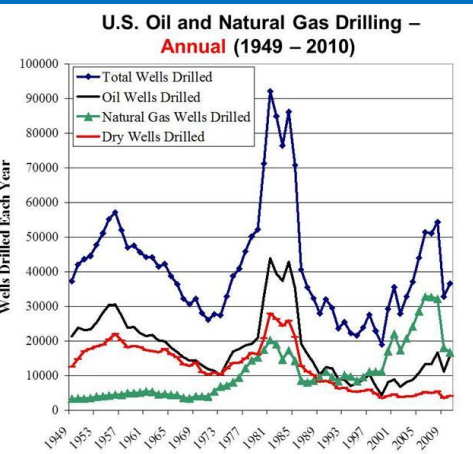


Phased Energy Development and the Precautionary Principle: Good for Critters and Communities.

Abstract



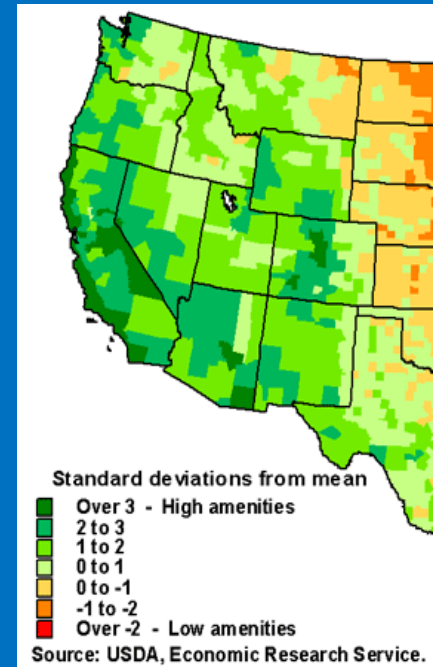
High quality outdoor recreation, open space and scenic vistas, clean air, clean water, abundant wildlife and biodiversity are representative of the “natural amenities” that have been major drivers of economic development in the Rockies over the last 30 years. While the economic role of natural amenities varies across the “new western” landscape, in many communities protecting the environment is a prerequisite for sustainable economic success.

In Colorado and other western states, public concerns are increasing about oil and natural gas drilling generally and hydraulic fracturing specifically. While oil and natural gas development does generate economic benefits, as the pace and scale of drilling increases so do the cumulative risks.

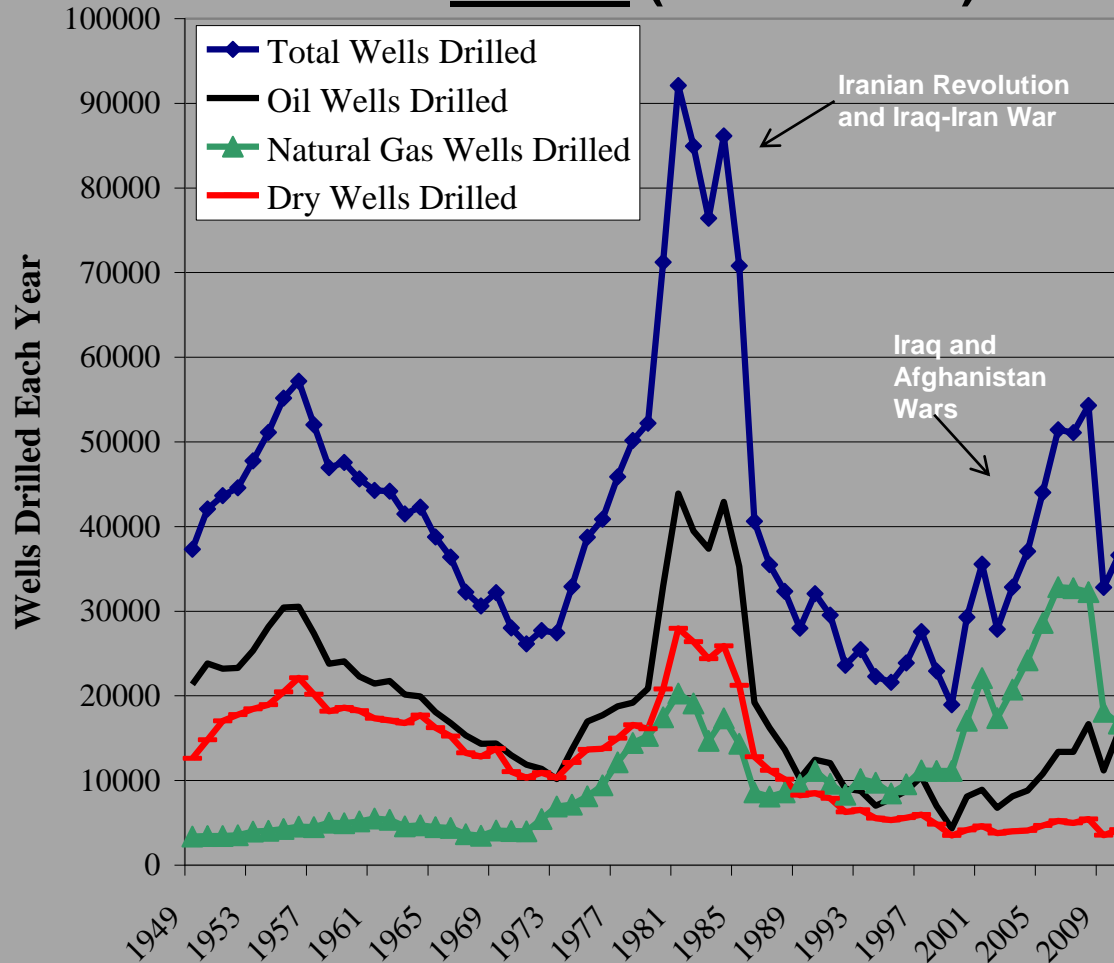
While Colorado has some of the strongest laws in the U.S. – many residents and local elected officials do not believe they go far enough – as evidenced by the intra-jurisdictional legal battles currently brewing. One strategy for moving forward is to implement phased energy development guided by the precautionary principle and backed by a suite of economic instruments.



Pete Morton, Ph.D.
Boulder, Colorado
peteinboulder@gmail.com
November 2012



U.S. Oil and Natural Gas Drilling – Annual (1949 – 2010)



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.

Data Source: U.S. Department of Energy, Energy Information Administration, (2012)

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

Community concerns – NO_x, VOCs, ozone and kids health, hydraulic fracturing risks, truck traffic and infrastructure costs, property values, displaced jobs when other businesses are “crowded out”, natural amenities and quality of life issues, loss of retirement income, competition for water with farmers, boom-bust economy, loss of local control, revenue lag and fiscal risks, water treatment plants and recycled fracking water

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

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 birds

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.

Fugitive Emissions Matter for the Health of Children and Adults in Local Communities.



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.

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

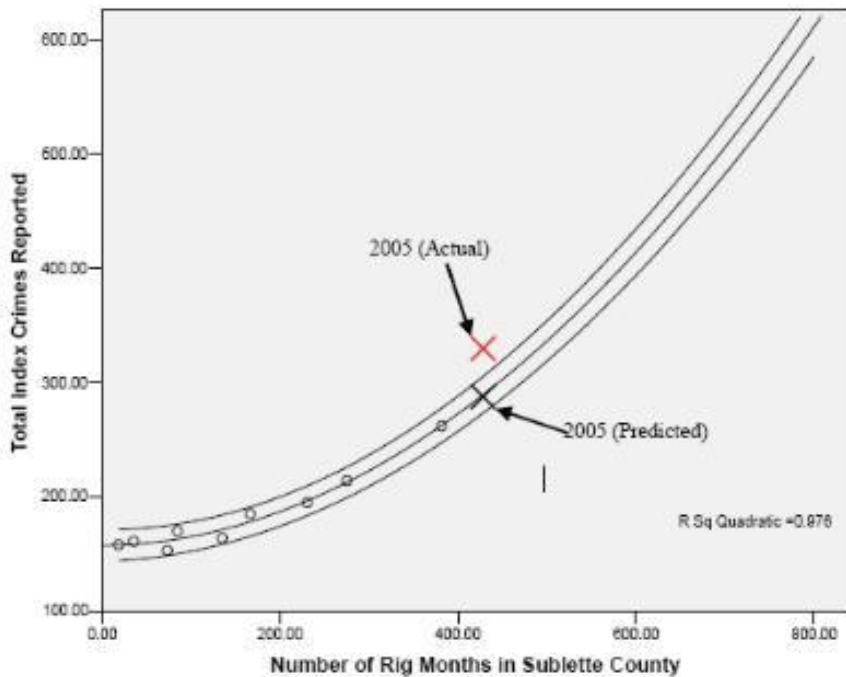
- increased trucks and traffic congestion
- increased wear and tear on local infrastructure
- a rise in crime and emergency service calls
- increased demand for public services
- revenue lag creates short term fiscal risk
- potential to “crowd out” existing residents and businesses

	Five-Year Needs
Roads/streets	\$14,120,000
Water	\$25,000,000
Wastewater	\$26,925,000
Storm drainage	\$1,270,000
Parks/recreation	\$5,645,000
Police	<u>\$4,638,000</u>
Total	\$77,598,000

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

Rig-Based Trend of Reported Index Crimes 1996-2004



Source: Wyoming Unified Crime Reporting 1996-2004; Drilling Records Inc. 1996-2004. Prepared by: Jeffrey Jacquet - Sublette County, Wyoming.

Source: Jacquet, 2005

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).

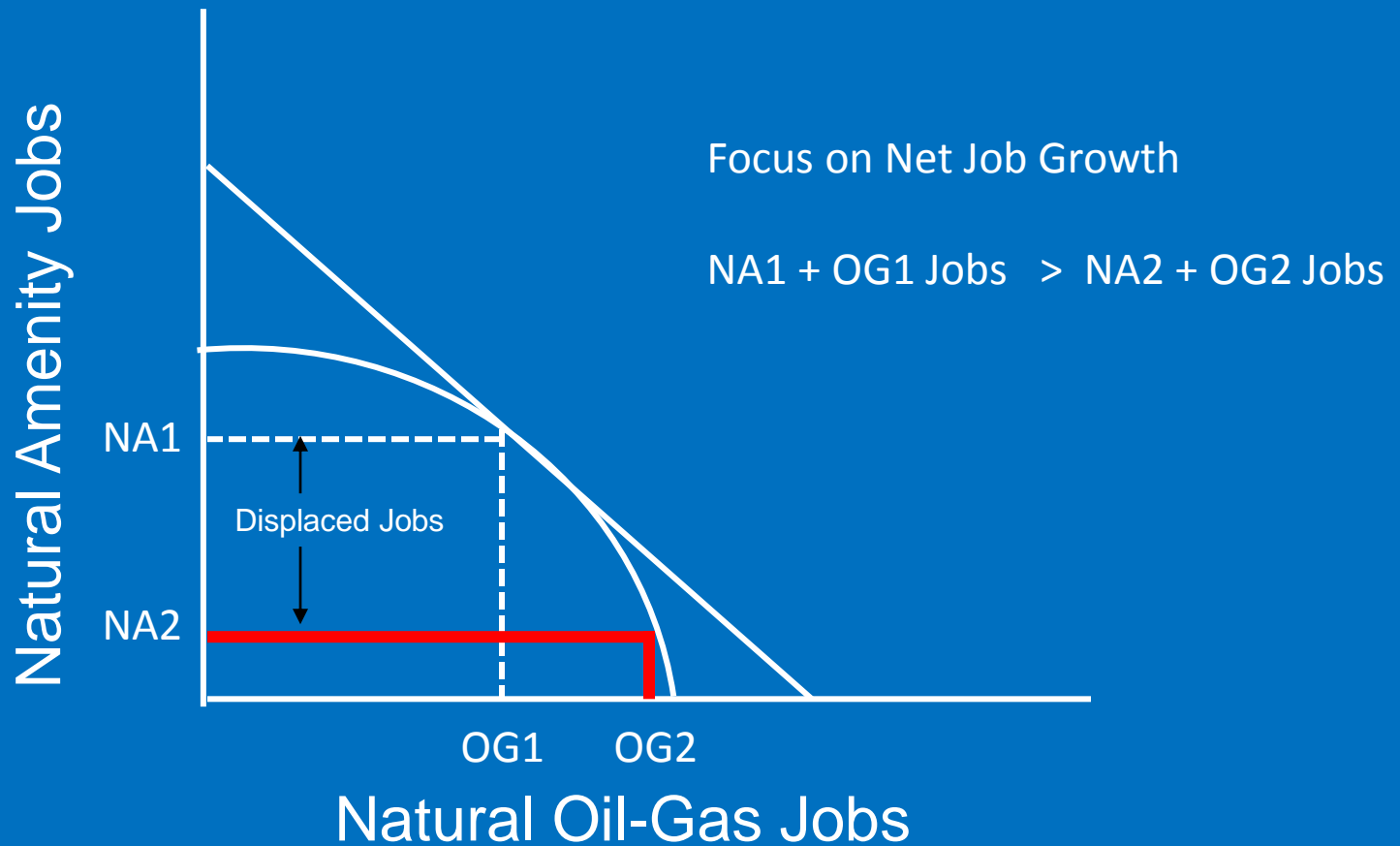
Price Waterhouse Cooper, (2009) estimated **190,408 jobs** in Colorado's oil and natural gas industry. Report prepared for the oil and natural gas industry (includes direct, indirect and induced jobs).

Wobbekind et al. (2011) estimated **107,566 jobs** 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.

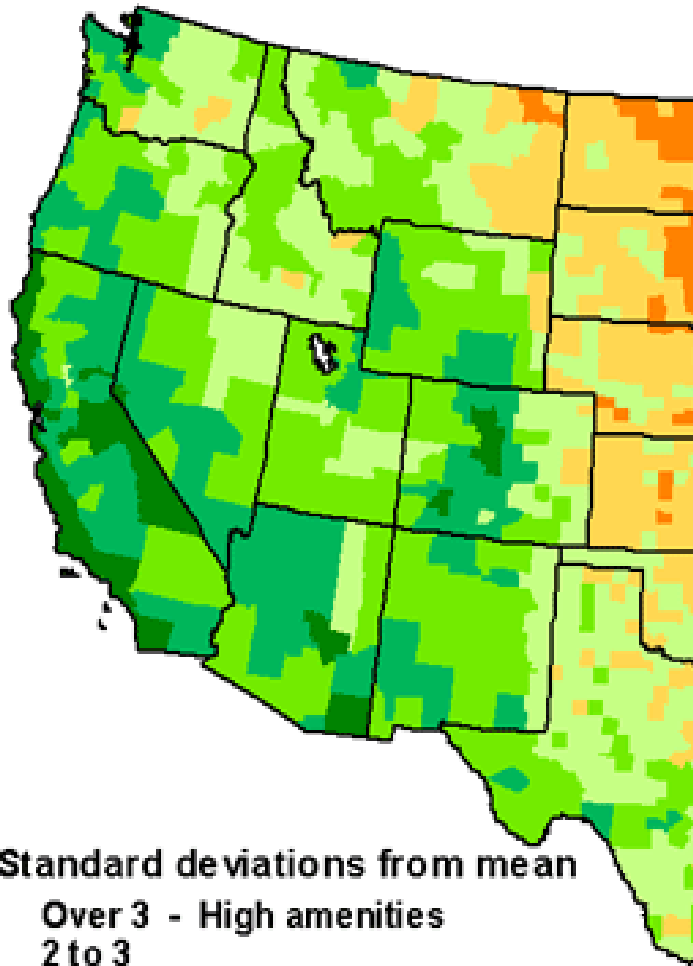
Job estimates vary widely based on the assumptions chosen, the data collected, and whether an input-output model is used to generate estimates of indirect and induced jobs.

Simultaneous Production of Natural Amenity Jobs and Natural Oil-Gas Jobs

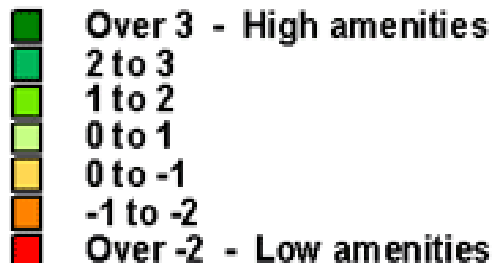


Oil and gas development does not occur in an economic vacuum. Community planners need to distinguish between short term economic impacts and long term plans for sustainable economic development.

Natural Amenity-Based Economic Development



Standard deviations from mean



Source: USDA, Economic Research Service.

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).

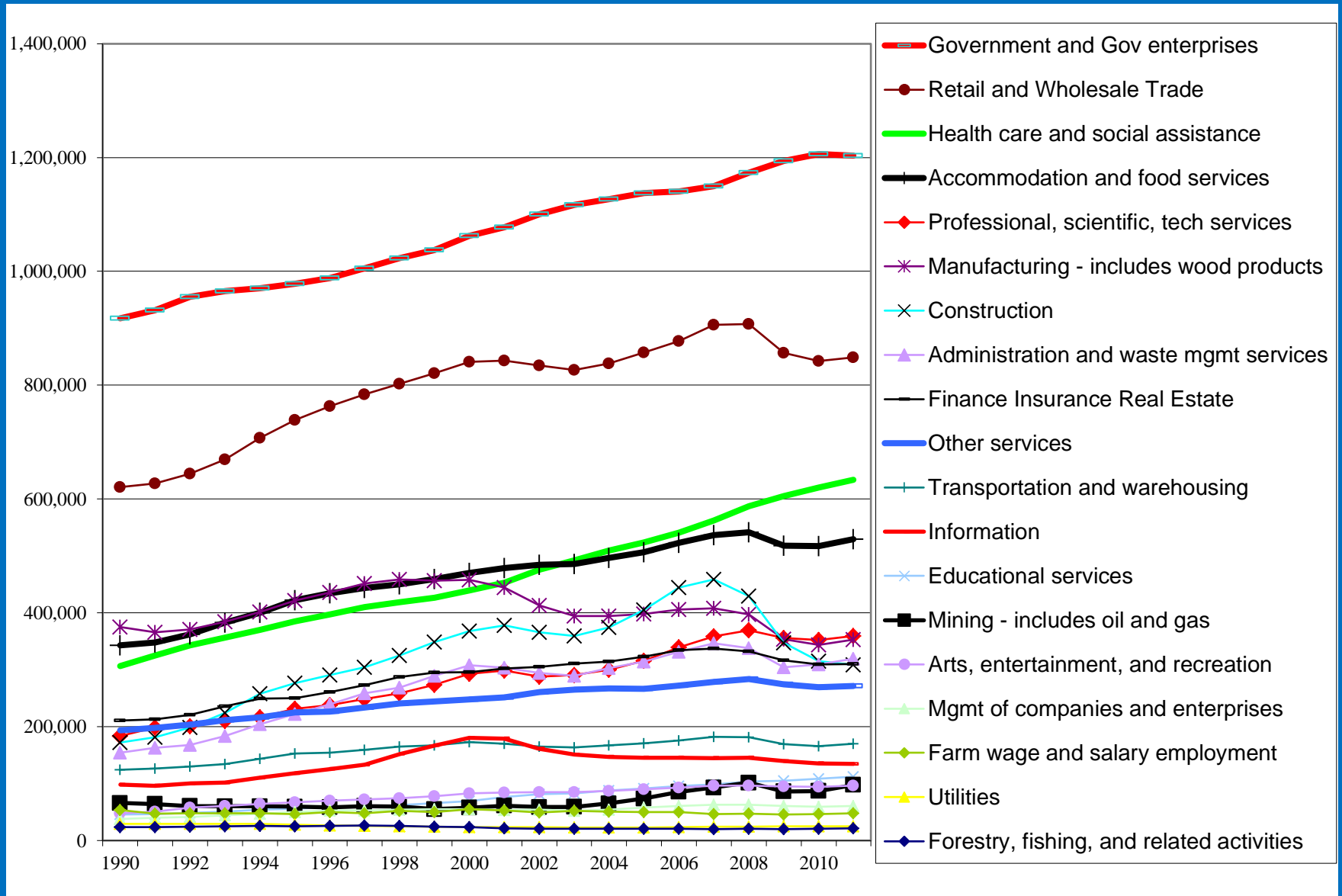
Natural Amenities when combined with community amenities can attract:

- 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.

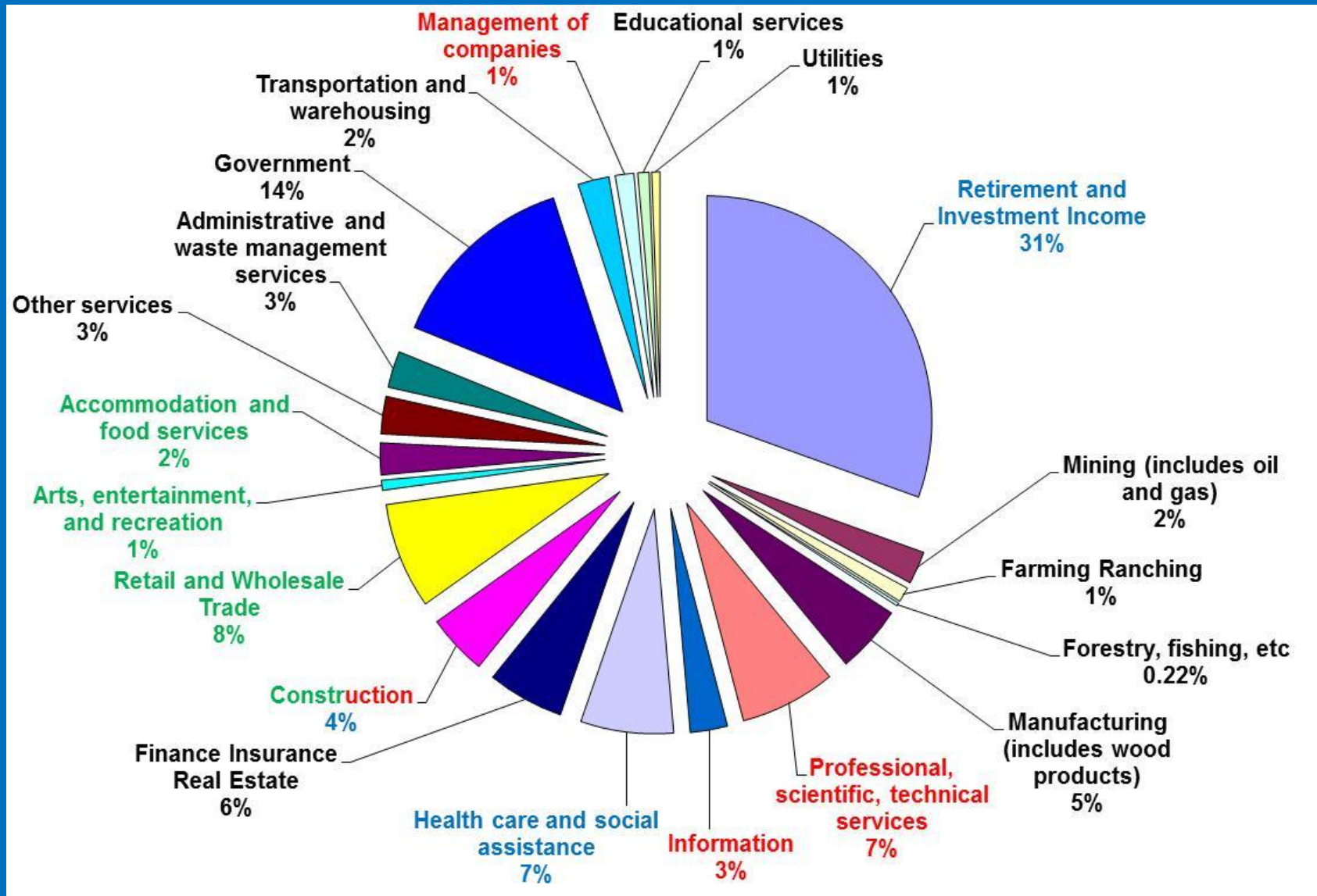
(See last 3 slides of presentation for a list of natural amenity references from the economic literature)

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

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

Increasing Levels of Natural Amenity-based Economic Development



Percent of Total Jobs

	2011 6-STATE ROCKIES (CO, ID, MT, NM, UT, WY)		2011 COLORADO		2010 BOULDER COUNTY	
	Percent Jobs	Rank	Percent Jobs	Rank	Percent Jobs	Rank
Government and Gov enterprises	20.4	1	19.0	1	13.7	2
Retail and Wholesale Trade	14.4	2	14.1	2	11.1	3
Health care and social assistance	10.7	3	10.2	3	9.7	5
Accommodation and food services	9.0	4	9.5	4	6.6	7
Professional, scientific, tech services	6.1	5	7.3	5	15.3	1
Manufacturing	6.0	6	5.4	8	7.3	6
Administration and waste mgmt serv	5.4	7	5.8	7	4.2	10
Finance Insurance Real Estate	5.3	8	6.1	6	11.0	4
Construction	5.2	9	4.9	9	3.6	11
Other services	4.6	10	4.9	10	5.0	8
Transportation and warehousing	2.9	11	2.6	12	0.8	14
Information	2.3	12	3.0	11	4.4	9
Educational services	1.9	13	1.8	14	2.1	13
Mining - includes oil and gas	1.7	14	1.2	16	0.7	15
Arts, entertainment, and recreation	1.6	15	2.0	13	3.3	12
Mgmt of companies and enterprises	1.0	16	1.3	15	0.5	16
Farm wage and salary employment	0.8	17	0.5	17	0.4	17
Utilities	0.4	18	0.3	18	0.1	19
Forestry, fishing, and related activities	0.4	19	0.2	19	0.2	18

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

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

Source: Morton (forthcoming)

Colorado Conflicts

- Battlement Mesa – Roan Plateau
- Carbondale -- Thompson Divide
- Boulder County
 - Town of Erie
 - Longmont – City drilling ban and Ballot Question 300
 - Boulder County Moratorium

The conflicts are a result of “old west” economic development colliding with “new west” economic development.

Phased Energy Development: Regulating the Pace and Scale of Drilling

Phased development can be implemented by:

- Limiting the acres leased
- Limiting the number of drilling permits granted
- Limiting the number of drill rigs permitted to operate in an area at one time
- Capping number of wells allowed
- Allowing new wells only after old ones are closed and site fully restored
- Placing some areas off-limits to drilling

Phased development requires:

- Full disclosure
- Collecting baseline data
- Monitoring environmental and socioeconomic impacts
- Inspection and enforcement
- Adjusting pace and scale based on monitoring results

Source: Haefele, M. and P. Morton. 2009. The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains. Western Economic Forum, Winter 2009.

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

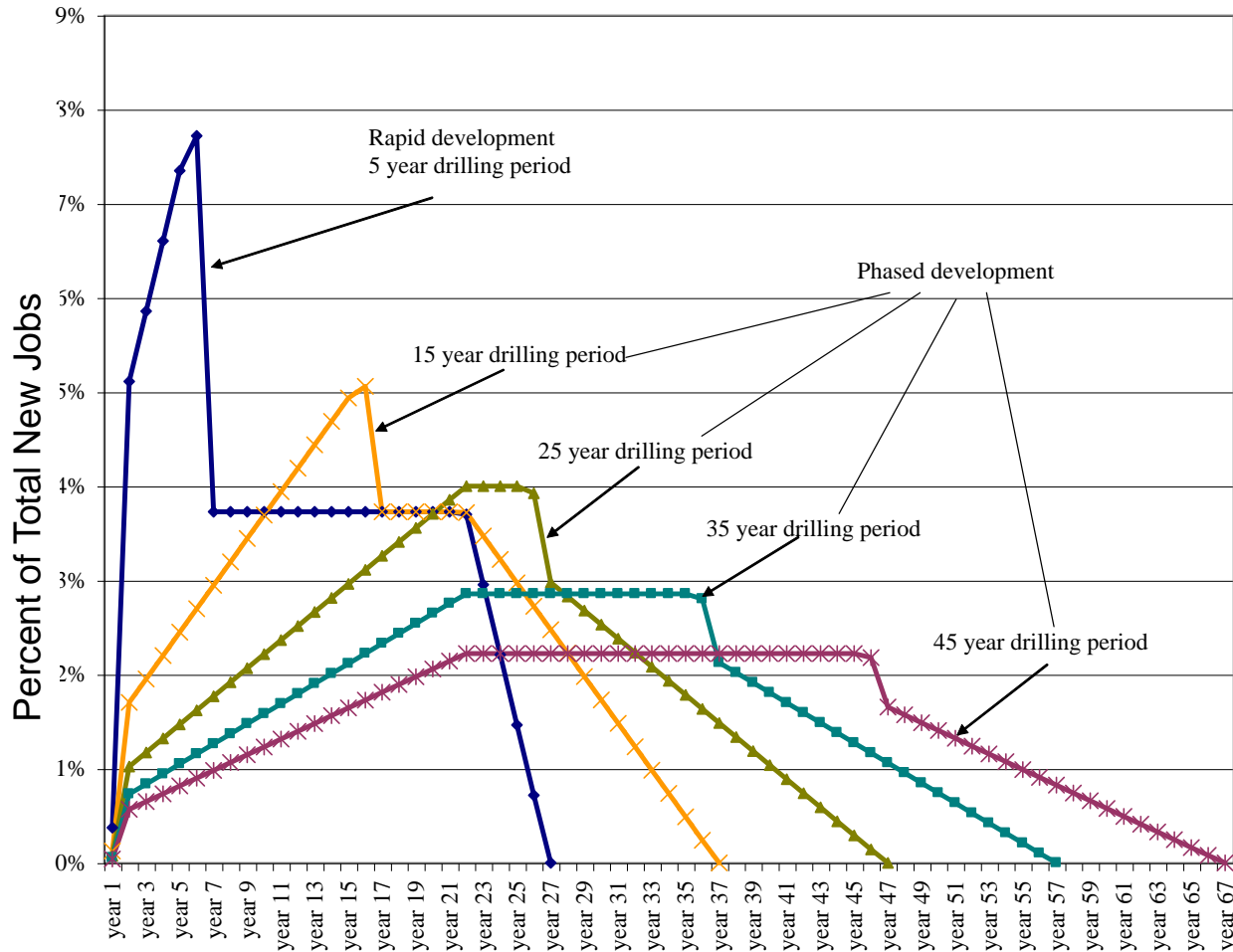


Figure 4. Estimated Annual Percentage of Total New Employment Under Five Development Timing Scenarios

Source: Haefele, M. and P. Morton. 2009. The Influence of the Pace and Scale of Energy Development on Communities: Lessons from the Natural Gas Drilling Boom in the Rocky Mountains. Western Economic Forum, Winter 2009.

Precautionary Principle = (try to) do no harm

Boulder County Comprehensive Plan Oil and Gas Policy Amendments

All policies, procedures and regulations dealing with oil and gas exploration and development shall be based on the implementation of the “precautionary principle” so as to ensure the safety, public health and protection of Boulder County’s residents, environment, infrastructure, and resources with respect to local and cumulative, short and long term considerations.

Adopted by Boulder County Planning Commission August 15, 2012

Plausible risk – take precautionary actions

Not having data does not mean there isn’t any harm

Precautionary Principle redistributes risk

Good data and monitoring that proves no harm

Precautionary Principle = (try to) do no harm

- Establish current level of harm from past drilling decisions
 - Past scale and pace of drilling
 - Examine integrity of wells
 - Closure and reclamation progress for abandoned and orphaned wells
 - Staff-budget for inspection, enforcement and monitoring
 - Frequency of waivers and exemptions to regulations-stipulations
 - State of scientific research
 - Adequacy of bonding for closure and reclamation
- Assess cumulative effects – need PEIS and Risk Assessment
- Collect baseline water and air quality data (VOCs, Ozone, Methane)
- Select Management Indicator Species - collect population and habitat data
- Identify potential areas that should be off-limits to drilling (i.e. local watershed)
- Talk with other communities about lessons learned
- Require Best Management Practices
- Require most effective performance technologies
- Moratorium?
- Ban?

Suite of Economic Instruments

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

Federal 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 bonding of \$10,000 for an individual project, \$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.
- 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

- Surface Owner Protection
 - \$2000/well for non-irrigated land
 - \$5000/well for irrigated land
 - State-wide “blanket bond” \$25,000
- Seismic Operations
 - \$25,000 state-wide bond
- Soil Protection, Pugging and Abandonment
 - \$10,000/ shallow well – less than 3000 feet
 - \$20,000/ deep well – greater than 3000 feet
 - \$60,000 state-wide bond – up to 99 wells
 - \$100,000 state-wide bond – more than 100 wells
- Inactive wells
 - \$10,000/ shallow well determined to be an “excess inactive well”
 - \$20,000/ deep well determined to be an “excess inactive well”
 - or submit plan to re-activate or reclaim well in future

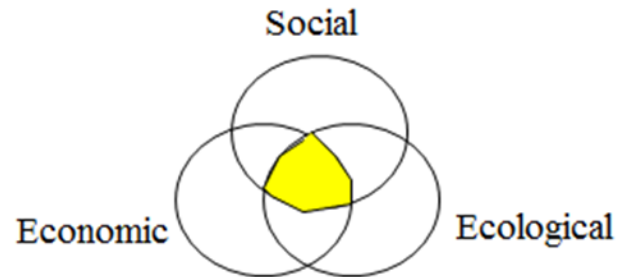
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Green Up Colorado's Oil and Gas Laws and Regulations

- Expand the type of disclosure data collected:
 - compliance history of each operator
 - amount and source of water used for hydraulic fracturing
 - chemical content of backflow and produced waste water
 - quantity and quality of recycled fracking water
 - volume of methane emissions
 - frequency of spills and accidents.
- All data should be made publically available in a searchable database
- More oversight and monitoring
- Increase drilling setbacks to ½ -1 mile from schools and homes
- Require buffers around riparian areas, recreation trails, and critical habitat
- Eliminate state-wide blanket bonds
- Establish site-specific bonding requirements
- MOU with counties that limit pace and scale of drilling
- MOU with counties that cap number of wells
- MOU with counties that allow moratoriums or bans
- Eliminate property tax credit to increase severance revenues to taxpayers
- Use revenue for monitoring, inspection and enforcement jobs

Sustainable Energy Development



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

One goal of sustainable energy development should be to avoid the “resource curse”.

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.



For more information about this presentation contact

Pete Morton, Ph.D.

Boulder, Colorado

peteinboulder@gmail.com

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