

Tacoma LNG Facility



Jim Hogan
Project Manager
Puget Sound Energy

PHMSA LNG Workshop
Wednesday, May 18, 2016

Agenda

- Puget Sound Energy Overview
- Project Drivers
- Project Overview
- Challenges
- Conclusions and Lessons Learned

Tacoma LNG Project

A small-scale liquefaction and storage facility to serve

- PSE natural gas customers
- Local transportation and marine companies

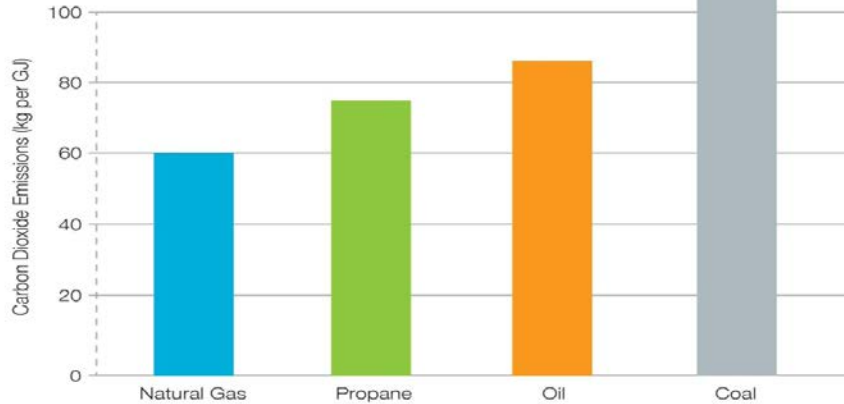


Project Drivers

- **Environmental**
- **Economic** (*Market Drivers*)
- **Resource Supply**

Environmental Benefits of Natural Gas

Natural gas: the cleaner alternative to traditional fuels

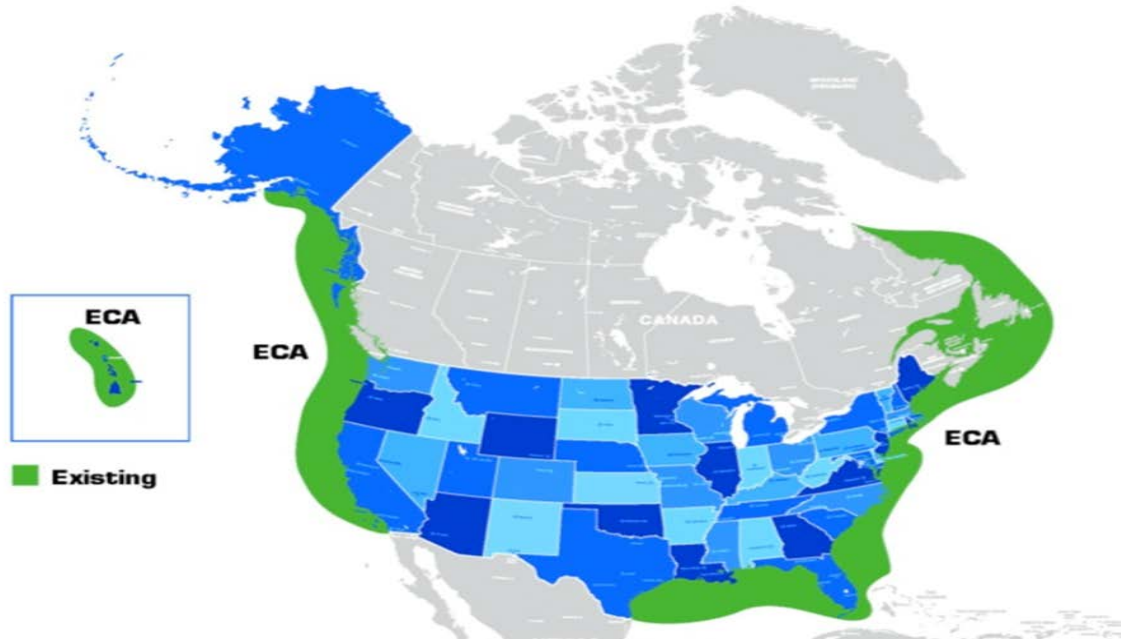


 PUGET SOUND ENERGY

- Greenhouse Gases **reduced by up to 30%**
- Particulate matter **reduced by 90%**
- Risk of harmful fuel spills **eliminated**

Emission Control Area Adoption

- Requires lower sulfur fuels for operation in ECA
- Pre-2010: 1.5%
- 2010: 1.0%
- 2015: 0.1%



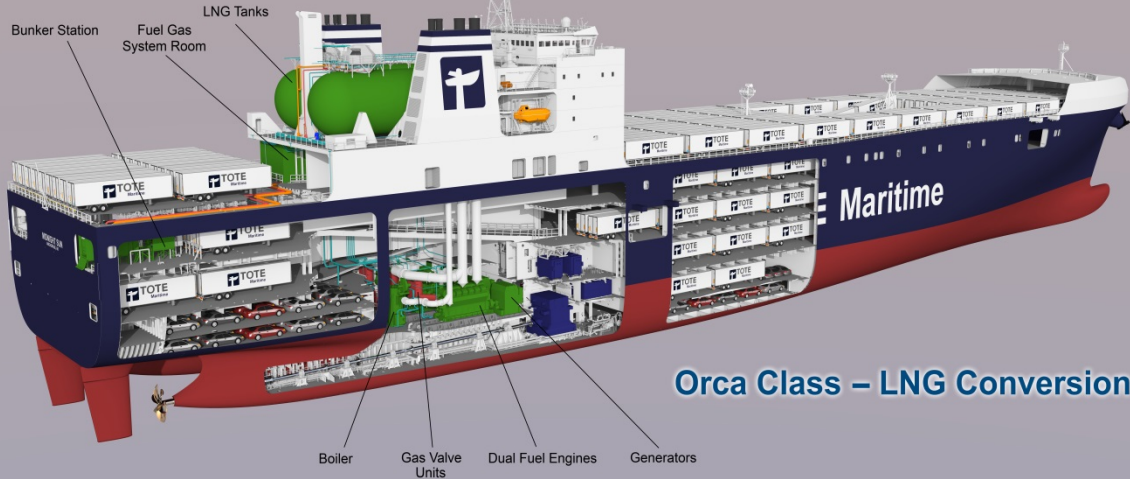
TOTE Maritime Solution

- Two new Marlin class LNG powered container ships for Puerto Rico service
- Convert two Orca class trailer ships to LNG for Anchorage service
- Solicit industry for LNG supply in Port of Tacoma and Port of Jacksonville



TOTE Maritime Solution

TOTE Maritime Alaska



Orca Emissions with LNG:

- 100% reduction of SO_x
- 91% reduction of PM
- 90% reduction of NO_x
- 35% reduction of CO₂

Economic and Market Drivers

Transportation Customers are Seeking Clean Fuel Options

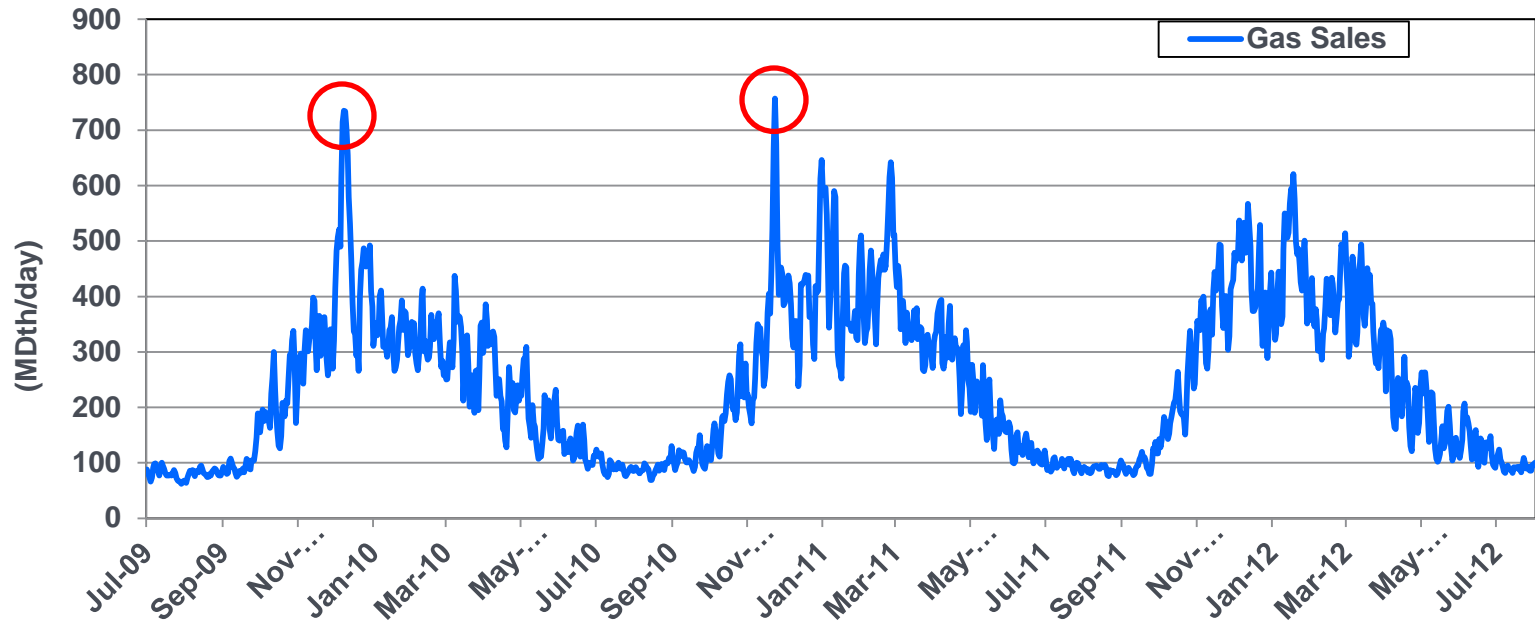


Economic and Market Drivers

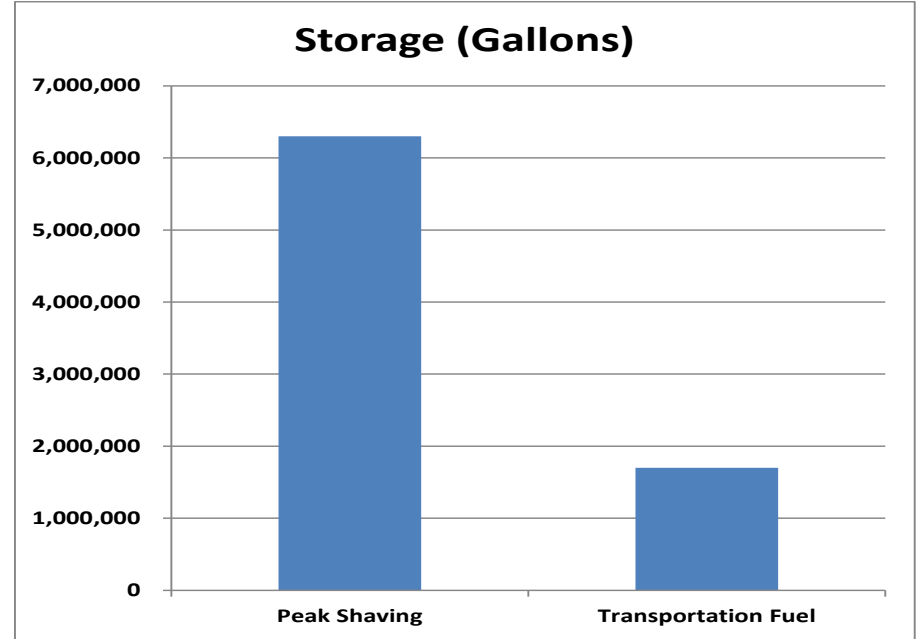
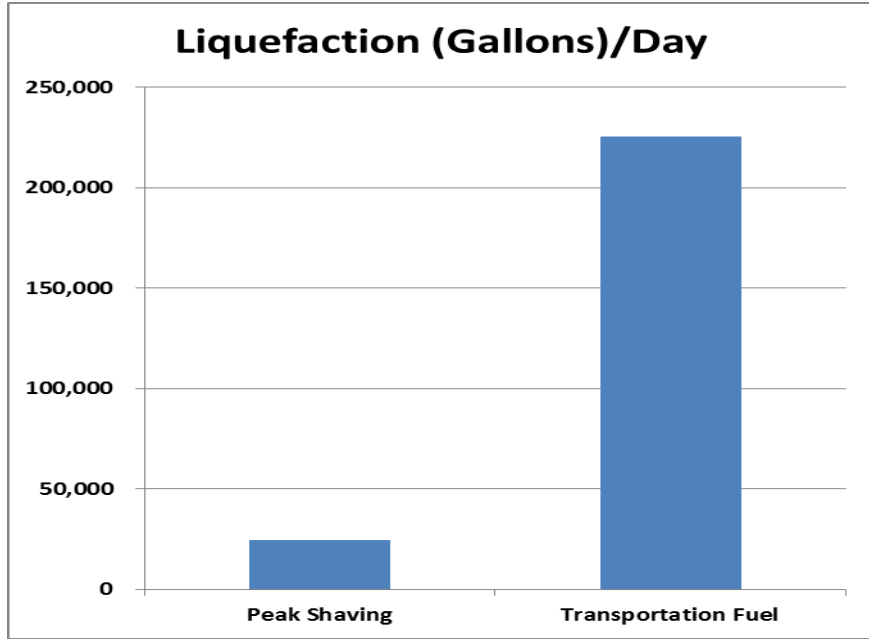


- Lack of infrastructure and high cost of entry for both suppliers and users of LNG as a transportation fuel.
- Current oil prices make fuel conversion less attractive.

Traditional Utility Peak Shaving



Dual Use Drives Efficiencies



Project Overview

- 8 million gallon full containment concrete tank on seismic isolators
- 250,000 gpd (.4 mta) SMR liquefier
- 66,000 dekatherms per day vaporizer
- 2 truck racks
- Direct fuel line to TOTE terminal

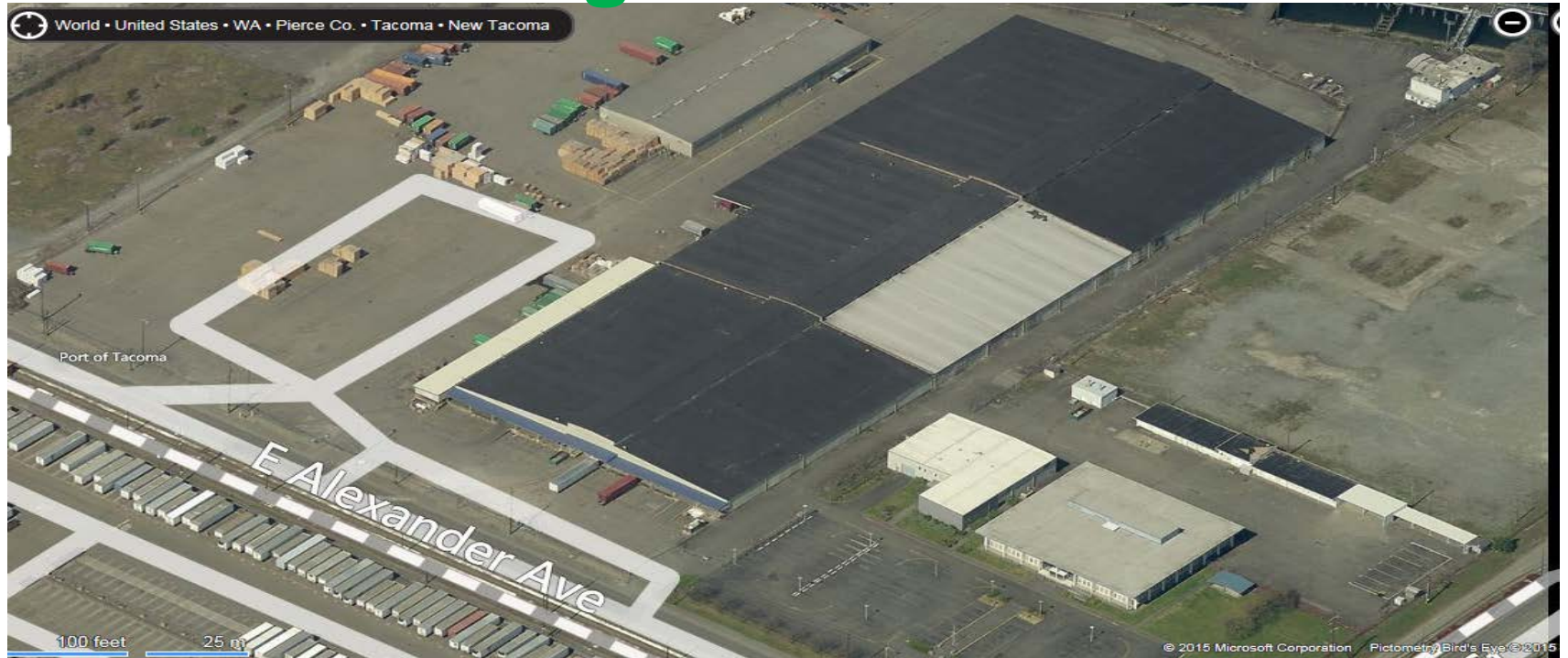
Port of Tacoma



Tacoma LNG Facility Site



Existing Site Conditions



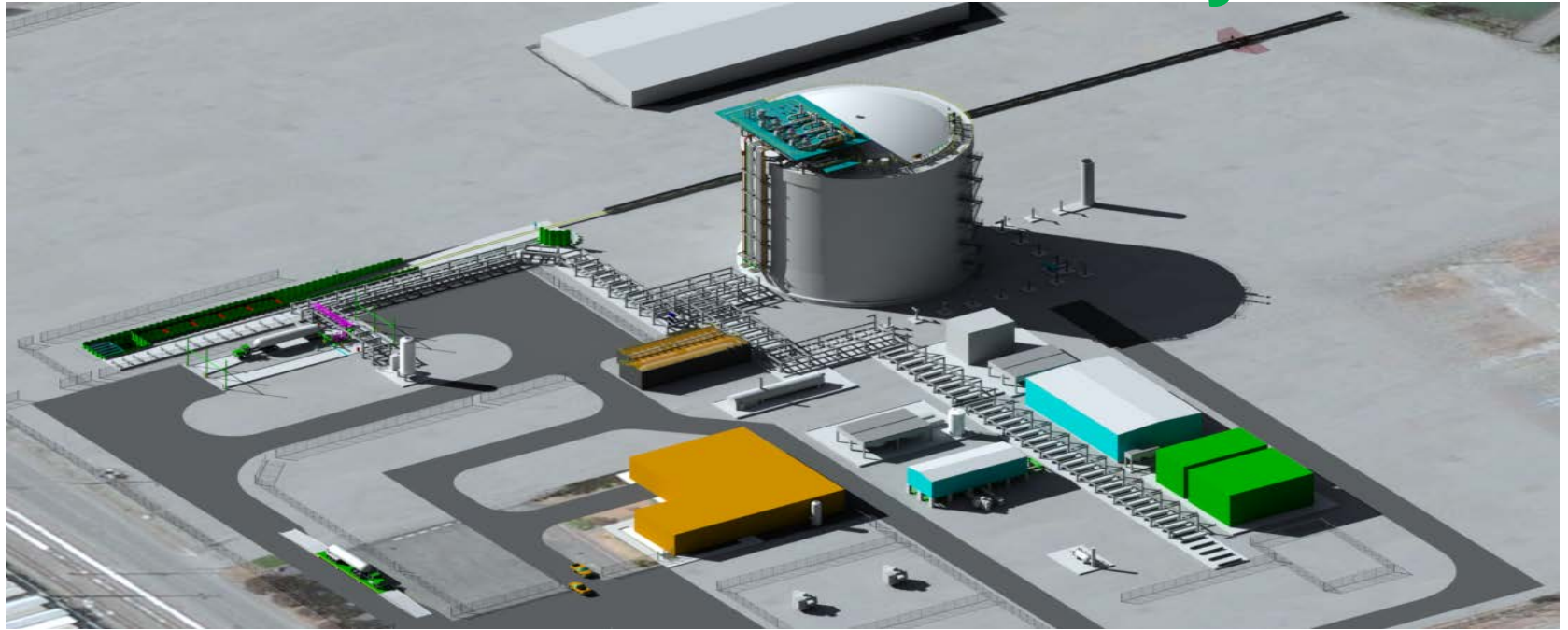
Existing Site Conditions



Site at Completion



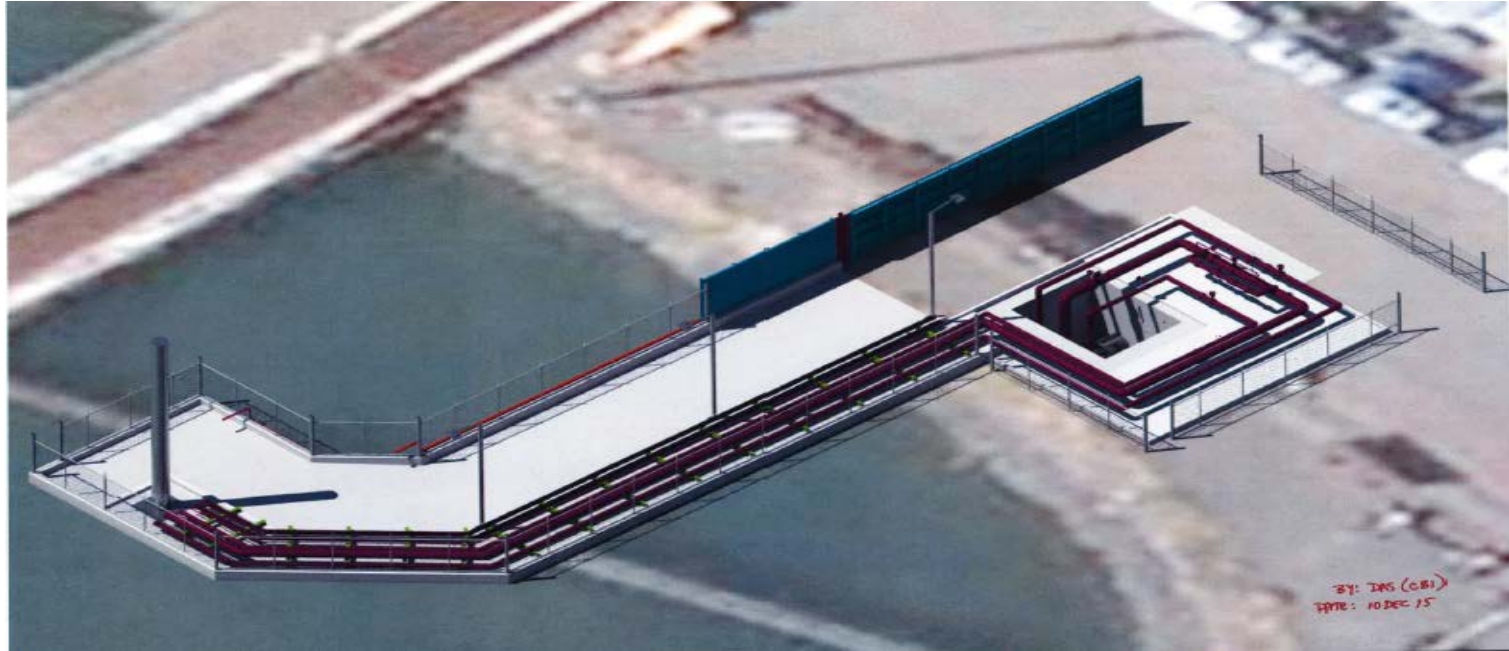
Tacoma LNG Facility



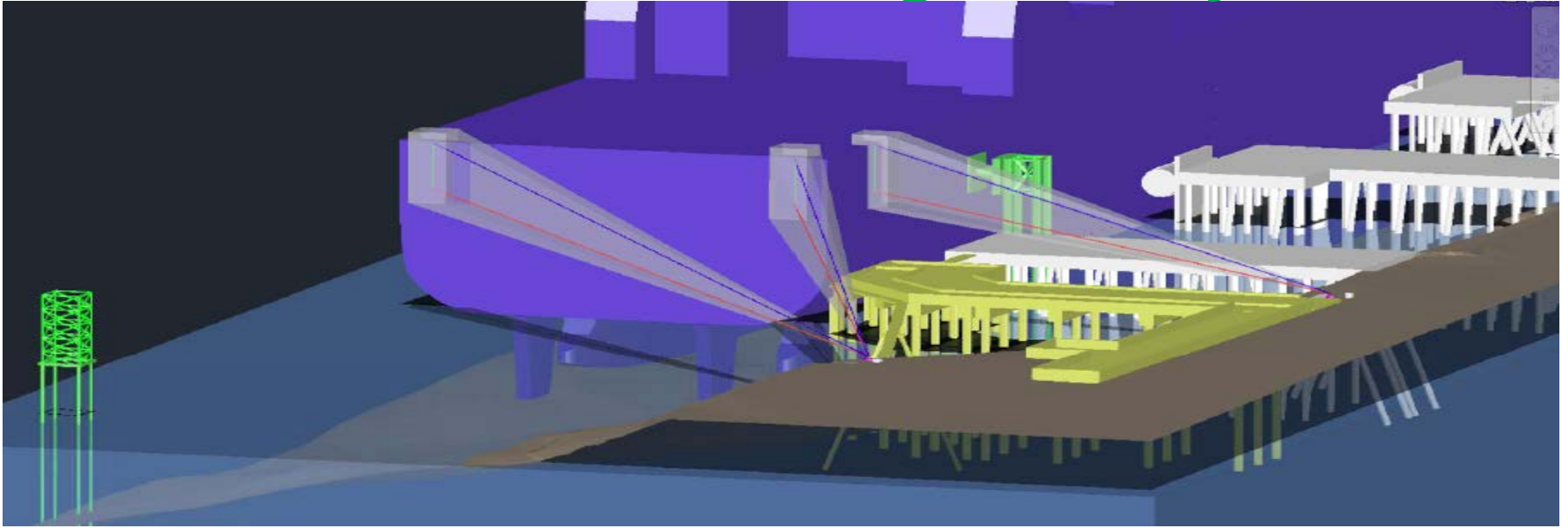
Tacoma LNG Facility



TOTE Loading Facility



TOTE Loading Facility



Siting Challenges



- Permitting process is not for the faint of heart.
- Over 16 local, state, and federal agency approvals needed.

Siting Challenges – Port Location

- Port site offers proximity to marine market, but with challenges:
 - High land cost – prime industrial waterfront property
 - Relatively populated environment – smaller footprint, tight exclusion zones, etc.
 - Lower pipeline operating pressures drive higher capex and opex for inlet compression

Siting Challenges – Port Location

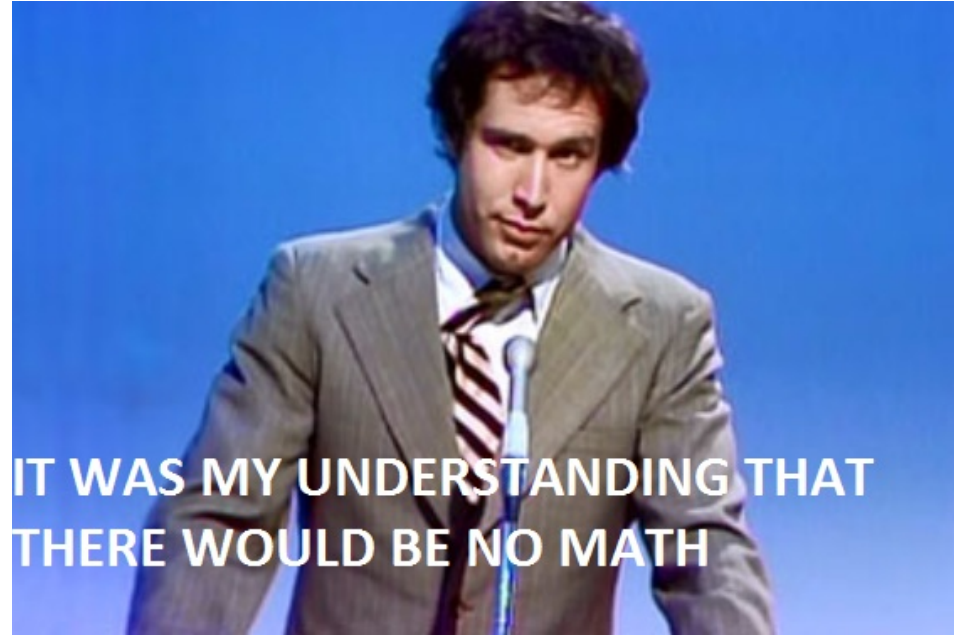
- Location at end of the pipeline prevents re-injection of heavies back into the system
- Port of Tacoma is man-made (dredge and fill)
 - Significant (and expensive) geotechnical challenges to overcome

Commercial Challenges

- Marine industry and utility industry are very different!
 - Utilities want long term contracts (20+ years)
 - Marine industry is used to real time purchases
 - Contracting requires creative and collaborative ideas

Commercial Challenges

- We don't even use the same units.
- BOE of IFO380 at LHV vs. MMBTU at HHV



Regulatory Challenges

- Facility falls under both PHMSA and USCG regulations.
 - Conflicts in the codes require collaboration between multiple agencies.
 - PHMSA and USCG regs are similar, but different in many areas.

Regulatory Challenges

- Regulatory lag on standards adoptions
 - NFPA 59A (for example)
 - PHMSA: 2001
 - USCG: 1994
 - City of Tacoma: 2009



Conclusions and Lessons Learned

- Regulators are supportive of LNG as a transportation fuel.
- Long term partnerships are essential.
- Collaborate early and often with stakeholders.
- **Solid relationships are the key to success.**

An aerial photograph of Tacoma, Washington, showing the city's layout, the waterfront, and the surrounding hills. In the background, the snow-capped peak of Mount Rainier is visible under a clear sky. The image is used as a background for contact information.

Questions?

www.tacomacleaning.com

jim.hogan@pse.com