

TANKS



LNG Industry asked several companies to discuss some issues regarding LNG tanks.

Chris Desjardins, Bechtel Energy, Tanks General Manager

Chris Desjardins is the General Manager for the Tanks business line in Bechtel's Energy global business unit. In this role, he has overall responsibility for the development and delivery of all Bechtel's ongoing and prospective tanks projects across the globe.

Desjardins has over 30 years of experience in management and business development in the EPC industry and holds a Bachelor of Science in mechanical engineering from the University of Ottawa, Canada.

He is currently leading the team on the ground at the CPC Taichung project in Taichung, Taiwan. He is deeply dedicated to process and digital improvements that achieve increased worker safety and productivity.

Mark D. Butts, CB&I, a McDermott Company, VP Engineering

Mark D. Butts is Global Engineering Lead for the CB&I business line, including engineering project execution, storage product line strategy, and business and technical development initiatives, and has over 29 years industry experience with CB&I.

The company's product lines include LNG storage tanks, LNG peak shavers, refrigerated gas storage and facilities, pressure vessels, atmospheric tanks, water storage, and special structures.

Q1. What factors are considered when designing and selecting storage tanks?

Chris Desjardins, Bechtel Energy

As more countries around the world commit to ambitious energy transition initiatives, Bechtel is ready to assist them in meeting their emission reduction goals and building a greater energy economy for the global community. Customers' goals are the company's goals, and Bechtel can provide innovative solutions, experienced teams and personnel, and industry-leading experience to help deliver our partners' projects.

Finding the ideal storage solution starts with building a one-team relationship early on.

By maintaining strong communication, the company is able to truly leverage its experience to develop a unique solution tailored to the customer's needs.

There is a vast difference in designing and executing LNG export, import, and peak shaver storage facilities depending on regulatory requirements, land availability, seismic and geological conditions, LNG liquefaction and/or vaporisation requirements, and potential LNG shipping constraints.

For more than 60 years, Bechtel has continued to partner with customers all over the world to advance progress towards cleaner, greener, and safer energy security.

Mark D Butts, CB&I, a McDermott Company

The first consideration is the product being stored. The company's structures store bulk liquid such as water, oil and refined products, chemicals, and refrigerated gases such as LNG, liquid hydrogen, and ammonia. Each require unique design and storage configurations offered by CB&I.



The company also designs for geographic location, including local seismic (earthquake) and soil conditions. Plot size available for construction and siting of the facility are important factors for engineering design and constructability.

Process design requirements such as flow rates, operating pressures, etc., must also be considered, as well as local regulations established by the Jurisdiction Having Authority (JHA), the community, state, or country.

Finally, industry codes and standards establish important requirements for any project.

Q2. How are storage solutions being made more cost-efficient?

Chris Desjardins, Bechtel Energy

Late engagement often results in additional cost and longer schedules because the opportunity to influence early decisions that shape the project development and execution is missed.

Being involved early and working collaboratively opens more opportunities to explore innovative approaches to



Bechtel Energy: Together with CPC Corp. and MRY, Bechtel is delivering cleaner, greener, and safer energy for Taiwan, supporting the country's energy growth and security.



Bechtel Energy: The water treatment plant at Shell Polymers Monaca repurposes water from the Ohio River to generate steam and provide cooling onsite in Beaver County, northwest of Pittsburgh, Pennsylvania, USA.

material selection, supply chain, construction methodologies, and commercial models in partnership with customers. This is more important than ever with the recent rising global costs impacting all aspects of projects.

By prioritising early engagement, Bechtel supports its customers by providing a low cost and short time to market on storage solutions, which is achieved by using its EPC execution model with optimised designs that produce lower quantities to minimise material and field hours.

Additionally, to support the LNG storage market, Bechtel has:

- Established a facility to research advanced materials and welding techniques at its Welding and Applied Technology Centre in Houston, Texas, the US.
- Opened its Global Tanks Detail Engineering Centre of Excellence in Taipei, Taiwan, that focuses on storage tank detailing.
- Digitalised its core EPC processes, tools, and systems to make them more efficient through its Digital Enterprise Program.
- Introduced 3D modelling and laser scanning to improve design and constructability to eliminate rework.

Mark D Butts, CB&I, a McDermott Company

CB&I's project delivery model ensures high quality and cost-effective solutions for our customers and customers projects. This model de-risks our customers' projects by ensuring on-time and on-budget project delivery. The company offers a range of small and large scale solutions, so it is able to offer 'economies of scale'.

The company has a broad geographic footprint with a local presence in markets around the world, enabling CB&I to access local resources and labour. Its global supply chain offers access to diverse markets for materials, equipment, and subcontractors.

Economies of scale, coupled with its global supply chain, aid the company greatly in areas of cost. CB&I maintains long-term technical and commercial relationships with the world's largest steel plate suppliers, as just one example.

Q3. How important is insulation, and how is this achieved?

Mark D Butts, CB&I, a McDermott Company

Very important, as the right materials must be chosen for the right applications. CB&I includes an Insulation Technology team with its own fleet of proprietary equipment to install specialised insulation systems. The company can control all aspects of the insulation system design, supply chain, proprietary construction equipment and field operations to execute the insulation



scope of work on a global footprint. This is an important aspect of CB&I's project delivery model.

Q5. Numerous types of LNG storage tanks exist. Can you detail the technology behind one of your most popular tanks?

Mark D Butts, CB&I, a McDermott Company

One of CB&I's most popular tank designs is full containment concrete, with an inner tank manufactured with cryogenic grade steel, and an outer tank constructed with reinforced post-tensioned concrete.

CB&I also recently pioneered the world's first full containment double steel tank, with the inner and outer tanks both manufactured from cryogenic grade steel.

Q6. With standards and regulations frequently revised and updated, how does this impact tank designs and quality?

Mark D Butts, CB&I, a McDermott Company

CB&I actively participates on the main Code Committees. It helps shape the requirements and stay current with code changes as they happen, including the codes listed below, which minimises any adverse impacts to tank designs and quality:

- ‰ API STD 625 – Tank Systems for Refrigerated Liquefied Gas Storage.
- ‰ NFPA 59A – Standard for the Production, Storage, and Handling of LNG.
- ‰ EN 14620 – Design and manufacture of site built, vertical, cylindrical flat-bottomed steel tanks for the storage of refrigerated, liquefied gases.

- ‰ EN 1473 – Installation and equipment for LNG – Design of onshore installations.

Q7. Can you detail a critical infrastructure project where your company overcame some challenges with regards to its storage solutions?

Chris Desjardins, Bechtel Energy

Every project with the magnitude and complexity of an LNG tank faces many challenges that the one team – consisting of Bechtel, customer, and sub-contractors – works together to overcome.

When presented with complex challenges, the company is able to draw upon the wealth of knowledge and unique experience of the Bechtel Fellows and Distinguished Engineers to quickly execute a solution.

CPC Taichung, the company's active LNG tank construction project in Taiwan, involves executing the EPC of two 180 000 m³ full-containment LNG tanks that, when completed, will become the largest storage tanks ever built in Taiwan. The project is in an active seismic zone, which presents unique design challenges. The LNG tanks and surrounding sub surface were specially designed to ensure the design addressed the seismic criteria specified. Additionally, seismic events may cause increased LNG sloshing waves, which called for a specialised roof design not often seen outside Southeast Asia.

Mark D Butts, CB&I, a McDermott Company

The Tacoma LNG facility at Puget Sound Energy in Tacoma, Washington, the US, is a dual use facility, operating as an LNG peak shave and a bunker fuelling station.

In addition to the dual nature, the storage tank is designed with seismic isolators due to its location in the high earthquake zones on the West Coast of the US. **LNG**

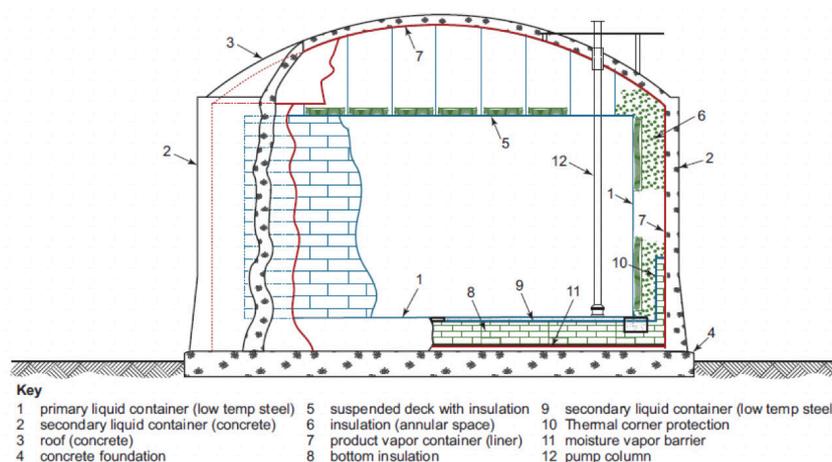


Figure 5.9—Full Containment Tank System
Steel Primary Container, Concrete Secondary Container, and Concrete Roof

CB&I, a McDermott Company: Full containment tank system, including: steel primary container, concrete secondary container, and concrete roof.