

## CASE STUDY



# Underground Gas Storage Monitoring

Daqing, Northeast China

## Project Overview

Underground gas storage (UGS) is one possibility for the storage of natural gas. Gas storage is important as a temporary buffer to smooth demand variations.

In order to provide efficient and safe gas storage operations, continuous, real-time well monitoring systems are needed, both during the injection and withdrawal phases. As a part of its gas storage monitoring infrastructure, the China National Petroleum Corporation (CNPC) required continuous downhole temperature and pressure sensing systems for its UGS project in Daqing Oilfield in order to ensure well integrity and evaluation.

In addition to monitoring downhole parameters, the customer also faced the challenge of selecting a technology that functions in the harsh conditions of the installation

site. The systems installed onsite had to be compliant with the ATEX Zone 1 requirements (meaning normal duties are accompanied by the occasional presence of explosive gases or combustible dust) and also withstand cold winter temperatures down to -30 °C.

## Solution

Conventionally, a well integrity assessment is carried out by special tools and equipment, these tools typically do not allow continuous and simultaneous measurements of the entire well length. One of the possible alternatives to continuously monitor downhole parameters during injection and withdrawal is fiber optic sensing (FOS) technology.

Within the current UGS project, CNPC decided to deploy Distributed Temperature Sensing (DTS) technology in combination with

## Background

- Continuous downhole temperature monitoring solution required for underground gas storage
- ATEX Zone 1 compliance
- Low ambient temperature performance (down to -30 °C)

## Solution & Benefits

- Two Distributed Temperature Sensing (DTS) units with ATEX housing alongside an optical fiber pressure gauge
- 24/7 wellbore integrity monitoring
- Complete assessment of all downhole conditions enables quick response in emergencies

Fiber Bragg Grating (FBG) pressure sensors along three horizontal wells at two of the oilfield’s well sites in order to record downhole conditions, assess casing integrity and identify crossflow behind the casing.

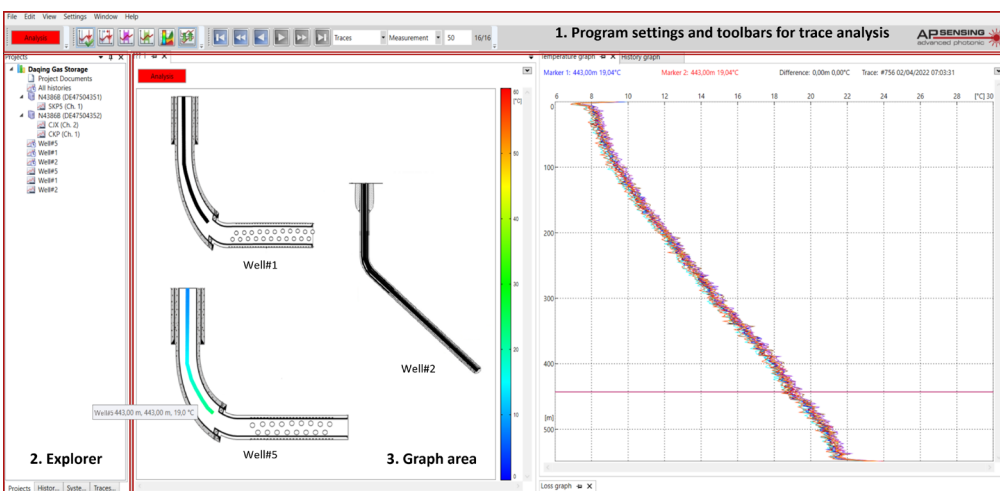
AP Sensing, alongside local partner Anton Oilfield Services Ltd., provided CNPC with FOS technology that allows continuous temperature sensing during the well operations at Daqing Oilfield. Two AP Sensing interrogator units (DTS N4386B) with ATEX housing were permanently installed at two well sites and connected to fiber optic cable running on the production tubing. The FOS cable was permanently installed down to the position of the production packer. Additionally, AP Sensing’s SmartVision software was utilized for real-time data acquisition and analysis, with the pressure gauge connected to SmartVision via Modbus TCP.



## Benefits

AP Sensing’s DTS technology enables 24/7 wellbore integrity monitoring through the analysis of temperature data in combination with FBG pressure data, leading to a better understanding of the downhole conditions of the underground gas storage and providing data that supports further action when needed without any additional interventions.

AP Sensing’s technologies are used for verification and interpretation of well status, maximum accuracy of interpretation, enhanced accuracy of the production and injection profile analysis and clear recording of abnormal downhole events. These records are more accurate and convenient than conventional monitoring methods in obtaining downhole condition insights and help the operator to make a complete assessment of all downhole conditions in order to respond quickly in emergencies.





## Conclusion

After Daqing UGS project commissioning, five local operators in China were qualified to use fiber optic sensing technology. The client satisfaction was corroborated by the planned deployment of further AP Sensing distributed sensing systems (both DTS and DAS) on an upcoming project in Changqing Oilfield in 2022.

AP Sensing SmartVision GUI. The area (1) displays all program related settings and toolbars. The Explorer (2) displays the project. The Graph area (3) displays: well schematics for 3 UGS wells and data analysis graph with temperature traces (axis X – temperature, axis Y – measured depth)

For more information:

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