Using GIS and Data Mining for Western Canada Coalbed Methane (CBM) Exploration

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Nexen Inc.
About Nexen

- **Canadian energy company**
  - Head office in Calgary
  - Canadian Occidental Petroleum (Can Oxy)

- **Global operations**
  - Canada (heavy oil, CBM, Athabasca oil sands)
  - United States GOM
  - North Sea, Norway, Yemen, Colombia, Nigeria

- **Global exploration**
GIS At Nexen

- Transitioned from CAD to GIS over 8 years ago

- GIS Services (20 people)
  - Embedded GIS Analysts and Technologists in business units
  - Geomatics Engineering
  - GIS Development
  - Technical Graphics

- Corporate GIS enterprise
  - Mainstream tool for decision making
Geospatial Projects Group

- Exploration & Production Business Geographics
  - Beyond traditional GIS mapping

- Geospatial analysis and data mining
  - Innovative geospatial solution
CBM team were interested in expanding their interest in a coal zone

Ideal situation:
- Lease blocks in the desired coal zone
- Lease blocks in geologically suitable locations
- Expiring in the next couple of years
- Owned by companies of interest
- Close to Nexen’s existing land holdings
The GIS and Data Mining Approach

- ArcGIS was used for building the data
  - Eliminating stacked lease data
  - Geologic surface generation

- Spotfire’s DecisionSite was used for data mining land holdings
CBM Lease Data

- Lease data is difficult to map
- 46,288 lease blocks in AOI
- Data is stacked
Rights to certain zones creates stacked data
Query for coal zone of interest eliminates the stacked data
21,201 lease blocks for Coal Zone A
Distance Calculation

- Distance of each lease blocks to nearest Nexen lease
Lease Dataset

Attributes
- Operator
- Expiry date
- Distance
Coal Point Distribution

- **Data:**
  - +37,000 well points
  - Points are stacked
  - Each well bore penetrates 1 or more coal beds

- **Attributes:**
  - Coal zone name
  - Bed number
  - Depth to top and bottom of each bed
Technical Parameters:
- Depth
- Total thickness
- Net thickness
- Gas content

Calculated values for each technical parameter
Technical Parameters: Depth

- Measure of ground elevation to top of first bed

Ground Elevation (0m)

= Depth to top = 200m

Top of top bed (200m)
Technical Parameters: Total Thickness

- Total thickness from top of first bed to bottom of last bed in coal zone
Technical Parameters: Net Thickness

- Net thickness is the total thickness of each bed, added together.
Technical Parameter: Gas Content

- Nexen proprietary formula
Surface Generation

- Surfaces created using values from technical parameters
- Geostatistical analyst
  - Exploratory spatial data analysis
  - RMSE evaluation
- Cross validation and error checking
Datasets

- **Lease Data**
  - Operator
  - Expiry date
  - Distance

- **Technical Parameters**
  - Depth
  - Total Thickness
  - Net Thickness
  - Gas content
Add values from each surface to the lease data
Demo
CBM Analysis Results

- Identification of lease data opportunities

- GIS Analysts collaborate with GG&E
  - Dynamic interaction with the data (not a static map)
  - Provides a brainstorming session
  - Results in spin-off analysis projects
  - GIS is part of the process instead of providing only a product
Finding the right CBM lease data is:

- A competitive advantage
- Assist project teams to discover their own data
- Reveal hidden opportunities
- Speed project development
- Increase in efficiency
- Can save money
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Questions?