Abstract

The growing list of complaints from local residents about the community, health and environmental damages from drilling can no longer be downplayed or ignored by oil and gas companies or by local, state and federal decision-makers. We believe that the political, economic and judicial views on what constitutes “responsible oil and gas development” must evolve to reflect the current understandings of the environmental and socioeconomic consequences of oil and gas development. We propose a new framework for implementing responsible oil and gas development based on a phased development strategy guided by the precautionary principle and adaptive management, and backed by an updated suite of economic instruments based on the polluter pays principle. We believe our framework provides a more responsible approach to oil and gas development than historic oil and gas development patterns.
Road Map

a. TWS Research
b. Land Ethic
c. Preview of Phased Energy Development
d. Energy Consumption Ethic
e. NIMBY Hypocrisy Curves
f. 100 year supply of Natural Gas and ask a Philosophical Question
g. Brief Review of the Domestic Drilling Boom
h. Brand Damage to Oil and Gas Industry
i. Economically Recoverable Natural Gas
j. Resource Triangle and Market Prices
k. Externalities – Hidden Costs
l. Fugitive Emission
m. Wildlife Impacts
n. Community Development – Boom-bust and the Resources Curse
o. Natural Amenity Development
p. Redefining Responsible Oil and Gas Development
q. Some Research Questions
The Wilderness Society Energy Research
2001 - 2008

• Report comparing jobs from drilling in the Arctic National Wildlife Refuge to the jobs from investments in energy efficiency and renewable energy (2002).


• Developed original GIS methods for estimating the level of habitat fragmentation from proposed plans for natural gas drilling (2007).

• Law review articles on risk assessment, NEPA and energy development (2007).

• Journal articles on boom and bust energy development and its impact on local communities -- including recommendations for phased development (2007)

• GIS assessment of oil and natural gas underneath the Wyoming Range (2008).
The Land Ethic

“All ethics so far evolved rest upon a single premise that the individual is a member of a community of interdependent parts….The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land.

In short, a land ethic changes the role of *Homo sapiens* from conqueror of the land-community to plain member and citizen of it. It implies respect for his fellow-members, and also respect for the community as such.”

*Aldo Leopold (1949), A Sand County Almanac.*
Drilling at a fast pace and over a large scale is inconsistent with an American Land Ethic. Pace and scale of drilling are key variables in determining the economic development impacts and the magnitude of externalized damages to the environment and to public health. Faster and bigger are not always better. We support the right of local communities to regulate the pace and scale of oil and gas development.

Source: Klopf, Culver and Morton (2007); Haefele and Morton, (2009), Morton and Kerkvliet (forthcoming)
Regulating the pace and scale of management is not a new concept for limiting negative and unintended consequences. At the time of the founding of the U.S. Forest Service, rapid overcutting of the forest resource was a primary concern of President Teddy Roosevelt and his Chief Forester Gifford Pinchot. Controlling the pace and scale of logging, a practice known as forest regulation, was recommended by Pinchot in order to provide “for the greatest good of the greatest number for the longest time” (Pinchot 1947). Phased energy development similarly slows the pace and scale of oil and natural gas drilling to avoid its worst consequences – foreseen and unforeseen (Aplet and Morton, forthcoming).
We begin at the beginning, when every square foot of the land we call the public domain was controlled by Native American tribes.

“The tribes are not going anywhere, and they’re not an ordinary stakeholder,” Echo-Hawk explained. “Their interests must be taken into account, their needs and their authentic aspirations, and in our discourse we need to be accountable to that.” But at its core, this discourse should be founded upon… – a new American land ethic that moves beyond the colonial understanding of land in terms of potential yield and instead values and protects indigenous habitat, holy places, and cultural resources. “I apologize if I’ve been the skunk at the picnic,” Echo-Hawk said in closing, “but I wanted to really drive home a very strong indigenous perspective on the subject at hand.”

Reference: Limerick et al. 2012. Center of American West Summary
In 1859 oil was struck in Pennsylvania. The magic fluid unleashed Yankee ingenuity, put America on wheels, and helped to create the world’s richest superpower….Today it is difficult to overstate oil's importance to our economy. Four percent of the world's people, we use 25% of the world's oil—nearly 20 million barrels per day. **We are an Oil Tribe, the Petroleum Clan, imbibing about 3 gallons per person per day.**

The automobile is our most cherished icon, a new car our symbol of success. **The local gasoline station is our secular temple** where each week 150 million Americans “fill ‘er up.” An average American drives 1,000 miles a month, 12,000 miles a year, the distance to the Moon every 20 years. The Oil Tribe numbers 280 million. **Hungry for speed, addicted to motion, we consume our weight in petroleum every 7 days.**

To help reduce our energy consumption, citizens and businesses could voluntarily embrace an "energy consumption ethic" -- which flows directly from an American "land ethic".

An energy consumption ethic includes:

1) Reducing our consumption of fossil fuels; and

2) "Greening up" the supply chain of the fossil fuels that we use. This could be accomplished with a Third Party Certification Process to provide a market-based mechanism similar to the Forest Certification Process and LEEDS.
“Doing the same thing and expecting different results is one definition of insanity.”

Source: Confucius, Ben Franklin, Albert Einstein, Narcotics Anonymous
By embracing an energy consumption ethic, individuals and businesses can directly address their addiction and their hypocrisy by reducing consumption (C2 to C1) and moving down the curve of hypocrisy (H2 to H1). Investing in renewable energy to reduce consumption of fossil fuels will also reduce hypocrisy.

Source: Morton and Kerkvliet (forthcoming)
In 2013, the Potential Gas Committee estimated that the U.S. has 2384 Tcf of undiscovered technically recoverable natural gas. When the U.S. proven reserves of 305 Tcf are added to the total, the potential U.S. supply of natural gas supply is 2689 Tcf.

Let’s assume an economic recovery rate of 100 percent for the undiscovered technically recoverable natural gas. Based on current U.S. natural gas demand, domestic supplies will last 105 years.

If we decrease our annual consumption of natural gas 1 or 2 percent -- down to half of our current rate of consumption -- U.S. domestic natural gas supplies will last 165 years and 186 years, respectively.

In contrast, if our annual consumption of natural gas increases 2 percent, domestic natural gas supplies will last only 53 years.

If our annual consumption of natural gas increases 5 percent, domestic natural gas supplies will last only 35 years.

Source: Morton and Kerkvliet (forthcoming)
Rawls’s Veil of Ignorance and Our Decision to Rapidly Consume our Oil and Natural Gas

The “veil of ignorance” deprives parties of all knowledge of particular facts about themselves, about one another, and even about their society and its history.  John Rawls, A Theory of Justice, 1971

**Question** : If you did not know whether you were to be alive in 2009 -- the current generation -- or in the year 2525 – a future generation -- would you:

A) Prefer the current generation to rapidly consume our remaining non-renewable oil and natural gas endowment?

B) Prefer the current generation to dramatically reduce its consumption in order to leave some oil and natural gas in the ground for future generations?

In addition to reducing consumption, individuals and businesses can express their preferences in the market place more responsible oil and gas development and a “cleaner and greener” fossil fuel supply chain. A Third Party Certification process can provide a market-based mechanism for shifting the curve of hypocrisy resulting in less hypocrisy for a given level of consumption.
Annual drilling data reveal the boom and bust nature of oil and gas drilling. More than 2.5 million oil and gas wells have been drilled in the U.S. – more wells drilled than in any other country. The U.S. drilling history includes 1.1 million oil wells, 784,000 dry wells, and 678,000 natural gas wells.

The Fractivism Movement is Likely to Continue to Grow if Drilling Negatively Impacts More Landowners and Communities.
The Oil and Gas Industry and Brand Damage

From Clean Burning Natural Gas to Fracked Gas

Technically Recoverable Estimates May Not be Economic to Recover at Current Prices

Dismissing Environmental and Community Concerns Threaten Industry’s “Social License to Operate”

Ridiculing Your Customers by Calling them Extremists and Radicals is a Really Bad Marketing Plan

Questionable Job Claims Undercut Industry’s Credibility
If we are going to base natural gas supply estimates on what’s technically possible, we should do the same for renewable energy. It’s technically possible to be getting most if not all of our energy from renewable energy sources.
Estimates of the cost of oil shale processing plants increased 8-fold -- from original estimates of under $200 million in 1968 to over $1.6 Trillion in 1980

…science tells us that greenhouse gas emissions are an externality; in other words, our emissions affect the lives of others. When people do not pay for the consequences of their actions we have market failure. This is the greatest market failure the world has seen.” Sir Nicholas Stern, UK Treasury, October 2006
Historically high prices for oil and natural gas fueled the domestic drilling boom.
U.S. Natural Gas Supply Curve, with Uncertainty

Source: Morton and Kerkvliet (forthcoming)
Fossil Fuels and Centralized Power = Buying a Main Frame Computer

Renewable Energy and Distributed Power = Buying a Laptop Computer
“...science tells us that greenhouse gas emissions are an **externality**; in other words, our emissions affect the lives of others. When people do not pay for the consequences of their actions we have market failure. This is the **greatest market failure the world has seen.**”  Sir Nicholas Stern, UK Treasury, October 2006
The Hidden Costs from Oil and Natural Gas Drilling Spillover into our Communities and Environment

**Direct use costs** – displacement or loss of land for habitat, recreation opportunities, hunting, farmland, grazing, reclamation costs, water quantity and drought

**Community concerns** – NOx, VOCs, ozone and kids health, truck traffic and infrastructure costs, property values, loss of local control, displaced jobs and revenues due to “crowding out”, natural amenities and quality of life issues, loss of retirement income, displaced farming due to competition for water, boom-bust cycles, revenue lag and fiscal risks, water treatment plants and recycled fracking water, draining of reservoirs for fracking water and the loss of fishing and recreation revenue

**Science benefits foregone** -- loss of natural areas for scientific study

**Off-site damages** – fugitive methane emissions, water pollution from spills, noise pollution from compressor stations, visual impacts, erosion from well pads and roads, pipeline explosion risks, road dust on petroglyphs and snowpack, seismic activity from injection wells

**Biodiversity impacts** – loss and fragmentation of wildlife habitat by roads and well pads, pipelines are conduits for invasive weeds, endocrine disrupters impact to amphibians and fish, produced water holding ponds and bird deaths

**Ecosystem service costs** – water lost to fracking, impacts to aquifer re-charge and wetland function, carbon lost via land use change, fossil fuels and climate change

**Passive use benefits foregone** -- loss of option, bequest and existence benefits generated by open space, parks and wildlands.

Decrease in Property Values from Oil and Gas Facilities
There is currently only one peer-reviewed article on the impact of oil and natural gas facilities on residential property values. The results show that property values are negatively correlated with the number of gas wells. The study’s mean estimates indicate that when residential properties are within 4 km (about 2.5 miles) of oil and gas facilities, property values decline 4-8 percent. The impact can easily be twice that depending upon the level and composition of the nearby industry activities. Source: Boxal, P.C. et al. 2005. The Impact of Oil and Natural Gas Facilities on Rural Residential Property Values: A Spatial Hedonic Analysis. Resource and Energy Economics.

Increased Road Costs from Truck Traffic
A consulting report on increased road maintenance costs completed for Douglas County indicates that drilling creates a fiscal hole for taxpayers, and the faster the pace of drilling the deeper the fiscal hole. A recent analysis completed for Boulder County found additional road costs from drilling truck traffic amount to $33,000-45,000 per well. Source: Douglas County Oil & Gas Production Transportation Impact Study (2012). Boulder County Oil and Gas Roadway Impact Study (2012).

Increased Health Care Costs from Ozone Pollution
Ozone pollution exacerbates a range of health problems for local residents including respiratory illnesses and asthma. A recent Wyoming Department of Health study found that the number of clinic visits for adverse respiratory-related effects increased 3 percent for a 10 ppb increase in 8-hour max ground-level ozone. It makes little sense to allow a hazardous industry within city limits if kids and parents get sick and miss more work or school. Source: Pride, K., J. Peel, B. Robinson, A. Busacker, J. Grandpre, F. Yip, T. Murphy. 2013. Associations of Short-Term Exposure to Ozone and Respiratory Outpatient Clinic Visits — Sublette County, Wyoming, 2008–2011. Wyoming Department of Health, Public Health Division.
Within the Pinedale Resource Area in Wyoming, 99 percent of all Volatile Organic Compounds (VOCs) and 97 percent of nitrogen compounds (NOX) were released by oil and natural gas operations.

The National Research Council estimated the hidden costs from burning fossil fuels – like fugitive emissions -- exceed $120 billion per year.

Photo Credits: Earthjustice and EarthWorksAction.
Figure 5.1 The U.S. Natural Gas Infrastructure, Including Gas Consuming Sectors

Source: MIT 2011
“To improve understanding of leakage rates for policy-makers, investors, and other decision-makers, we review 20 years of technical literature on NG emissions in the United States and Canada… We find (i) measurements at all scales show that official inventories consistently underestimate actual CH4 emissions, with the NG and oil sectors as important contributors; (ii) many independent experiments suggest that a small number of “super emitters” could be responsible for a large fraction of leakage; (iii) recent regional atmospheric studies with very high emissions rates are unlikely to be representative of typical NG system leakage rates; and (iv) assessments using 100-year impact indicators show system-wide leakage is unlikely to be large enough to negate climate benefits of coal-to-NG substitution.”

“Footprint” of Big Piney-Labarge Oil and Gas Field

1,400 miles of linear features
3.8 miles$^2$ of spatial features
7 mile$^2$ (4%) physical footprint

Percentage of the Study Area with Different Feature Edge Densities

<table>
<thead>
<tr>
<th>Linear feature density (miles/square mile)</th>
<th>Based on a one-square-mile grid</th>
<th>Based on a four-square-mile grid</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 3</td>
<td>22%</td>
<td>12%</td>
</tr>
<tr>
<td>3 - 6</td>
<td>49%</td>
<td>64%</td>
</tr>
<tr>
<td>6 - 9</td>
<td>20%</td>
<td>14%</td>
</tr>
<tr>
<td>&gt; 9</td>
<td>9%</td>
<td>10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Indicator Value</th>
<th>Impact/Observation</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagebrush-obligate birds</td>
<td>328 foot distance to nearest road</td>
<td>Within this distance the density of sagebrush-obligate birds drops by 50 percent regardless of the amount of activity on the road.</td>
<td>Ingelfinger 2001</td>
</tr>
<tr>
<td>Greater Sage-grouse</td>
<td>1 well pad per square mile pad density</td>
<td>Measurable negative impacts on breeding populations are observed at this density.</td>
<td>Wyoming Game and Fish Department 2008</td>
</tr>
<tr>
<td>Mule Deer</td>
<td>1.6, 1.9, and 2.3 mile distances from well pads</td>
<td>Minimum distances away from well pads that deer are most likely to occur over three years of progressive oil and gas development.</td>
<td>Sawyer et al. 2006</td>
</tr>
<tr>
<td>Pronghorn</td>
<td>0.6 mile distance to nearest road</td>
<td>Distance from a maintained road at which pronghorn exhibit avoidance.</td>
<td>Ockenfels et al. 1994</td>
</tr>
<tr>
<td>Bighorn Sheep</td>
<td>433 foot distance to nearest road</td>
<td>Sheep flee from human activity on roads at this distance.</td>
<td>Papouchis et al. 2001</td>
</tr>
</tbody>
</table>

Source: Dr. Janice Thomson – The Wilderness Society Seattle, WA
Core Areas Beyond Infrastructure Effect Zone

Core areas beyond 250-foot effect zone

Core areas beyond one-quarter mile effect zone

Drilling for natural gas resulted in the loss and fragmentation of wildlife habitat – and a 40% decline in deer populations.

All this drilling happened in less than 5 years – much faster than assumed by the BLM in its EIS.

Source: SkyTruth and The Wilderness Society
If we want to see elk, mule deer and pronghorn antelope in Yellowstone National Park in the summer we need to protect their migration routes to their critical winter habitat south of Pinedale, WY.

Source: www.uppergreen.org
Hypothetical Oil and Gas Field Build-out

GIS Modeling of Projected Natural Gas Drilling Build-out In Little Snake Resource Area. NW Colorado

Map 3D - Existing & Model Well Pads and Greater Sage-Grouse Priority Habitat
Scenario 3: Colorado Division of Wildlife Recommendations (All disturbance Restrictions Mandatory)

Lessons from Drilling Booms in Pinedale, WY and Rifle, CO

- increased trucks and traffic congestion
- increased wear and tear on local infrastructure
- a rise in crime and emergency service calls
- increased demand for public services
- revenue lag creates short term fiscal risk
- potential to “crowd out” existing residents and businesses

Source: BBC Research and Consulting, 2008

- an influx of non-local workers
- workers filled motels displacing tourist spending
- retirees may relocate to another community
- subject to boom and bust cycles
- elevated VOCs and ozone pollution

Source: Jacquet, 2005
The Resource Curse

Many studies have found that national economies relying heavily on natural resource extraction are poor performers in terms of growing income, decreasing poverty, and improving lives. This poor performance has become known as the “resource curse”. The earliest studies found evidence of the resource curse in nations such as Nigeria, where declining per capita incomes and increasing poverty accompany dramatic increases in oil production.

A 2011 study of U.S. counties found that a typical resource rich county whose economy was 20 percent dependent on resource extraction experienced slower per capital income growth compared to a county with 5 percent dependency.

A 2007 study of U.S. states found that in 20 years, a state with a five percent greater resource reliance than the average would have $1400 less per capita income; in 40 years the lag would be $4600. This study also found that resource reliance is correlated with an increasing number of public officials prosecuted for corruption.

References

The economic challenge is to adapt sustainable development concepts -- grounded in the stewardship of renewable resources -- to non-renewable resources like oil and gas.

Goals of responsible energy development includes avoiding boom and bust cycles and the resource curse – while also protecting our natural amenities.

Source: Morton and Kerkvliet (forthcoming)
Natural amenities include open space and scenic vistas; birds, wildlife, blue-ribbon fisheries; recreation amenities, such as hiking and biking trails, hunting, ski areas; lakes, mountains and environmental amenities (clean air and water).

Natural Amenities when combined with community amenities can attract:
- high skill labor force
- small businesses and entrepreneurs
- recreation and tourism-based businesses
- retirees who bring their accumulated wealth

Natural amenities are often site-specific and not easily matched by urban areas or other regions.

Source: Morton and Kerkvliet (forthcoming)
Job Trends in the Rockies (CO, ID, MT, NM, UT, WY) 1990 - 2011

Data Source: Regional Economic Information System, Bureau of Economic Analysis, U.S. Department of Commerce, 2012

Source: Morton and Kerkvliet (forthcoming)
Total Personal Income in Rockies (CO, ID, MT, NM, UT, WY), 2011

Data Source: Regional Economic Information System, (2012). Bureau of Economic Analysis, U.S. Department of Commerce

Source: Morton and Kerkvliet (forthcoming)
Colorado has the most mature natural amenity-based state economy in the Rockies. Colorado’s Boulder County provides an example of a mature natural amenity-based local economy.


Source: Morton and Kerkvliet (forthcoming)
Oil and Natural Gas Job Estimates: A Moving Target

McDonald et al., (2007) estimated **70,779 jobs** in Colorado’s oil and natural gas industry. Report prepared by Booz Allen consulting and the Colorado School of Mines (includes direct, indirect and induced jobs).

Price Waterhouse Cooper, (2009, 2013) estimated **190,408 and 213,100 jobs respectively** in Colorado’s oil and natural gas industry. Report prepared for the oil and natural gas industry (includes direct, indirect and induced jobs).

Wobbekind et al. (2011, 2013) estimated **107,566 and 111,000 jobs respectively** in Colorado’s oil and natural gas industry. Report prepared for Colorado Oil and Gas Association by economists at University of Colorado (includes direct, indirect and induced jobs).

Morton (2012) estimates **27,633 jobs** in Colorado’s mining sector which includes the oil and natural gas industry. Includes only the direct jobs estimated with data from Bureau of Economic Analysis, U.S. Department of Commerce.

Job estimates vary widely based on the assumptions chosen, the data collected (primary or secondary), and whether an input-output model was used to generate estimates of indirect and induced jobs.

Source: Morton and Kerkvliet (forthcoming)
Assumptions Matter

What quantity of oil-gas is “off-limits”?
Was technically recoverable oil-gas used to estimate jobs?
What is the assumed scale of drilling?
What is the assumed pace of drilling?
How productive are the wells?

Define direct jobs. How wide a net?

% local landowners? % local mineral owners?

Use built-in model parameters or collect primary data to estimate % local expenditures?

IMPLAN model assumptions
1. Static model for a dynamic economy (e.g. labor is not mobile)
2. No change in technology
3. No spatial component
4. Fiscal and environmental costs not counted
5. Crowding out-economic displacement effects not considered
6. Net revenue is not calculated

TOTAL ESTIMATED JOBS

Source: Morton and Kerkvliet (forthcoming)
### Jobs Supported by Oil and Gas in Colorado (direct, indirect and Induced jobs)

<table>
<thead>
<tr>
<th>IMPLAN Sector</th>
<th>Oil and Gas State Employment</th>
<th>% of Oil and Gas Employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining (includes oil and gas)</td>
<td>15,304</td>
<td>22%</td>
</tr>
<tr>
<td>Government</td>
<td>9,701</td>
<td>14%</td>
</tr>
<tr>
<td>Professional Services</td>
<td>5,995</td>
<td>9%</td>
</tr>
<tr>
<td>Retail</td>
<td>5,722</td>
<td>8%</td>
</tr>
<tr>
<td>Health Care and Social Services</td>
<td>5,184</td>
<td>7%</td>
</tr>
<tr>
<td>Accommodations/Food Service</td>
<td>3,954</td>
<td>6%</td>
</tr>
<tr>
<td>Finance &amp; Insurance</td>
<td>3,764</td>
<td>5%</td>
</tr>
<tr>
<td>Other Services</td>
<td>3,719</td>
<td>5%</td>
</tr>
<tr>
<td>Administration</td>
<td>3,316</td>
<td>5%</td>
</tr>
<tr>
<td>Wholesale</td>
<td>2,658</td>
<td>4%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>2,235</td>
<td>3%</td>
</tr>
<tr>
<td>Transportation/Warehousing</td>
<td>2,094</td>
<td>3%</td>
</tr>
<tr>
<td>Management</td>
<td>1,587</td>
<td>2%</td>
</tr>
<tr>
<td>Arts/Entertainment/Recreation</td>
<td>1,396</td>
<td>2%</td>
</tr>
<tr>
<td>Construction</td>
<td>1,067</td>
<td>2%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>984</td>
<td>1%</td>
</tr>
<tr>
<td>Information</td>
<td>882</td>
<td>1%</td>
</tr>
<tr>
<td>Education Services</td>
<td>768</td>
<td>1%</td>
</tr>
<tr>
<td>Utilities</td>
<td>249</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td>Ag/Forestry/Fishing/Hunting</td>
<td>199</td>
<td>&lt; 1%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>70,779</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Data Source: McDonald et al. (2007) Colorado School of Mines/Booz-Allen Study, Exhibit 2-46
McDonald et al. (2007) did a good job collecting primary data by surveying companies to capture expenditure and revenue patterns. The survey results show very low multipliers for indirect and induced effects.

For example, the multiplier for the Piceance Basin was 1.09 – indicating a high level of non-local jobs (i.e. out-of-state contractors and drilling crews).

"While the Piceance Basin has considerable drilling and completion, and recompletion investments, a considerable amount of the economic activity leaks out of basin (73%) and out-of-state (57%).“ Page 29.

For the State of Colorado, oil and gas extraction generated $19.5 billion dollars in revenue – approximately 79% of which leaks out of the state.

Source: Morton and Kerkvliet (forthcoming)
Oil and Natural Gas Job Estimates: A Moving Target

If the Oil and Gas industry is going to expand direct jobs to include retail jobs – for symmetry in analytical methods -- all industries should use expanded direct jobs in IMPLAN. For example:

a) Outdoor Recreation Industry should include REI retail jobs as direct jobs;

b) The Micro-Brewery Industry should include retail jobs in liquor stores direct jobs; and

c) The Timber Industry should include Home Depot retail jobs as direct jobs.

Because IMPLAN job estimates vary widely based on the assumptions chosen and the data collected -- it is much better to compare just the direct jobs between industries.

Morton (2012) estimates 27,633 direct jobs in Colorado’s mining sector which includes the oil and natural gas industry – less than 2 percent of total jobs.

Source: Morton and Kerkvliet (forthcoming)
Natural Oil and Gas Job Questions

Did industry expand the direct oil-gas jobs to include 7-11 clerks and gas station attendants?

Who will get the jobs created? Are they local jobs?

Was the proportion of goods and services purchased locally estimated with primary data collected through surveys of companies and landowners?

Were landowners and mineral holders assumed to be local residents?

Was any sensitivity analysis completed on key assumptions and data inputs?

How will other regional industries, such as recreation and tourism, be impacted?

Source: Morton and Kerkvliet (forthcoming)
Simultaneous Production of Natural Amenity Jobs and Natural Oil-Gas Jobs

Focus on Net Job Growth

NA1 + OG1 Jobs > NA2 + OG2 Jobs

Oil and gas development does not occur in an economic vacuum. Community planners need to distinguish between short term economic impacts and long term plans for sustainable economic development. If not properly regulated and timed, oil and gas development may threaten the health of our economy both today and in the future.

Source: Morton and Kerkvliet (forthcoming)
Goals for Responsible Oil and Gas Development

1. Promote more sustainable economic development by mitigating boom and bust cycles, avoiding the resource curse, and protecting natural amenities;

2. Internalize negative externalities (hidden costs) into supply curve;

3. Manage risk by reducing exposure to hazards, managing emergent technological risks, and decreasing uncertainty; and

4. Compensate our children and grandchildren for the use of fossil fuels that could have been available to them.

Source: Morton and Kerkvliet (forthcoming)
Phased Energy Development: Regulating the Pace and Scale of Drilling

Phased development can be implemented by:

- Placing some areas off-limits to drilling
- Capping number of wells allowed to control for cumulative effects
- Allowing new wells only after old ones are closed and site fully restored
- Full disclosure
- Collecting baseline data – environmental, health, socio-economic
- Monitoring, Inspection and Enforcement
- Adjusting pace and scale based on monitoring results

Adjusting the pace and scale of drilling based on monitoring results provides a built-in incentive system for adequately funding data collection and monitoring (i.e. if no monitoring is completed then pace and scale cannot be increased). By regulating pace and scale local communities can better manage cumulative impacts.

Capping the total number of wells can be used to control for cumulative effects. Once the cap is reached, new wells are allowed only after old ones are closed and the site successfully restored. This type of regulatory approach provides a built-in incentive system for closing and reclaiming old wells in a timely fashion.

Source: Haefele and Morton, (2009), Morton and Kerkvliet (forthcoming)
Figure 4. Estimated Annual Percentage of Total New Employment Under Five Development Timing Scenarios

Slowing the Pace and Scale of Drilling Provides a more Sustainable Economic Development Path for Communities

Precautionary Principle = ( try to ) do no harm

• The Precautionary Principle is the guiding principle for managing risk while implementing phased energy development. The Precautionary Principle can be summarized with two phrases: “try to do no harm” and “the less you know the slower you go”. Protecting the environment becomes a goal not a constraint on development.

• Establish current “baseline level of harm”
  • Scientific adequacy of baseline data
  • Past scale and pace of drilling
  • Examine integrity of current wells
  • Closure and reclamation progress for abandoned and orphaned wells
  • Adequacy of bonding for closure and reclamation
  • Adequate staff-budget for inspection, enforcement and monitoring
  • Frequency of waivers and exemptions to regulations-stipulations
  • State of scientific research

• Plausible risk take precautionary actions -- landowner education, update land use plans, pass a moratorium, etc.

• Good governance and due diligence requires good data and information – and not having data does not mean there isn’t any harm

Source: Morton and Kerkvliet (forthcoming)
Slowing down is a positive step forward for reducing our addiction to fossil fuels and addressing global climate change.

Allow time for the federal and-or state government to assess cumulative environmental impacts and risks associated with our decade long drilling boom.

Directly protects biodiversity – birds, fish, wildlife, T&E species -- by reducing amount of habitat lost and fragmented by drilling operations.

Allow more time for due diligence by agency biologist-ecologists.

Allow time for air and water quality baseline data to be collected.

Allow more time to study health impacts from undisclosed fracking fluids.

More time to hire and train staff for regulatory oversight, inspection and enforcement.

Allow more time to study the cumulative effects from using 2-6 million gallons of water each time a well is hydraulically fractured.

Reduce levels of ozone, fugitive methane and VOC emissions from drill sites.

Protect the natural amenities that are important drivers of the Rocky Mountain states’ economies.

Moderate the negative fiscal impacts of drilling on communities.

Increase total jobs by reducing displaced workers due to the “crowing out effect”.

Source: Morton and Kerkvliet (forthcoming)
Updated Suite of Economic Instruments

- Performance bonds
- Royalty rates
- Fines and Penalties
- Impact fees
- Contingency fund
- Mitigation credits
- Carbon-Methane tax
- Severance taxes
- Market forces
  - change in consumer preferences
  - sequestration payments
  - Boulder municipal power
  - green certification

Source: Morton and Kerkvliet (forthcoming)
Oil and Gas Bonding: What’s the Problem?

- Coal mine bonding is site specific with the bond amount equal to the actual cost of reclamation and updated each year. In contrast, Federal oil and natural gas bonding provides blanket coverage and bonding amounts have not been updated since the 1950s and 1960s.

- The federal government only requires $25,000 for a statewide bond or $150,000 for a nationwide bond – no matter how many federal oil and gas wells a company has permitted and drilled.

- Anderson et al. (2009) estimated that Wyoming has a current shortfall in bonding of around $814 million – a shortfall that will require taxpayers to clean up the mess. U.S. GAO reports that similar bonding shortfalls (i.e. a taxpayer liability) exist in other western states.

- The U.S. has more than 130,000 abandoned and orphaned oil and gas wells.

- Colorado State Bonding for Soil Protection, Pugging and Abandonment
  - $60,000 state-wide bond – up to 99 wells
  - $100,000 state-wide bond – more than 100 wells

Source: Morton and Kerkvliet (forthcoming)
Site Specific Bonding

• Dramatically increase amounts of federal and state bond requirements

• Eliminate federal and state-wide bonds

• Establish site-specific bonding requirements
  
  • Bonding Amounts can be designed specifically for a site
  
  • Bonding amounts for higher risk sites can be higher
  • Closer to homes and schools
  • Sites with higher reclamation costs
  • Sites in riparian areas and flood plains

• Site specific bonding provides a local source of money for closure and restoration. Money for closure stays in the county or community.
## Estimated Increased in Tax Revenue from Higher Royalty Rates for Production of Oil and Natural Gas from Federal Lands in Colorado (2012)

<table>
<thead>
<tr>
<th>Royalty Rate</th>
<th>Natural Gas (includes NGL)</th>
<th>Oil</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.67%</td>
<td>$29,124,580</td>
<td>$7,475,138</td>
<td>$36,599,718</td>
</tr>
<tr>
<td>18.75%</td>
<td>$43,651,949</td>
<td>$11,203,744</td>
<td>$54,855,692</td>
</tr>
<tr>
<td>25%</td>
<td>$87,303,897</td>
<td>$22,407,488</td>
<td>$109,711,385</td>
</tr>
</tbody>
</table>

Royalties are paid by companies to the government for the right to produce oil and natural gas on federal lands. About half of the collected royalties are distributed to states where the drilling took place and the remainder is deposited in the U.S. Treasury. The federal onshore royalty rate hasn’t changed since the 1920s and remains at 12.5 percent of the amount or value of production.

Source: Morton and Kerkvliet (2013)
Summary

The growing list of complaints from local residents about the community, health and environmental damages from drilling can no longer be downplayed or ignored by oil and gas companies or by local, state and federal decision-makers. We believe that the political, economic and judicial views on what constitutes “responsible oil and gas development” must evolve to reflect the current understandings of the environmental and socioeconomic consequences of oil and gas development.

We have proposed a new framework for implementing responsible oil and gas development based on a phased development strategy guided by the precautionary principle and adaptive management, and backed by an updated suite of economic instruments based on the polluter pays principle.

These are not new concepts – but have been applied to the management of renewable resources since the early 1900s. We are simply applying them to the management of non-renewable resources. We believe our framework provides a more responsible approach to oil and gas development than historic oil and gas development patterns.
Oil and Gas Questions

What probability was used to estimate the amount of recoverable oil-gas?

If oil prices fall below $30 or 50 per barrel, how much of our domestic oil can be extracted profitably?

How much of our 100-year domestic supply of natural gas can be extracted profitably at current prices?

How high do natural gas prices have to go to extract 100 percent of the 100-year domestic supply?

Will the NET fiscal revenue to states and communities increase if they are allowed to regulate the pace and scale of oil and gas development?

Does a slower pace of development reduce the costs from boom and bust cycles and the resource curse?

How does a slower pace and scale of development affect the economics of natural gas?

Can a Third Party Certification process be an effective market mechanism for steering technological innovation towards producing energy while protecting natural amenities?

Can we push technology to “turn costs into revenues”?
Oil and Gas Research Questions

Does a slower pace and scale of development allow wildlife sufficient time to adapt migration routes to newly designated wildlife corridors?

Does phased energy development allow time for “habitat banking” to actually work?

What type of model(s) is best suited to help assess the cumulative effects and risks from proposed drilling plans?

Can we develop a spatially constrained optimization model that produces economically recoverable amounts of oil-natural gas while protecting core wildlife and bird habitat?

Can a spatially optimizing phased development approach to oil and natural gas drilling be used in scenario planning in order to manage future risks to communities?

Can a pre-drilling spatial optimization model of phased development of natural gas be used to reduce future reclamation costs?

Does a slower pace of development by protecting natural amenities lead to a more diverse and stable economy with higher economic multipliers?

How can we better design U.S. tax policy, regulatory policy, and market-based incentives to more efficiently internalize negative externalities into our nation’s energy supply curve?
Take Precautionary Measures and Look Before You Leap
For More Information

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Conservation Economics Institute  www.conservationecon.org

Restoring the West – Utah State University
http://www.restoringthewest.org/

YouTube video of 2012 presentation at Utah State University
https://www.youtube.com/watch?v=VjZH2p5Rajo

Our Longmont