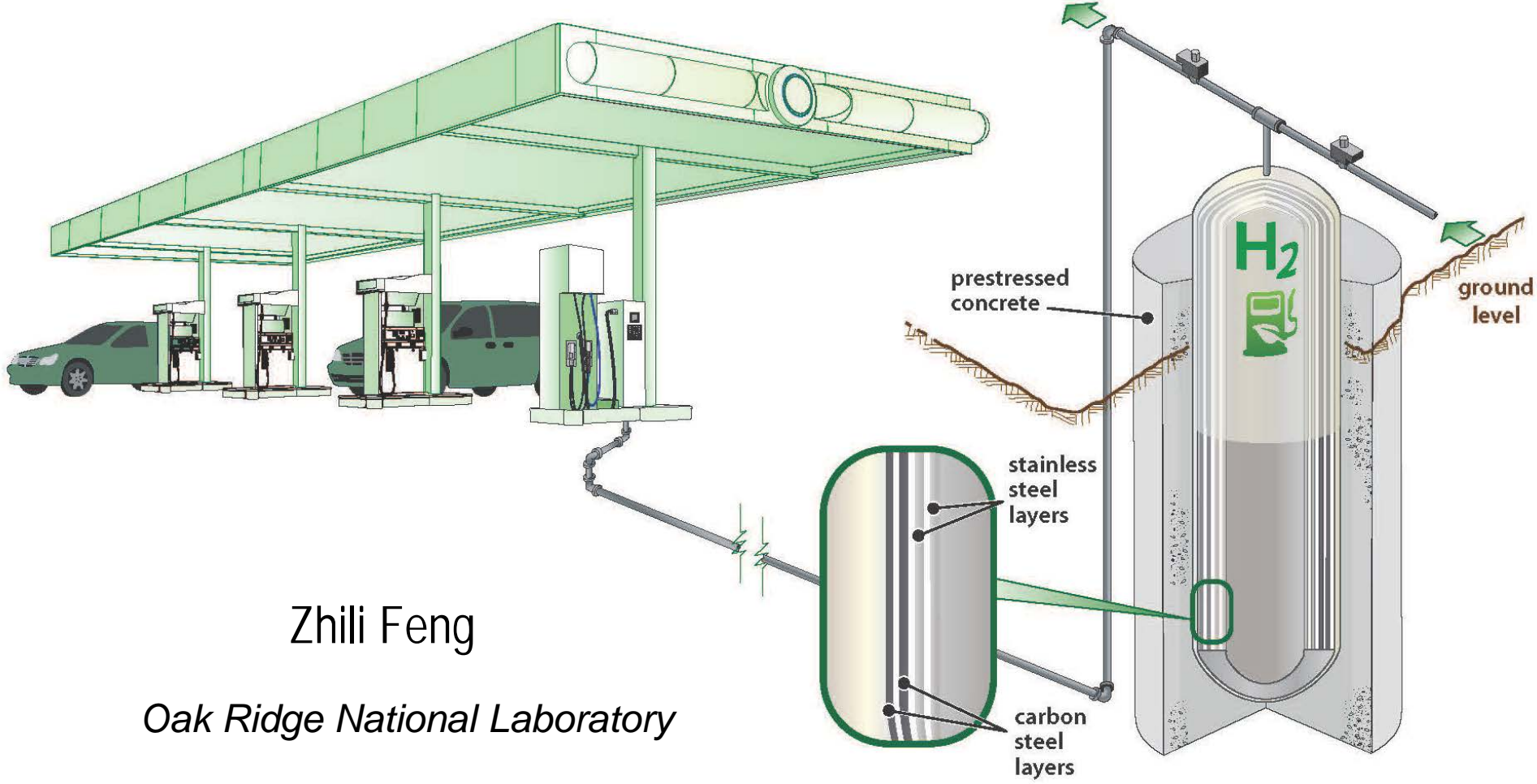


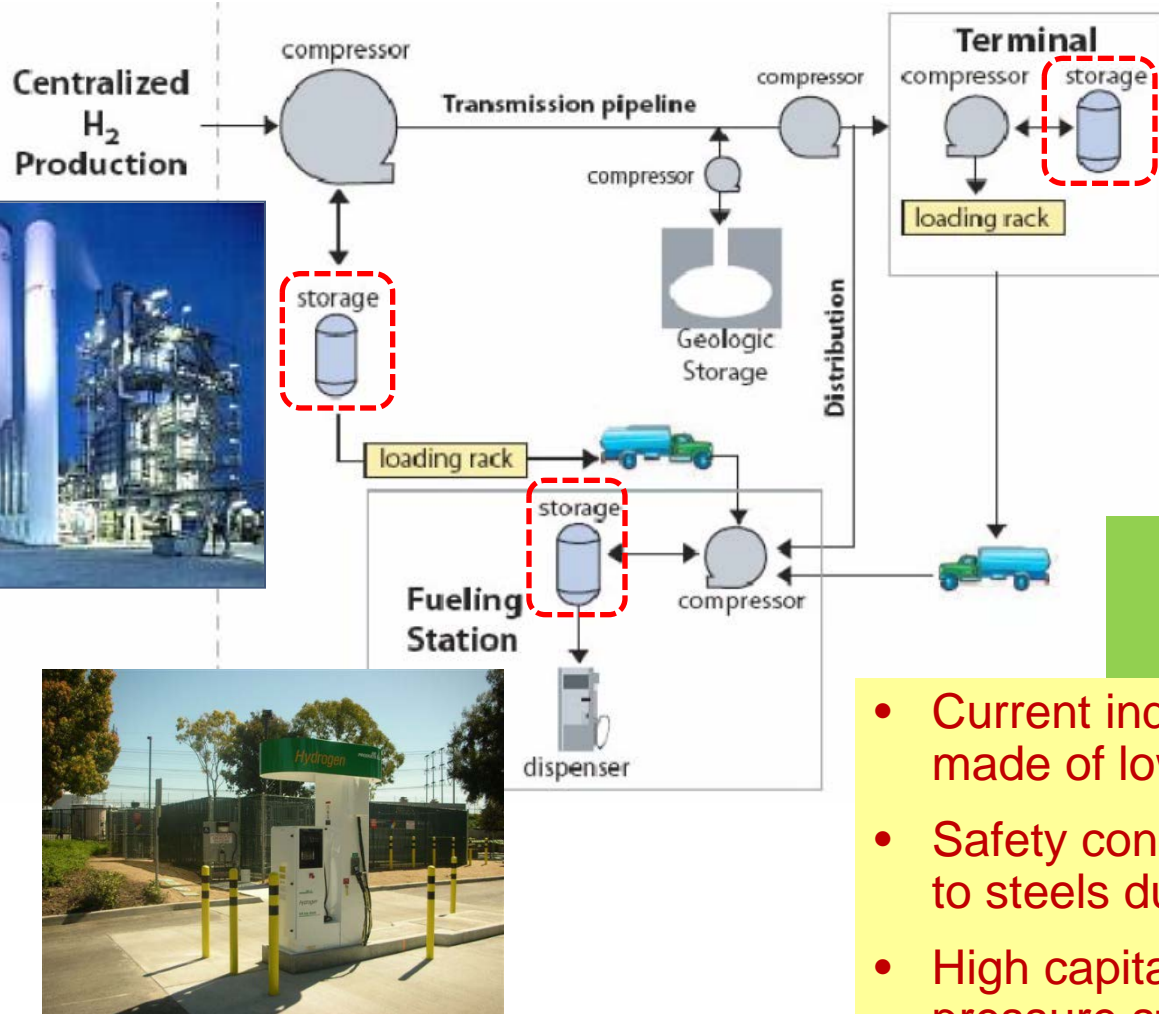
Stationary High-Pressure Hydrogen Storage



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Technology Gap Analysis for Bulk Storage in Hydrogen Infrastructure



Bulk storage in hydrogen delivery infrastructure *

- Needed at central production plants, geologic storage sites, terminals, and refueling sites
- Important to provide surge capacity for hourly, daily, and seasonal demand variations

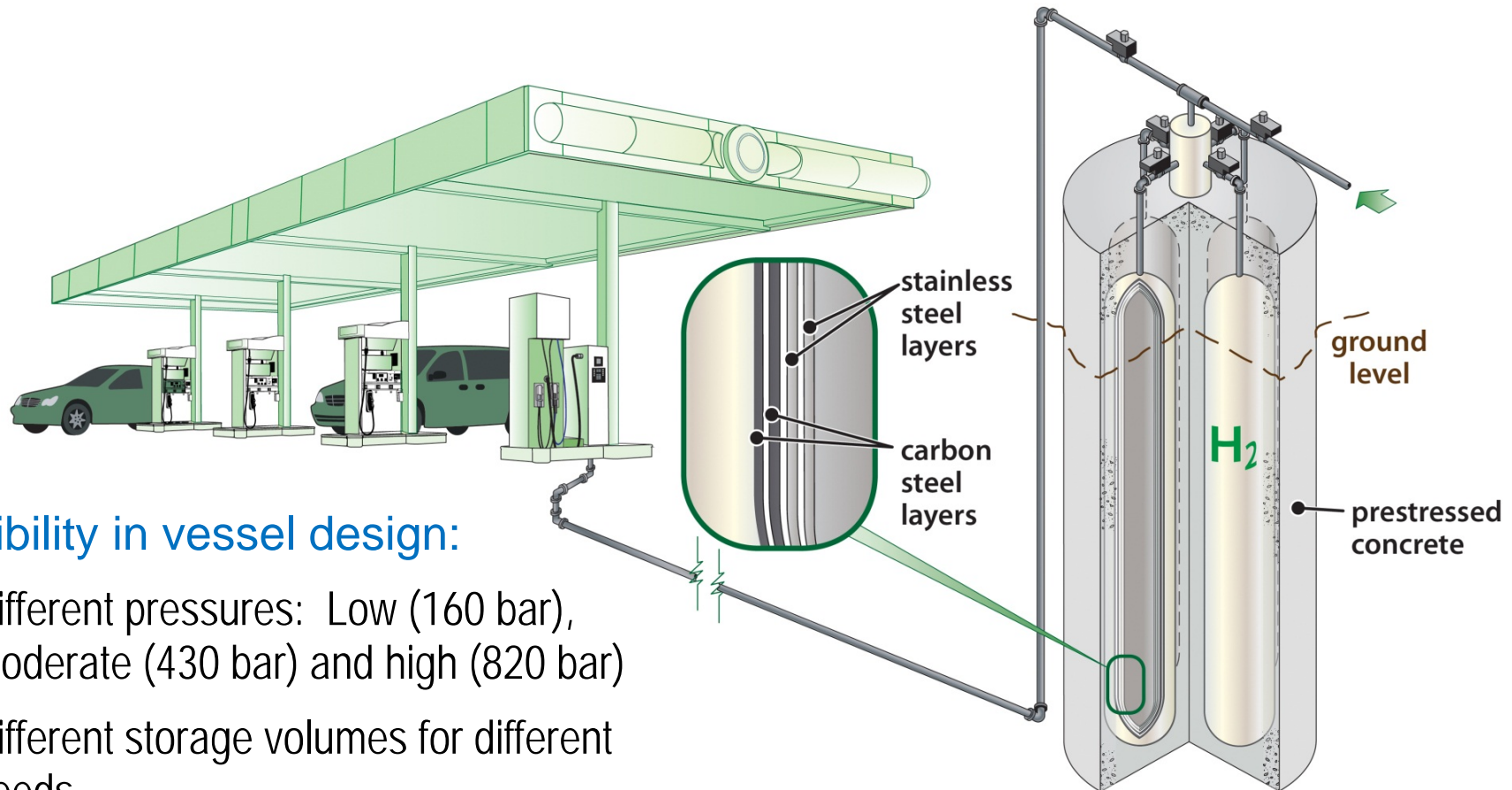
Technical challenges for bulk storage

- Current industry status: pressure vessel made of low alloy steels
- Safety concern: hydrogen embrittlement to steels due to long-term H₂ exposure
- High capital cost especially for high-pressure storage

Gaseous Hydrogen Delivery Pathway *

Technology Development

- Develop and demonstrate the steel/concrete composite vessel (SCCV) design and fabrication technology for stationary storage system of high-pressure hydrogen that meet DOE technical and cost targets
- Address the significant **safety** and **cost** challenges

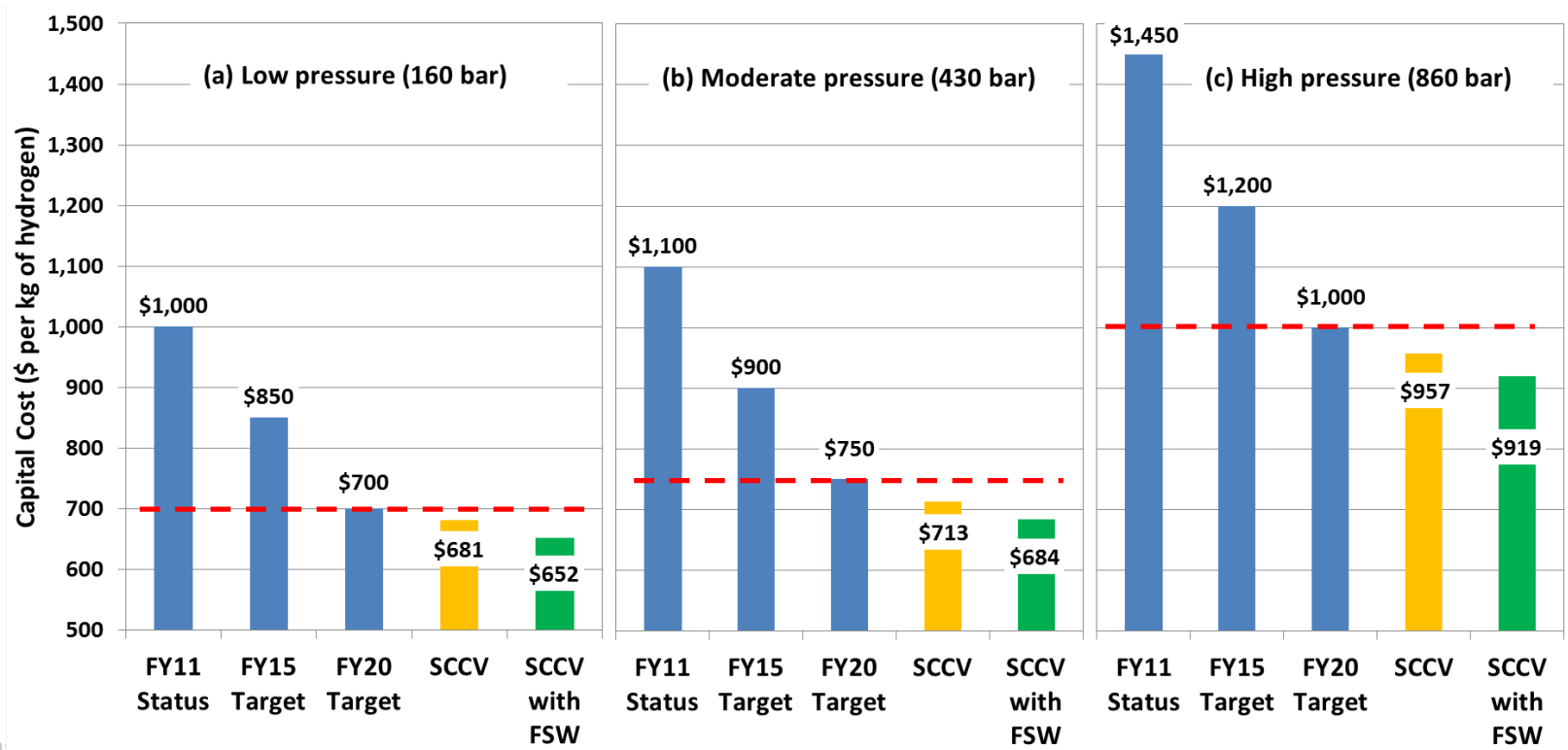


Flexibility in vessel design:

- Different pressures: Low (160 bar), moderate (430 bar) and high (820 bar)
- Different storage volumes for different needs

Manufacturing Cost Analysis

- Detailed manufacturing cost analysis demonstrated that the SCCV technology can exceed the relevant cost targets set forth by DOE
- Baseline SCCV design:
 - 1,500 kg of H2 (Interior volume = 2,300 ft³ @ 5,000 psi & 25° C), capable of refilling 260 passenger cars (5.6 kg H2 tank per car)
 - 50/50 load carrying ratio, 6 ft diameter, 27.5 ft height



Demonstration: Mock-Up SCCV Design

- Design, engineering and manufacturing a small but representative mock-up SCCV (1/4 – 1/5 size), capturing all major features of SCCV design and fabricatability with today's manufacturing technologies and code/standard requirements
- Obtain "real-world" performance data
- Anticipated completion date: June, 2014.

