State Demography Office Overview

• **Embedded within a State agency**
  - Responsible for acquiring, warehousing, and disseminating population data needed by state agencies and other public entities

• **Department of Local Affairs**
  - Prepares data, information, and technical & financial assistance tailored to account for local perspectives, needs, and pressing issues

• **Public information**
  - Make data and information readily available to the public, including citizens, businesses and non-profit agencies

• **Outreach**
  - Work with local governments and others to understand what the numbers are saying – *numbers convey little without context.*
State Demography Office’s Core Competencies

- Population
  - Year-by-year Estimates
  - Projections (out to 2040)
  - Characteristics – age, household formation, ethnicity, etc.

- Economy – State, Planning Regions, Counties
  - Employment estimates on an annual basis
  - Job Forecasts (out to 2040)
  - Base Industry analysis – Economic Drivers, Direct, Indirect, & Induced jobs

- Geographic Information Systems (GIS) mapping & analysis
- Census state data center
Why are non-renewable resources so indispensable to economic life?

- Minerals and Energy Resources are used in virtually all human endeavors:
  - Preparing & Preserving Food
  - Shelter, Lighting and Climate Control
  - Raw material in the Production of Capital and Final Goods
  - Communications
  - Transportation
  - Provision of High value-added goods and services
  - Enhancing human productivity

“Energy is the Master Resource.”
– Julian Simon, 20th Century
Energy Economist
Historically, Non-Renewable Resources have been a Major Source of Economic Growth

- From 1911-2011, U.S. life expectancy increased 70% and real per capita Gross Domestic Product (GDP) grew 600%
- Extraordinary gains fueled by extensive extraction and consumption of
  - 340 billion barrels of oil,
  - 60 billion tons of coal, and
  - 1,090 trillion cubic feet of natural gas.

- In 1890 the U.S. exceeded the U.K. in GDP per capita and attained preeminence in world productivity by 1913.
- It was no anomaly that in 1913 the U.S. was also the world's largest producer of every major industrial mineral of that era.
  - The mineral intensity in U.S. manufacturing exports actually increased sharply between 1879 and 1914, the very period in which the country became the world’s manufacturing leader.
Non-renewable resources remain critical to U.S. economic pre-eminence

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Petroleum</td>
<td>First</td>
<td>Third</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>First</td>
<td>First</td>
</tr>
<tr>
<td>Coal</td>
<td>Second</td>
<td>Second</td>
</tr>
</tbody>
</table>

Source: British Petroleum, Statistical Review of World Energy 2013
U.S. Oil Production spiked in the last Decade…

U.S. Production of Crude Oil (Thousand Barrels)
So has Natural Gas…

U.S. Dry Natural Gas Production (MMcf)
While Coal has steadily increased over time.
Oil & Gas Employment has led Post-Recession Job Growth in the U.S.

- From the start of 2007 through the end of 2012, total U.S. private sector employment increased by more than 1,000,000 jobs, or 1%.
- Over the same period, the oil and natural gas industry increased by more than 162,000 jobs, a 40% increase.
Surge in Non-renewable Resource Production has exerted Profound Changes in State Economies

• Job growth in Mineral and Energy intensive states has been robust

• Unemployment rates low relative to non-resource states

• Strong Gains experienced in Per Capita Income growth

• Yielded windfall tax revenue to mineral and energy intensive states and shored up public finances
Employment Growth in “Energy” States

- Since the 1960s “Energy States” have tended to enjoy:
  - Faster job growth relative to non-energy States
  - Enter Recessions Later
  - Exit Recessions Faster

Source: Federal Reserve Bank of Kansas City
Unemployment Rates have been Lower in Energy States
Rapid Per Capita Income Growth has Pushed “Energy States” to top tier of the Nation

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis

Per Capita Personal Income - Top 10 States 2011

- Connecticut: $56,889
- Massachusetts: $47,301
- New Jersey: $45,747
- Maryland: $45,529
- New York: $41,663
- Wyoming: $41,663
- Virginia: $41,663
- New Hampshire: $41,663
- North Dakota: $41,663
- Alaska: $41,663
- U.S. Average: $41,663

Source: U.S. Dept. of Commerce, Bureau of Economic Analysis
Rapid Growth of North Dakota Severance Taxes has Swelled Government Coffers

North Dakota Severance Tax Share of Total Tax Collections (in thousands of dollars)

Source: Federal Reserve Bank of St. Louis
Importance of Non-renewable Resource Taxation

• Non-renewable Resource Extraction generates “Rents” that can be captured by Factors of Production and Governments
  • Rents are defined in economics as a return to a factor of production that does not affect her/his behavior.
  • Provided Resource prices exceed producers’ operating costs, revenues generated above the cost threshold (rents) could be taxed away without affecting producer behavior in the short run
  • Ideal to tax; unlike capital, non-renewable resources are immobile

• Additional revenue is gained via taxes on extractive sector capital, wages, and spending by mining employees and the accompanying indirect and induced spending effects
Non-renewable Resource Taxation Confers Fiscal Advantages to Resource-Abundant States

• Governments generally use taxes on non-renewable resources for the following purposes.

• Defray costs of expanding public services demand on account of surging extractive activity – particularly housing, health, transportation and protective services.

• Reduce other taxes to improve economy’s competitiveness in attracting other base industries – the so-called “Alberta Effect.”
  • Alberta has no provincial retail sales, capital, payroll, or machinery taxes
  • Alaska, Texas, and Nevada lack Individual Income Taxes
  • Wyoming has neither an Individual nor Corporate Tax

• Preserve, Invest, and Dispense non-renewable resource revenues in “Permanent Funds.”
  • Alaska, New Mexico, Alberta, Norway, among others
Natural Resources Production has Always been an Important Part of Colorado’s Economy
Colorado Non-renewable Resource Production Value, in billions of nominal dollars

$11.4 billion

Source: Colorado Geological Survey
Distribution of Colorado Mineral & Energy Value 2010 (in $Billions)

- Natural Gas: $6.76
- Oil: $3.4
- Minerals: $1.33
- Coal: $1.2
- CO₂: $0.37

Source: Colorado Geological Survey
Colorado Oil Production (2012)

Source: Colorado Oil & Gas Conservation Commission
Colorado Gas Production (2012)

Source: Colorado Oil & Gas Conservation Commission
Colorado’s Location Quotients, Non-renewable Resource Sectors (2012)

<table>
<thead>
<tr>
<th>NAICS Sector</th>
<th>Colorado</th>
<th>Wyoming</th>
<th>Texas</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAICS 21 Mining and oil &amp; gas extraction</td>
<td>2.22</td>
<td>18.11</td>
<td>4.17</td>
</tr>
<tr>
<td>NAICS 211 Oil and gas extraction</td>
<td>2.85</td>
<td>12.54</td>
<td>6.35</td>
</tr>
<tr>
<td>NAICS 212 Mining, except oil and gas</td>
<td>1.45</td>
<td>23.86</td>
<td>0.57</td>
</tr>
<tr>
<td>NAICS 2121 Coal mining</td>
<td>1.56</td>
<td>42.58</td>
<td>0.45</td>
</tr>
<tr>
<td>NAICS 2122 Metal ore mining</td>
<td>2.35</td>
<td>ND</td>
<td>0.08</td>
</tr>
<tr>
<td>NAICS 213 Support activities for mining</td>
<td>2.34</td>
<td>17.58</td>
<td>5.14</td>
</tr>
</tbody>
</table>

Source: U.S. Bureau of Labor Statistics
Colorado Non-Renewable Resource Jobs, 2001 - 2012

<table>
<thead>
<tr>
<th>Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>14,711</td>
</tr>
<tr>
<td>2002</td>
<td>14,697</td>
</tr>
<tr>
<td>2003</td>
<td>15,239</td>
</tr>
<tr>
<td>2004</td>
<td>16,546</td>
</tr>
<tr>
<td>2005</td>
<td>19,436</td>
</tr>
<tr>
<td>2006</td>
<td>23,314</td>
</tr>
<tr>
<td>2007</td>
<td>28,158</td>
</tr>
<tr>
<td>2008</td>
<td>32,161</td>
</tr>
<tr>
<td>2009</td>
<td>27,776</td>
</tr>
<tr>
<td>2010</td>
<td>27,651</td>
</tr>
<tr>
<td>2011</td>
<td>31,505</td>
</tr>
<tr>
<td>2012</td>
<td>34,049</td>
</tr>
</tbody>
</table>
Colorado Job growth from 2001-2012 has been lead by the Non-renewable Resource Sector

<table>
<thead>
<tr>
<th>Industry</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas / Mining</td>
<td>12.0%</td>
</tr>
<tr>
<td>Mgmt of Companies</td>
<td>7.1%</td>
</tr>
<tr>
<td>Education Services</td>
<td>5.3%</td>
</tr>
<tr>
<td>Health Services</td>
<td>3.4%</td>
</tr>
<tr>
<td>Arts</td>
<td>2.2%</td>
</tr>
<tr>
<td>Prof. Business Services</td>
<td>2.0%</td>
</tr>
<tr>
<td>Government</td>
<td>1.6%</td>
</tr>
<tr>
<td>Other Services</td>
<td>1.3%</td>
</tr>
<tr>
<td>Accomodation &amp; Food</td>
<td>1.2%</td>
</tr>
<tr>
<td>Administration</td>
<td>1.1%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>0.8%</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.1%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.1%</td>
</tr>
<tr>
<td>Retail Trade</td>
<td>0.0%</td>
</tr>
<tr>
<td>Finance</td>
<td>-0.1%</td>
</tr>
<tr>
<td>Transport &amp; Warehousing</td>
<td>-0.2%</td>
</tr>
<tr>
<td>Wholesale Trade</td>
<td>-0.4%</td>
</tr>
<tr>
<td>Construction</td>
<td>-2.0%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>-2.4%</td>
</tr>
<tr>
<td>Information</td>
<td>-2.9%</td>
</tr>
</tbody>
</table>

Oil & Gas / Mining averaged growth of 12% per year from 2001-2012 with Manufacturing declining by 2.4% per annum over the same timeframe.
Oil & Gas / Mining averaged growth of 12% per year from 2001-2012 with Manufacturing declining by 2.4% per annum over the same timeframe.

Colorado Job growth from 2001-2012 has been lead by the Non-renewable Resource Sector.

<table>
<thead>
<tr>
<th>County</th>
<th>Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kiowa</td>
<td>5.8%</td>
</tr>
<tr>
<td>Denver-Boulder MSA</td>
<td>6.7%</td>
</tr>
<tr>
<td>Yuma</td>
<td>7.0%</td>
</tr>
<tr>
<td>Colorado Average</td>
<td>7.4%</td>
</tr>
<tr>
<td>Park</td>
<td>7.7%</td>
</tr>
<tr>
<td>El Paso</td>
<td>7.8%</td>
</tr>
<tr>
<td>Elbert</td>
<td>7.8%</td>
</tr>
<tr>
<td>Morgan</td>
<td>8.0%</td>
</tr>
<tr>
<td>Clear Creek</td>
<td>8.8%</td>
</tr>
<tr>
<td>Chaffee</td>
<td>8.8%</td>
</tr>
<tr>
<td>Rio Blanco</td>
<td>8.9%</td>
</tr>
<tr>
<td>Lake</td>
<td>9.0%</td>
</tr>
<tr>
<td>Saguache</td>
<td>9.6%</td>
</tr>
<tr>
<td>Delta</td>
<td>10.7%</td>
</tr>
<tr>
<td>Larimer</td>
<td>12.6%</td>
</tr>
<tr>
<td>Mesa</td>
<td>12.9%</td>
</tr>
<tr>
<td>La Plata</td>
<td>13.8%</td>
</tr>
<tr>
<td>Adams</td>
<td>14.1%</td>
</tr>
<tr>
<td>Mineral</td>
<td>14.1%</td>
</tr>
<tr>
<td>Ouray</td>
<td>14.6%</td>
</tr>
<tr>
<td>San Juan</td>
<td>16.8%</td>
</tr>
<tr>
<td>Weld</td>
<td>23.2%</td>
</tr>
<tr>
<td>Garfield</td>
<td>23.6%</td>
</tr>
<tr>
<td>Broomfield</td>
<td>29.1%</td>
</tr>
<tr>
<td>Douglas</td>
<td>58.0%</td>
</tr>
</tbody>
</table>
Why is Mineral & Energy Production so important to resource-abundant counties?

• Mineral & Energy Production constitutes an important “base industry”, which in turn produces indirect and induced jobs through the multiplier effect
  • Extractive activities tend to have relatively large multipliers

<table>
<thead>
<tr>
<th>Industry</th>
<th>Weld</th>
<th>Garfield</th>
<th>La Plata</th>
<th>Delta</th>
<th>Routt</th>
<th>Moffat</th>
</tr>
</thead>
<tbody>
<tr>
<td>LQ: NAICS 21 - Mining and oil &amp; gas extraction</td>
<td>9.87</td>
<td>16.12</td>
<td>4.76</td>
<td>16.08</td>
<td>6.61</td>
<td>19.62</td>
</tr>
<tr>
<td>Job Multiplier: Mining and Oil &amp; Gas</td>
<td>2.86</td>
<td>2.42</td>
<td>2.92</td>
<td>2.70</td>
<td>2.42</td>
<td>2.42</td>
</tr>
<tr>
<td>Job Multiplier: Agriculture</td>
<td>2.24</td>
<td>1.75</td>
<td>1.68</td>
<td>1.79</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>Job Multiplier: Manufacturing</td>
<td>2.59</td>
<td>1.90</td>
<td>1.86</td>
<td>2.03</td>
<td>1.90</td>
<td>1.90</td>
</tr>
<tr>
<td>Job Multiplier: Government</td>
<td>1.45</td>
<td>1.36</td>
<td>1.35</td>
<td>1.38</td>
<td>1.36</td>
<td>1.36</td>
</tr>
</tbody>
</table>
Fiscal Importance of Non-renewable Resources to County Governments

- Mineral & Energy Extraction Produces an important source of revenue to local governments to furnish the public goods and services demanded by constituents

- Mining and Oil & Gas account for 73% of Taxable Property in Garfield County, 49% in La Plata, 45% in Weld, and 31% in Moffat

Source: U.S. Bureau of Labor Statistics
Colorado Severance Tax & Federal Mineral Lease Receipts by Calendar Year

Source: Treasury Department, State of Colorado
Total Energy Impact Grants Awarded
FY2008-2010

Dollars Represent Awards
- $14,100,000 - $26,000,000
- $8,900,000 - $14,100,000
- $3,500,000 - $8,900,000
- $1,500,000 - $3,500,000
- $0 - $1,500,000

Awarded $75,553,004 in Federal Mineral Lease (FML)
Awarded $163,276,195 in Severance Revenue
Total Energy Impact Assistance Fund Award $238,829,199
Leveraged $827,582,987
Total Investment in Communities $1,066,412,186

Energy Impact Grant
Leverage Ratio is 1:3.4
For every dollar awarded from the Energy Impact Assistance Fund, over three additional dollars come from local sources.
Mineral & Energy Extraction Issues
Mineral & Energy Prices are Markedly Variable

• Mineral & Energy Prices are prone to undergo severe and prolonged bouts of “Boom & Bust”

• Sharp swings in commodities prices exacerbate vulnerability of mineral & energy intensive economies to strong growth followed by depressed activity.

• Mineral and Energy production generates negative externalities and complicates the planning and provision of public services.
Commodity Price Swings: Oil Prices

• Applying the Bry-Boschan Algorithm, which is used by the National Bureau of Economic Research to identify Recessions in GDP data, to monthly Real U.S. Oil Prices monthly from Jan. 1970 – Aug. 2013 yielded the following:

• Average Contraction 17.5 Months; Longest Contraction 56 months (Nov. 1981 - July 1986)

• Average Expansion 17.4 Months; Longest Expansion 36 Months (Jan. 2005 – Dec. 2007)

• Average Price Decrease during contraction: -44.2%
• Average Price Increase during expansion: 55.1%
Determinants of Mineral & Energy Price Movements

- Distinction Must be Made between Short and Long Run

- Short Run driven by macroeconomic fluctuations, highly inelastic supply and demand curves
  - Low Own Price Elasticity of Demand in SR
  - Low Price of Substitute Elasticity of Demand
  - High Income Elasticity of Demand
  - High Own Price Elasticity of Supply up to Capacity Constraint
  - Short Run Supply vulnerable to strikes, government expropriation, and cartel activities

- Long run: Largely shifts in supply curve driven by changes in production costs
  - Ongoing tug of war between scarcity and technological change; Demand mostly irrelevant
Mineral Supply & Demand in the Short Run

Source: Colorado School of Mines
Mineral Supply & Demand in the Long Run

Source: Colorado School of Mines
Impact of Oil & Gas Development on Local Economies

- Oil & Gas activity tends to occur in rural areas and local communities possess limited ability to absorb and service new development
  - Public lands and topographic barriers can force inefficient development
- Existing road systems not intended to serve high levels of traffic and heavy trucks
- Worker shortages, compounded by rising housing and cost of living expenses, make retention of workers across all non-energy industries difficult and expensive.
  - Scarcity of contractors and the competition for their services along with shortages of materials drives up the costs of new projects and personnel.
- New residents arrive first and revenues follow, sometimes years later
Oil & Gas Impact on Roads

- Oil & Gas activity produces high volumes of traffic in an area with limited road system capacity
  - The industry is decentralized and highly mobile, and its employees and subcontractors commute each day to job sites in remote areas
  - High volumes of vehicle traffic persist even as activity transitions from drilling to production and maintenance

- Road expansion, a mixture of surface improvements, system expansions, safety enhancements, and on-going maintenance, are the most pressing needs.
  - Funding for immense road system upgrades expensive and difficult to plan, finance, and construct speedily
Traffic Congestion and Population Growth

Percent Growth 2000-2007:

- **Garfield**: 39% (VMT), 16% (Population)
- **Rio Blanco**: 35% (VMT), 1% (Population)
- **Mesa**: 25% (VMT), 12% (Population)
- **Moffat**: 23% (VMT), 2% (Population)
- **State of Colorado**: 11% (VMT), 10% (Population)

Source: Colorado Department of Transportation, 2007.
Oil & Gas Impact on Local Services

• The iterant nature of the Oil & Gas coupled with its tendency to induce sudden population increases creates socio-economic challenges.

• Although beneficial for local residents, a surge in Oil & Gas activity can strain the delivery capacity of local governments, hospitals, protective services and schools.

• Housing and multi-family rents driven up by well-remunerated Oil & Gas workers.

• Influx of generally single young men can give rise to the so-called “Gillette Syndrome” or dislocations arising from rapid population growth on account of non-renewable resource extraction.

  • Kohrs (1974) found Gillette, WY the self-styled “Energy Capital of the United States” suffered from increased crime, mental health disorders, and social instability relative to non-energy communities in Wyoming
Oil & Gas Impacts on Public Finance

• Funding and timing of investment in indispensable capital infrastructure, such as roads, water, sewer and community amenities are immediate fiscal challenges

• The extended interval between infrastructure demands and tax revenue receipts exacerbates funding challenges

• Residents need functioning communities when they arrive, but most revenue sources (property taxes, sales taxes and severance taxes) occur only after new workers are in place, drilling and production is complete, and tax revenue flows

• “Tax lag” problem is further exacerbated by the necessity to plan, design, finance and construct critical infrastructure even before resident relocation
  • Uncertainty heightened by the realization that new arrivals’ duration in town driven by the machinations of world energy prices and greener pastures (cheaper extraction locations) elsewhere
Public Finance Timing Issue

**Infrastructure Needs**

**Capital Revenues**

3 to 8 Years

New Resident Demand

Construction

Planning & Design

Revenues Received

Source: BBC Research & Consulting
Impacts on Local Economic Development

The Non-renewable resource sector’s willingness and ability to pay high wages on the part amid a boom in commodity prices can impinge on local economic development in several ways

• First, the sector, particularly oil and gas registers an initial surge in jobs related to drilling; once drilling and wells completed, the sector needs fewer jobs to oversee production
  • Drilling jobs created per producing well drilled is 3.4; Production & Maintenance Jobs per producing well 0.17
  • Ratios falling as drilling technology continues to become more efficient.

• Second, non-renewable resource extraction may depress local economies’ traditional export sectors (e.g. manufacturing, agriculture)
  • **Resource Movement Effect** occurs when non-renewable sector’s demand for labor raises the local wage rate and draws labor away from the traditional export sector alike, causing production to decline in the traditional sector
  • **Spending Effect** occurs when employees in the non-renewable sector spend money on local goods and services, increasing local prices and further reducing competitiveness of the traditional export sector
Does the “Dutch Disease” Hypothesis Hold Empirically?

- The empirical evidence is mixed at both the case study and cross-country comparison level
  - Results depend on the nation(s) chosen, time period, and empirical estimation methods

- Sub-national, sub-state data tends to show that the traditional export sector does not shrink in non-renewable resource abundant counties amid a boom relative to non-abundant counties

- Still an open research question
Summary

• Commensurate with its “Boom-and-Bust” moniker, the effects of mineral and energy extraction possess both promise and peril.

• Non-renewable resource extraction tends to be welfare-enhancing for economies undergoing a boom in production.

• Nevertheless, the costs borne by communities to defray sector impacts and the uncertainties surrounding its duration can create significant social, economic, and fiscal challenges.

• Planning for the current and future local needs during both Booms and Busts becomes Imperative.
Do you have Questions for my Answers???