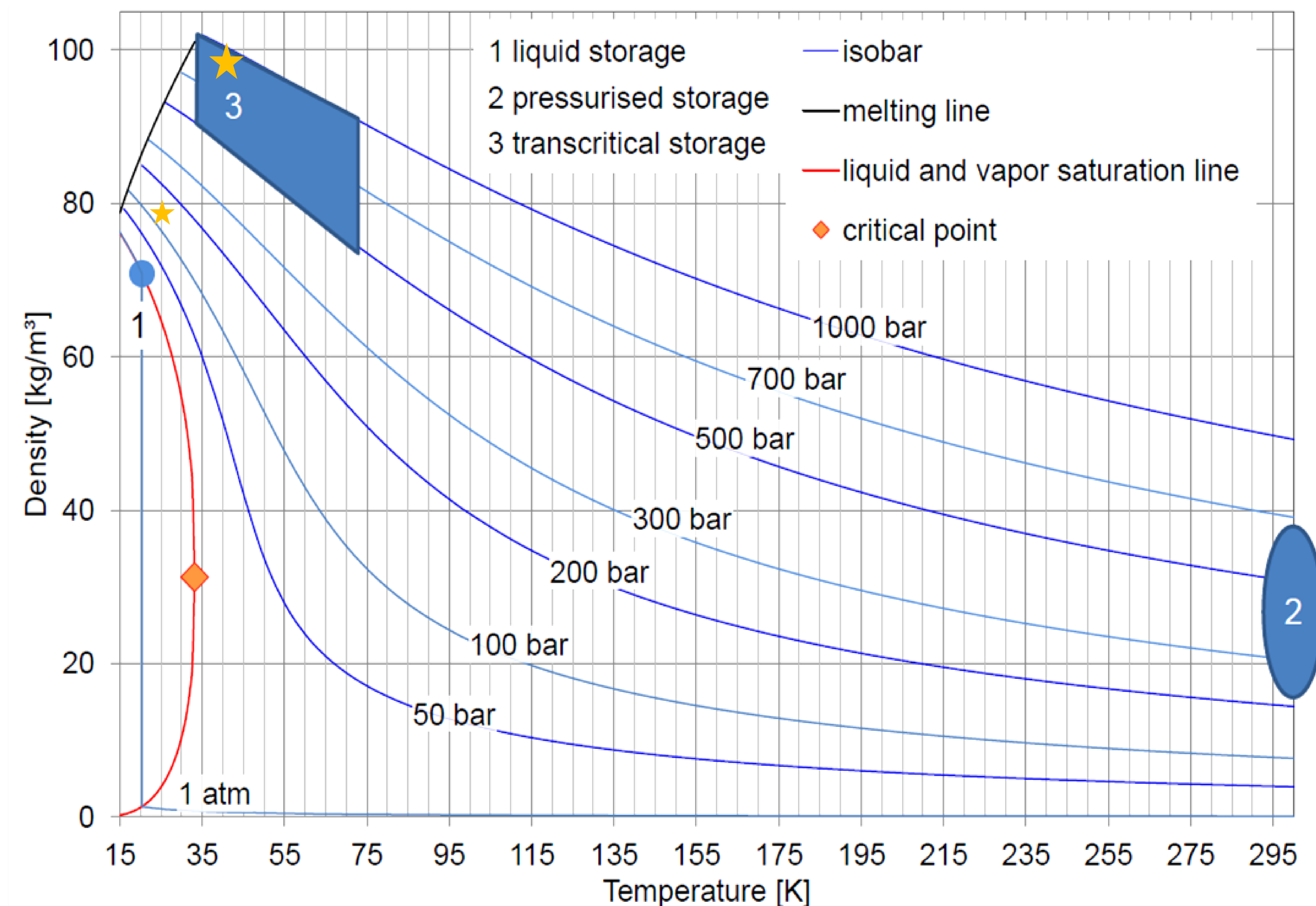
For that we provide:

- + Design of Cold Storage Systems
- + Calculation of Storage Capacity and Efficiency
- + Development of active Cooling Systems to prevent heating of the cold stored gas and boil-off
- + Realization of Complete Storage Systems



# Cold Storage of Hydrogen

- + Investigations on the charging and discharging process of hydrogen tanks
- + Tests and qualification of components of any kind in the temperature range from 10 K and under pressure conditions ranging from high vacuum to 1000 bar hydrogen atmosphere.
- + Development of special components (for instance pumps) for Cold Storage Systems
- + Developments of new storage technologies to achieve high hydrogen storage densities (up to about 100 kg/m<sup>3</sup>). See chart below:



experimental results, e.g.  $\rho > 97 \text{ kg/m}^3$ , (39 K; 960 bar)