

Kinder Morgan CO₂ Improves Team Collaboration, Reduces Data Management Costs, and Integrates Reservoir Intelligence into Production

The Background

Kinder Morgan CO₂ Company, L.P. (Kinder Morgan CO₂) is the largest transporter of carbon dioxide in North America. The company delivers approximately 1.2 billion cubic feet per day of CO₂ through about 1,300 miles of pipelines for use in enhanced oil recovery (EOR) projects to recover crude oil from mature fields. This CO₂ is both used in the company's EOR projects and sold to third-party customers. Kinder Morgan CO₂ is one of the largest oil producers in the state of Texas, with nearly 100% of its production associated with its EOR, or tertiary, oil operations in the Permian Basin in West Texas. It has geoscience teams located in both its Houston and Midland locations.

The Challenge

A desire for more advanced technical capabilities: The geoscientists at Kinder Morgan CO₂ were seeking an improvement in software that they were using to solve various technical challenges. They were looking for improved methods to perform time-to-depth conversion using well and seismic data, workflow-driven model building, seamless integration of workflows between disciplines, and the ability to collaborate and visualize their data with other asset team members.

Data transformation: Kinder Morgan CO₂ geoscientists were using six different suppliers' software, working across offices in Houston and Midland, and supporting multiple assets in the Permian and Paradox Basins. In the petrophysics domain alone, operators were using software from three separate suppliers, as well as multiple vendors' applications for geophysics, geomodeling, geological analysis, and simulation. This environment led to the creation of fragmented

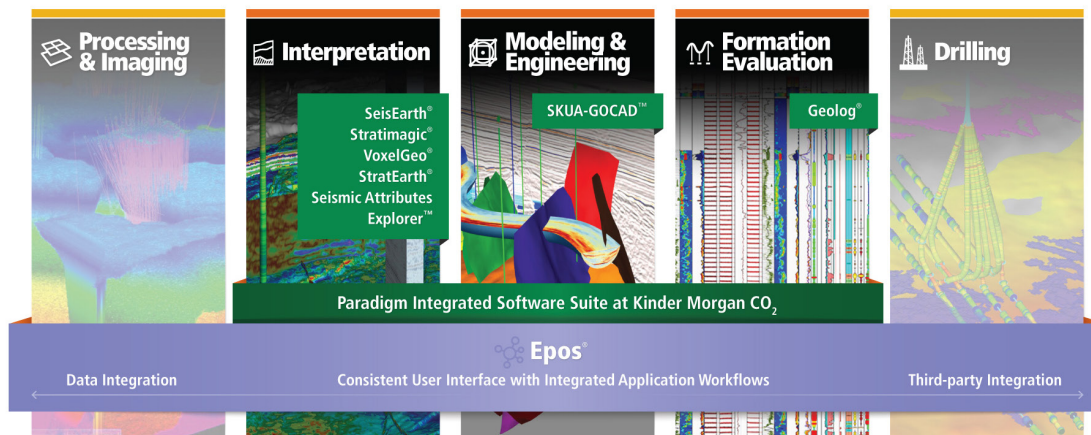
workflows and a communication challenge, as users attempted to normalize data for hand-offs among asset team members working in disparate software programs.

Maintain or reduce cost: Kinder Morgan CO₂ was looking for opportunities to reduce its overall software costs.

The Solution

When the Paradigm and Kinder Morgan CO₂ teams first met, they identified the challenges and agreed on the criteria for moving forward with a potential solution. In addition to their technological and financial requirements, they placed strong emphasis on the ability to deploy and adopt a new solution with minimal disruption to the production environment.

Technical: Kinder Morgan CO₂ and Paradigm jointly agreed to use source data from one of Kinder Morgan CO₂'s assets for time-to-depth conversion, and the Paradigm technical team would complete the Kinder Morgan CO₂ required workflow using Paradigm's integrated suite of products. The data evaluation would include capabilities that were not available in existing Kinder Morgan CO₂ applications, as well as methods and workflows that were being used in daily tasks. The results presented to Kinder Morgan CO₂ showed that Paradigm's solution successfully addressed their challenges, and provided additional value. The entire evaluation was completed within Kinder Morgan CO₂'s expected timeline, and highlighted the required workflows. The work was performed using Paradigm's integrated petrophysics (Geolog), geophysics (SeisEarth), geomodeling, and reservoir engineering (SKUA-GOCAD) solutions.



Kinder Morgan CO₂ representatives were satisfied with the technical capabilities presented, and were impressed with the accuracy and efficiency of the results achieved in a relatively short time frame.

Optimized data management: By integrating data from multiple vendors, it was clear that Kinder Morgan CO₂ would benefit from centralized data management without having to repeatedly transform it from one vendor format to another. This integrated data was shared by multiple users, reducing data duplication while allowing Kinder Morgan CO₂ asset team members to collaborate seamlessly and manage their data flexibly, based on each team's requirements.

Financial: Paradigm and Kinder Morgan CO₂ worked together to create a financial solution that would enable replacement of the “grab bag” of existing products with an integrated Paradigm solution, reducing overall software cost and consulting fees.

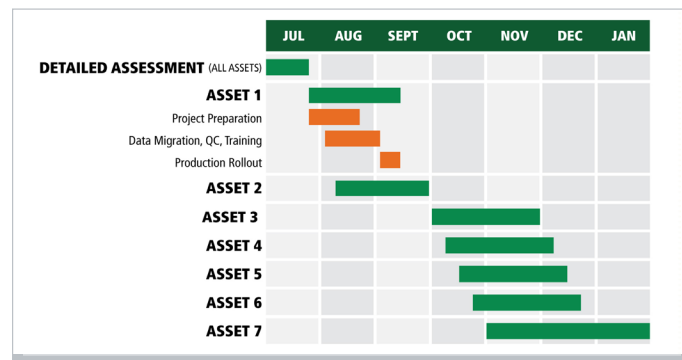
Deployment without Disruption: Paradigm provided a detailed deployment plan that included a phased approach, per asset team, and a clear timetable. The plan ensured that any data to be migrated from other vendors was identified and the methods to migrate the data tested. Users received “Essentials Training” and Paradigm provided on-site mentors when they began working in the new environment. Throughout the project, Paradigm subject matter experts were on-site at Kinder Morgan CO₂ to ensure a smooth transition of data, minimal disruption to the users' daily responsibilities, and training on advanced capabilities, such as time-to-depth conversion, that were unsatisfactory in previous vendors' software.

Detailed Execution and Validation

The Paradigm Team presented a detailed, 6-month, phased approach for successful project execution and completion, to be performed by the joint team. This approach included a dashboard to reflect weekly project status for data migration of seven assets, software deployment, workflow building, addressing user requests, training, and on-site mentoring. The lessons learned from the initial asset teams were used to accelerate the project timeline. As time went on and additional assets were completed, the projects were run in parallel, further shortening the transition cycle. The last asset was migrated by Kinder Morgan CO₂ with no assistance from Paradigm. This validated the plan and reinforced the value of Paradigm's advanced integrated technology, comprehensive training, and mentoring programs.

Thorough training played an important role in the success of this project. In-class training was provided to 35 users at the Paradigm office in Houston, with additional training offered through Paradigm Online University. This intensive training enabled the users to quickly learn and implement the software. On-site mentoring by Paradigm experts played a critical role in the quick adoption of the new integrated technology.

In the end, the migration project was completed on time and on budget. The successful execution of the plan allowed Kinder Morgan CO₂ to consolidate and standardize on a unified Paradigm platform, replacing four of its existing vendors for all 35 users. Adoption of the integrated solution improved interaction among users between office locations, resulting in a significant reduction in the time spent handling data. This



▲ Project timeline for migrating seven Kinder Morgan CO₂ assets. After the initial assessment, each asset team completed three major phases to migrate to the new system (see Asset 1 above).

allowed the users to spend more time interpreting and analyzing their data and much less time assembling it, and empowered them to move through their multi-disciplinary workflows more efficiently.

Finally, the Paradigm Geoscience Services team helped jump-start the broad adoption of Paradigm solutions by engaging the team for the Reservoir Driven Production Optimization offering. The project consisted of performing reservoir characterization, developing detailed geological models, reviewing and integrating the production data, and applying advanced reservoir engineering to a key asset in the Permian Basin. Using the earth model along with advanced streamline simulation analysis, the team was able to validate future drilling sites, evaluate the effectiveness of the existing operations, and provide valuable recommendations for optimizing production and improving field performance. Along the way, Kinder Morgan CO₂ staff was able to see firsthand the value of Paradigm's software, and accelerate its own ability to use the newly deployed software suite.

Benefits

- Excellent collaboration among 35 users, 7 asset teams, and 2 locations through integrated user workflows and consolidation of datasets, resulting in a significant reduction in the time spent handling data.
- Better science providing advanced technical capabilities. Key workflows that had been difficult or impossible to perform were now being executed, including time-to-depth analysis, workflow-driven model building, more accurate and efficient modeling, and faster and simpler data loading. This enabled the company to perform more technical work in-house, thus lowering consulting costs.
- Overall software cost savings and much easier technical and administrative management, by consolidating to two primary vendors.
- Minimal disruption to the production environment during the transition period through comprehensive project management, extensive training, and on-going support.
- Ability to validate planned drilling sites and make actionable recommendations to production engineering teams for optimizing future production from existing reservoirs.