BIM for RESOURCE EXTRACTION

The economic climate and global political landscape have created a demand to identify and extract viable gas and domestic energy sources as well as mineral deposits in the U.S. One such phenomenon is shale gas like the Marcellus Shale reserve in the northeast, the second largest gas field like it in the world. For companies and firms engaged in identification, design, construction and maintenance of well pads the race is on.

Recoverable reserves could be as large as 84 trillion cubic feet, which would make the Marcellus the second largest gas field in the world behind the super-giant South Pars field in Qatar and Iran. At current gas prices, which are relatively low, the value of recoverable reserves in the Marcellus is roughly two trillion dollars.

Experts are saying that under the best scenarios the development of Marcellus could mean $24 billion in total economic value to the region, which would positively impact all sectors of the economy including the service industry, construction, and manufacturing.

The majority of shale oil/gas is nearly a mile or more below the surface. These great depths make shale formations an expensive target. Successful wells must yield large volumes of gas to pay for the drilling costs that can easily exceed a million dollars for a traditional vertical well and much more for a horizontal well with hydraulic fracturing. The fractures (also known as "joints") in the shale are vertical. So, a vertical borehole would be expected to intersect very few of them. However, a horizontal well, drilled perpendicular to the most common fracture orientation should intersect a maximum number of fractures.

The process involves exploration, drilling, building gas processing plants, and pipeline construction. These activities require goods and services from many sectors of the economy, including construction, transportation, and engineering services.

As exploration increases, one of the areas of concern is focused around having sufficient infrastructure in place to support it from upstream to downstream activities. This need translates to a demand in services that include:

- Construction of new roads provide access to well sites in undeveloped areas
- Rehabilitation of local and state roads to repair damage created by the large number of trucks traveling to and from well sites
- Enhanced reconstruction of existing roads to avoid suspension of permits and to address political and community concerns
- Extensive piping systems for movement of natural gas from producing regions to consumption regions
In addition to the significant demand for services, there are various challenges that plague the industry and create a need for more streamlined operations and business processes. Some of the most prevalent issues include:

- **Increasing Competition in Shale** - The Shale gold rush is fueling a hot competition among businesses that want to claim a share of what is promoted as an abundant long-term energy source.
- **Environmental Issues** - Environmental concerns with hydraulic fracturing include the potential contamination of ground water, risks to air quality, the potential mishandling of waste, and the health effects of these.
- **Permitting and Regulatory Requirements** - Strict schedules and increased requirements can cause lost time and a drop in well activity. New regulations are occurring at all levels of government to minimize the impact of resource extraction, forcing companies to maintain a flexible process of design and operations.
- **Scheduling Complexities** - Companies are engaged in complex processes as part of every day resource extraction activities. Due to the complexity, the scheduling of transportation and construction activities need to be tracked and managed closely throughout the project, while also communicating the process to shareholders and the public.

As a result of these demands, what is needed is a streamlined process of design and data management that reduces errors, is model based, supports 3D visualization and simulation, and capable of sustainable workflows. BIM (Building Information Models) is that process that engineers, designers, geotechnical scientists, and operators are using to gain the most efficient process for resource extraction.

A large opportunity exists to help oil/gas owners and engineering firms to capture more of this growing opportunity, by completing projects faster and helping address adjacent obstacles facing the industry. BIM represents a benefit for both the engineering firm to increase their ability to address and complete the planning and design portion of many of these projects as well and allowing energy companies to quickly realize an economic return on costly drilling processes, or find other suitable project sites.

This is where BIM for Resource Extraction is focused. BIM for Resource Extraction is an integrated process of planning, design and analysis over the life-cycle of a mining project (oil, gas, coal, etc.). The BIM lifecycle encompasses the four major areas of resource extraction.

- The **planning** phase typically using GIS technologies for site selection and study
- The **design** phase using CAD tools for intelligent model based design
- The **build** phase for simulation and analysis through construction of design information
- And finally, the **manage** phase for asset management during operations
Planning

Site Selection and Planning – With AutoCAD Map 3D and using FREE GIS for selection of parcels, you can plan your projects with greater confidence and help inform critical design decisions earlier in the process. Using GIS tools to do spatial analysis and filtering data to find the best parcels capable of yielding ideal mining operations helps you develop a better understanding of existing conditions, and geospatial analysis capabilities can help you gain insight into project feasibility and impact.

AutoCAD® Map 3D software is a model-based infrastructure planning and management application that provides broad access to CAD and GIS data, helping geospatial and planning professionals make more informed design and management decisions.

Design

Well Pad Design – AutoCAD Civil 3D can be used for intelligent model-based design of grading associated with well pads by quickly evaluating earthwork calculations to eliminate waste, as well as providing a tie into site access roads. This streamlines time-consuming design tasks with specific tools and configurable standards.

Roadway Design and Corridor Analysis – AutoCAD Civil 3D allows designers to quickly identify the most optimal egress routes for transportation to and from the site in order to reduce unnecessary grades. The intelligent model will be used to rehabilitate the
existing roadways and highways to meet permit requirements.

AutoCAD® Civil 3D® software brings the power of BIM to infrastructure projects to help civil engineering professionals stay coordinated, more easily and efficiently explore design options, analyze project performance, and deliver consistent, higher-quality documentation.

Site Hydrologic Analysis – Autodesk Storm and Sanitary Analysis can be used to analyze hydrology of the site and promote sustainable design, determining locations and design of retention ponds for frac water and water run-off scenarios. The reporting tools allow engineers to easily produce results from analysis of stormwater pipes, quality and storage volumes required for permitting documentation.

Autodesk® Storm and Sanitary Analysis software is a comprehensive hydrology and hydraulic analysis application for planning and designing urban drainage systems, highway drainage systems, storm sewers, and sanitary sewers.

Construction/Build

Construction Simulation and Analysis - Autodesk Navisworks can be used to simulate the construction in 3D of the well pad and associated infrastructure. Navisworks will also show possible collision among different design elements to minimize costly change orders.

Autodesk® Navisworks® Manage software is a comprehensive review solution for analysis, simulation, and coordination of project information. Multidisciplinary design data can be combined into a single integrated project model for interference management and clash detection. Navisworks Manage helps design and construction professionals anticipate and avoid potential problems before construction.

Manage

Asset Management – AutoCAD Map 3D can be used to manage the well pad assets. Autodesk Infrastructure Mapping Server can also be applied at this stage to publish design and GIS data over the web, keeping stakeholders and managers up to date with your operations.

With all editions of the Infrastructure Design Suite, you can manage your infrastructure information more dependably with intelligent industry models that help you maintain data quality standards and better support future decision making for operations, maintenance, and capital planning.

3D Modeling – Using the newly released Autodesk Infrastructure Modeler, models can be integrated into a seamless 3D environment that can be shared with stakeholders, and used for permitting and public review boards minimizing public concern.

Autodesk® Infrastructure Modeler is a tool for land planning, transportation, energy or water utility infrastructure projects that helps to digitally create and communicate design proposals. Quickly and effectively generate compelling project proposals by merging existing CAD, GIS, 3D model and raster data to help develop a context model and use 3D infrastructure sketching tools to create design alternatives all in one model.
With help from Autodesk Infrastructure Design Suite, you can realize the benefits of BIM for Infrastructure. Whether you are working on transportation, land, water, or energy projects, BIM is an intelligent model–based process that can provide insight, helping you take your projects from concept to completion, faster, more economically, and with less environmental impact. Three editions of the Autodesk Infrastructure Design Suite are available to meet your particular business needs: Standard, Premium, and Ultimate.

BIM for Resource Extraction using Autodesk Infrastructure Design Suite helps you:

- Gain greater insight into planning, design, and construction with integrated analysis capabilities to better predict project outcomes.
- Help increase visibility into constructability, cost, and schedules.
- Increase turn around in permitting and regulatory compliance facing the industry today and tomorrow.
- Accommodate the rigorous changes facing the industry throughout a project’s life-cycle and make documentation and communication of a project more effective.
- Provide sustainable workflows using environmental data with the project’s design information being able to create less impact and mitigating costly lawsuits.