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Ecological Economics: Gary Flomenhofs

Coalbed Methane: The Next Best Thing

Throughout human history, as our species has faced the frightening, terrorizing fact that we do not know who we are or where we are going in this ocean of chaos, it has been the authorities, the political, the religious, the educational authorities, who attempted to comfort us, by giving us order, rules, regulations. IN-Forming, forming in our minds their view of reality.

--Tim Leary

I. Introduction

Despite what recent widespread attention might lead one to believe, Coal Bed Methane (CBM) is nothing new in the fossil fuel industry. What is new is the industry's categorization of CBM's usefulness. In the early days of western coal mining, circa 1900, CBM was worse than useless, it was a valueless nuisance, causing explosions and asphyxiation of miners, resulting in hundreds of deaths. Until the late 1980s and early 1990s, industry used a miner's canary to deal with CBM. The avian respiratory system is far more sensitive to changes in atmospheric oxygen concentration than the mammalian respiratory system, and the death of the canary signaled the presence of CBM, serving as a warning to miners to get out of the mine-shaft.

Today, industry uses huge pumpjacks, derricks, and Christmas tree wellheads to deal with CBM. The late 1980s and early 1990s brought with them an increased demand for gas-fired electricity plants, along with a myth that natural gas is clean energy. Drilling technologies were discovered that extract methane from coal seams (200-5,000 feet below the surface) by pumping groundwater out of the seam, releasing the gas and allowing it to escape up the well. CBM went from a useless nuisance to a valuable commodity.

With the "heightened emphasis on federal land for oil and gas exploration, higher profits for industry, increased revenue for the state... and a near quadrupling of natural gas prices in the last year to almost \$10 per million cubic feet (MCF)," CBM has become big business. Thomas F. Darin and Amy W. Beatie, 31 *Environmental Law Reporter* 10566, (2001). An average CBM well produces 100,000 cubic feet of methane per day, which can be worth as much as \$10,000, depending on the market price. Hal Clifford, *Powder Keg: Coalbed Methane splinters the Powder River Basin, High Country News Special Report – Coalbed Methane Boom*. The cost of finding and developing CBM is only between 20¢ and 40¢ per thousand cubic feet; in the words of one analyst, CBM companies are "just beautiful economically." *Ibid*.

Big profits from natural gas have lead to big development. Over the past decade, CBM development in Montana's Powder River Basin has skyrocketed, and the growth is only expected

to accelerate: by mid-August 2001, private companies had drilled 10,538 wells, and it is projected that there may be 80,000 wells by 2010. Ibid. Eventually, the entire basin could be covered in wells, with one well every eighty acres for a total of 139,000 wells. Ibid.

Fidelity Exploration and Production Company serves as one example of an oil and gas company exploiting CBM. Fidelity touts their activities as environmentally sound, claiming that “Clean-burning natural gas is increasing in demand primarily due to its environmental benefits . . . Each unit of natural gas production that is used for electric generation displaces other fuels, which are not as environmentally friendly.”

http://www.fidelityoil.com/docs/fep_stewardship.html. Fidelity reminds us that in traditional coal mining, methane, a potent greenhouse gas, simply escapes into the atmosphere as a fugitive emission. In developing CBM, Fidelity captures what would otherwise become fugitive emissions, thereby helping to reduce greenhouse gas emissions. Unfortunately, as Fidelity sees it, this environmental stewardship is being thwarted by pesky environmentalists: “access to drillable lands and resistance from those opposed to development of coalbed natural gas are the company’s primary challenges.” http://www.fidelityoil.com/docs/fep_pres.html.

Fidelity’s activities are portrayed as win-win. In addition to helping the environment, Fidelity claims that CBM development is good for the economy. “CBNG development will create good paying jobs, and significantly increase revenues to local, state, and federal governments, as well as schools . . . Coalbed natural gas will have a significant positive economic impact on Montana residents for years to come . . . As responsible operators, [Fidelity] has long recognized that much-needed economic growth can and must co-exist with a healthy environment.” <http://www.montanacoalbed.com/ecobenefits.asp>.

While local opposition to CBM development exists, NIMBYism does nothing about the public’s demand for energy. “Rarely is there a local constituency for oil and gas drilling. Generally, local folks don’t want it in their backyard. Local elected officials hear from them. But ultimately, we need this activity somewhere. There is a disconnect between local desires and society’s general needs.” Ray Ring, *Backlash, High Country News Special Report – Coalbed Methane Boom* (quoting Ken Wonstolen of the Colorado Oil and Gas Association). Operating under this paradigm, it is obvious that CBM is badly needed: “[methane] reserves are being tapped out: in rough numbers, in the last 25 years, Gulf of Mexico production is down 24

percent, and mid-continent production (including Texas) is down 36 percent The Rockies have the remaining reserves. This is where we're going to get our energy from." Ibid.

Such is the current state of affairs. America is on a Sisyphean quest to satiate its insatiable demand for energy; CBM presents itself as the latest panacea, proof that technology and human creativity will always save the day.

II. Scale

CBM is not a "renewable resource" in the meaningful sense of the term. CBM is produced, along with coal, from the compaction of plant matter, carbon dioxide and water. Over millions of years, pressure and heat transform organic material into peat, lignite, subbituminous coal, bituminous coal, and eventually anthracite coal. Large volumes of methane and other gaseous byproducts are produced and bound to the coal by van der Waals forces and water pressure. See 31 ELR 10572. Releasing the water releases the pressure and frees the gas. Ibid. While coal deposits and CBM will eventually renew, millions of years is not a meaningful human time frame. Like all other fossil fuels, CBM is considered a fixed stock fuel, a finite supply, which we can use at whatever rate we choose, limited only by extractive technology.

Unlike solar and wind energy, CBM is finite. Increasing CBM production to accommodate America's transition from coal to natural-gas-powered energy plants will not change the fact because the dominant American economic paradigm champions infinite growth, America is fettered to unsustainable growth fueled by non-renewable fuels. The hard fact is that physical laws do not allow for the unlimited growth that neoclassical economics promises. Even if industry's claims of CBM's superiority as a more environmentally-sound fuel are accurate, cleaner burning fuels do not solve the inherent problem of scale: no matter how clean it burns, someday CBM will run out.

CBM development is driven by the existing economic paradigm. In this paradigm, the ecosystem is seen as a part of the larger whole of the economy. CBM goes in, and money comes out. There are two problems with this vision. First, for CBM to go in, it must be taken out of a stock, leaving less for tomorrow. That means not only will the supply eventually run out, but also that costs of extracting tomorrow will be more than today. The marginal cost of fossil fuel extraction is increasing. Second, more than just money comes out. It is true that CBM burns cleaner than other fuel sources, but basic chemistry holds that no matter what hydrocarbon we

start with, if we combust it, we will always end up with carbon dioxide and water. This is where the first law of thermodynamics comes in. Once burned, the CBM doesn't just go away. No matter how "clean" CBM is, there will always be a sink of high-entropy matter. Burning fossil fuels always fills the sink with a high-entropy greenhouse gas while simultaneously depleting a finite stock of low entropy matter.

Ecological economics views the economy as a subset of the larger ecosystem. As we increase our use of fossil fuels, be it oil (from any source) or methane (from any source), we are using up a non-renewable, finite stock of energy, and are filling a sink of harmful waste materials. Unbreakable physical laws require that limitless growth ultimately cripple itself by exhausting all sources of low entropy matter while overwhelming all available waste sinks. As the economy grows, sources of energy become scarce, and the massive amounts of waste exceed the ecosystem's natural ability to neutralize and incorporate carbon dioxide and other byproducts.

Clearly, CBM development at the current pace and with current motives is not sustainable. No energy development program driven solely by a desire to strengthen and fuel a growing economy can be sustainable. In addition to this obviously unsustainable aspect of gas development, "the single most devastating impact to CBM extraction is the dewatering process. If 51,000 wells are drilled in the next decade," remember, there may be as many as 80,000 by 2010, "the amount of water withdrawn from local aquifers will greatly lower the water table, wastewater [sic], increase erosion, pollute surface waters, and continue to cause ground subsidence." 31 ELR 10575.

Freshwater accounts for less than 3% of the water on the planet; only 1% is readily exploitable. Peter Gleick, *The World's Water: The Biennial Report on Freshwater Resources 2002-2003*, Island Press 2002. "The average CBM well discharges 12 gallons [of water] per minute (gpm) onto the ground surface Reports of 85 gpm per well, per day are not uncommon. Through June, 2000, CBM production in Wyoming . . . has resulted in the discharge of 500 million barrels of water, in order to produce 177 billion cubic feet (or .177 TCF) of methane. At 15 gpm, each well will produce over 21,000 gallons of water per day, and approximately 8 millions [sic] gallons of water per year. At the projected 51,000 wells by 2010, the surface of the PRB will receive nearly 1 billion gallons of discharge water per day, totaling 365 billion gallons of water per year." 31 ELR 10575. That 2000 projection was ominous

enough at the time, but the situation has proven much, much worse. In 2003, 19693826 MCF of gas was extracted from the PRB, producing 35009611 Billion Barrels of Water.

<http://wogcc.state.wy.us/Mcrmsprod.cfm?code=Powd>.

For a short while, industry wondered why people were complaining about water when they lived in an area that had such a need for it. The answer is CBM water is more harmful than helpful. Locals are upset because while CBM water is clear and cold, that's where its benefits stop. CBM water is highly saline, and its extraction causes the depletion of connected aquifers, which are used as water sources for families and cattle. Dewatering coalbed aquifers destabilizes coal seams, causing whole landscapes to drop in elevation, sometimes more than 15 feet. Moreover, the underground coal seam, depleted of water and exposed to oxygen, is highly susceptible to spontaneous combustion. See 31 ELR 10566. The rapid extraction of CBM water greatly exceeds the sustainable use of water in any region, especially the arid, water-dependant west.

Western water is scarce and in high demand. Ranchers need water for cattle; fish and other aquatic organisms need streams and rivers for habitat; plants and wildlife depend on the creeks and ephemeral streams for survival; and farmers use creeks and rivers for irrigation. The high salinity of CBM water precludes all of the above uses. CBM water contaminates creeks and rivers by altering their chemical composition and significantly changing their temperature, it also permanently deteriorates soil's productive capability. The Roman's sack of Carthage is a memorable historical example of the effects of salt on soil: salt was plowed into the fields, rendering them permanently unsuitable for agriculture, ensuring the destruction of an entire society. CBM discharge water increases the salt concentration in soils. Eventually, in a time scale of just a few years, CBM discharge water, even that from wells with relatively low salinity levels, will sufficiently saturate contacted soils with salt to kill native vegetation and crops. See 31 ELR 10576.

Courts have viewed CBM water as industrial waste, fitting it within the definition of pollution under the Clean Water Act. Northern Plains Resource Council v. Fidelity Exploration and Development Company, 2003 U.S. App. Lexis 6852 (9th Cir. 2003). Yet CBM development, like the rowers in Willy Wonka's Chocolate factory, shows no sign of slowing.

As development accelerates, so does the depletion finite energy stocks; the production of greenhouse gasses; the pollution of creeks, rivers, streams, and lakes; the extirpation of heat-

sensitive and saline-sensitive aquatic species; the lowering of water tables and subsequent depletion of much-needed drinking-water aquifers; and the permanent contamination of soil. Such activity cannot continue indefinitely. If the CBM doesn't run out first, the environment will be rendered incapable of supporting further growth. CBM is no cure for the larger problem of the scale of the macro economy. On the contrary, accelerated CBM development only fuels growth and its destructive byproducts.

For CBM development to slow, the current dominant economic paradigm must shift. Rather than viewing growth as the sine qua non of economic progress, economics must begin to recognize the role of the ecosystem in development. Sustainability at an optimum scale, not ever-greater levels of production and development must be the goal and benchmark by which progress is measured.

II. Distribution

Even if CBM were being extracted in a scale-sensitive manner, the distribution of profits is unjust and unequal, distributing all benefit to the companies extracting the gas, and all cost to the private landowners who have to put up with drilling operations on their land.

Initially, there is a conflict between surface and subsurface owners of lands affected by CBM development. Much of the West was settled under the Stock-raising Homestead Act (SRHA), 43 USCS §291, et. seq.. The act, in order to encourage settlement of 'wild' western lands, gave surface estates suitable to support a productive ranching operation to the first settler to lay claim to the land. To have its cake and eat it too, the Government was careful to grant only a surface estate to the settlers, keeping the subsurface mineral estate for itself.

These split estates are a source of enormous conflict. Since the subsurface estate, by the terms of the SRHA, was given primacy over the surface estate, when the government issues a mineral lease, the lessee is free to build roads and drill wells on the surface owner's land, without providing compensation, in order to get at the gas.

In addition to the physical effects of roads and wells, drilling operations are noisy. The pumps and wells themselves are loud, and compressor stations, necessary to transport the gas, are unbearably loud. Moreover, 21,000 gallons of water per day flowing over the surface estate

has many landowners hopping mad. Creative lawyers are already testing their luck with the traditional tort claims of trespass and nuisance, in an effort to more justly distribute the costs and benefits of CBM development.

In addition to the surface/subsurface owner conflict, because much of CBM development is occurring on public lands, there is also a conflict of interest between the public and the developing companies. The Bureau of Land Management auctions off Western mineral estates, and while BLM regulations require notice to be posted, many ranchers never hear of the auctions, and the estates are often leased for as little as \$2.00/acre. Not only are the surface estate owners bearing all of the physical cost, in terms of environmental damage, property value depreciation, noise pollution, water pollution, negative business effects (farming, ranching, etc), and not seeing any of the benefit, but also the American public at large is negatively affected. CBM developers are purchasing leases, from the public, for a fraction of what they would otherwise sell for. If given proper notice, many of the ranchers would buy the mineral rights to their surface estates themselves. Industry is truly reaping windfall profits because of this arrangement, making a Return on Investment ranging from 20 to 44 percent – representing above-normal profits of about \$59.00 to \$159.00 per barrel of gas extracted.

http://www.powderriverbasin.org/cbm/expert_georold.shtml. None of those above-normal profits are currently being shared with either the surface estate owners or the American public, the owners of the minerals.

Any level of CBM development, whether sustainable or maximally exploitative, should distribute the benefits to all affected parties. This means lease prices should better reflect true market value so that the Landlords, the American public, are adequately compensated for the use of their minerals. An extraction tax could be levied to further ensure the public is fully compensated for the use of its resources. The exploitation of public resources ought to benefit the public, the owners of the resource, not simply the capital owner.

Furthermore, surface estate owners should be compensated for having to bear the true costs of development. CBM developers are reaping their enormous profits at the expense of individual surface-estate owners. Redistributing the profits of development operations to those parties is just and equitable. Rather than having to put up with whatever activity CBM developers undertake, surface estate owners should be empowered to draft agreements with companies, allowing them to specify who gets access to wells, when and how they can get there,

how the water will be discarded, how the company will fund measures to fix problems that arise, and how much percentage of gross income from gas sales will go to compensate for use of the surface estate. The mineral estate's primacy should not be allowed to consume the rights of the surface owner.

III. Allocation

The problem of CBM allocation is a relatively straightforward one. Natural gas prices, while climbing, do not accurately reflect the true cost of exploitation and combustion of the resource. CBM is a true market good, it is both rival and excludable, so no innovative scheme need be devised to allocate it. The market will do a fine job, so long as the true costs are accurately reflected.

CBM development has enormous ecosystem costs, as well as costs to the surface estate owners. Pricing these costs is not for the faint of heart, but the market economy never has been. If we want the market to allocate CBM in a way that takes account of its true cost, then that cost must be put into terms that the market understands: dollars.

The costs to the surface owners may be easier to tackle than ecosystem costs since courts have been doing it for centuries. Assuming a nuisance or trespass is found, a court will then balance the equities to determine whether an injunction should issue. For CBM, as for cement in Boomer, it seems clear that no court will completely enjoin CBM production. As in Boomer, it is likely that a Coase-inspired solution will be devised, and the industry will pay the surface owner for the servitude on her land. The amount will be calculated the same way any other servitude is: the owner will be compensated for the loss of some of the rights in her property-rights bundle.

Ecosystem pricing is trickier. CBM water's multiple environmental effects are outlined above. Putting dollar values on plant life, aquatic diversity, and in-tact landscapes, free from subsurface conflagrations, is not an exact science, but it need not be. These costs can be arbitrarily set at a level suitable to account for the extent of damage done. Ultimately, like NEPA with environmental protection, the process is more important than substance. By forcing the market to consider the external costs of CBM development, people will think about issues of scale and ecosystem function. Humans do have a conscience, and if they are forced to take a

hard look at the consequences and true costs of actions, they may simply choose to ratchet down the scale of the economy, to chill the endless growth. In addition, simply by going through the process of considering the true costs of CBM, renewable alternatives, because they have fewer total costs, will look more attractive. Prices can be arbitrarily adjusted to favor the ‘lower-impact’ renewables over the ‘lower-cost’ CBM.

CBM prices could be adjusted by levying a tax on their use, extraction, or both. Tax revenue could be used to subsidize renewable alternatives, further widening the price gap between CBM and renewables, causing the market to allocate more ecosystem-friendly renewable energy and less of the damaging CBM.

IV. Conclusion/Solutions

The only truly meaningful solution to problem of rampant CBM development and economic growth is a paradigm shift, a change in “preanalytic vision,” as Daly refers to it. Herman Daly and Joshua Farley, *Ecological Economics*, p. 23.

Choosing economic development over economic growth as the goal and indicator of a productive economy involves more than a choice to end reliance on low-entropy fuel sources. It is more than recognizing the fundamental truth of some basic physical laws and pointing out neoclassical economics' ignorance of such laws. Choosing development but not growth will involve embracing and nurturing different modes of thought. Daly emphasizes two necessary presuppositions to embracing a policy of development over a policy of growth. The shift in our preanalytic vision must eliminate both determinism and nihilism. Daly and Farley, *Ecological Economics*, p. 43.

First, if humans do not possess free will, then there are no alternatives to the course we are on. If we are Daniel Dennet’s biological machines, driven by chemical reactions alone, and if beliefs are merely explanatory devices, useful for predicting and explaining behavior, then what is the point of a discussion of policy alternatives? See Daniel C. Dennet True Believers: The Intentional Strategy and Why it Works, found in Jack S. Crumley, *Problems in Mind: Readings in Contemporary Philosophy of Mind*, Mayfield, at 226 (2000). There is no point, and therefore, if we are going to discuss policy alternatives in any meaningful sense, in the sense that

we believe there exist different alternatives among which we can choose, we have to reject determinism.

Second, there must exist an objective measure of the value of the alternatives such that there is one objectively superior choice among them. If we move beyond good and evil, we lose any normative ground on which to rest our justification for the superiority of any policy choice. If there is no morality, if we cannot rank or distinguish among alternatives, then there is no point arguing about the ‘merits’ of one alternative over the other. Why discuss policy when A’s as good as B’s as good as C’s...?

So, we begin by assuming that there are alternatives which can be chosen among, and that some of those alternatives are inherently and objectively better than others. Having made these two assumptions, certain natural laws lead us to deduce that an ever-growing economy is an inferior alternative to a steady-state economy. This recognition is the shift in preanalytic vision. With the rejection of determinism and nihilism, the consideration of economic alternatives leads inexorably to one conclusion: a steady state economy is superior to a continuous growth economy.

If people embrace that basic vision, the work is done. Every policy determination will be informed by the reigning paradigm, and society will move effortlessly towards the end-goal of that paradigm: a steady-state economy. Currently disturbing, revolutionary ideas like redistribution schemes and true-cost pricing, when viewed under the rose-colored glass of a ‘steady-state paradigm,’ will be embraced as the clearly superior, morally correct policies. Quite simply, just as we currently choose policies that assume the inherent correctness of continuous economic growth, in a world where we believed in the inherent, objective correctness of a steady-state economy, we would choose policies to ensure the continuance and success of the steady-state economy.

In the specific case of CBM, a change in preanalytic vision would lead to the recognition of the inherent inequity and injustice of the current distribution of CBM development profits. The Extraction of public resources would be taxed, allowing redistribution of the revenue; surface-owner’s rights would be recognized, allowing common law protections of the interests of landowners. Drillers would be held responsible for a better outcome.

Additionally, allocation problems would be solved. People would recognize the true costs of CBM development. Seeing through the extensive industry greenwashing campaigns,

Americans would demand true-cost pricing of CBM. CBM could be taxed to put its price in line with its cost, and renewables could be subsidized to ease and facilitate the transition from unsustainable reliance on stock fuels to sustainable use of fund services.

The necessary first step to any meaningful reform and eventual solution is a paradigm shift. Once people embrace the idea of the steady state economy, institutions will be mobilized to work within that framework, rather than within one favoring endless growth. Once people's paradigm has shifted, once they no longer view technology as the panacea and infinite growth as the one true goal, ways of operating within and furthering development of the steady-state economy will come naturally, just as ways of fueling growth continue to arrive day after day in the current system.

The most we can do to effectuate a paradigm shift is to continue to talk about ecological economics. Let it be known that many of us do not favor continuous growth. Spread the message through print and word of mouth. As always, the most powerful and effective tool is education. With our non-determinist, non-nihilist paradigm recognizing the inherent, objective superiority of a steady-state economy, political and lawful institutions would represent that paradigm as part of fulfilling their function; teachers need only enforce those newly-embraced 'norms' on their students. The words of the Supreme Judicial Court of Maine in Patterson v. Nutter, 7 A. 273, 274 (Me. 1886) deserve to be quoted at length:

“It is to secure [the permanency of political institutions] that the state provides schools and teachers. Schoolteachers, therefore, have important duties and functions. Much depends upon their ability, skill, and faithfulness. They must *train* as well as instruct their pupils. The acquiring of learning is not the only object of our public schools. To become good citizens, children must be taught self-restraint, obedience, and other civic virtues. To accomplish these desirable ends, the master of a school . . . must govern these pupils, quicken the slothful, spur the indolent, restrain the impetuous, and control the stubborn. He must make rules, give commands, and punish disobedience.”

When the rules and civic virtues of our society and schools are informed by the steady-state paradigm, our society will be able to better inform its members, producing generations of virtuous, restrained, disciplined, steady-state-championing Americans. The paradigm shift will lead to policies perpetuating a steady-state economy. Some day, students will learn in their history classes that we once lived by the incomprehensibly silly notion that growth was progress.

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