

A Critical Review of the Compulsory Integration Requirement,

Title 9 of Article 23

New York State Environmental Conservation Law

A White Paper (as amended)

By William C. Fischer

Synopsis: In June of 2005 the New York State Senate unanimously passed Bill # S5553-B, which was sponsored by then Sen. George Winner (R-NY).^{1,2} It amended Title 9 of Article 23 of the Environmental Conservation Law to provide for the compulsory integration of private property. This paper examines the consequences of that legislation and makes the following arguments with regard to the regulatory regime proposed by the New York State Department of Environmental Conservation (NYSDEC).

- NYSDEC's policy objectives are not fulfilled by its proposed regulations
- The Environmental Conservation Law (ECL) statute does not authorize the compulsory integration of gas bearing shale deposits
- Compulsory integration threatens residential developments and mortgages
- Compulsory integration of *gas bearing shale deposits* constitutes an unauthorized taking
- NYSDEC's definitions are inconsistent and contradictory with the ECL statute definitions
- Compulsory integration is not in the public interest, foster disrespect for the rule of law, and promotes civil disobedience.

First Principles

"Cujus est solum, ejus est usque ad coelum ad infernos" is an old maxim meaning the owner of the land owns everything up to the sun above and down to hell below.³ The 5th Amendment to the Constitution of the United States provides, in part: "...nor shall private property be taken for public use, without just compensation."⁴

Declaration of Policy 23-0301: "It is hereby declared to be in the public interest: to regulate the development, production and utilization of natural resources of oil and gas in this state in such a manner as will *prevent waste*; to authorize and to provide for the operation and development of oil and gas properties in such a manner that a *greater ultimate recovery* of oil and gas may be had and that the *correlative rights* of all owners and *the rights of all persons* including landowners and the general public may be fully protected, and to provide in similar fashion for the underground storage of gas, the solution mining of salt and geothermal, stratigraphic and brine disposal wells...."[emphasis added].

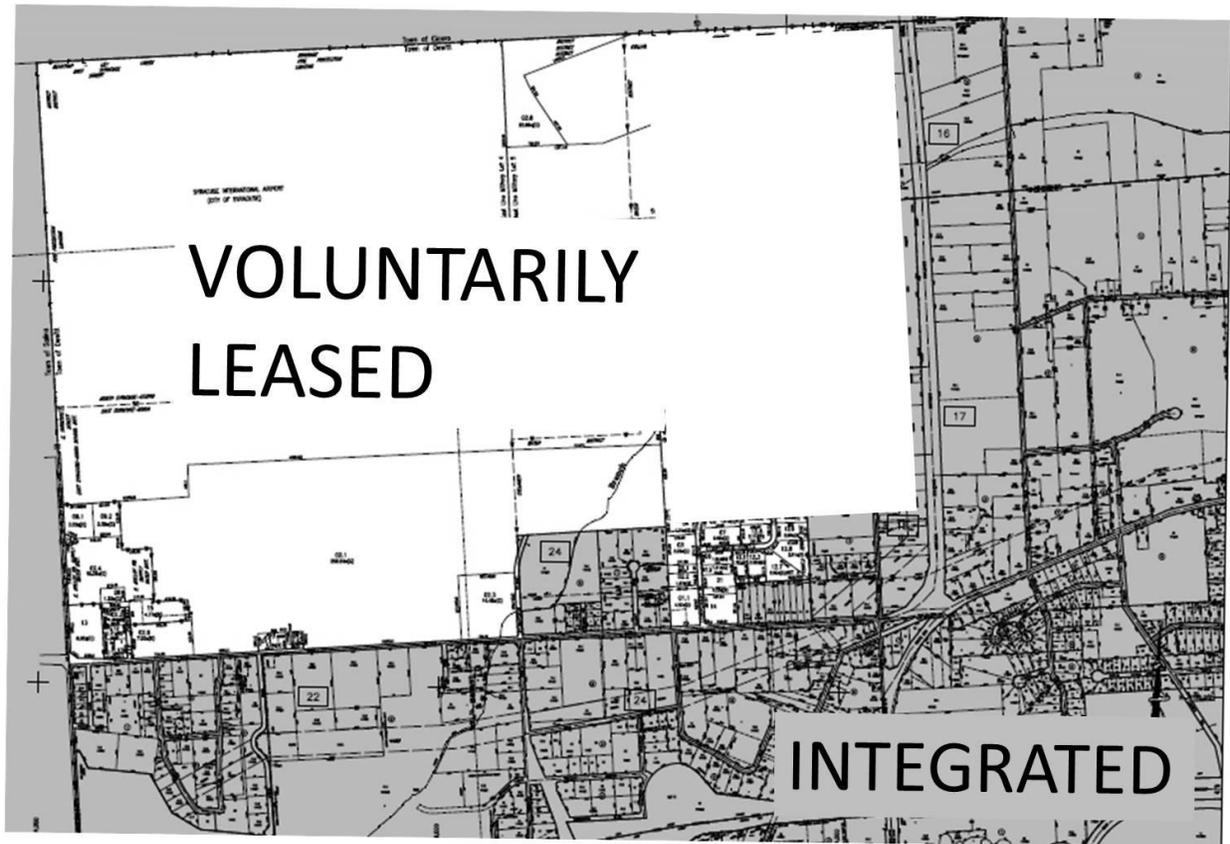
The compulsory integration amendment provides that upon the un-notarized affidavit⁵ of a prospective well operator that he controls by fee ownership, or lease, at least sixty percent of the land within a prospective spacing unit, the landowner(s) of the remaining forty percent of the property within that spacing unit are **required** to select one of three options:

- (1) “participating owner” - pay up front, a proportionate share of all estimated production costs, and accept a proportionate share of any fees and liability occasioned by the well operators negligent or intentional actions, receive a proportionate interest in the well's production;
- (2) “non-participating owner” - pay a disproportionate share of the development costs, penalties and fees incurred by the well operator, be subject to all liabilities and cost recoupment, at a 300% “risk penalty”, and be subject to a proportionate share of all costs going forward; or
- (3) “royalty owner” - pay no development costs, and be exposed to no liability but forfeit the signing bonus ordinarily included in a negotiated lease and seven-eighths of all gas revenue.

None of these three options permit the owners to either decline to be integrated, or drill their own well.

Compulsory integration threatens residential developments

The application of Article 23 is not restricted to rural areas. It is entirely possible, even likely, that within a single 640 acre spacing unit, a well operator could obtain a lease to the gas rights of a 384 acre farm, airport, park, swamp or cemetery adjacent to a residential development. Title 9 could then integrate as many as 512 half acre suburban properties or 1024 quarter acre city lots.



Mortgages are threatened

All mortgages prohibit hazardous activity and hazardous substances on the property. The involuntarily integration of properties into hazardous industrial sites risks the foreclosure of thousands of mortgages and can only serve to further depress construction starts in an already unstable economy.

“Residential fracking carries heavy industrial risks, and the ripple effects could be tremendous. Homeowners can be confronted with uninsurable property damage for activities that they cannot control. And now a growing number of banks won’t give new mortgage loans on homes with gas leases because they don’t meet secondary mortgage market guidelines. New construction starts, the bellwether of economic recovery, won’t budge where residential fracking occurs since construction loans depend on risk-free property and a purchaser. This shift of drilling risks from the gas companies to the housing sector, homeowners and taxpayers creates a perfect storm begging for immediate attention.”⁶

Original Intent

The 2005 amendment modified New York State's existing 1963 oil and gas legislation with the three-pronged objective of encouraging development, preventing waste, and protecting the rights of all stakeholders (i.e., landowners, the public, and well operators). The 1963 provisions were written prior to the development of high volume, slick water, hydraulic fracturing, (an enhanced method of extracting natural gases locked in shale formations), and were based upon the technology of the time; i.e. vertical drilling into oil and/or gas *fields and pools*. Because oil or gas will flow toward the point of lowest pressure, the 1963 unitization law was authorized as necessary to efficiently drain oil pools and gas domes which underlay more than one property.

Unauthorized Taking

Title 9 does not authorize the compulsory integration of gas bearing shale formations. Bill # S5553-B seems to have left unchanged the definitions section of the 1963 version. Thus the law gives a well operator the right to drill and extract oil and/or gas only from the gas fields and pools of integrated landowners as those terms are defined in ECL, Title 1 - (23-0101 - 23-0102). A close reading of those terms is integral to the argument which follows.

6. "Field" means the general area overlaid by one or more pools.

7. "Gas" means all natural, manufactured, mixed, and byproduct gas, and all other hydrocarbons not defined as oil in this section.

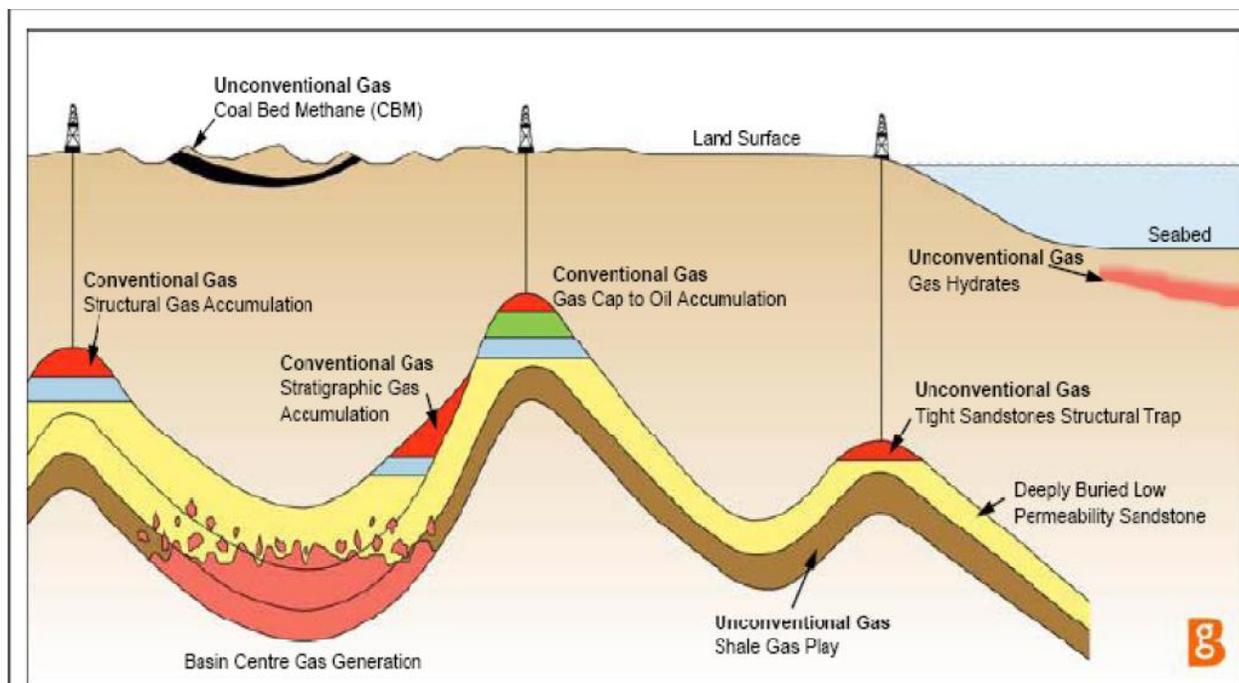
14. "Pool" means an underground reservoir containing a common accumulation of oil or gas or both; each zone of a structure which is completely separated from any other zone in the same structure is a pool.

17. "Reservoir" means any underground reservoir, natural or artificial cavern or geologic dome, sand or stratigraphic trap, whether or not previously occupied by or containing oil or gas.

A gas bearing shale formation, or anything which could be construed as such, is not included in the terms ‘field’, or ‘pool’. Because a ‘pool’ of gas is defined as “a structure which is completely separated from any other zone in the same structure”, that term as used in Title 9 would not apply to gas bearing

shale formations which are nearly monolithic and continuous solid structures, some of which underlie several states.

Gases and liquids are fluids. There is nothing in science that controverts this statement. Hydrocarbons, including natural gas and liquid crude oil, are lighter than water and rock, and will migrate upward through faults and fissures in the rock layers above until they either reach the surface or become trapped within porous rock structures by impermeable rocks above. When hydrocarbons accumulate beneath a stratigraphic trap, an oil field forms. The components are separated by differences in density, with a layer of water below the oil layer and a layer of gas above. The gas and oil can be extracted by drilling and pumping. The obvious difference between these discrete fields and pools of oil and gas, as compared to shale gas formations can be readily seen in the following⁷ graphic.



The term 'Reservoir' is never used in Title 9. That is to say, nothing in Title 9 makes reference to or includes anything which could be construed as a gas bearing shale formations. And, no agency of the State may promulgate rules and regulations which exceed that authorized and intended by statute.

"[N]ew language cannot be imported into a statute to give it a meaning not otherwise found therein' (McKinney's Cons Laws of NY, Book 1, Statutes § 94, at 190). Moreover, 'a court cannot amend a statute by inserting words that are not there, nor will a court read into a statute a provision which the Legislature did not see fit to enact' (id., § 363, at 525). Also, an 'inference must be drawn that what is omitted or not included was intended to be omitted and excluded' (id., § 240, at 412)."⁸

Gas is a not a mineral; although it may be contained within a mineral deposit such as the Marcellus Shale. In order to hydraulically fracture a gas bearing mineral deposit, some of the shale must first be

mined [removed] for the well bore. Drilling the well bore must precede the fracking process. Title 9 does not define, address or give authority for the mining of, or the extraction of minerals from shale gas formations.

Inconsistent Terminology

Further verification that the compulsory integration legislation, was not intended to include gas bearing shale formations is evidenced by the NYSDEC proposed definitions⁹ of Operations Associated with High-Volume Hydraulic Fracturing.

“(20) 'reservoir' shall mean a waterbody designated for use as a dedicated public water supply and is classified as A or AA in its entirety pursuant to Parts 800 to 941 of this Title.”

The classification AA or A is assigned to reservoirs used as a source of drinking water. Thus if NYSDEC's definition of 'reservoir' is applied as used in the term 'pool', of the ECL statute Title 1 - (23-0101 - 23-0102), we are left with the oxymoron that 'Pool' means an underground dedicated public supply of drinking water containing a common accumulation of oil or gas or both. Under the current proposed NYSDEC regulations¹⁰ this may become a self fulfilling prophecy as the use of diesel fuel as a carrier fluid is not expressly prohibited.

Trespass

A person commits a trespass when they intentionally enter and remain unlawfully on land in possession of another *or cause a thing to do so*.¹¹ A trespass does not occur when an intrusion is privileged. Privilege is obtained through consent of the property owner or by law. There are at least three types of subsurface entries that may result in a subsurface trespass: “

- (1) directionally drilled wells;
- (2) injected fluids in enhanced recovery projects; and
- (3) hydraulic fracture operations.¹²

Title 9 does not give to a well operator the right or authority to deposit and leave on another's property hundreds of tons of sand, toxic chemicals and polluted water. Whether those deposits are surface or subsurface is immaterial.

Rule of Capture

Under the rule of capture, the owner of a tract of land acquires title to the oil or gas which he produces from wells on his land, even though part of the oil or gas may have migrated from adjoining lands.

Frac radius

The hydraulic length of the fracture, or frac radius, can be controlled by the amount of pressure applied from the surface and its effective limits closely monitored by the analysis of seismic returns. “Engineers select the injection pressure, volumes of material injected, and type of proppant to achieve a desired result based on data regarding the porosity, permeability, and modulus (elasticity) of the rock, and the pressure and other aspects of the reservoir.”¹³ Thus, an inadvertent subterranean trespass into another landowner's shale deposit need not occur any more than a lumber company need trespass onto another landowner's forest.

“The length of a fracture is measured in three ways. The longest measurement is the hydraulic length, measured by the distance the fracturing fluid will travel. The propped length is the “slightly shorter distance the proppant will reach.” The shortest length is the effective length, which measures the distance within which the fracture will actually improve production”.¹⁴ Therefore, Title 9 should be modified to establish a setback distance equal to or greater than the “propped length” from an un-leased owner’s property line in order to avoid “frac trespass”.

Title 9 as amended by Bill # S5553-B, not only fails to achieve a single objective of its declared policies, it is so constructed as to actively prevent and oppose those objectives.

Correlative Rights

As the name suggests, The doctrine of correlative rights is based on the premise that every owner in common share equally in the risks and proceeds according to his proportionate share. The doctrine of correlative rights emerged in Pennsylvania during the nineteenth century because liquid oil and free gas in (domed) reservoirs will flow to a point of low pressure. Under correlative rights, each landowner over a common reservoir has the legal right to take the oil and gas through lawful operations on his own land. And each landowner over the common reservoir has a duty not to damage the reservoir. Each of the landowners have reciprocal rights and duties which include the prevention of waste, spoilage, and malicious depletion. The option for an adjacent owner to drill his own well is a sort of correlative right,¹⁵ and the denial of these rights is a contradiction to the stated objectives of Title 9. The opportunity to produce his proportionate share of the oil and gas under his property boundaries is the landowner’s common law right under a theory of ownership of the minerals in place.¹⁶

Under Article 23 correlative rights are conditional, not assured. “The department, without considering correlative rights, may grant a permit to those entities described in paragraphs b and c of subdivision 3 of section 23-1901 of this article for the purposes of natural gas development if the department determines, after notice and hearing, that the natural gas resource would not be developed by any other entity within twelve months of the close of the hearing record.”

Waste

No waste is incurred in the absence of compulsory integration. Solid mineral deposits do not flow. Locked in the interstices of shale formations, natural gas will remain there indefinitely and will not migrate until the flow is stimulated by hydraulic fracturing of that mineral deposit. The rule of capture is irrelevant to the HVHF process of extracting gas from shale deposits. The gas will not escape or be wasted. It can remain there secure, just as it has for eons past. To believe otherwise would suggest that only one well is necessary to drain the entire Marcellus formation.

The argument that multiple facilities are occasioned in the absence of compulsory integration is false. The current technology of horizontal boring allows the drill bit to be steered and placed with precision anywhere in the shale bed. Any shale deposits in a spacing unit not under the control of a well operator can later be drilled, fracked, flared and completed from the same well pad were it under a compulsory integration order. Compulsory integration is not necessary to decrease the number of well pads, access roads and ancillary facilities, such as compressor stations dehydrators, etc.

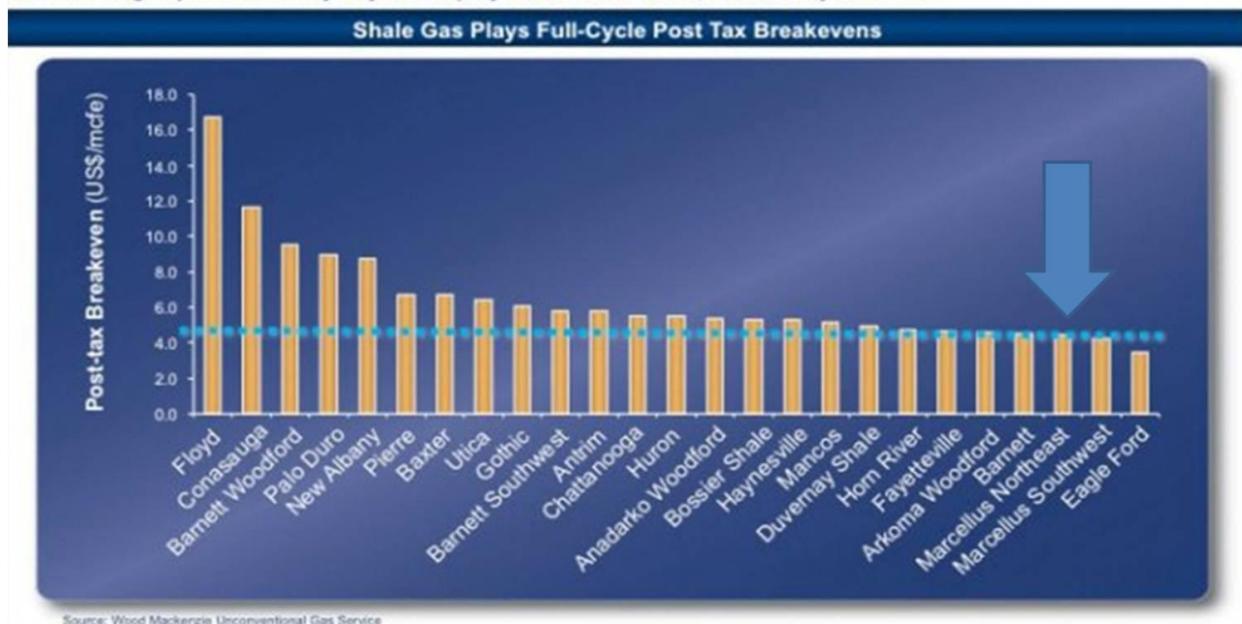
The permitted practice of flaring a well¹⁷ creates waste and pollution. As amended in 2005, Article 23 makes no provisions to prevent the enormous waste of natural gas during the flaring process of

completing a well. On July 28, 2011, the U.S. Environmental Protection Agency (EPA) proposed a suite of highly cost-effective regulations¹⁸ that would reduce harmful air pollution from the oil and natural gas industry and prevent this waste. The 2005 legislation should be amended to adopt those regulations.

Waste is further occasioned by abuse of public subsidy. What is obtained for free is often squandered. As permitted by the New York State Department of Environmental Conservation, shale gas extraction is subsidized by the uncompensated use and consumption of public roads, public water^{19 20}, public air²¹ and increased public health costs^{22 23}. Thus a profit which could not otherwise be realized by the industry accelerates the process of depletion. Compulsory integration further adds to these uncompensated costs a benefit (to the industry) of 40% more property to exploit at less than market value. Absent public subsidy by New York taxpayers, the Marcellus Shale, would not be profitable as shown in the following²⁴ graphic:

Why?

At current gas prices the majority of the plays are uneconomic, on a full-cycle basis



Waste is created by excess. Dominion Cove Point LNG, LP has recently applied to the Department of Energy for a blanket authorization to export Liquefied Natural Gas to foreign countries²⁵, specifically because recent development of the Marcellus Shale has produced too much gas, thus depressing the market price. Therefore, consistent with the policy objectives of Title 9, an export tax should be imposed on the removal of this sovereign resource from the State. In the absence of such a tax, waste and unnecessary depletion are promoted.

Compulsory integration prevents conservation. While a landowner may wish to prevent such waste and conserve his gas for future generations, or even until the market prices may rise, compulsory integration requires him to give up his gas to a company with whom he has never negotiated a lease and to sell that gas at less than optimum returns.

Ultimate Recovery

The argument for a greater *ultimate* recovery, with regard to gas bearing shale formations is irrelevant because:

1. Stopping short of trespassing into another owner's shale deposit does not prevent its future development,
2. Compulsory integration can do nothing to increase the amount of gas already formed by natural processes.
3. Much like the failed kolkhozy collective farms of Soviet Russia²⁶, compulsory integration will prevent the operation of a free market by artificially creating an excess of natural gas, thereby depressing the mercantile price on world markets. With a decrease in selling price, and with the economics of the Marcellus Shale already near or below the break-even point, (see above graph), further depressing the price will serve only to discourage commercial development and constrain the recovery of this resource until unnecessary and wasteful depletion of this finite resource again balances with the demand to create a rise in prices.

Public Taking, Public Purpose

For purposes of the Fifth Amendment's Taking Clause, property taken by the government from A and given to B must satisfy two criteria. First, the taking must be for a "public use". Second, no private property shall be taken for public use, without just compensation. In *Kelo v. City of New London*, 545 U.S. 469 (2005), the Supreme Court held in a 5–4 decision that the general benefits a community enjoyed from potential economic growth qualified such redevelopment plans as a "public purpose" which, in the opinion of the majority, constitutes a permissible "public use". The provisions of Article 23 fail to meet the criteria which underlie the justification for public taking.

1. In *Kelo*, an underlying assumption was that, if not redeveloped, the subject properties would otherwise lie fallow or depreciate. Under a compulsory integration order, the value of un-leased properties cannot be enhanced, but only diminished. Like a mature woodlot, the act of extracting the gas resource from the mineral deposits will devalue the property. However, unlike a woodlot, if left untapped, the gas bearing shale formation would only appreciate in value as surrounding voluntarily leased properties are depleted of this finite, non-renewable resource.
2. A premised justification for taking in *Kelo*, was that higher taxes resulting from redevelopment would flow to the state (the ultimate source of authority for the taking), and thereby indirectly reduce the tax burden of the public. But since New York State has no severance tax, no taxes will flow from the taking. The public will bear the burdens of this industry without participating in the benefits.
3. There has been no conclusive demonstration that promoting HVHF will, on balance, result in economic growth. The issue remains in debate^{27 28}.
4. Like a stand of virgin timber, undisturbed shale deposits are at their highest potential. This is not a redevelopment. It needs no remediation.

Unjust Compensation

Just compensation is normally measured by "the market value of the property at the time of the taking contemporaneously paid in money."²⁹ None of the three options mandated by Title 9 remits a fair and reasonable compensation to the integrated landowner(s).

1. As an integrated royalty owner,(the default option), if the well produces, the landowner(s) will be paid " the lowest royalty in an existing lease in the spacing unit, but no less than one-eighth of the [net] revenue received by the well operator for the share of production attributable to your acreage." Further, this legislation mandates that the landowner will be deemed ineligible for a signing bonus. Since the well operator could save as much as \$128,000 (640 acres × 40% × \$5,000) not paid in a signing bonus, this windfall profit should be taxed as such.
2. Title 9 obviates the incentive for a well operator to negotiate a lease. Once a well operator has obtained the mineral rights to sixty percent of the prospective spacing unit, it is against his own best interest to pursue further leases within that spacing unit. Compulsory integration has short circuited this negotiation process. This is against public interest and contrary to the provisions of the 5th Amendment to the Constitution.
3. A 300% "risk penalty" on 40% of the spacing unit equates to 120% of the drilling costs which the Non-Participating Owner(s) will be forced to absorb. No rational basis has been established which can justify such a disproportionate penalty. As the Doctrine of Correlative Rights dictates that both benefits and risks be shared equally, the objectives stated in Title 9 could only be justified if on average, three out of every four wells drilled in the Marcellus Shale resulted in a dry hole. Further, Title 9 does not address the issue of whether this 300% penalty is a windfall that should be assessed as a tax against the well operator or treated as a tax credit to the Non-Participating Owner.

Example: Assume a \$5M development cost per well (includes siting, drilling, fracking, completion and transportation costs), with a gross revenue of \$25M = net \$20M over the life of a well. Also assume all 40% of the spacing unit are Non-Participating Owners. Then the computed "risk penalty" is $\$5M \times 40\% \times 300\% = \$6M$, or \$1M more than the operator's cost of developing the well. This "risk penalty" will accrue to the benefit of the well owner, which in almost every case is a foreign corporation. But in every case this "risk penalty" money will not come into New York State.

The net revenue to the Non-Participating Owner will be $(\$20M * 40\%) - \$6M = \$2M$. Thus, even assuming domestic ownership of the Non-Participating Owners, the taxable inflow to the State is only 25% of the potential revenue. Thus by this legislation, the State has shorted the Non-Participating Owner by 75% and has shorted itself by 75% of taxes on that revenue. This is waste by the State and it unjustly deprives the landowners of the full value of their property assets in violation of the Fifth Amendment.

The scheme is patently unfair. As almost all costs to develop the first 60% will already be incurred, the downside risk to the well operator is a 40% loss of potential net revenue, while the downside penalty to the non-participating owner may consume his entire compensation.

Article 23 makes no provisions for auditing the accounts of the well operator, either by the state or by the integrated owner(s).

Not in the Public Interest

Title 9 is not in the public interest to the extent that compulsory integration "puts in play" up to 40% more private property that would otherwise remain un-leased. Development of clean, sustainable, renewable, energy resources (solar, wind, wave and geothermal) will not occur until government policies **balance the profitability** of those technologies with the mining of fossil fuels.

Public Perception

Compulsory integration fosters disrespect for the rule of law. Private property rights are such an integral part of the American experience that even citizens unfamiliar with the 5th and 14th amendments, recognize compulsory integration as fundamentally wrong. While many citizens may dislike having to pay taxes, most understand the public necessity of funding government functions. But compulsory integration engenders more than outrage. It is generally perceived as corporate larceny enforced by government. Hate has two components, dislike and fear, and it is the power of government to take by forcible compulsion which creates that fear. Further, upon learning that not one member of the House or Senate spoke in opposition to this bill, citizens are universally dismayed. As disrespect for the rule of law promotes civil disobedience and risks rebellion, this law must be amended for the public good.

"We've got a bad thing made by men, and by God that's something we can change."³⁰

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About the author: In 2010, Mr. Fischer was successful in petitioning the Environmental Quality Board of the PA. DEP to upgrade the Silver Creek Watershed, (a 52 square mile area in Susquehanna County), to Exceptional Value status. He also acted as an intervener before the PA. Public Utility Commission in opposing the Application of Laser Marcellus Gathering Company LLC., in its bid for eminent domain in Pennsylvania (Docket No. A-2010-2153371). Mr. Fischer served both with the United States Marine Corps and the New York State Police. Since 1980 he has maintained a private investigation business in both New York and Pennsylvania.

¹ Conflicts of Interest – New York Style: Senator George Winner's Shale Play, DC Bureau, Allison Sickle, June 1st, 2011, <http://www.dcbureau.org/20100601751/natural-resources-news-service/conflicts-of-interest-new-york-style-senator-george-winners-shale-play.html>

² NY SENATOR WHO OPPOSED DRILLING MORATORIUM HAS TIES TO INDUSTRY, New York State Senator George Winner owns stock in companies doing business in the Marcellus shale and his law firm represents the gas drilling industry. Senator Winner gave a strong speech opposing the bill, which the Senate passed overwhelmingly. <http://www.nydailynews.com/nylocal/2010/08/05/2010-08-05>

³ Harvard Legal Essays, Written in Honor of and Presented to John Henry Beale and Samuel Williston, 1977, Ayer Company Publishers, Incorporated, p. 522, note 8. The maxim is said to have been first used by Accursius of Bologna, in the thirteenth century.

⁴ The last two words of the amendment promise "just compensation" for takings by the government. In *United States v. 50 Acres of Land (1984)*, the Supreme Court wrote that "The Court has repeatedly held that just compensation normally is to be measured by "the market value of the property at the time of the taking contemporaneously paid in money." *Olson v. United States, 292 U.S. 246 (1934)* ... Deviation from this measure of just compensation has been required only "when market value has been too difficult to find, or when its application would result in manifest injustice to owner or public." *United States v. Commodities Trading Corp., 339 U.S. 121, 123 (1950)*.

⁵ Form 05—1-1: Affirmation Of Acreage Control & Rights In Target Formation

⁶ Radow, Elisabeth N., Homeowners and Gas Drilling Leases: Boom or Bust?, New York State Bar Association *Journal/December 2011, Vol 83, No.9*

⁷ Clarke, Robert, Wood Mackenzie product Manager, Unconventional gas Services, The Global Unconventional Gas Trend, January 26,2010

⁸ IN THE MATTER OF WESTERN LAND SERVICES, INC., ET AL., v. DEPARTMENT OF ENVIRONMENTAL CONSERVATION OF THE STATE OF NEW YORK ET AL., 97694. Appellate Division of the Supreme Court of New York, Third Department. Decided and Entered: November 23, 2005.

⁹ Proposed Express Terms, 6 NYCRR Parts 550 through 556 and 56, Subchapter B: Mineral Resources, Part §560.2

¹⁰ Proposed Express Terms 6 NYCRR Parts 550 through 556 and 560. Subchapter B: Mineral Resources. §560.6 Well Construction and Operation. (b) Site Maintenance, (24) Diesel fuel may not be used as the *primary* carrier fluid for hydraulic fracturing operations.

¹¹ RESTATEMENT (SECOND) OF TORTS § 158 (1965); see *Gregg v. Delhi-Taylor Oil Corp.*, 344 S.W.2d 411, 416 (Tex. 1961) (stating that entry can occur by causing a thing to cross the boundary and

does not require a person to enter). The Restatement definition also includes remaining on land of another or failing to remove a thing that the person is under a duty to remove.

¹² Terry D. Ragsdale, *Hydraulic Fracturing: The Stealthy Subsurface Trespass*, 28 TULSA L.J. 311, 317 (1993).

¹³ Coastal, 268 S.W.3d at 8

¹⁴ Coastal, 268 S.W.3d at 5.

¹⁵ *Halbouty v. R.R. Comm'n of Tex.*, 357 S.W.2d 364, 375 (Tex. 1962) (stating, when discussing the rule of capture, that "[i]f the owners of adjacent lands have the right to appropriate, without liability, the gas and oil underlying their neighbor's land, then their neighbor has the correlative rights to appropriate, through like methods of drainage, the gas and oil underlying the tracts adjacent to his own")

¹⁶ *Elliff v. Texon Drilling Co.*, 210 S.W.2d 558, 562 (Tex. 1948).

¹⁷ Subdivision (a) of Section 556.2 is revised and a new subdivision (f) is added to read: (c) The release or flaring of gas, to the extent permitted by subdivision (b) of this section, shall be done in accordance with a flare permit issued by the division.

¹⁸ <http://www.epa.gov/airquality/oilandgas/pdfs/20110728factsheet.pdf>

¹⁹ Jackson RB, B Rainey Pearson, SG Osborn, NR Warner, A Vengosh 2011 *Research and policy recommendations for hydraulic fracturing and shale-gas extraction*. Center on Global Change, Duke University, Durham, NC.

²⁰ Richard A. Kerr (13 May 2011). "Study: High-Tech Gas Drilling Is Fouling Drinking Water". *Science Now* **332**: 775. Retrieved 27.06.2011

²¹ Howarth, Robert W. and Atkinson, David R., *Assessment of the Greenhouse Gas Footprint of Natural Gas from Shale Formations Obtained by High-Volume, Slick-Water Hydraulic Fracturing*, Cornell University, (November 15, 2010)

²² Bachran, Dr. Mary, *CHEMICALS USED IN NATURAL GAS DEVELOPMENT AND DELIVERY*, Introduction, Analysis and Comments, The Endocrine Disruption Exchange, Inc., November 17, 2006

²³ Law, Adam, M.D., 16 Muriel St, Ithaca, NY 14850, Letter to New York State Governor David A. Paterson dated 12-20-2009

²⁴ Clarke, Robert, Wood Mackenzie product Manager, Unconventional gas Services, The Global Unconventional Gas Trend, January 26, 2010
²⁵ <http://www.federalregister.gov/articles/2011/09/21/2011-24225/dominion-cove-point-lng-lp-application-for-blanket-authorization-to-export-previously-imported>

²⁶ The creation of kolkhozy in the Soviet Union during the country-wide collectivization campaign of 1928-1933 was an example of *forced* collectivization, the immediate effect of which was to reduce grain output and almost halve livestock, thus producing major famines in 1932 and 1933. (Wikipedia)

²⁷ Barth, Jannette M., Ph.D., *The Economic Impact of Gas Drilling In the Marcellus Shale*

²⁸ Christopherson Christopherson, *The Economic Consequences of Marcellus Shale Gas Extraction: Key Issues* Cornell University Department of City & Regional Planning, CaRDI Reports Issue 14, Sept. 2011.

²⁹ *Olson v. United States*, 292 U.S. 246 (1934)

³⁰ Steinbeck, John, *The Grapes of Wrath*, 1940