# COAL SYMPOSIUM

**USU-Eastern Alumni Room**  
23 October 2014  
*8:30 am*

## AGENDA

<table>
<thead>
<tr>
<th>Time</th>
<th>Presenter</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:25 am</td>
<td>BLM Welcome</td>
<td>Welcome</td>
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<tr>
<td></td>
<td>Roger Bankert</td>
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</tr>
<tr>
<td>8:30 am</td>
<td>Rural Planning Group</td>
<td>“The Future of Utah Coal”</td>
</tr>
<tr>
<td>9:00 am</td>
<td>Norwest Corp</td>
<td>Delivered Export price and the FOB mine price</td>
</tr>
<tr>
<td></td>
<td>Pat Akers</td>
<td></td>
</tr>
<tr>
<td>9:30 am</td>
<td>U of Utah</td>
<td>Seismometer Array Effectiveness - Derrick Chambers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitoring active subsidence - Jessica Wempen</td>
</tr>
<tr>
<td>10:15 am</td>
<td>Break</td>
<td></td>
</tr>
<tr>
<td>10:30 am</td>
<td>NIOSH Modeling/Design and Seismic</td>
<td>Modeling/Design and Seismic Monitoring</td>
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<tr>
<td></td>
<td>Monitoring</td>
<td></td>
</tr>
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<td></td>
<td>Mark Larson, Pete Swanson</td>
<td></td>
</tr>
<tr>
<td>11:15 am</td>
<td>Coal Hollow Mine</td>
<td>Larry Johnson</td>
</tr>
<tr>
<td></td>
<td>Alton, Utah</td>
<td></td>
</tr>
<tr>
<td>Noon</td>
<td>End – individually meet and discuss</td>
<td></td>
</tr>
<tr>
<td></td>
<td>with presenters</td>
<td></td>
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</tbody>
</table>
# Record of Attendance – Mining

Instructors Name: Coal Symposium  
Location:  
Room #: 10-23-14 - ALUMNI

<table>
<thead>
<tr>
<th>Students Name</th>
<th>Date/Hours</th>
<th>Email/Signture</th>
</tr>
</thead>
<tbody>
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<td>Mike Hansen</td>
<td>EA</td>
<td></td>
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<tr>
<td>Nick Bateke</td>
<td>EIG</td>
<td></td>
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<td><a href="mailto:ogibson@skyline.com">ogibson@skyline.com</a></td>
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Instructor’s Signature: 
Date:  
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<th>Date/Hours</th>
<th>Signature</th>
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</thead>
</table>
| Chuck Semborski | 10/23 | Chuck Semborski  
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| Bill King | 10/23 | Bill King  
| Larry Johnson | 10/23 | Larry Johnson  
| Chris Conrad | 10/23 | Chris Conrad  
| Steve Chrusciel | 10/23 | Steve Chrusciel  
| Steve Ruby | 10/23 | Steve Ruby  
| Roger Bland | 10/23 | Roger Bland  
| Patrick Church | 10/23 | Patrick Church  
| Jessica Wetzel | 10/23 | Jessica Wetzel  
| M. K. McCartney | 10/23 | M. K. McCartney  
| Ken Hoffman | 10/23 | Ken Hoffman  
| Mason Bishop | 10/23 | Mason Bishop  
| Peter Hess | 10/23 | Peter Hess  
| Darren Olsen | 10/23 | Darren Olsen  
| Rob Hamilton | 10/23 | Rob Hamilton  
| Dana Dean | 10/23 | Dana Dean  
| Roland Heck | 10/23 | Roland Heck  
| Lisa Banhart | 10/23 | Lisa Banhart  
| Andy Bedigian | 10/23 | Andy Bedigian  
| Julie Suh | 10/23 | Julie Suh  
| Vicky Miller | 10/23 | Vicky Miller  
| Nadeen Harrison | 10/23 | Nadeen Harrison  
| Arminda Daniels | 10/23 | Arminda Daniels  
| John Blake | 10/23 | John Blake  
| Priscilla Burton | 10/23 | Priscilla Burton  

Instructor's Signature: ____________________________
Date: ____________________________
Export Economics for Utah Coal

Pat Akers
VP Surface Mining/Financial Services

October 23, 2014
Coal Export/Import Markets

Major Coal Importers - 2013

Major Coal Exporters - 2013
US Exports by Region

![Bar chart showing US exports by region from 2008 to 2013. The chart compares exports across the Appalachian, Interior, and Western regions over the years. The data shows a trend of increasing exports in all regions from 2008 to 2013.]
Export Economics for Utah

• Destination Price Set by Market
  – Importers
    ▪ China, Japan, India, Europe
  – Exporters
    ▪ Indonesia, Australia, Columbia, South Africa, Canada

• Economics Set by Quality, Price, Logistics
  – BTU’s, Ash, Sulfur
  – Transportation
  – Loading and Handling
Local Movement

EXPLORER the Depths of our Experience | www.norwestcorp.com
Regional Movement

To Stockton, CA $20.20/ton

Rail Origin Point: Savage, UT

To Pasadena, TX $36.90/ton
International Movement

FIGURE 1.6
BLM Coal Shipping Route
Stockton, California to
Nagasaki, Japan

Legend
- Cities
- Country boundaries
- Coal Haul Route
- Stockton to Nagasaki

$13.10 per ton
## Typical Example

<table>
<thead>
<tr>
<th></th>
<th>Japan</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark BTU's/Lb.</td>
<td>11,491</td>
<td>11,340</td>
</tr>
<tr>
<td>Mine BTU's/Lb.</td>
<td>12,350</td>
<td>12,350</td>
</tr>
<tr>
<td>Destination Price US$/Tonne</td>
<td>$74.31</td>
<td>$77.80</td>
</tr>
<tr>
<td>Destination Price US$/Ton</td>
<td>$67.55</td>
<td>$70.73</td>
</tr>
<tr>
<td><strong>BTU Adjustment</strong></td>
<td>4.91</td>
<td>6.14</td>
</tr>
<tr>
<td><strong>Transportation and Handling</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trucking from mine to rail</td>
<td>6.40</td>
<td>6.40</td>
</tr>
<tr>
<td>Loading to rail</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Rail freight to port</td>
<td>20.20</td>
<td>36.90</td>
</tr>
<tr>
<td>Loading to vessel</td>
<td>12.90</td>
<td>7.70</td>
</tr>
<tr>
<td>Ocean going freight</td>
<td>13.10</td>
<td>11.60</td>
</tr>
<tr>
<td><strong>Total Transportation and Handling</strong></td>
<td><strong>$54.60</strong></td>
<td><strong>$64.60</strong></td>
</tr>
<tr>
<td><strong>Net price at Mine</strong></td>
<td><strong>$17.86</strong></td>
<td><strong>$12.27</strong></td>
</tr>
</tbody>
</table>
Export Challenges for Western US Coal

• Typically lower quality than international market benchmark (some exceptions)
• Price
• Location relative to major importers and exporters
• Transportation and Handling Costs
• Port Capacity on Western US Coast
Existing and Proposed Port Capacity
EXPLORE the Depths of our Experience
Countries Where Norwest Has Worked

[Map of the world showing countries where Norwest has worked]

Exploration of the Depths of our Experience | www.norwestcorp.com
CIB Projects Funded 2009-2013
Coal Study
The world produced an oversupply of coal amounting to roughly 840 million short tons during the 5-year period between 2008 and 2012, a trend many experts expect to continue.

Global coal prices dropped roughly 40 percent between 2011 and 2014, decreasing the profit margins of US coal exporters.

With China, Japan, and South Korea importing half of the world’s coal exports, Indonesia and Australia (who ship half of the world’s coal exports) have a distinct geographic advantage in the global coal market, contributing to their ability to sell coal at low rates.
UNITED STATES

- Over half (8,433) of all coal miners in Eastern Kentucky have been laid off since the first quarter of 2009.

- The United States is experiencing a shift away from coal-fired power. The state of Nevada, for instance, reduced its coal-fired power production from 70 percent of its total power generation in 1992 to 12 percent in 2012.

- Since 2010, over 150 of the nation’s coal-fired power plants have closed or been scheduled for retirement.
UNITED STATES

- The Energy Information Administration reports 11 planned coal-fired generating unit additions (4 percent of planned capacity) in the United States in comparison with 281 natural gas-fired generating unit additions (45 percent of planned capacity).

- The Environmental Protection Agency (EPA) estimates that 46 to 50 gigawatts of coal-fired generating capacity—over four times PacifiCorp’s total generating portfolio—will go offline as a result of its proposed CO2 regulation. Consequently, the EPA projects that thermal coal production in the United States will decline by roughly 26 percent.
The Los Angeles Division of Water and Power (LADWP)—the primary customer of the Intermountain Power Project (IPP)—will not be renewing its power purchase agreement, set to expire in 2027, with IPP. Instead, the LADWP intends to build a new natural gas plant adjacent to IPP’s existing facilities and begin purchasing natural gas-fired electricity from IPP by 2025.

The Carbon Plant, operated by Rocky Mountain Power, is set to close its doors in 2015 due to the prohibitive costs of operating under existing federal regulations.

The Bonanza Plant was recently fined for excess for pollution and faces uncertainty due to an increasingly stringent regulatory environment.
The Impetus

UTAH

- **Rocky Mountain Power** (RMP) is not planning to build additional coal-fired generating capacity in Utah. Furthermore, RMP intends to reduce its reliance on coal by 15 percent over the next 10 years.

- Natural gas production in Utah, occurring primarily in the Uintah Basin, exceeded coal production for the first time in 2010, with that trend continuing over the past four years.

- Earlier this year, the **Ute Indian Tribe** announced plans for a 1,000-megawatt natural gas power plant, demonstrating increasing competition for Utah’s coal-fired power plants.
Coal Thrives
Coal Survives
Coal Dives
The Certainties
Coal is an abundant resource in Utah

15th

Utah ranked 15th among coal-producing states in 2012, accounting for approximately 1.7 percent of the nation’s coal production.

Source: EIA, Annual Coal Report (2013)

While Utah possesses billions of tons of recoverable coal, much of it is off limits due to its location within the Grand Staircase-Escalante National Monument.

Source: UGS, Utah Energy Statistics, Table 2.3 & UGS, Annual Review and Forecast of Utah Coal Production and Distribution (2009)

- Cumulative coal production (7%)
- Not feasibly recoverable coal resource, per UGS (30%)
- Coal resource located within Grand Staircase-Escalante National Monument (67%)
- Remaining recoverable coal resource (6%)
Utah coal is renowned for its clean qualities

### COMPARISON OF CHEMICAL QUALITIES BY REGION

Source: EIA, Coal Market Module (2012) & EIA, Average Coal Commodity Spot Prices

<table>
<thead>
<tr>
<th>SO2%/lb</th>
<th>Utah Mines</th>
<th>BTU/lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.76</td>
<td>Uintah Basin</td>
<td>11,192</td>
</tr>
<tr>
<td>0.80</td>
<td>Wyoming PRB</td>
<td>11,700</td>
</tr>
<tr>
<td>1.2</td>
<td>C. Appalachia</td>
<td>8,800</td>
</tr>
<tr>
<td>3.0</td>
<td>N. Appalachia</td>
<td>12,500</td>
</tr>
<tr>
<td>5.0</td>
<td>Illinois Basin</td>
<td>13,000</td>
</tr>
</tbody>
</table>

Note: Actual chemical qualities vary within individual mines, within basins, and change over time; consequently, these figures represent averages, not absolutes.
Most of Utah’s coal doesn’t leave the state

**DISTRIBUTION OF UTAH COAL (2012)**

Source: UGS, Utah Energy Statistics, Table 2.19

- **26.0%**
  - Over one quarter of all coal produced in Utah is used at the Intermountain Power Project in Delta, Utah

- **48.8%**
  - Close to half of all coal produced in Utah is used elsewhere in the state
Coal keeps Utah’s electricity rates low

Between 1982 and 2012, coal prices in Utah ranged from $0.97 to $1.91 per million B.T.U., compared to $1.62 and $6.92 per million B.T.U. for natural gas.

Source: UGS, Utah Energy Statistics, Table 5.18

Average Residential Price of Electricity (¢/kWh)

Source: EIA, Average Price by State (2012)
Utah relies heavily on coal-fired power
Demand for power in Utah continues to grow

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Annual Residential Power Consumption (MWH)</th>
</tr>
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<tbody>
<tr>
<td>1972</td>
<td>6 MWH</td>
</tr>
<tr>
<td>1992</td>
<td>8 MWH</td>
</tr>
<tr>
<td>2012</td>
<td>10 MWH</td>
</tr>
<tr>
<td>2032</td>
<td>12 MWH</td>
</tr>
</tbody>
</table>

Source: UGS, Utah Energy Statistics, Table 5.23 and Table 5.19a
Most Americans favor alternatives to coal

PREFERENCE FOR RENEWABLE ENERGY DEVELOPMENT BY AGE
Source: Gallup Poll

- 18-24 YEARS: 80%
- 35-54 YEARS: 65%
- 55+ YEARS: 49%
- OVERALL: 64%
Regulation is negatively impacting the coal industry

26% The E.P.A. estimates that thermal coal production in the United States will decline by roughly 26 percent as a result of its proposed clean energy plan

Source: EPA, Proposed Clean Energy Plan (2014)

Increased frequency of federal air quality regulation

Source: Various
The natural gas boom threatens coal

**In 2010, Utah’s natural gas production surpassed its coal production for the first time**

Source: UGS, Utah Energy Statistics, Table 1.8
The Key Uncertainties
1. Public opinion
2. Governmental regulation
3. Technological advancement
4. Market forces
5. Catastrophic event
1. Public opinion
2. Governmental regulation
3. Technological advancement
4. Market forces
5. Catastrophic event
1. Public opinion
2. Governmental regulation
3. Technological advancement
4. Market forces
5. Catastrophic event
1. Public opinion
2. Governmental regulation
3. Technological advancement
4. Market forces
5. Catastrophic event
1. Public opinion
2. Governmental regulation
3. Technological advancement
4. Market forces
5. Catastrophic event
The Scenarios
COAL THRIVES

Public opinion
Regulation
Technology
Markets
Catastrophe

COAL SURVIVES

COAL DIVES
COAL THRIVES
Regulation
COAL SURVIVES
Technology
COAL DIVES
Markets
Catastrophe
Questions?
Innovation in monitoring evolving mine subsidence by DInSAR

Jessica M. Wempen

10/23/2014
Introduction – Subsidence

As the trona mines in southwest Wyoming utilize longwall mining more extensively and progress toward higher extraction ratios the potential for subsidence increases.

Traditional methods of measuring subsidence, including GPS and aerial surveys, can have millimeter level accuracy, but the spatial extent is limited.
Introduction - DInSAR

- **Differential Interferometric Synthetic Aperture Radar** is a satellite-based remote sensing process that can generate subsidence data on a regional scale with a high data density.

- **DInSAR** has the potential to quantify the impact of subsidence over large regions and long time scales.

- **DInSAR** could be a useful method for enhancing traditional subsidence surveys.
The Japanese Satellite ALOS (Jan 2006 – Apr 2011) collected SAR data that is suitable for subsidence monitoring.

- **ALOS** had a Phased Array type L-band Synthetic Aperture Radar with a wavelength of 24 cm.

- L-band provides good penetration of atmosphere and ground cover, and produces data with high coherence.
Measuring Subsidence

- Progressive DInSAR derived displacement maps for four trona mines in southwest Wyoming are presented in the following slides.

- Subsidence troughs generated by longwall mining are clearly identifiable. Solution mining also produced measurable subsidence.

- From Dec 2007 to Mar 2011, longwall mining generated a maximum subsidence of 1.3 m. Over the same period, solution mining produced a maximum subsidence of 0.5 m.
Image Quality - Decorrelation

- Image quality is affected by the temporal and spatial decorrelation.

- Temporal decorrelation is caused by variation in ground cover over time. It can be influenced by vegetation growth, snow, or other changes on the surface.

- Baseline decorrelation is caused by significant changes in the satellite orbital positions.
Image Quality

- Long elapsed times between pairs of data lead to large differences in the path of the satellite and high change gradients on the surface, which can lead to poor quality maps.

- High quality, long-term displacement maps can be generated by pairing SAR data over short periods and summing the displacements.
Image Quality

- There is a significant difference between the maximum subsidence in the paired map and the cumulative map:
  - Maximum subsidence is 0.79 m for the paired data.
  - Maximum subsidence is 1.30 m for the cumulative data.

- In the paired data, processing errors generated by the large temporal and spatial baselines reduce the image quality.
Conclusions

- DInSAR can be useful for evaluating subsidence over large regions with relatively long time scales.

- The elapsed time between SAR pairs can significantly affect the accuracy of the data but high quality displacement maps can be generated by pairing SAR data over short periods and summing the data.

- Displacement maps derived from DInSAR can quantify the development of subsidence over time, the impact of subsidence in a mining region, and identify when subsidence is complete.
Alton Coal Development, LLC
Coal Hollow Project
Coal Hollow Coal Mine
Company Overview

- Alton Coal Development is a Limited Liability Company formed in 2004
- Privately owned
- Office located in Cedar City, Utah
- Currently has permitted and operating the Coal Hollow Coal Mine located 4 miles south of Alton, Utah.
- ACD is in the process of acquiring 3500 acres of Federal coal adjacent to the Coal Hollow Mine, in southern Utah.
- ACD is in the permitting process for to begin Underground Operations on the existing permit.
- ACD is in the process of applying for 8 million more tons of private coal.
Coal Hollow Mine General Location
Location (Continued)
Project Reserve Description

- Permit is in place for private (fee) area that contains 5 million recoverable ton and is presently being mined.

- In NEPA (EIS) process for Federal reserves that contain 45-50 million recoverable tons.

- Additional private coal located at the north end of LBA that contain approximately 5 million ton

- Additional Private underground coal located within the existing permitted area.

- Private and State Underground Coal
Permitted Mining Area
Aerial View of Private Land (North)
Permitted Mining Area
Aerial View of Private Land (East)
Permitted Mining Area
Looking South at Current Operations

MINING TODAY
BEGINNING OPERATIONS

- October 2010: Mine and Reclamation Plan Approved
- To February 2011: Construction of Facilities (ponds, ditches, diversions, drainage control, roads, structures, coal yard).
- February 15, 2011: First coal shipped
ROBINSON CREEK DIVERSION CONSTRUCTION

Drainage Construction
POND CONSTRUCTION
ROAD CONSTRUCTION
WEATHER CONDITIONS
Project Overview

- Projected to produce 2 million tons of coal per year
  - Presently 750,000 tons per year
- Truck/shovel mining operation
- Highwall mining operation
- Underground mining operation
- Concurrent reclamation practices
- Based on size of operation, Operational mining will be confined to a small footprint (approximately 80-120 acres)
- Coal will be sized for market at the mine site, no other coal processing
- Small coal stockpile located at mine with load out to transport coal by truck to client or railhead projected to be located west of Cedar City.
Proposed Rail Loadout
Removal of Top Soil
Sub Soil Storage
Overburden Removal
Top of Coal
Mining with 992 Loader
Mining with Excavator
Overburden Removal
Completing Overburden Removal
Mining with Highwall
The Launch Vehicle
Cutter head module advancing
In The Hole
Coal Yard
Coal Loadout
Reclamation

Surface Mining Control and Reclamation Act (SMCRA)

Mine Reclamation Plan

- Overburden material is placed, compaction tests are required to 85% compaction

- Subsoil material is placed at 36-42 inches thick on top of the overburden.

- Top Soil is placed on top of the Sub Soil 6-12 inches thick

- The surface is prepared by disking

- Seed mixes determined by the MRP are used

- Mulch and/or Fertilizers are incorporated into the process
Reclamation: Ready for Seed
Typical Final Reclamation
FEDERAL COAL
LEASE BY APPLICATION (LBA)

- DEIS completed for Public Comments December 2011
- Town meetings for public review December 2011 through January 2012
  - Public comment period  days (extended to 86 days)
  - Approx. 162,000 comments submitted with 14,500 being unique.
  - Each unique comment to be addressed
- Supplemental to the DEIS is generated
- SDEIS to be completed
- Town meetings for public review
- Public comment period 60 days
- Final EIS released
- ROD (Record of Decision)
- Leasing process begins
Male in Active Work Area
Male on Disturbed Ground
Within 500 feet of Active Pit
Within ½ Mile of Coal Yard
On Disturbed Ground