

Design and Safety Considerations for existing LNG Peak Shaving Plants

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Design and Safety Considerations for existing LNG Peak Shaving Plants -A Project Example-

❖ The plant

**❖ Brief plant
description**

❖ Project phases

❖ Pre-Studies

❖ Conformity study

❖ Costing study

❖ The project

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The Plant

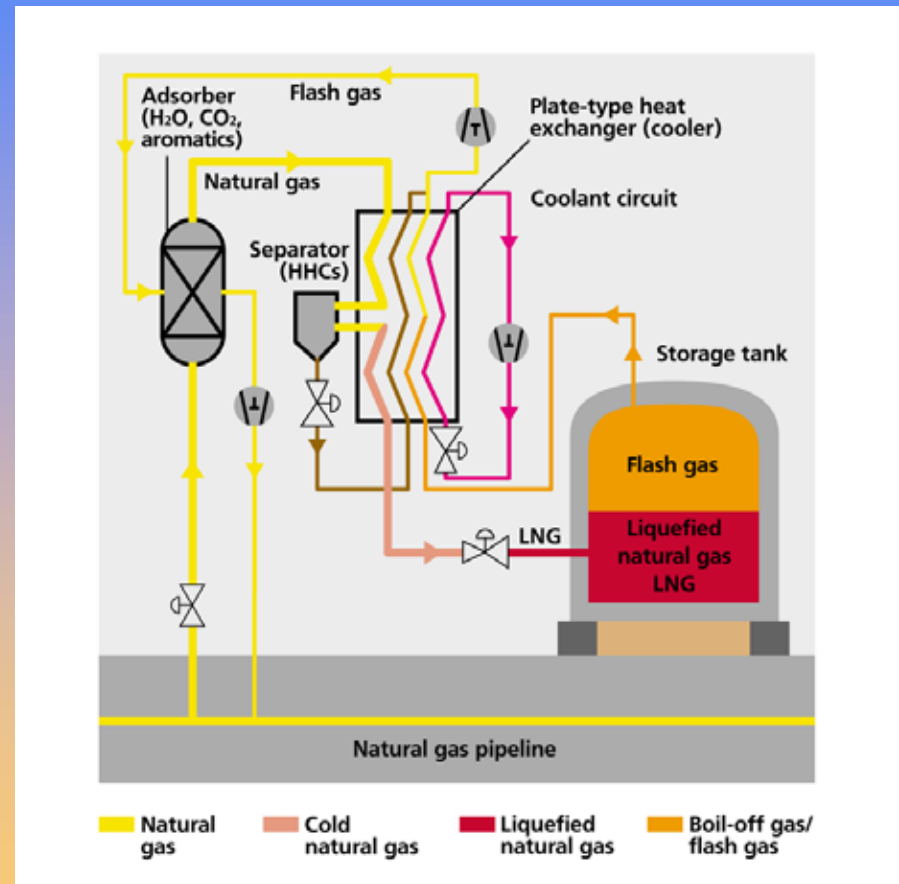
- ❖ LNG Peak Shaving Plant
- ❖ Located at Dormagen Nievenheim, Germany
- ❖ Part of ~ 4,000 km HP Gas Pipeline Grid of RWE Energy
- ❖ Mainly cavern storage
- ❖ Start up in 1976
- ❖ Built by CBI Germany
- ❖ Only two cryogenic LNG installations in Germany



Brief Plant Description

❖ Gas Treatment and Liquefaction

- ❖ Gas treatment with two adsorber systems
- ❖ To remove moisture, aromatics, CO₂
- ❖ Liquefaction with MRL cycle
- ❖ MRL Methane/Propane
- ❖ Liquefaction capacity 2,400 Nm³/h



Brief Plant Description

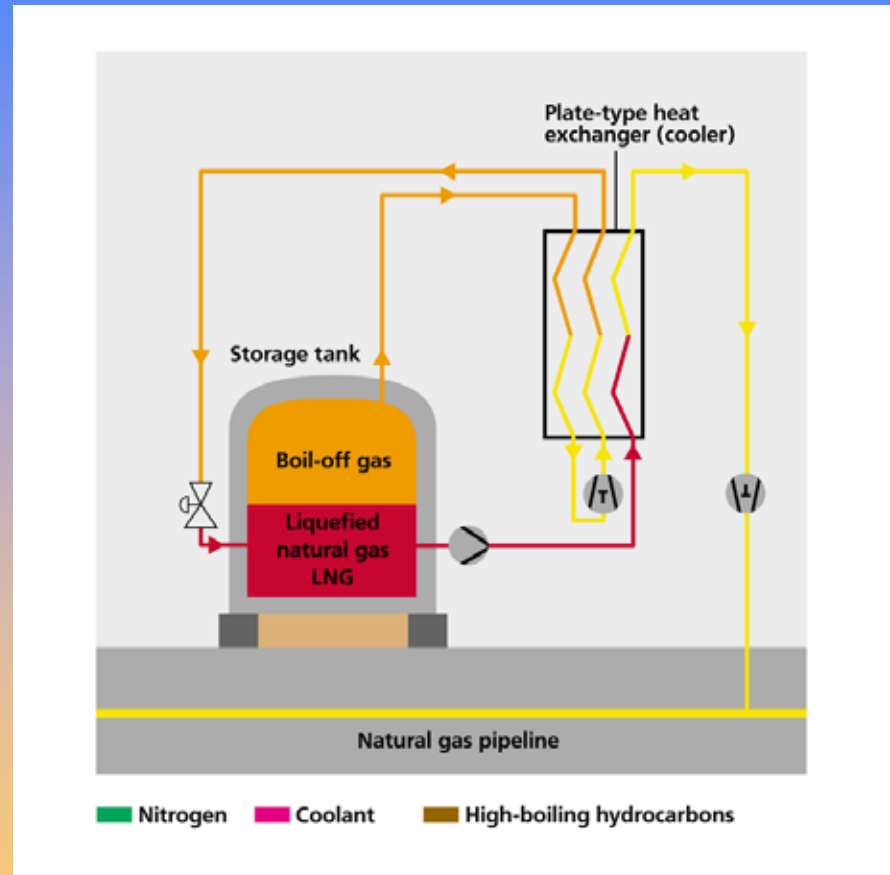
❖ LNG Storage

- ❖ Double wall steel tank (API 620 Q)
- ❖ Inner tank 9% nickel suspended deck
- ❖ Outer tank CS
- ❖ Bottom/shell penetrations
- ❖ Geo. V. 22,700 m³



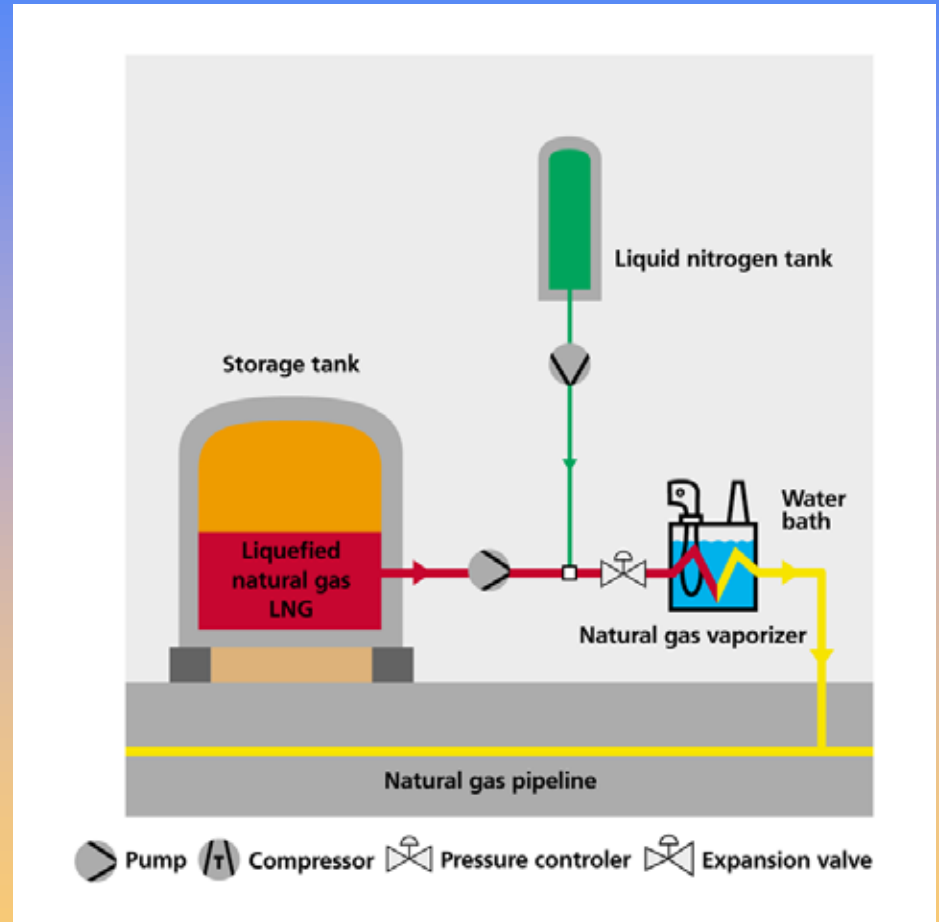
Brief Plant Description

- ❖ BOG Handling
(exist.)
- ❖ Partly re-circulated back to tank
- ❖ Partly send to pipeline



Brief Plant Description

- ❖ NG Send Out System
- ❖ Two HP Pumps , outside tanks, 2 x 80m³/h LNG
- ❖ Two submerged combustion vaporizers
- ❖ Send out rate: 2 x 50,000 Nm³/h
- ❖ Conditioning with LN2
- ❖ Truck loading system







Pre- Studies

I. First Study to check the

- ❖ Compliance of the plant with actual rules & regulations
- ❖ E.g. EN 1473/NFPA 59A
- ❖ Safety Study to review actual installed safety features
- ❖ Active & passive safety equipment

II. Target

- ❖ Life Extension of the plant
- ❖ Increased level of automation
- ❖ Alternative peak shaving concepts

Plant Views



III. Results

- ❖ **EN 1473 allows no penetrations of the primary and secondary container walls (>> submerged tank pumps)**
- ❖ **NFPA 59A allows penetrations, however the design spill shall be defined as the full liquids content of the tank (>> with submerged pumps the design spill reduced to 10min. Nom. Pump capacity)**
- ❖ **Entire revamping needed instrumentation & control system**
- ❖ **Partly revamping needed for mechanical equipment**

IV. Costing study

- ❖ **Costing of various alternatives**
 - ❖ **Revamping of plant + submerged pumps**
 - ❖ **Revamping of plant with additional safety features (water curtains, foam systems, thermal insulation of impoundment area)**
- ❖ **Other alternatives such as close down of plant**

- ❖ Client decided to take out the plant for one winter season to:
- ❖ Empty and warm up the LNG tank
 - ❖ Install submerged pumps
 - ❖ Install new instrumentation & control system
 - ❖ Revamp partly mechanical equipment/ piping, control building etc.
 - ❖ Install new BOG handling system (was added to the project 2Q/2004)
- ❖ Project duration 1Q/04 – 4Q/05

Process simulation

- ❖ Change in gas composition
- ❖ Optimization due to input from operators
- ❖ E.g. gas treatment & liquefaction process
- ❖ Level of automation
- ❖ New BOG System

❖ Safety

- ❖ Hazop Study
- ❖ SIL Allocation

❖ Tank Decommissioning

- ❖ Data assessment after 30 years operation

❖ Static calculations of existing tank

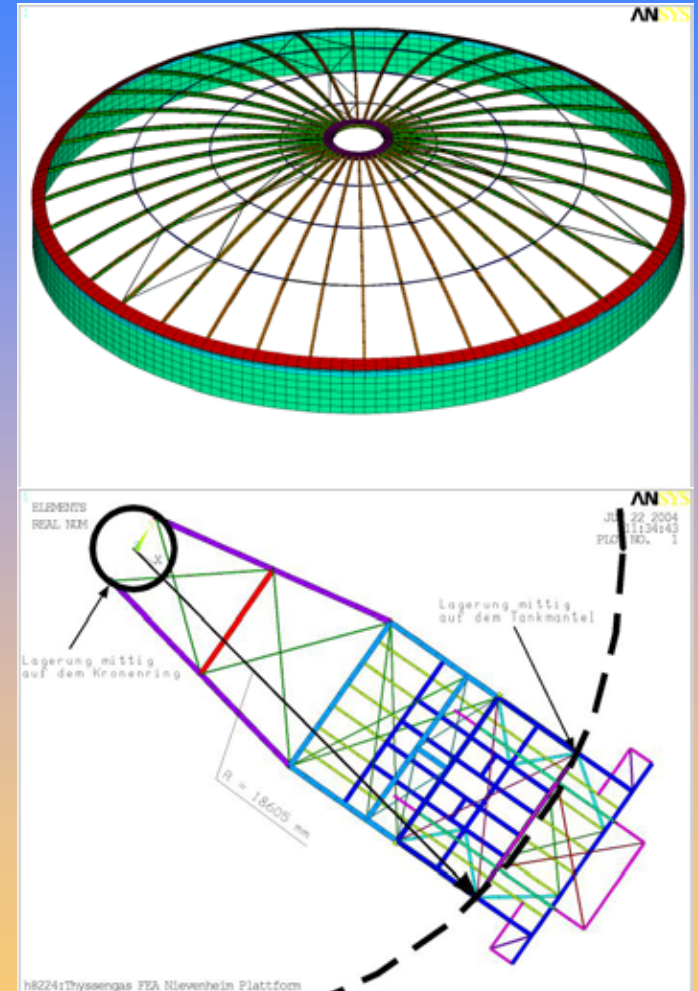
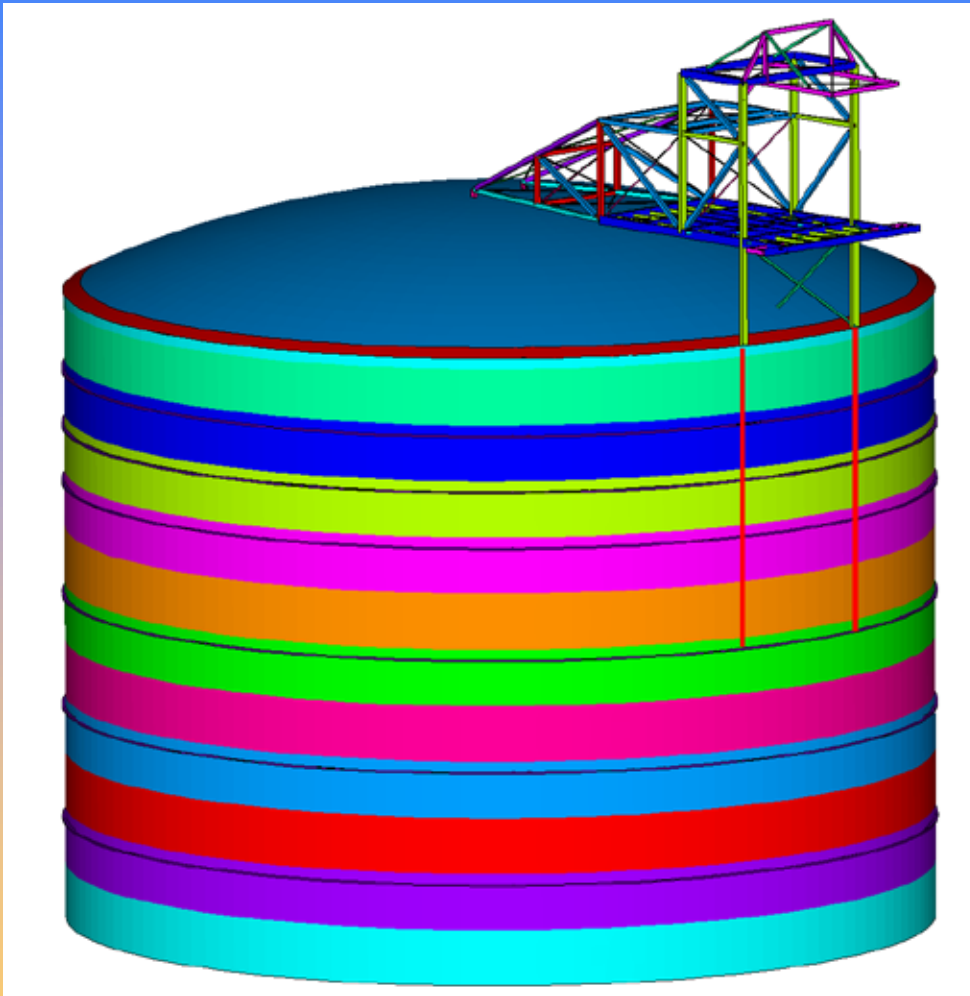
- ❖ Install new pumps/pump platform
- ❖ Recalculated the tank due to change in rules & regulations
- ❖ Install additional outer shell stiffeners

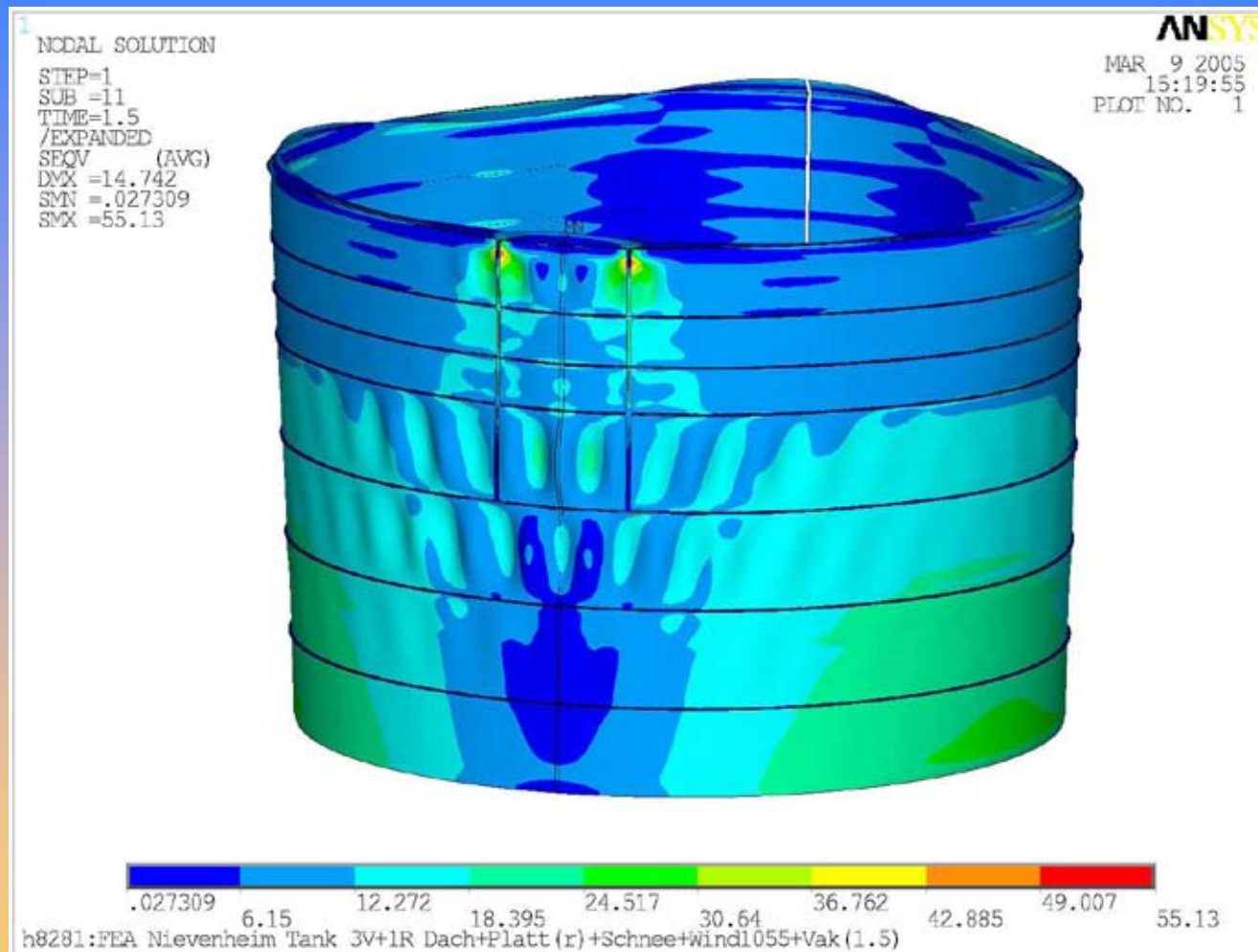
Local authorities/ Environmental

- ❖ Change in Rules & Regulations
- ❖ Safety Report

Design Aspects

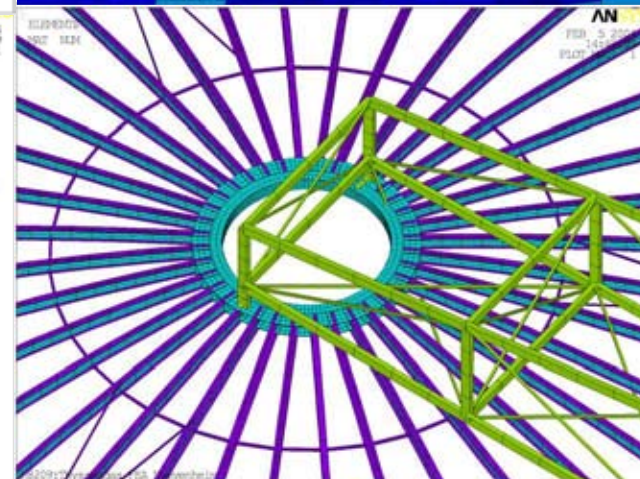
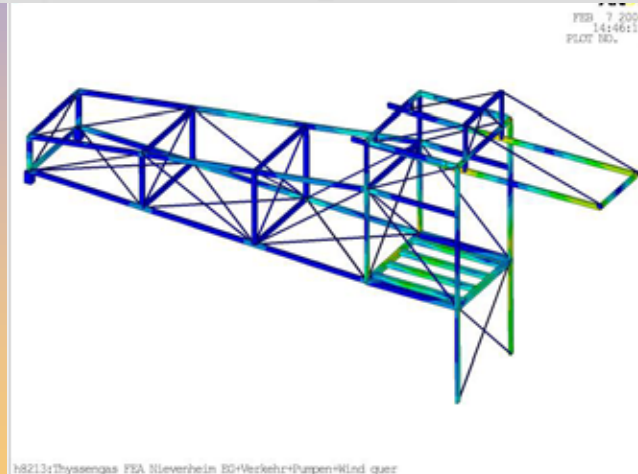
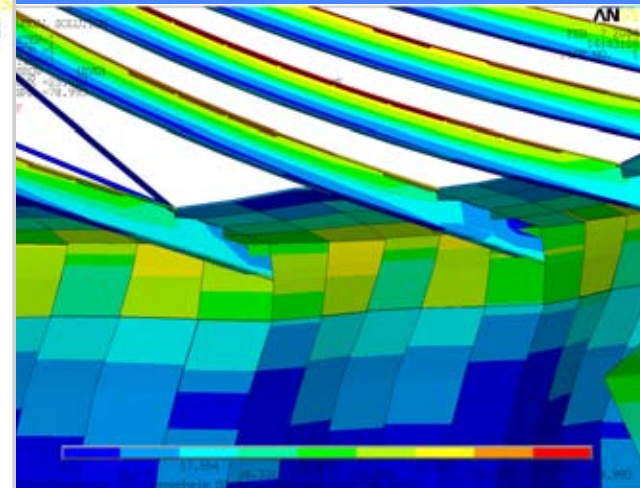
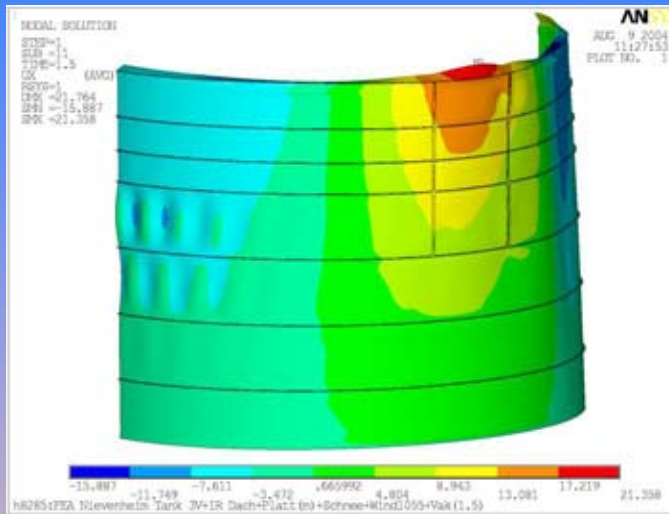
Tank Design





Design Aspects

FE Calculations



Project Execution

- ❖ **Decommissioning of tank starts at approx. 2,5 m liquid level (April 2004)**
- ❖ **Temporary connection between RT Loading pumps and HP send out pumps**
- ❖ **Result : Tank more or less 100 % liquid emptied**
- ❖ **Warming up**
- ❖ **Purging with nitrogen**
- ❖ **Purging with air**
- ❖ **Opening the tank**



Project Execution Tank Opening – Suspend. Deck







Project Execution

Plant Views



Project Execution

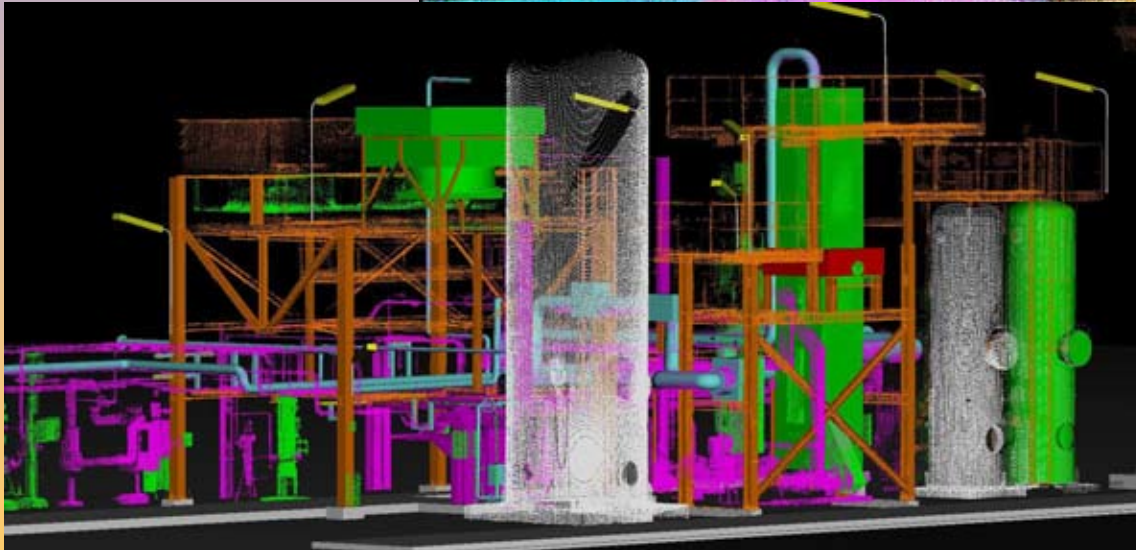
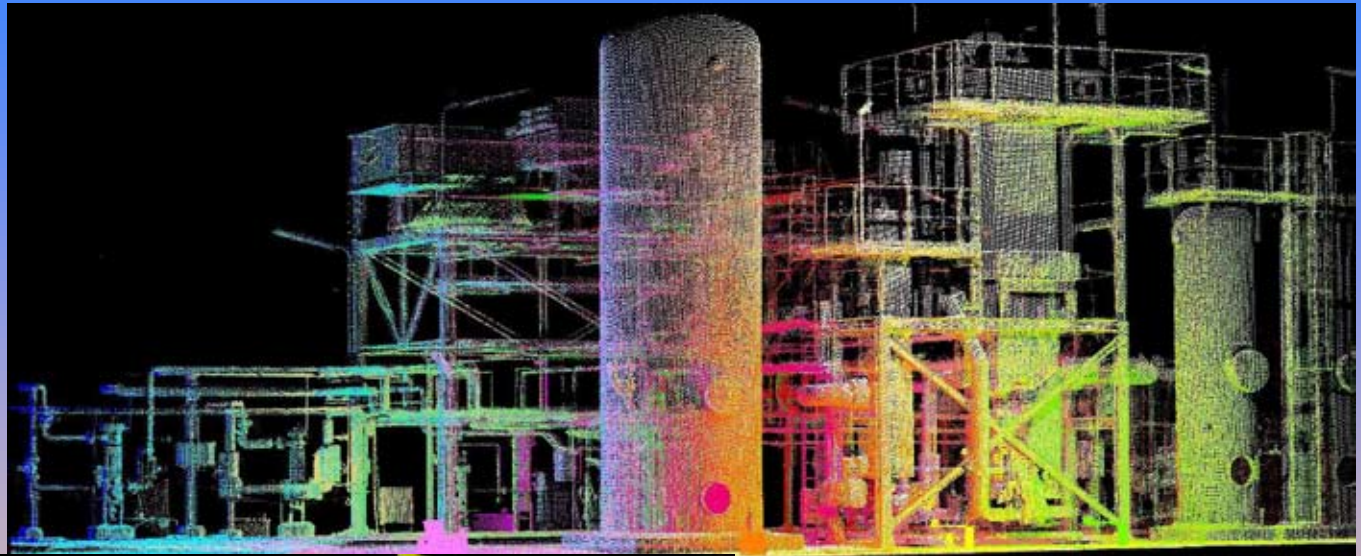
New Pump Platform



Project Execution -Laser Scanning (Test Project)



Project Execution -Laser Scanning (Test Project)



Project Execution -Laser Scanning (Test Project)



Project Execution -Laser Scanning (Test Project)



Project Execution -Laser Scanning (Test Project)



Project Organisation

- ❖ Entire project execution with one Engineering company including:
 - ❖ pre studies
 - ❖ basic, detailed engineering
 - ❖ procurement assistance
 - ❖ supervision and start up
- ❖ Direct procurement of equipment

Summary /Conclusions

- ❖ **Detailed Pre Studies required**
- ❖ **Close cooperation between Client/ Engineering company**
- ❖ **Detailed planning of activities**
- ❖ **Tailor made solutions required**
- ❖ **No critical findings after 30 years of use**
- ❖ **Findings/results can be used for other projects too (LNG/LEG)**

Summary /Conclusions

We hope that we can report during the next GASTECH venue the next important step in the project

The restart of the LNG Peak Shaving Plant



Thank you for your attention !

(* Pictures/Diagrams page 3-7 , source: RWE)