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Property Rights Regimes to Optimize Natural Resource Use - Future CBM Development and Sustainability

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Property Rights Regimes to Optimize Natural Resource Use—Future CBM Development and Sustainability****

ABSTRACT

Property rights regimes that promote sustainable development in the context of coalbed methane (CBM) exploration and production recognize and optimize the value of multiple natural resources including minerals, water, flora, and fauna. Institutional mechanisms that account for and mitigate both the short- and long-term external impacts from CBM development promote sustainability. The long-term potential for a vibrant recreational and tourist economy on a particular landscape may be compromised by overly shortsighted mineral resource extraction.

INTRODUCTION

As in the United States, coalbed methane (CBM) is a promising source of energy in Canada. "More than 6,000 NGC [natural gas from coal] wells have been drilled in Alberta, the focal point for NGC activity in Canada since 2001....By 2025, unconventional gas is expected to account for about 80 per cent of new drilling activity and 50 per cent of total gas production in Canada."[1] The Alberta Energy and Utilities Board (EUB) anticipates that by the year 2025 80 percent of the wells drilled in the province will be CBM wells, with CBM accounting for 50 percent of the total marketable gas.[2]

This article examines issues posed by Canadian CBM development in light of the U.S. industry experience and examines property rights regimes that promote sustainable development through the optimal use of natural resources.

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1. Mike Dawson, *An Unconventional Future for Natural Gas Supplies in Canada, in* UNCONVENTIONAL GAS: THE FUTURE BEGINS 8[5] (proceedings of the eighth annual conference of the Canadian Society for Unconventional Gas, Calgary, Alberta, Canada, Nov. 2006).
2. *Id.*

THE EMERGING CBM INDUSTRY IN CANADA

Though active exploration exists in British Columbia, Saskatchewan, and Nova Scotia, Alberta is the only Canadian province in which considerable commercial CBM production has been reported as of January 30, 2006.[3] The Energy and Utilities Board (EUB) anticipates that CBM production in Alberta will increase from approximately "21 billion cubic feet (bcf) in 2004 to 539 bcf in 2014, an increase from less than 0.5% of the total marketable gas production to approximately 12%" within a decade.[4] Figure 1 shows coal zones of potential interest for CBM production in Alberta. The coal zones contain the following potential CBM resource-in-place:[5]

Zone	Potential CBM in trillion cubic feet (tcf)
Horseshoe Canyon	66
Mannville	320
Scollard Formation (Ardley Coal Zones)	53
Belly River Group (Lethbridge, Tabor and Mackay Coal Zones)	66

The central challenge of CBM exploration and production is one of "sustainable development."[6] The definition of sustainability in the Brundtland Report that has been frequently quoted is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[7] Sustainable development prompts the government to consider solutions relevant to new policies, laws,

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3. Jeffrey Fiell, Opportunities in Coalbed Methane: Economic Upside for Investors 12-15 (Octagon Capital Corp., Jan. 30, 2006) (based on work completed by the Alberta Geological Survey and Alberta Energy & Utilities Bd.).

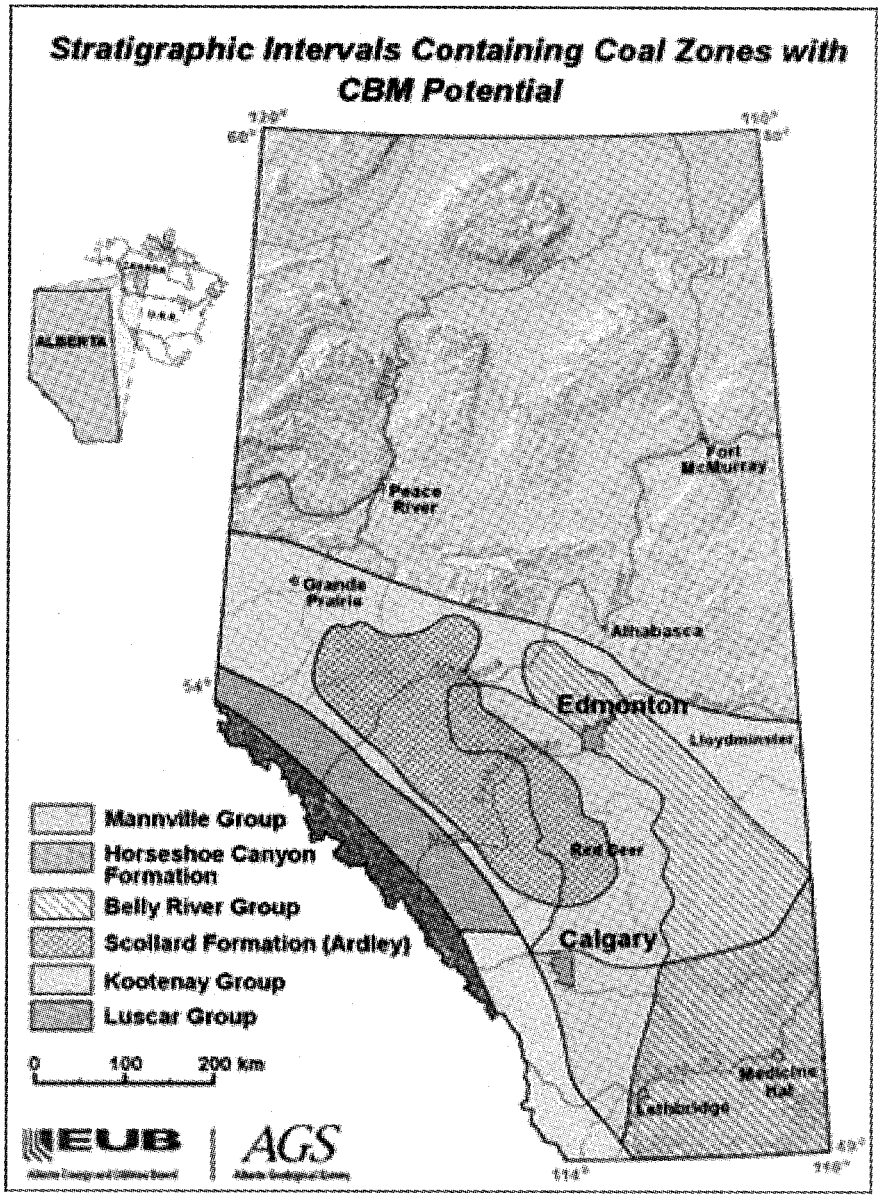
4. *Id.* at 15. Most of the CBM production in Alberta to date is from the Horseshoe Canyon Formation in an area located east of Highway No. 2 between Edmonton and Calgary. In central Alberta, commercial production has also been reported from wet coals in the Mannville Group.

5. *Id.* at 14-15.

6. Notwithstanding previous references to sustainable development, the term was popularized in U.N. WORLD COMMISSION ON ENVIRONMENT & DEVELOPMENT, OUR COMMON FUTURE (also known as the Brundtland Commission Report) (1987) [hereinafter OUR COMMON FUTURE].

7. *Id.* at 43. The Brundtland Commission Report has prompted action to manage the development of natural resources including the conservation and optimal use of those resources to protect the quality of life for current and future generations.

Figure 1


Stratigraphic Intervals Containing Coal Zones with CBM Potential
ALBERTA
Peace River
Fort McMurray
Grande Prairie
Athabasca
Edmonton
Red Deer
Calgary
Medicine Hat
Lethbridge
Mannville Group
Horseshoe Canyon Formation
Belly River Group
Scollard Formation (Ardley)
Kootenay Group
Luscar Group
0 100 200 km
EUB
AGS

relationships, and participation to create changes for an improved future.[8] For example, the Alberta Government, through the Department of Sustainable Resource Development, has publicly confirmed its commitment to "the wise management of Alberta's natural resources and environment for the benefit of Albertans now and in the future."[9]

Our analysis of the CBM development challenge in the context of sustainability will proceed in six stages. First, this article briefly reviews some of the major environmental and social issues triggered by CBM development. Second, the article outlines a conceptual framework for analyzing the problems, focusing on "externalities" or "external effects" of development to provide the best uniform understanding of the challenges associated with CBM development. Third, two kinds of external effects—localized and diffused, which pose distinct issues and invite different solutions—are distinguished. In sections four through six, three kinds of solutions are discussed: property rights, stakeholder consultation, and voluntary contingent taxes (VCT). The first two (property rights and stakeholder consultation) exist in regulatory schemes but could be considerably improved. The third (VCT) represents a promising addition to the policy mix.

IMPACTS OF CBM

In Canada as in the United States, the CBM industry is emerging to replace dwindling conventional natural gas reserves.[10] The American CBM development experience in the last two decades provides a useful context for anticipating and managing issues that will arise in Canada. In its analysis of the environmental impact of CBM production on water resources, the U.S. Geological Survey in 2000 reported that "scientific understanding of, and production experience with, coal-bed methane are both in the early learning stages. Much is yet to be learned... about the environmental implications of developing the resource."[11]

In several states in the western United States, ground water is drawn from aquifers to facilitate CBM production, creating potentially damaging environmental consequences. A study published by the University of Colorado in 2002 noted that CBM development "may affect

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8. *Id.* at 308-10.

9. Ralph Klein, *Foreword* to ALBERTA ENERGY, ALBERTA ENV'T & ALBERTA SUSTAINABLE RESOURCE DEV., ALBERTA'S COMMITMENT TO SUSTAINABLE RESOURCE AND ENVIRONMENTAL MANAGEMENT 1 (1999), http://www.srd.gov.ab.ca/srem/pdf/1999_Commitment_document.pdf.

10. Dawson, *supra* note 1.

11. Vito Nuccio, Coal-Bed Methane: Potential and Concerns, U.S. Geological Survey, FS-123-00 (2000).

underground water quantity and contaminate aquifers, underground water supply may be diminished as dewatering occurs, groundwater may be contaminated by mineral-laden discharged water, and local ecosystems may be adversely affected by the surface release of large quantities of water."[12]

Some landowners, ranchers, and environmental groups in the western United States have expressed concerns about the impact of CBM exploration and production on water quality and the volume of water that will be available for future use in ranching and agriculture.[13] The surface discharge of water produced by CBM development can cause erosion that floods sediment into rivers and interferes with fish reproduction.[14] When the water contains minerals it can also interfere with plant growth.[15] Furthermore, water produced from CBM wells may cause aquifer and potable well contamination, endangerment of wildlife from produced water discharges, destruction of wildlife habitats and ecosystems, and increased erosion from produced water discharges.

Methane migration is another problem accompanying CBM development in the western United States. The U.S. Geological Survey (USGS) has reported that methane can migrate from CBM wells through the soil or water into areas overlying coal seams, and in some areas methane may contaminate groundwater resources.

Methane migration into residential neighborhoods has created significant public outcry.[16] In response to residents fearful of the potential for methane explosions in and near their houses, the USGS and the Wyoming Geological Survey completed a risk assessment in the Rawhide Village Subdivision in Campbell County, Wyoming.[17] The government agencies confirmed that the migration of CBM created a hazard for residents and the subdivision was abandoned.

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12. Gary Bryner, *Coalbed Methane Development in the Intermountain West: A Primer, in* COALBED METHANE DEVELOPMENT IN THE INTERMOUNTAIN WEST 2 (University of Colorado School of Law, 2002), *available at* http://www.colorado.edu/law/centers/nrlc/CBM_Primer.pdf.

13. *See, e.g.*, Press Release, Northern Plains Resource Council, Montana Irrigators Ask State to Limit Salinity, Sodium Pollution (June 25, 2002).

14. Thomas F. Darin & Amy W. Beattie, *Debunking the Natural Gas "Clean Energy" Myth: Coalbed Methane in Wyoming's Powder River Basin*, 31 ENVTL. L. REP. 10,566, 10,579 (2001).

15. Gary Bryner, *Coalbred Methane Development in the Intermountain West: Producing Energy and Protecting Water*, 4 WYO. L. REV. 541, 543, 546 (2004).

16. Nuccio, *supra* note 11; CBM/NGC MULTI-STAKEHOLDER ADVISORY COMMITTEE, COALBED METHANE/NATURAL GAS IN COAL: FINAL REPORT 29-30 (2006), http://www.energy.gov.ab.ca/245.asp; Kate MacNamara, *Fighting Off Another Invader: First It Was Thistles, Now It's the Gas Trapped in Coal*, NAT'L POST (Don Mills, Ontario), Aug. 21, 2004, at FP 1.

17. Nuccio, *supra* note 11, at 2.

Beyond the impacts on water resources and the potential for methane migration, some landowners and residents have objected to land surface impacts of CBM development. Such impacts are similar to those arising from conventional oil and gas development and include land surface disturbance from new roads, drill pad sites, water disposal sites, and other facilities. But because CBM development usually requires the drilling of more wells in a smaller area than conventional oil and gas production, traffic and vehicle noise levels, noise from compressors, and air pollution are more intense. The increased number and density of wells and the corresponding larger number of compressors and pumps for CBM-produced water and to pressurize the methane can result in elevated noise levels.[18] Venting and flaring of uneconomical volumes of gas as part of a pilot testing program to determine the economic viability of production from CBM wells is a practice that has been employed during the initial dewatering of coal seams.[19]

Even though CBM offers exciting new opportunities for energy development in Alberta, it also poses new challenges that may not be effectively addressed by the regulatory and property rights regimes designed for conventional gas. First, in certain fields, the development of CBM entails significant issues of produced water extraction, disposal, and purification. Even though to date most of the commercial CBM production in Alberta has been from "dry" coals that have produced negligible amounts of water, recent exploration and development indicates that wet coals in some areas of the province contain large volumes of CBM, and for that reason there is concern about the environmental impact from CBM development on this vital resource.[20] Second, the time profile for pilot testing CBM wells is frequently longer than in the case of conventional gas wells. Third, drilling spacing units are smaller and well densities significantly higher, ranging from two to eight CBM wells per section, as compared with the common spacing of one well per section for conventional natural gas. Fourth, the magnitude and spatial extent of the resource, combined with the possibility of higher well densities, raises the possibility that full development of the resource might fundamentally and permanently alter the landscape of Alberta in undesirable ways.

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18. *See* Bryner, *supra* note 12.

19. Venting and flaring have prompted complaints from landowners about noise and safety. *See* EUB, EnerFAQs10: Coalbed Methane, http://www.eub.ca/portal/server.pt/gateway/PTARGS_0_0_260_222_0_43/http%3B/extContent/publishedcontent/publish/eub_home/public_zone/eub_process/enerfaqs/enerfaqs10.aspx.

20. *See* Kelly Cryderman & Renata D'Aliesio, *Farmers, Landowners Voice Opposition to Coal Bed Methane*, CALGARY HERALD, June 19, 2006, at A6; Renata D'Aliesio, *Inventory of Water Too Slow*, CALGARY HERALD, June 26, 2007, at B6; Hanneke Brooymans, *Government Urged to Meter Rural Well-water Use*, EDMONTON J., June 26, 2007, at B5.

Given the more dramatic environmental and economic issues posed by this new energy source, it behooves the government to take the time to carefully sort through the institutional mechanisms best suited to managing the difficult tradeoffs among their alternative futures. Alberta and British Columbia landowners, ranchers, and environmental groups have responded with concern about the impact on water quality and the volume of water available for other uses in ranching, agriculture, and consumption. Media coverage about the environmental impacts from CBM development has been significant in Wyoming, Montana, Colorado, and New Mexico. How are the parties to this issue to understand and deal with this complex panoply of issues prompted by the emerging CBM industry? The next section provides a framework.

AN ECONOMIST'S PERSPECTIVE—REGULATING CBM DEVELOPMENT IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

The language of "sustainable development" is de rigueur almost everywhere these days. No doubt, this language has become so popular partly because it has proven to be vague and flexible enough to serve the rhetorical purposes of "agencies with vastly different goals" and to support "a wide variety of policy decisions from a given set of facts."[21] At a minimum, however, sustainable development entails the intergenerational criterion of "meet[ing] the needs of the present without compromising the ability of future generations to meet their own needs."[22] In other words, the portfolio of assets constituting Alberta's natural resources must be maximized for the net benefit of Albertans, present *and* future. From the perspective of economics relating to the disciplinary approach presented here, this requires institutional mechanisms that can account for and mitigate both the short- and long-term external impacts of any particular kind of development.

"External impacts" are effects on other interests in the relevant neighborhood that, in the absence of carefully crafted property rights or regulation, will not be properly taken into account by the developer but that must be factored into any overall accounting of economic and social well-being. Overall well-being, in short, means taking into account not only the direct and immediate economic benefits of proposed developments—say, the extraction of subsurface commodities—but also the full costs and

21. BRUCE R. PARDY, ENVIRONMENT LAW: A GUIDE TO CONCEPTS 267 (1996). *See also* JAMES OTTO & JOHN CORTES, THE REGULATION OF MINERAL ENTERPRISES: A GLOBAL PERSPECTIVE ON ECONOMICS, LAW AND POLICY 8–40 (2002).

22. OUR COMMON FUTURE, *supra* note 6, at 43.

benefits of alternative choices, including alternatives that might be foreclosed to future generations by the "external effects" of current proposals. For example, the long-term potential for a vibrant recreational and tourist economy on a particular landscape may be compromised by overly shortsighted resource extraction.

When economists make these assessments, the core notion of value is *benefit to people*, usually measured in units of some composite consumption good (more crudely, money). And *willingness to pay* is the standard measure of value. In principle, to evaluate the social desirability of an action one simply needs to identify all of the effects of the action, the persons who bear the effects, and their willingness to pay. The result will be positive if the effects of the action are beneficial to them or negative if the effects of the action are detrimental to them. Three different sorts of benefit or value are usually distinguished:

- use value: the value of using some environmental asset at some point in time (e.g., drilling for gas and oil)
- option value: the value of having the option or opportunity to use some environmental asset at some future point in time (e.g., for tourism)
- existence value: the value that people place on the existence of an environmental asset (e.g., an ecological community or a particular species).

Notions of cost are based on the same willingness-to-pay foundation: a cost is simply a benefit foregone. The cost of using some environmental asset today is simply the value of the asset in its best alternative use. Thus, if the best alternative to dense CBM well development in some part of the province is tourism, then the foregone tourism opportunities caused (or exacerbated) by the external effects of resource extraction are the opportunity costs of that development.

This willingness-to-pay approach allows one to analyze and resolve the difficult tradeoffs that inevitably arise in any policy discussion by denominating all benefits and costs in the same *willingness-to-pay* currency. The ability to evaluate and resolve these tradeoffs is the principle advantage of the approach. With this in mind, what are the "external effects" of CBM development, how well are current policies equipped to handle them, and how might they be improved?

THE "EXTERNAL EFFECTS" OF CBM DEVELOPMENT

Not only are the external effects of CBM development extensive, they pose novel issues and problems for two main reasons. First, they tend to be less *localized* (or more *diffused*) than the comparable effects of

conventional oil and gas development. Second, this more problematic diffusion of effects tends to compound over time in a non-linear fashion.

Localized and Diffused Effects

Localized and diffused external effects raise quite different management problems. The actual drilling of wells and the construction of the road and pipeline networks to service them entail the *localized* nuisance effect of dust, weeds, noise, and other effects on neighboring businesses, residents, and ecological communities. Importantly, the localized external effects associated with a development in one locality tend to be *separable* from those associated with another development in a different locality. That is, the nature and magnitude of the localized external effects in one locality are independent of whether or not development occurs in a different locality.

In varying degrees, *localized* external effects can be anticipated before development, identified and measured when they occur, and verified by outsiders after they occur. Moreover, those who bear such localized external effects tend to anticipate or actually feel them acutely. Information about these external effects is relatively easy to acquire, and the incentive is strong for affected interests to become informed and to act on the information acquired. This has implications for the kind of institutional regime best equipped to ameliorate such external effects.

By contrast, in some circumstances, the relevant *neighborhood* in which external effects operate extends so far that the external effects, no longer meaningfully "local," are best described as *diffused*. This is true for certain ecological communities, as when development closes off migration corridors that would normally allow wildlife to move over very extensive "neighborhoods." Similarly, when development degrades environments valued for their natural beauty or their ability to sustain biological diversity, such as the mountains and foothills of Alberta, the external effects are borne in part by potential tourists from around the world.

Typically, it is extremely difficult and costly to identify those subject to *diffused external effects* and, therefore, to measure those effects. Diffuse effects are likely to be small individual by individual but quite large when aggregated over all those who are affected. That means that those affected, at least those humans affected, have little incentive to bring their issues forward and no incentive at all if it is too costly. In fact, people may very well be unaware of the effects until they actually occur.

By comparison with localized effects, information about diffused external effects is much more difficult to acquire, and the (human) incentives to acquire and act on them are much reduced. Again, this will affect the design of institutions intended to manage such external effects.

Localized external effects are much easier to deal with than diffuse external effects.

Some aspects of CBM development can have both localized and diffused external effects. For example, in some CBM developments, large quantities of water, sometimes highly saline water, must be extracted to relieve pressure and release CBM. If such water is not properly treated and disposed of, there will be localized external effects on surface rights holders and ecological communities in the immediate neighborhood. At the same time, downstream impacts may extend quite far, generating diffuse external effects.

The terms "localized" and "diffused" are relative to the scale of analysis and may thus be used differently depending on the spatial scope of either the substantive issues or the regulatory authority attempting to deal with them. An effect extending over areas as large as the province of Alberta will be "diffused" from the perspective of a particular CBM development but will be quite "localized" from a global perspective. And some effects of CBM development, such as those associated with carbon emissions, involve globally diffused externalities. The neighborhood for these effects is the entire planet. But these global issues are no different for unconventional gas than for conventional gas and oil and will not be sorted out at the provincial level.

Thus far, the terms "localized" and "diffused" have been used primarily to convey their usual spatial meaning. But external effects may also be relatively localized or diffused *over time*. The landscape disruption occasioned by the construction of pipelines, for example, involves significant external effects, but recent advances in landscape reclamation have made these effects increasingly temporary. In effect, they are temporally localized.

Other aspects of oil and gas development have much longer, perhaps permanent, effects; they are temporally diffused. Obviously, the more temporary an effect is, the less will the longer-term "option" and "existence" values of the environmental assets be reduced by its current "use value" for energy development. Underscoring this temporal dimension of external effects is crucial for any notion of sustainable development, which necessarily requires accounting for the options and opportunities of future generations. Needless to say, if it is difficult to adequately measure and manage external effects that are spatially diffused to far flung *living* individuals, it is doubly difficult to account for the needs of the unborn.

The Compounded Diffusion of External Effects

In the case of CBM, the temporal diffusion of external effects is exacerbated by the fact that the typical production profile for

unconventional gas is longer and flatter than that for conventional gas. Interestingly, this increased *temporal* diffusion of external effects compounds the *spatial* diffusion of the same effects. That is, to produce a given flow of gas over an extended period of time from non-conventional resources requires that the area devoted to extraction be several times larger than it would be from conventional gas resources. The temporal and spatial effects of CBM development compound each other, creating effects that are diffused over larger areas and longer periods of time.

This compounded diffusion of effects is made even worse by the fact that the external effects of CBM development may be *non-linear*, increasing as more and more of the resource is developed. There are at least two reasons for this. First, areas less attractive for tourism will probably be developed first, meaning that external effects on tourism and recreation will increase as development gradually moves into more attractive regions. Second, and more important, as this developmental shift occurs, tourist activities become more narrowly focused on a diminishing set of recreational opportunities, with the result that the recreational/tourism experience itself is progressively congested and thus degraded, even in areas with no CBM development. The external effects of initial CBM development in recreationally less attractive regions will be relatively more localized spatially than later developments in areas actually or potentially attractive to tourist activity, and the overall diffusion of external effects will compound in a non-linear fashion.

The compounding diffusion of external effects will be temporal *and* spatial to the extent that landscape degradation is long lasting. Further, the external effects that would be associated with extensive development of Alberta's unconventional gas reserves will, potentially, affect many generations of future Albertans.

In essence, CBM development has significant external effects. Moreover, not only are these effects frequently of the more difficult-to-manage diffused variety than is true of conventional gas and oil development, but the diffusion of effects tends to compound over time and space as development proceeds. These features of CBM development pose novel management issues. Indeed, it is probably accurate to say that, at this point in time, few if any Albertans have an accurate sense of possible futures, depending on the ways in which this valuable resource is developed and managed. And it is certainly accurate that no substantial number of Albertans grasps the range of possible futures. Hence, any effort to reasonably assess the diffuse external effects of development must begin with a substantial effort to detail the range of possible futures.

It is risky to assume that the property-rights and regulatory regimes designed for conventional oil and gas development will serve equally well to manage the novel issues posed by CBM development. Given the widespread distribution of the resource across Alberta, extensive

development needs to be carefully considered and managed to avoid and mitigate the compounded diffusion of negative externalities.

How ought these issues be approached? If the problem lies in not taking certain undesirable effects into account because they are external to the most immediately compelling interests and concerns of the decision maker, then the solution may be to design institutions that will make those effects more central to the decision maker, i.e., to cause the relevant decision maker to "internalize" what would otherwise be an external effect. These institutions include carefully constructed property rights, regulatory regimes, and tax incentives.

PROPERTY RIGHTS

In a market economy, well-designed property rights will be one key to effectively internalizing external effects. Property rights work best to achieve this when they are *exclusive* and *transferable* by voluntary exchange. A property right to an asset is *exclusive* if all benefits and costs associated with the use of the asset accrue to the owner of the asset. External effects, by definition, signal the failure of exclusivity. Many of the difficult issues raised by unconventional gas development are driven by the failure of exclusivity. In the case of localized external effects, appropriately designed property rights can often achieve the desired internalization of external effects.

Property Rights for Localized Effects

Two examples—International Paper (IP) and the King Ranch—illustrate how property rights exclusivity internalizes external effects. In each of these cases, landowners' property rights were exclusive with respect to the potential benefits and costs associated with both tourism and forestry/agriculture, thus encouraging the commercial costs and benefits of both to be internalized.

In the case of IP, "one of the largest timber producers in the United States,"[23] commercial accounting now focuses not just on the company's traditional timber production but also on the potential commercial value to be derived from recreational or tourist activities on its land. Recognizing "that the relative values of timber and recreation had shifted and that creating new rights for hunting and camping would increase profits for the company...the company created and marketed rights to these activities, so that by the late 1990s recreational revenues constituted 25 percent of IP's

23. TERRY L. ANDERSON & PETER J. HILL, THE NOT SO WILD, WILD WEST: PROPERTY RIGHTS ON THE FRONTIER (2004).

total profits"[24] in "the 1.2 million acres of timber-producing land in its mid-south region."[25]

To realize this significant return on recreational activities, IP had to be more careful about how and where it logged than if the recreational alternative had not been included in its accounting. Because of its broader accounting, IP acquired a strong incentive to log in ways that would sustain viable habitat and recreationally desirable landscapes. The alternative ways of deriving commercial value from the landscape—resource extraction and tourism—turned out to be, if not complementary, at least not mutually exclusive.

The famous King Ranch in Texas provides the second example. This ranch, one of the largest in the world, has over time expanded its core cattle operation into a more generalized agribusiness. Indeed, this business has diversified beyond agriculture into industries as diverse as energy exploration,[26] publishing,[27] retail,[28] and ecotourism,[29] with hunting central to the ecotourism.[30] The point here is that, as in the case of IP, paid hunting has become a prominent part of the King business. The Ranch's website advertises its full 825,000 acres as "pristine wildlife habitat" on which it sells hunting leases and by-the-day hunting opportunities.[31] Like IP, the King Ranch has a strong incentive to conduct its other commercial activities, such as cattle ranching, farming, and energy exploration, in ways that sustain and enhance the considerable income stream generated by "pristine wildlife habitat."[32]

Because both IP and the King Ranch enjoy a regulatory and property rights context that allows them to sell not only the traditional commercial products derived from their lands (cattle and lumber) but recreational opportunities such as hunting, they have a serious stake in accounting for these different ways of deriving value and in optimizing the balance between them. Had the legal framework prohibited them from selling the relevant tourism opportunities, the recreational cost of less

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24. *Id.*

25. *Id.*

26. King Ranch, The Legacy: The End of the War and Building a Business, http://www.king-ranch.com/end_of_the_war.html.

27. King Ranch, King Ranch Operations: Kingsville Publishing, http://www.king-ranch.com/publishing.html.

28. King Ranch, King Ranch Operations: Robstown Hardware Company, http://www.king-ranch.com/robstown.html.

29. King Ranch, Stewardship and Education, http://www.king-ranch.com/stewardship_overview.html.

30. King Ranch, Hunting: Hunting on the Ranch, http://www.king-ranch.com/hunting_overview.html.

31. *Id.*

32. *Id.*

environmentally sensitive ways of conducting other aspects of their businesses would have been an "external effect" for these companies. For example, if IP had conducted indiscriminate clear cutting, the cost would have been borne by others, including unborn generations whose aesthetic and recreational opportunities would have been curtailed, including those who may have sought an opportunity for recreational commerce.

Because costs that are internalized are taken most seriously, the full-cost accounting required for sustainable development is most likely when the relevant decision maker effectively internalizes all of the costs and benefits. IP and the King Ranch internalized the relevant costs and benefits because they "owned" and could thus sell recreational opportunities. The situation, however, is more complex in the case of subsurface mineral and energy resources, where the exclusivity principle of property rights is often breached.

In Alberta, subsurface mineral rights are often owned by the public and managed on its behalf by the government, even if the surface rights are privately owned. The government typically sells exploration rights to third parties. Where surface and subsurface rights are fragmented in this way and no exclusive property right exists with respect to the relevant activities, it is trickier to determine the best decision maker (or decision-making process) to internalize and balance the costs and benefits of relevant alternatives.

Whether Alberta should undo the fragmentation of surface and subsurface rights in the case of private freeholds may be worth assessing; however, even if that were desirable or possible, the solution would not address the vast bulk of land, which is not fragmented. Complicating the situation even further is the fact that some public lands are leased to farmers and ranchers, creating a hybrid kind of situation. Given widespread public ownership, the internalized full accounting of costs and benefits no doubt requires an appropriately designed public regulatory process. First, however, an evaluation of the policies that currently apply to private freeholds and leaseholds must be performed. That is, the questions must be asked: to what extent does our current policy mix encourage the internalization of external effects, and how might its capacity to do so be improved?

Even where the relevant property rights are fragmented, a property rights regime can be devised to achieve some salutary internalization of the external effects of development. This occurs where external effects are focused on a small number of identifiable parties, the policy regime requires all parties to come to agreement on any development, and side payments between the parties are allowed. Internalization of the external effects of

development occurs to the extent that those who bear the external effect receive compensation for it.[33]

Alberta approximates such a regime because the landowner or leaseholder who controls the surface rights to land on which development occurs can demand and receive compensation for disruption of farming/ranching activities, noise, aesthetic decline, etc. under the Surface Rights Act.[34] On the other hand, the landowner/leaseholder cannot necessarily prevent access altogether. If the petroleum lessee is unable to negotiate a surface lease, a right of entry order may be obtained from the Surface Rights Board, which considers concerns of the surface rights holder and the appropriate amount of compensation for surface access to drill the well. If a strict property rights framework implies a strong veto over development access onto one's land, this is a "soft" veto, subject to regulatory override. Nevertheless, it is strong enough to provide the incentive needed to give the landowner/leaseholder some leverage to obtain compensatory payment and an incentive to negotiate an agreement. An important open question in our minds is whether or not a strong veto might be more appropriate.

The incentive to welcome energy exploration on private land and leaseholds is further strengthened under marginal farming/ranching conditions, where selling access to resource exploration can often bring a welcome income boost. For example, an Alberta rancher in Woodlands County who receives $1200 per well concedes that "you can't make that amount of money by farming [the] land" taken up by a wellsite.[35] Elsewhere in the province landowners receive $2500 per well,[36] which can amount to quite an income boost if several wells are drilled on a property.[37]

In effect, this allocation of property rights facilitates a negotiated solution where energy development occurs after those who hold surface and subsurface rights have come to an agreement after weighing relevant costs and benefits. A significant advantage of negotiated solutions of this sort is that a regulator or referee need not anticipate, measure, and attach value to these external effects. Instead, the activities are devolved to the

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33. This insight is usually attributed to Ronald Coase, who was awarded the 1991 Nobel Prize in Economics for his work on property rights and transaction costs. *See, e.g.*, Ronald Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

34. RSA 2000, c. S-24, §§ 1, 25(1).

35. Hanneke Brooymans, *Coal Front: Is Coalbed Methane Alberta's Next Energy Boon, or Another Environmental Boondoggle?*, ALBERTA VIEWS, July/Aug. 2004, at 46.

36. *Id.* at 47

37. Other kinds of energy developments can similarly become attractive revenue sources for farmers and ranchers, as in Denmark, where farmers consider the payments for the construction of wind turbines to be a cash crop and therefore favor having them installed on their land. Chris Turner, *Fantasy Islands, Two Postcard-perfect Danish Islands May Finally Be Making Eco-warrior Dreams a Sustainable Reality*, ENROUTE, Mar. 2006, at 90.

parties that have the incentive to get it right and that actually bear the effects.

The fact that those who own or control surface rights on lands where wells are developed must be compensated for the external effects of energy exploration is a laudable development. The current compensation scheme, however, is not without its perversities. For example, landowners and leaseholders are paid for the amount of disturbance to their land, effectively a per-well system of compensation. This creates an incentive that favors more wells while disincentivizing technologies that minimize the number of wells, such as directional drilling. On the one hand, the Alberta Energy and Utilities Board (EUB) sees "drilling multiple wells from a single surface location" as a matter of "good land use" and an option to be "highly encouraged" in discussions with landowners.[38] On the other hand, one company CEO reports that "'landowners will get snarky with us if we say we want to drill directionally,'"[39] because, being paid by the well, they stand to lose money from this environmentally friendly technology.

The perverse incentive of the compensation rules tends to multiply well sites unnecessarily not only on any particular property but across local properties. Brooymans reports that a landowner who would rather have avoided energy exploration on her land did not "think we had a choice."[40] Since the energy companies "were coming anyway,"[41] she observed, why should her family put up with all the costs associated with nearby developments while their more energy-friendly neighbors reaped the financial benefits?[42] Better to invite the companies on to one's own land as well.

To make matters worse, Alberta's property rights regime facilitates negotiated settlements only between the developer and the freehold landowner who holds the mineral rights where direct development will occur. The regime does not provide for the localized external effects imposed on neighboring properties that do not host development. To address the latter issue, Alberta's policy framework shifts from property rights to a regulatory process under which landowners within a specified radius of a proposed development have standing to raise concerns and represent their interests. The developer must attempt to resolve any conflicts that arise, subject to supervision and ultimate disposition by the EUB.

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38. EUB, EnerFAQs10, *supra* note 19, at 3.
39. Brooymans, *supra* note 35, at 47 (quoting Michael Gatens).
40. *Id.* at 46 (quoting Irene Olson).
41. *Id.*
42. *Id.*

Missing from that process is the powerful incentive that sustains effective negotiation in a property rights framework: the right of the owner of surface rights on neighboring lands to negotiate before development an agreement pertaining to external effects. While adjacent landowners may rely on the common law torts of nuisance or negligence law for compensation when CBM development has negative quantifiable environmental impacts, in practice this remedy is rarely selected because of the costs of litigation and the asymmetric incentives in any such situation.[43]

The problem of external effects on other properties in the local neighborhood is best handled by an extension of the property rights approach in which all parties with surface rights within the designated radius of the development have the same kind of transferable veto over development held by the actual development property. Before development, the developer would be obligated to negotiate an agreement with all owners within some development radius. The agreement would provide for the addressing of development problems.

Consider water quality issues. In some of the western states, water well impact agreements should provide for monitoring water well quality at regular intervals and for compensation to be paid to the landowner or surface rights holder in the event that water quality deteriorates. Other agreements that protect adjacent landowners from other impacts (such as noise) should also be considered.

This approach would broaden the internalization of the costs and benefits of development throughout the relevant locality by giving neighbors the same leverage to negotiate compensation for negative external effects. In principle, the situation faced by developers under such a regime would be no different from the problem real estate developers face when they set out to assemble a block of land held by a number of owners, or the problem that the aggressor in a hostile takeover bid for a public company encounters. As in the case of the site owners, the neighbors' veto could be made "soft" enough to allow a particularly intransigent minority to be overridden in the public interest at appeal, but "hard" enough that negotiated settlement is generally preferable to regulatory appeal.

The desired result is a process that is more streamlined from the regulatory point of view and that relies more heavily on negotiated settlement among the affected parties. Among many other benefits, the possibility of negotiated compensation for properties without well sites might weaken their incentive to attract additional, superfluous wells. More complex regulatory processes have a role to play in addressing diffused

43. Since typically the developer is involved in many such situations and the land owner just one or a few.

external effects, but property rights solutions have clear advantages in the case of localized effects.

In addition to extending the scope of negotiated solutions to more affected landowners, rules should allow landowners to internalize all of the relevant external effects. Currently, such a scheme is hampered by the legal inability to sell the kind of hunting and fishing access that, as noted above, induces IP or the King Ranch to engage in more strategic logging and agriculture. For many farmers and ranchers in Alberta, hunting is the kind of recreational activity to weigh and balance against energy exploration and marginal agriculture.[44] Certainly, the experience of other jurisdictions shows that vibrant economies can emerge to serve this interest.

But Alberta's farmers and ranchers are in precisely the situation hypothesized above in which IP was unable to sell recreational rights. For IP, such a situation would favor more indiscriminate clear cutting. For Alberta's farmers and ranchers, it adds to the incentive for unnecessary energy-related land disturbance, and the costs in lost tourism opportunities imposed by certain energy-development strategies remain "external effects." For IP and the King Ranch, on the other hand, the costs are "internalized."

The negative "external effects" are not only lost opportunities for local farmers and ranchers, but also for other local businesses that could serve the more extensive tourist trade that might otherwise arise. Ultimately, these external effects are borne by unknown numbers of potential tourists worldwide, both now and in the future. In this sense, they take us beyond *localized* to *diffused* external effects. Interestingly, although property rights are not as readily applicable to these situations, they can play an important role as proxies for diffused external effects.

Property Rights as Proxies for Diffused External Effects

As noted, diffused external effects raise significant informational issues because the innumerable parties are difficult to identify and often will not self-identify and participate because their individual stakes are small as compared to the significant aggregate impact. In some cases, this difficulty can be partly overcome by relying on entrepreneurial proxies for the many diffuse parties. This is a feasible strategy when diffused external effects on far flung individuals are reflected in the profits of firms that provide various goods and services that are complementary to the affected environmental assets. There are, for example, a variety of different sorts of

44. Skiing, hiking, recreational activities, and industries are already represented differently within national and provincial parks and are not as viable an option in many farming and ranching areas.

firms that provide services to tourists, such as restaurants, motels, gas stations, curio shops, guiding services, and so forth. Moreover, farmer/rancher landowners can in principle provide some of these services themselves and thus be an effective proxy.

These services, in effect, combine with environmental assets to produce the valued experience, tourism in this case. Typically the firms that provide these complementary services are easier to identify than the ultimate users, are smaller in number by orders of magnitude, and are often quite specialized in that the quality and quantity of the relevant environmental assets is a matter of great concern to them. Profits earned by hunting and fishing guides, to cite the most obvious example, are largely determined by the quality and quantity of the game and fish that the environment provides. These firms are potentially one important source of information on the significance of external effects. Because they can be identified, are relatively small in number, and have a significant stake in the quality and quantity of the relevant environmental assets, the task of getting reliable information about the value of the diffused external effects of development on them is more manageable. However, they capture only a part of the value to ultimate users, so the effect on their profits of a particular development is a lower bound on the true value of the diffused external effects of the development.

Acquiring the relevant information from many of these proxies, to say nothing of the potential ultimate users, poses difficulties that cannot often be solved by property rights. Reflection on IP and the King Ranch, however, shows that appropriately designed landowner property rights *can* be part of the solution if the landowner can sell them, such as recreational opportunities like hunting and fishing. It is worth exploring further why this does not occur in Alberta and what might be done to remedy the situation.

Significantly, the situations of the energy and the hunting/fishing economies in Alberta are rooted in the same conceptual starting point. As in the case of subsurface resources, the public typically retains ownership of the wild animals that roam the surface. Here, too, exploitation rights (hunting and fishing licenses) are sold to third parties, with the landowner suffering real costs. Unlike subsurface resources, the very presence of certain game animals can impose significant costs on farmers and ranchers.

For example, deer and elk herds can significantly reduce a ranch's carrying capacity for cattle. In itself, this might provide an incentive to welcome hunters. The overall impact of modern hunting on herd size is often negligible, however, and is offset by what a 1971 study prepared for the Western Stock Growers Association referred to as an annual invasion "by an army of hunters [the landowner] cannot control, with all the inherent risks of fire, damage to fences, wounding of livestock and disruption of

productive activities on the farm or ranch."[45] Under these circumstances, the farmer or rancher may calculate that it is better to reduce herd size by minimizing suitable wildlife habitat.

Meanwhile, hunters persist in the illusion that, aside from license fees paid to the government, the publicly owned resource in game "is costless and consequently must be free."[46] Among other things, this is taken to mean that hunters and fishers cannot be charged a fee by the landowners who allow them to hunt and fish. In fact, this perception is embedded in Alberta policy, which makes it "unlawful to directly or indirectly buy or sell, trade or barter, or offer to buy or sell access to any land for the purpose of hunting any big game, furbearing animals or game birds...except under authority of a Game Bird Shooting Ground License."[47]

The result, observes the Western Stock Growers Report, is highly ironic: while the landowner's economic interest pays him "to assault the game population on the habitat side[,] the Government of Alberta collects [significant funds] from hunters intent on gaining access to somebody's land in order that they might collect their 'free' game."[48] Under these circumstances, many landowners view hunting as an unmitigated cost and one they can avoid. In contrast to the case of subsurface resources, where the Surface Rights Board can impose access rights over landowner objections, landowners can prohibit hunting and fishing access altogether and without question.

In sum, an important asymmetry exists in the incentive structures confronting landowners vis-à-vis the two different kinds of publicly owned resources on or under their land. In the case of subsurface resources, landowners and leaseholders can charge for access and, given the prospect of an imposed agreement, have strong incentives to do so. In the case of wildlife, by contrast, since landowners are legally unable to realize any of the value associated with hunting and fishing, they can at least avoid its costs by closing off all access.

The result of these opposing incentive structures is to give landowners a positive stake in energy exploration and a negative stake in the local hunting and fishing economy. Other things being equal, they can thus be expected to cooperate in the expanding energy economy while at the same time contributing to the decline (or preventing the effective launch) of the hunting and fishing economy. They are definitely not put in an IP- or King Ranch-like position of having to weigh and balance the

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45. J. Paul Hedlin & Ralph Hedlin, Game Policy Needs in Alberta 5 (1971) (a study prepared for the W. Stock Growers' Ass'n).

46. *Id.*

47. Alberta Outdoorsmen, General Regulations, Hunting Privileges on Occupied, Private and Public Land, http://www.albertaoutdoorsmen.ca/huntingregs/genregs.html.

48. Hedlin & Hedlin, *supra* note 45.

opportunities for realizing value from both kinds of economy. On the contrary, for landowners at least, the playing field is strongly tilted toward the energy economy and away from the hunting and fishing economy.

Allowing landowners to realize value from both kinds of land access would level the playing field. In the IP example, IP's ability to reap recreational value from its lands will not lead it to abandon the forestry business. Given its real incentive to weigh and balance the two ways of realizing value, and assuming that both offer significantly attractive prospects, IP will be strongly motivated to try to find an optimal balance of both. Not only will a landowner who can realize value from *both* energy exploration and tourism be strongly inclined to do so, he also brings to the table a strong incentive to ensure that the energy-exploration side of his portfolio is conducted in ways that will not undermine the tourism side. A landowner with positive incentives on both sides of the ledger might, for example, be more favorably inclined toward the well-minimizing strategy of directional drilling, even under the perverse incentive of per-well payments,[49] if the foregone income from "extra wells" could be treated as a revenue-generating investment in tourism. Depending on the kind of hunting and the size of the hunting party, one or two days of paid hunting can easily surpass the annual income of a single well-site access agreement.[50]

The highly desirable goal of "sustainable energy, environment, and economy" requires balance. Achieving such balance means that those with a stake in its different sides and dimensions must be involved in the decision-making process. This means that representatives of each side—e.g., energy companies and environmental groups—should be at the table. But the chances of finding an optimal balance will be improved by the participation of those who have a simultaneous stake in the alternative sides of the equation and thus a personal interest in optimizing the mix. Landowners/leaseholders surely belong in this category, but they cannot make their best contribution unless public policy unlocks their capacity to have a real stake in the alternative ways of realizing value from their land.

The resulting improvement in the capacity of larger landowners to find creative ways of diversifying their operations is environmentally desirable not only because it can be expected to have a positive influence on the inevitable balancing of "sustainable energy, environment, and economy," but also because it may contribute to the long-term viability of

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49. Though this perverse incentive might itself be revisited.

50. Reported per-well payments range from $1200 to $2500 per annum. Consider that a three-day deer hunt at the King Ranch costs a minimum of $5500 per person, and may range up to $20,000 depending on the quality of the trophy bagged. Similarly, a quail hunt costs $450 per day per person. *See* King Ranch, Hunting, Pricing Info and Booking Status, http://www.king-ranch.com/pricing.html.

larger private landholdings in environmentally sensitive but recreationally attractive landscapes. This in itself has important environmental benefits. The fact is that landowners face more than just the two alternative non-agricultural ways of realizing value thus far discussed. In recreationally attractive regions, they can also gradually fragment their holdings, selling off small parcels of land at high prices. This is a perfectly understandable and rational strategy, especially since it is often the route to comfortable retirement for cash-poor but land-rich agriculturalists whose children choose not to follow a similarly cash-poor lifestyle. It should be noted that the desire to maintain the option of selling parcels of land is itself a reason to oppose the kind of extensive energy development that might well lower the price that recreationalists are willing to pay. But protecting land from energy exploration primarily to preserve it for eventual residential fragmentation has its own significant environmental costs. The problems of access roads and other kinds of habitat disturbance that come with energy exploration also come with residential/recreational fragmentation.

A land use mix in which large land holdings continue to play a role may achieve the best balance of environmental, commercial, and recreational values. But at least in regions dominated by private ownership, such a mix is likely to persist in the long term only if large landholdings in environmentally sensitive but recreationally attractive landscapes can be economically viable. Given the economic difficulties often facing purely agricultural operations on such landscapes (which tend to be agriculturally marginal for reasons closely related to their recreational attractiveness), the viability of large landholdings may well depend on a strategy of mixed diversification, like the one that has helped sustain the King Ranch as a commercially successful large land holding. Income derived from energy exploration is likely to play an important part in such a strategy, as it has in King's case. Such exploration on a landholding might well make it somewhat less attractive to prospective buyers of small parcels, but, if well managed, might be perfectly compatible with income from a vibrant hunting and fishing economy. Overly dense energy development might kill even that prospect, but more carefully designed development (with fewer wells using directional drilling, say) might optimize the balance of both kinds of "diversification income."

PROPERTY RIGHTS AND STAKEHOLDER CONSULTATION

The advantage of property rights is that they facilitate negotiated agreements among interested parties and thus do not require state intervention. Although more difficult in the case of diffused external effects, appropriately designed property rights can incentivize landowners to act directly as meaningful proxies for the external effects borne by far flung interests. Related property rights might have similar effects. For example,

outfitters are often allocated quotas of hunting licenses, in effect a kind of property right that gives them an important stake in outcomes and makes them an important source of relevant information.

However, while the potential of property rights should be as fully explored as possible, they will not be the entire solution for a number of reasons. First, much of Alberta's landscape is not privately held, meaning that even under ideal property rights regimes, private landowners and leaseholders will not be adequate proxies for the full range of diffused external effects. Appropriately designed property rights on public lands for outfitters and guides may help, but a wide range of other tourist service firms such as restaurants and motels are also important proxies, and they will not tend to have this kind of property right. Simply put, diffused external effects can be so large that negotiations among interested parties with well-defined property rights will go only so far. This means that some public regulatory process is also necessary.

One challenge for any regulatory process is gathering the relevant information about diffused external effects. How is information obtained from unknown numbers of widely dispersed tourists? Moreover, how is good information obtained from entrepreneurial proxies in the tourist service industry?

A common answer is some kind of "stakeholder consultation process" that gives various interests in addition to the site owners an opportunity to be heard. In fact, a stakeholder consultation process" currently exists, but it is designed mainly to address localized external effects, not diffused effects. The process allows neighboring interests to be heard and is strongly biased against exceeding local focus.

In Stage 1 of this five-stage process, the developer, or applicant, communicates to the public a detailed description of the project, which includes the identification of potential impacts of the project and a discussion of alternative ways of mitigating the impacts. Parties with an interest in the project must respond to the initial announcement within 14 days.

In Stage 2, the developer initiates a participant involvement program. Participants include all parties with a direct interest in the land, those who have the right to conduct activities on the land, and possibly other parties who express interest in the project. Parties within a specified radius of the proposed development are deemed to be participants. Pursuant to the Alberta Energy and Utility Board (EUB) guidelines, individuals who are unable to show a reasonable and direct connection between the proposed development and the rights or interests they believe to be affected or individuals who are not affected in a different way or to a greater degree than members of the general public have no standing in the process.

In Stage 3, the developer is obliged to identify and, if possible, resolve conflicts that arise in Stage 2. In Stage 4, unresolved concerns are addressed either through an appeal process or through a formal EUB hearing. In Stage 5, the EUB issues its disposition of the application, and the applicant informs participants in the process of the disposition.

Clearly, this process is not well designed to handle diffused external effects. It more or less explicitly excludes parties with a diffused interest in the project. The fact that it is initiated by the developer, the short timelines envisioned in the process, and the EUB guidelines regarding who ought to have standing in the process rule out meaningful participation by members of the general public who might have quite legitimate interests in the project.[51]

Moreover, because the process deals with development on a project-by-project basis, people who bear diffused effects have only a limited possibility of representing their interests and a very limited incentive to do so, even if they were granted standing. Residents of Edmonton or Calgary are quite unlikely to be aware of a particular proposal for development in the Porcupine Hills, and even if they are aware of it, the costs of representing their interests may very well be simply too onerous. Indeed, their interest would appear to be not in particular projects but in the pattern of development of much larger regions, such as the Cypress Hills, the Highway 22 Corridor, or others.

In essence, the current stakeholder process emphasizes the wrong problems, localized external effects, which are better handled by improved property rights mechanisms. The process needs to be modified to better address the problem of diffused effects. This article is not the place to detail alternative models for such a process, but it does seem appropriate to comment briefly on some features of a workable process.

To insure that diffused interests are represented, the process ought to consider development on a region-by-region basis. It ought to be initiated and driven not by developers but by some public body, preferably one that is independent of departments with strong existing interests in energy development. Any party or collection of parties willing to incur the costs of representing their interests ought to have standing in the process.[52]

Government departments could also be included among the participants. In fact, it might be desirable to require that key departments like Energy, Sustainable Resource Development, and Tourism participate

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51. Because, for example, they vacation in the affected area, or they anticipate that their children will want to use the area for recreational purposes, or they value the existence of wildlife in the area.

52. On the question of how non-governmental and non-corporate interests might afford such representation, see the section on "Voluntary Contingent Taxes," *infra*.

in the process. Some body or group should be charged with the responsibility of producing a state-of-the-art *contingent valuation study* to aid in the assessment of diffused external effects of different development scenarios for the region. The outcome of the process ought not perhaps be a development plan for the region but rather a set of guidelines for energy development in the particular region, including permissible well densities, guidelines concerning access to and decommissioning of roads built for development, and the identification and protection of particularly sensitive areas.

VOLUNTARY CONTINGENT TAXES (VCT)

As previously discussed, diffused external effects raise difficult measurement issues, especially when the effects are not associated with the use of the environmental resource in question. If, for example, the very existence of a pristine environment is valued by people who do not use the environment, they will be difficult to identify. Even if they can be identified, standard contingent valuation techniques may not accurately measure the value they place on the environment and the extent to which particular insults to the environment degrade that value.

The core problem with contingent valuation techniques is one of preference revelation. If a person is simply asked to reveal her willingness to pay to prevent some particular insult to the environment, she has no obvious reason to carefully assess her willingness to pay and no clear incentive to accurately report it. In fact, if she sees any causal connection between her reported value and the likelihood that the insult will be avoided, she has an incentive to inflate her willingness to pay.

Where applicable, property rights approaches are preferred precisely because they avoid the preference revelation problem. Owners of property rights and others who would like to acquire them have good reason to carefully assess the value of the rights to them, and obvious incentives to forge a bargain in which the party that places the largest value on the rights either acquires or retains them.

Recent theoretical and experimental work on charitable donations and the private provision of public goods suggests that in certain circumstances one can solve the preference revelation problem using a voluntary, contingent tax mechanism (VCT). Further, schemes of this sort have been tried in the field, and although the evidence is mixed, the results are encouraging.

To fix ideas, consider a public good, perhaps some conservation project, that costs say $10,000 and provides benefits to 100 people. The value of the public good to person i is simply a number, v_i. The sum over all 100 people of these values is their aggregate willingness to pay for the public good, $V=\sum v_i$. If V exceeds the $10,000 cost of the public good, then

the willingness to pay logic implies that the good ought to be provided, and if V is less than $10,000 it ought not to be provided.

Now suppose that these 100 people have the opportunity to pay a voluntary, contingent tax to pay for the public good, likely in an identified line on their tax return. Specifically, imagine that each person chooses her own contribution, t_i for individual i. The individual's tax is voluntary in that she chooses the amount to contribute, and it is *contingent* in that the designated amount will be tapped only if the total contribution, $T=\sum t_i$, is at least $10,000—that is, only if there is enough in the fund to provide the good. Further, in the event that T exceeds $10,000, imagine that the excess will be redistributed to individuals and that shares of individuals are proportional to their contributions. Rebates for unsuccessful projects (those that fail to generate the required level of funding), or for contributions in excess of requirements, could be handled in a number of ways—for example, as a tax credit in the following year.

Projects would come forward through a process of citizen participation. A project's eligibility for inclusion on the tax form would be dependent on preliminary contingent contributions by citizens amounting to some specified percentage (25%, for example) of the target amount.

The mechanism may create some added competition in the bidding for energy development rights in particular areas. Oil companies bid on these rights because they can make money. A coalition of citizens could bid on them to prevent oil companies from getting them or to impose their own conditions on development. Additionally, intervenor funding for neighboring landowners may assist them in preparing for meaningful participation in the stakeholder consultation process.

CONCLUSION

Clearly, CBM is a potentially valuable energy resource in Alberta, but its development raises a number of thorny issues that must be managed effectively if the provincial government is to optimize the use of all natural resources. First is the very magnitude of the resource. It is distributed across virtually the entire southern half of the province.

Second is the fact that CBM well densities are considerably higher than in conventional gas fields. The net result is that CBM development can have a much larger surface footprint. Thus, the potential for conflicts among competing uses of land and water resources is far greater with CBM than it has been with conventional natural gas.

Further, at this point in time, there is considerable uncertainty about the nature of these conflicts and how best to manage them. Indeed, it is probably accurate to say that few if any residents have a clear sense of the possible futures, depending on the manner in which this valuable energy resource is developed and managed. And it is certainly accurate that

a minority of provincial residents grasp the range of possible futures. Hence, prudence demands that a substantial research effort detail the range of possible futures, this article's first recommendation.

Given the nature of the issues posed by CBM development, parts of the regulatory framework that have served the province so well for conventional gas development may not be appropriate for future CBM development. Using the standard economics framework that focuses on localized and diffused external effects of development, this article has assessed the suitability of existing institutions for CBM development and explored modifications to them by focusing on property rights and stakeholder consultation.

The potential of CBM as a Canadian energy resource, and the fact that its development can have significant land impacts, the diffused external effects of development on ecosystems and in particular wildlife and the associated recreational and tourism opportunities can be very significant. It is, of course, difficult to assess with any precision the magnitude of these effects. In light of the importance of these activities to residents and the provincial government's commitment to sustainable development, an effort must be made to address the issues raised in this article. Under the current regulatory process, there is no effective way to assess diffused effects. It seems that a new, inclusive stakeholder process that focuses on development on a region-by-region basis is necessary. In particular, it should be open and include a state of the art contingent valuation study; various departments of government like Energy, Sustainable Resources, and Tourism with a stake in the outcome should make representations; and the process should not be based in any of these departments.

It may also be desirable to devise a new institution that would facilitate voluntary contingent taxes as a way of assessing diffused effects external effects and raising money for a variety of public good/environmental purposes. An institution of this sort could play a valuable role in a number of areas outside energy and environment.

It is also clear that the localized external effects associated with development are more significant for the CBM resource than for the conventional gas resource. Localized external effects are best handled by property rights, and the current system goes some distance in this direction but not all the way. Efforts should be undertaken to extend the internalization by property rights in a number of areas. Under Alberta's current property rights regime, in the battle for land use, no one speaks effectively for alternative uses of private or public lands that involve hunting and other recreational pursuits. In particular, farmers and ranchers have no positive stake in these activities even though their decisions with respect to land use and access determine in significant measure the realized value of these activities. As a result, the interests of farmers and ranchers are inappropriately tipped toward energy development. Efforts should be

undertaken to rectify this situation by enhancing the property rights of farmers and ranchers.

Given the increased density of CBM wells, localized external effects on neighboring properties will also be more significant in the future. Currently the regulatory system and the courts are beginning to address these effects; however, given the litigation costs and the asymmetry of the typical situation, litigation is not the most efficient or effective remedy. Instead, there should be meaningful consultation with neighboring landowners and a legal requirement that agreements be negotiated between CBM developers and adjacent landowners before CBM drilling proceeds.