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## The State of Play in Poland's Unconventional Shale and Oil Development

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# The State of Play in Poland's Unconventional Shale and Oil Development

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## Abstract

Following the huge gas and oil rush in the US, the world's gas and oil companies have been eyeing reserves in other countries including Poland, which is believed to be sitting on one of the largest reserves in the European Union. The Poles, seeking to diversify their energy sources and meet EU emissions standards, which are driving up electricity costs, met the news with tremendous fanfare. Following initial geological assessments, major international oil and gas companies soon made announcements to begin drilling operations in Poland. However, one of the major challenges of shale gas development is that it often requires voluminous speculative activity before the gas is successfully extracted. In the U.S. this was not such a problem because of several adventuresome energy firms willing to take on risk, but in Poland (and Europe in general) such firms are rare, and in former communist countries these firms are rarer still. This lack of critical infrastructure coupled with bureaucratic red tape in the permitting process has led to slow growth in exploration activities in Poland. Will Poland be able to successfully develop these resources? This manuscript explores the current state of play in Poland's unconventional gas and oil development.

Keywords: Shale gas development, Energy Policy, Unconventional energy resources, Europe

JEL Classification: G40, G41, G48

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# 1 Introduction

The recent decision of three energy firms to end their gas exploration in Poland has raised serious questions about the commercial viability of unconventional gas development in the country. Canada's Talisman Energy and the U.S.'s Marathon Oil decided to end exploration activities in 2013. This follows ExxonMobil's decision in 2012 to withdraw all exploration activities citing disappointing test drilling results. The pullout has raised doubts over the scale of Poland's shale gas reserves. Further, company executives complain about opaque environmental regulations, slow permitting processes, and a general lack of a national legislation on shale gas development.

The mania over hydrocarbon development in Poland was triggered by a U.S. Energy Information Administration (EIA, 2011) report that claimed that the country has 187 trillion cubic feet (Tcf) of technically recoverable shale gas resources, enough to meet domestic demand for over 300 years. Following the EIA's report, the U.S. Geological Survey (USGS) and Polish Geological Institute (PGI) collaborated on a preliminary assessment of shale gas and oil in Poland. The organizations released independent assessments of technically recoverable shale gas and oil. PGI estimated significantly less technically recoverable resources, approximately 8 to 22 Tcf, with an additional 1.6–2 billion barrels (BBL) of oil (Polish Geological Institute, 2012a). The USGS, on the other hand, estimated about 1.34 Tcf of shale gas and 0.17 BBL of shale oil (U.S. Geological Survey, 2011).

Why the large difference in assessments? A recent EIA report claims that both PGI and USGS studies were based on conventional oil development and gas logs, core, and seismic data collected during the 1970s and 1980s, and that neither study cited recent data from industry exploration programs in Poland (U.S. Energy Information Administration, 2013). The same EIA report also attributed the discrepancy to differences in methodologies. The bottom line is that Poland still does not contain any empirical shale production data because no company has yet successfully developed shale gas resources in large enough commercial quantities. Until such resources are recovered, no one knows exactly how much technically recoverable resources are available in Poland.

This manuscript explores the current state of play in Poland's unconventional gas and oil development. Based upon current studies and the authors' own recent visit to Poland, this manuscript is meant to elucidate the true state of play as experienced at ground zero. After interviews with numerous stakeholders, including academicians, US and Polish governmental officials, and industry representatives, this study offers an objective perspective into this shale play.

We intend to debunk three popular myths about Poland and its shale play. The first is that Poland is wholly dependent on Russia's natural gas to meet its current energy needs. The second is that Poland

has no proven resources of shale gas for significant commercial exploitation. The third myth is that the Polish government sees the development of this resource as a game changer for its energy future.

In the next section we offer a brief history of post-communist Poland and its transition to a modern capitalist-style economy. In section three we discuss Poland's current energy mix and the government's energy plan through 2030. In section four we outline current industry activity to date, including recent exploratory activity. Finally, in section five we discuss the future challenges to shale gas and oil development, and the country's prospects of using this resource as a bridge to a less-carbon intensive energy future.

## **2 Post-Communist Poland and the Transition to a Capitalist-Style Economy**

Despite the existence throughout the communist era of a large private agricultural sector and selected small-scale private retail and service sectors, the economy of the Polish People's Republic had practically collapsed by the end of the 1980s. Attempts in the early 1970s to stimulate the economy by attracting foreign investment and credits without fundamental reform of the central planning system left Poland with many fundamental problems including a huge foreign debt that it struggled to service, runaway inflation, crumbling infrastructure, rationing of basic consumer goods, a rampant black market, and widespread corruption. The resulting social and political unrest led to the emergence of the Solidarity movement in the summer of 1980, which following its suppression at the end of 1981 and retreat to the underground, still retained sufficient support to frustrate efforts of the Polish government to introduce limited, market-oriented economic reforms and more representative institutions. The stalemate was finally resolved by the compromise of semi-free national elections held in the summer of 1989, which created the Solidarity-led government, along with communist participation, in September (Stokes, 2011; Ekiert and Kubik, 1999).

In spite of this government's hybrid nature, a strong political consensus existed for the radical economic reforms of "shock therapy," guided by the first post-communist finance minister, Leszek Balcerowicz. The basic idea was to achieve macroeconomic stability as quickly as possible by maintaining budgetary austerity while pursuing unconstrained price liberalization. These shocks were to be followed by currency reform, privatization of state-owned property, the creation of a stock market, the overhaul of the existing tax structure, and the establishment of the legal and regulatory structures of a market economy. For the most part, these reforms, though initially quite painful in social terms, were

ultimately successful. Inflation was brought under control, the government was able to renegotiate the foreign debt and receive new loans, the Polish zloty became a convertible currency, which enhanced trade with new Western partners, and the Polish stock market became one Europe's largest and best-performing. At the turn of the millennium, Poland had largely met the economic criteria for accession to the European Union, which it entered in the first round of expansion in 2004. Two decades following the Balcerowicz reforms, Poland's economy had become characterized by moderately steady and healthy growth rates that gradually reduced unemployment. Though economic growth has been slowed considerably by the Great Recession and the crisis of the Eurozone in recent years, Poland has managed to avoid a decline in its GDP.

However, due to Poland's "negotiated revolution" in 1989, the break with the communist era was less pronounced in certain key areas. Brakes were applied to privatization of potentially more profitable state-owned enterprises when it became clear that the main beneficiaries were former communist power-holders and managers. Moreover, Polish nationalists, who emerged as a major force in post-communist Poland, opposed foreign (especially German) ownership and large foreign investments. Privatization was thus a slow and uneven process, beginning most successfully in the retail sector, and eventually embracing the banking and telecommunications industries. The steel and shipbuilding industries, once showpieces of the command economy, eventually were sold to private, mainly foreign, investors and their labor forces were dramatically downsized. By contrast, rail and air transportation remain under the management of the state, which retains majority ownership of shares that are traded on the stock market. This is also true of Poland's energy sector, whose central executive officers – whether their firms are involved in production, refinement or utilization – are state appointees. Three major firms dominate Poland's oil and gas market, the largest of which is PGNiG (Polish Oil and Gas), followed by Orlen and Lotos, all offspring of the state monopoly of the communist era. The majority of shale concessions thus far have been awarded to these Polish firms led by PGNiG, an indication of the Polish state's view of unconventional gas exploration and extraction as a "national project," rather than one dependent on foreign investment.

The state thus remains a major player in the Polish economy and the main player in the development of the country's energy resources. Aside from significant foreign capital investment, the obstacles to which are discussed below, only the Polish state possesses the financial resources to stimulate research and development of unconventional oil and gas. Its decision to invest major sums in industrial/academic collaboration through the "Blue Gas" Project (The National Centre for Research and Development, 2012), which is specifically targeted at developing "Polish" technologies of unconventional gas exploration and extraction, is a significant development. On the other hand, as revealed by the recent firings at PGNiG over the firm's dealings with Gazprom, important decisions affecting the energy sector

are often based on political rather than economic criteria, which serve as a reminder of communist-era practices.

Moreover, the state doesn't speak with one voice on energy policy. Instead there is cacophony of competing interests within Poland's coalition government, within the parties that make up the coalition, and among ministries. In the case of shale gas exploration and development, the Ministry of Finance, whose authority embraces supervision of the national energy firms, has been an enthusiastic and aggressive player, although its sails have been trimmed somewhat in recent months due to the controversy at PGNiG, which led to the resignation of the Finance Minister. The Ministry of Environment, in charge of drafting regulatory legislation in a difficult political climate, has adopted a more cautious approach that is sensitive to EU concerns. The Ministry of Science and Higher Education, on the other hand, has embraced energy-related research and development within its strategic plan and is in charge of administering Blue Gas funding. The Ministry of Economy, ostensibly in charge of energy policy and the author of the 2009 plan (see below), has had little to say about unconventional resources compared to its aforementioned counterparts. This is perhaps because the portfolio has been entrusted to the junior coalition partner, the agrarian Polish People's Party, which is not anxious to rock the EU boat since Poland (and especially Polish agriculture) is a major recipient of EU structural funds. The influence of competing coal and oil/gas lobbies on the government is also a significant factor. Despite the existence of an "energy plan," Poland does not have an energy policy that includes unconventional gas and that could guide and coordinate the activities of the various ministries involved.

The absence of a clear energy policy in Poland, of course, is not necessarily a legacy of communism. However, popular distrust of the state is such a legacy, especially since communist-era corruption was never really eradicated, while the successor parties of the Solidarity movement have had corruption scandals of their own. The creation of a Central Anti-Corruption Bureau (known by its Polish initials as CBA) in 2005 by the governing coalition led by the Law and Justice party was a response to this phenomenon, but the CBA itself was immediately transformed into a political tool used to attack Law and Justice's political opponents. Although the power of the CBA declined after the defeat of Law and Justice in the 2007 parliamentary elections, the popular perception of corruption of state officials is so strong that it has affected the relationship of government agencies with the private sector. Consequently, the business climate in Poland is considered by many to be relatively unhealthy compared to other EU member states. Particularly as Poland's impressive post-communist economic performance has given way to stagnation in the last few years, respect for the political process and the parties involved in it have fallen to an all-time low. Thus, the Polish state – even if it did speak with one voice or had an energy policy – would face an uphill battle in convincing public opinion especially at the local level of the benefits of development and the management of risks should shale gas resources prove to be recoverable

in commercially viable quantities. However, given the state's major involvement in the energy sector, only it and its representatives can play this public relations role. Thus far, their performance has not been particularly impressive.

### **3 Poland's Current Energy Mix and the Energy Policy 2030 Plan**

#### **3.1 Poland's Current Energy Mix**

Poland is currently the largest producer of hard coal in the EU, and its energy import dependence is among the lowest in the EU (European Commission, 2007). Hard coal and lignite play a significant role in Poland's energy mix, providing the largest share of electricity generation (approximately 92–94%) and resulting in high emissions and carbon dioxide (CO<sub>2</sub>) intensity (Nyga-Lukaszewska, 2011). The primary reason for Poland's heavy reliance on coal is due to its vast domestic deposits. According to the PGI (2012b), the country still contains over 25 billion metric tons of non-exploited hard coal deposits. At current rates of consumption – approximately 81.5 million metric tons of coal as of 2010 (European Commission, 2012a) – these non-exploited deposits are enough to potentially last the country for several centuries. It is of no surprise then that coal still plays a vital role in the country's energy policy plan through 2030 (discussed below).

Poland's concern, in addition to environmental impacts of coal development and consumption, is its over-reliance on one resource. Therefore, one of the primary objectives of the energy policy plan is to diversify Poland's energy resources with a mix of nuclear and renewables. Unconventional fossil fuel development was not part of the national dialogue prior to the energy policy plan's publication in 2009, other than discussions related to coalbed methane (U.S. Environmental Protection Agency, 1991).

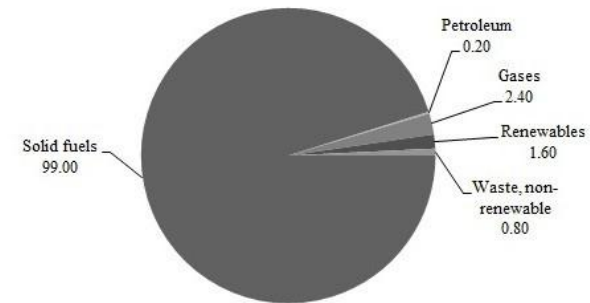
Other fossil fuel use in Poland represents a smaller portion of the primary energy supply, but the demand for these resources has been growing over the past two decades. Figures 1 and 2 show trends in Poland's energy supply and demand for the years 1990, 2000, and 2010 – these Figures are based on domestic production and consumption excluding imports. There are legitimate fears in Poland over energy security as Russia is Poland's largest natural gas and petroleum supplier, but Poland is not the grips of Russian energy suppliers such as Gazprom and Rosneft. Poland's energy mix is largely still dominated by hard coal, which it develops from its own resources. Nonetheless Poland's demand for petroleum and gas has increased over the past three decades by approximately 96% and 42%, respectively, and it is almost completely reliant on other countries for its gas needs as domestic gas

production only made up 3.7% of its energy mix in 2010. Over the same period, Poland's demand for solid fuels, including hard coal, has decreased by approximately 45%.

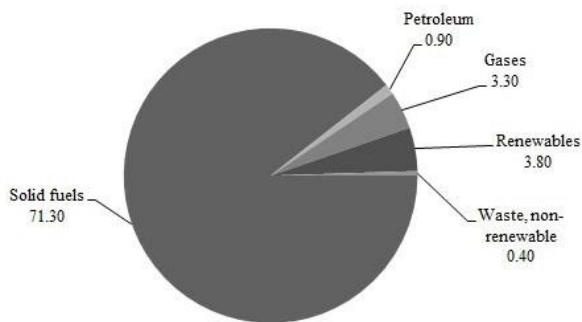
Poland is the EU's largest producer of hard coal and the second largest in Europe, following Russia. Electricity generation in Poland is based almost exclusively on domestic coal. Coal's 92% share in electricity generation in 2004 was highest among the EU member states. The share of natural gas in generation is very small, but it has been increasing over the past few years. Only a small percentage of electricity comes from oil and renewable sources, although this has been growing slowly as well.



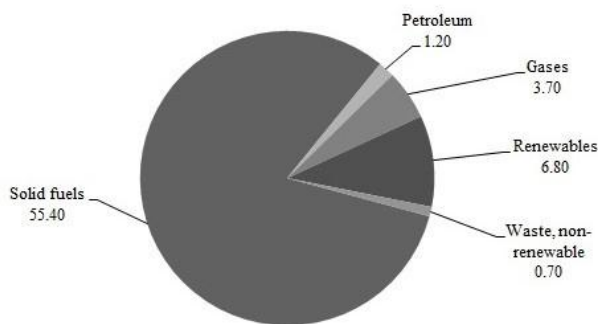
Figure 1: Poland's Energy Supply (Mtoe), 1990-2010



(a) 1990

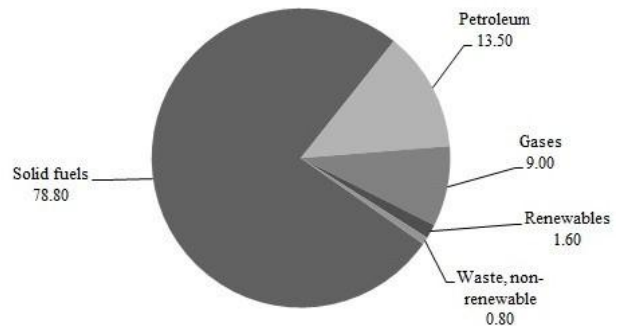


(b) 2000

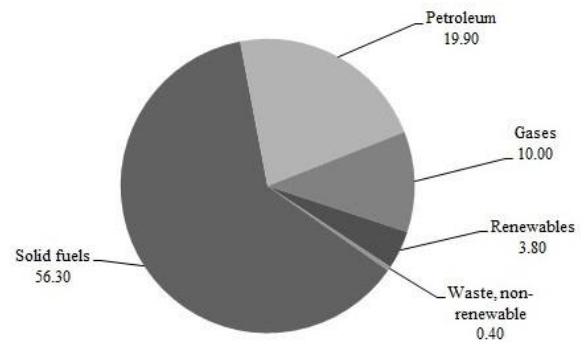


(c) 2010

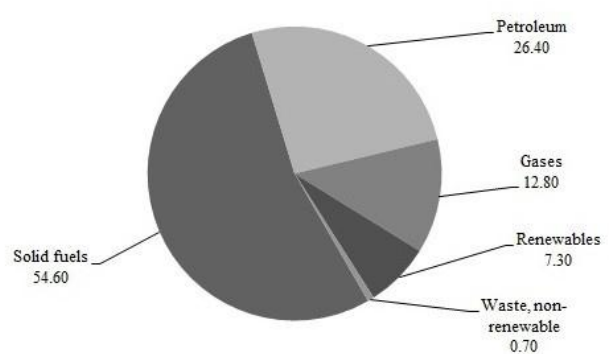
Figure 2: Poland's Energy Demand (Mtoe), 1990-2010



(a) 1990



(b) 2000



(c) 2010

Source: European Commission (2012a)

### 3.2 Poland's Energy Policy 2030 Plan

The Ministry of Economy was commissioned several years ago by Poland's national government to create an energy policy plan for Poland through 2030. According to this energy policy report (Polish Ministry of Economy, 2009), Poland's primary objectives of energy policy are to: improve energy efficiency; enhance security of energy supplies; diversify the electricity generation structure by introducing nuclear energy; develop renewable energy sources; develop competitive fuel and energy markets; and, to reduce the environmental impact of the power industry. Noticeably missing from the report are any references to unconventional fossil fuel development other than the broad objective of developing "competitive fuel and energy markets." The reason for the omission of unconventional fuel development is due to the timing of the report which was published in 2009, while the unconventional natural gas resource assessments by the EIA, PGI, and USGS were published later. Historically, attention to unconventional gas focused on coalbed methane and tight gas (International Energy Association, 2012). Poland's energy policy report makes several references to coalbed methane, not only for ensuring the safety of mining operations but also for industrial use. The report briefly mentions extending the natural gas extraction capacity in Poland to support the diversification of the country's resources for energy security reasons.

The full thrust of the report is on diversifying into nuclear energy, which is sensible given EU member requirements for participating in the emissions trading system and the accompanying need for low CO<sub>2</sub> emission generating technologies. The report calls for a launch date of 2020 for the country's first uranium powered plant, which Poland plans to develop domestically or obtain "from politically stable regions." The country plans to build a second reactor shortly thereafter. The report mentions that such an investment would be costly but does not discuss financing.

A looming problem in Poland is its rapidly aging coal-dependent power sector. Approximately 44% of Poland's existing power plants are over 30 years old (Trojanowska, 2012). This problem is exacerbated given that the country is also abandoning plans of adding coal-fired plant capacity as it moves to less carbon-intensive technologies. The estimated costs of rebuilding the capacity for the aging plants is approximately \$68B (U.S. dollars) or €50B (Easton, 2010). Further, Poland cannot rely upon on neighbors like Germany and the Czech Republic because they too are abandoning plans for new coal-fired capacity. Some have claimed that Poland's installed power generation capacity will be obsolete by 2016 (Easton, 2010). To overcome this problem, the thrust in the energy plan is to reduce dependency on coal and lignite by 40% over the next twenty years.

Again due to the timing of its publication, missing from the report are possible discussions of natural gas-fired generation. According to a report by the World Nuclear Association (2013), nuclear is cost competitive with other forms of electricity generation, except where there is direct access to low-cost

fossil fuels. In the U.S., only two nuclear reactors have been approved by the Nuclear Regulatory Commission (NRC) for construction since 1979. The NRC has received applications from 24 more reactors, but none is likely to be built soon given the boom in shale gas development and the subsequent downward pressure on natural gas prices (The Economist, 2013). The past 20 reactors built in the U.S. have cost between \$3 to \$6 billion, or \$3000 to \$6000 per kilowatt hour (Hinrichs and Kleinbach, 2013). A gas-fired plant costs almost ten times less and can be built much more quickly. Natural gas-fired electricity too offers the benefit of being less carbon intensive than coal-fired electricity. The U.S. Environmental Protection Agency (2013) estimates that natural gas fired plants produce half as much carbon dioxide, less than a third as much nitrogen oxides, and one percent as much sulfur oxides as comparable coal-fired plants. Thus, Poland will have to assess not only the net present value of constructing new electricity generation capacity, but also the cost of carbon dioxide emissions and the opportunity cost of foregone natural gas generation that is far cheaper and brought online quicker than nuclear generation. It is little wonder then why the Prime Minister Donald Tusk recently hinted at delaying the country's first nuclear power plant (Agence France-Presse, 2013b).

#### **4 Poland's Current Shale Gas Development**

Figure 3 offers a detailed geographic map of Poland's shale reserves. The darker orange color represents non-prospective resources for commercial development, whereas the area in the lighter yellow color represents prospective resources. Prospective resources are potentially recoverable fossil fuels from "undiscovered" accumulations by the application of future development projects. Non-prospective resources are quantities of petroleum (including natural gas) potentially recoverable from "known" accumulations that are not yet mature enough for commercial development (American Association of Petroleum Geologists, 2011). The non-maturity of the play is why shale or tight gas development is often referred to as "unconventional" development; otherwise, were the techniques "conventional," we would observe the resource being developed in commercial quantities. Currently, most of the shale play activity is concentrated in the Lower Paleozoic sedimentary basin, which exists as a north to southeast band through the center of Poland (U.S. EIA, 2013). The Baltic Basin shale formation lies north of Warsaw while the Lublin Basin is southeast of Warsaw. The prospective shale formation to the east of Warsaw is the Podlasie Basin. Not displayed are other prospective formations in and around the area of Krakow in the south central part of the country.

Figure 3: Map of Shale Gas Basins in Poland (Source: Dittrick (2011))

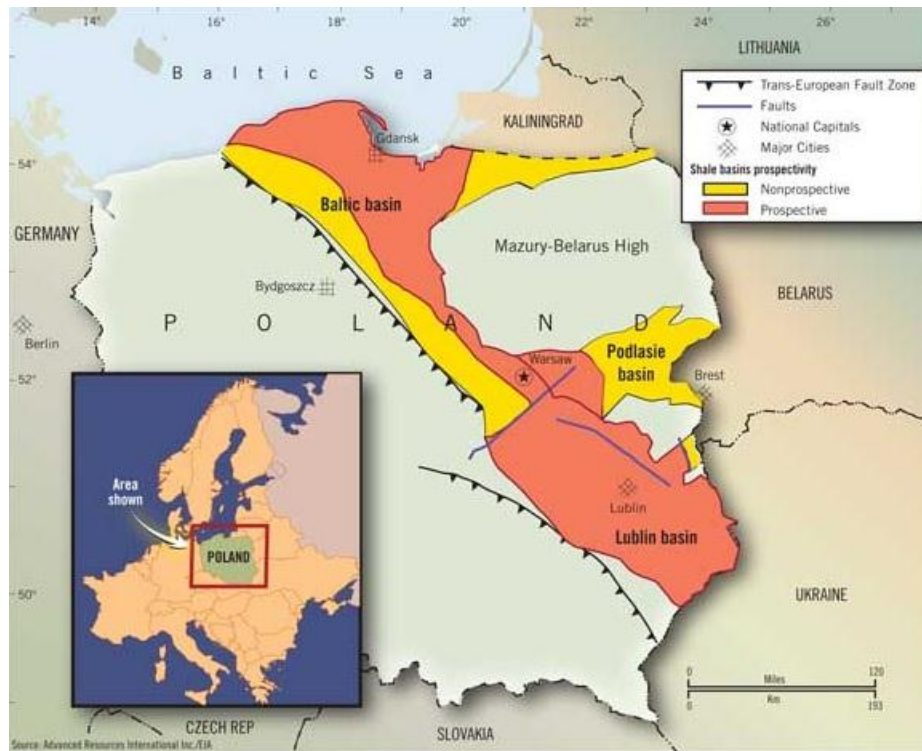
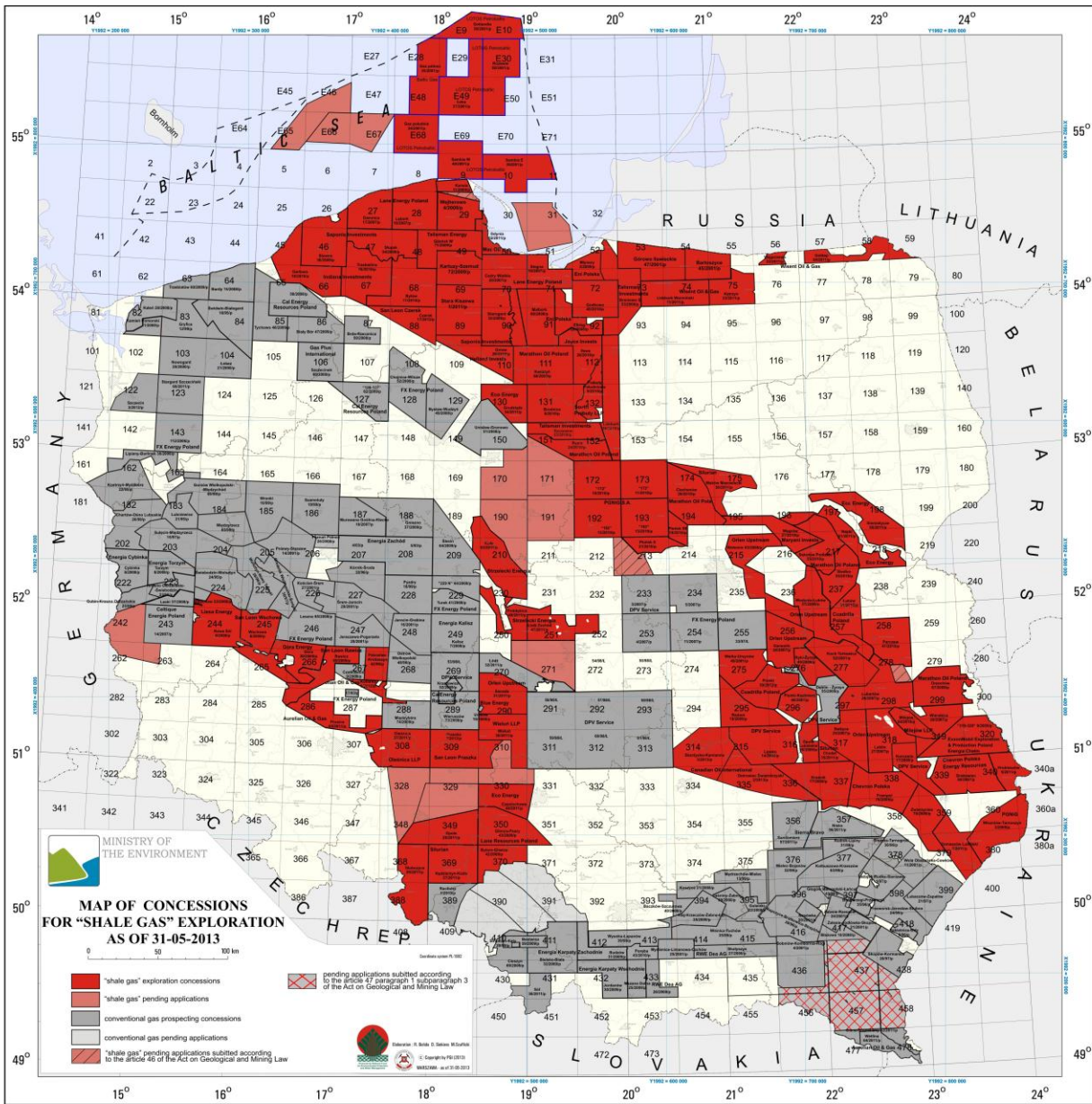


Figure 4 displays a detailed map of the current “concessions” for shale gas development and exploration in Poland through May 31, 2013. A concession is similar to a “lease” in U.S. parlance. The difference is that the Polish state owns all of the mineral rights below the surface. This differs from the U.S. where the surface and mineral rights may be owned by a private party, in which case the developer would sign a legally-binding lease with the private land owner to extract the resource. The legend in the lower left-hand corner of the map is difficult to read, but the brighter red color denotes the shale gas exploration concessions. The lighter red or pink color denotes pending applications; the darker gray color denotes conventional gas prospective concessions; and lighter gray are conventional gas pending applications. The other two colors pertain to pending applications submitted under Poland’s Act on Geological and Mining Law, which was designed to increase the efficiency of development by formalizing the concession application process (Polish Ministry of the Environment, 2011). It is not surprising that the shale gas exploration concessions (dark red) are primarily concentrated along Lower Paleozoic sedimentary basin, which is the orange band in Figure 3 running from the north to the southeast of Poland. Most of the exploratory concessions are located in the non-prospective Baltic, Lublin, and Podlasie Basins. As mentioned above, there are other prospective resources in the south central portion of the country around Krakow and to the west, so we see other concessions appearing in those parts of the

country as well. Furthermore, some concessions have been granted for off-shore shale gas development north of Gdansk in the Baltic Sea.

Figure 4: Map of Shale Gas Concessions in Poland, May 31, 2013



## 4.1 Ground Zero

Not displayed in either of the figures above is the actual state of play, or the political economy, in regards to shale oil and gas development in Poland. The authors visited Poland in June 2013 and conducted extensive interviews with stakeholder groups including academic researchers, governmental officials (including in-country U.S. Embassy and Consulate representatives), oil and natural gas industry officials, and private citizens. As a former communist country, there are several things about Poland that make the environment vastly different from that of the United States.

First, outside of the press there is little to no public discourse surrounding this contentious issue in Poland. The stakeholder groups are mutually frustrated, but there are rarely if ever opportunities for all parties to meet and discuss these issues in a public forum. This lack of discourse stems from the absence of a tradition of academic, governmental, and industrial stakeholder collaboration and partnership. The culture is changing slowly as demonstrated by the state's Blue Gas project, which is designed to foster such collaboration but still exists mostly on paper.

Second, the U.S. has a long history of prospective activities in the oil and gas industry. The early history of this development conjures up images of "wildcatters" in 19th century Pennsylvania and early 20th century Texas, in which entrepreneurs took on huge risks drilling for oil in unknown fields in hopes of striking it rich. The American market economy helped foster not only this spirit of entrepreneurship but also the growth of a vast support infrastructure for the industry and related activities. Over generations, American firms have developed an expertise in both conventional and now unconventional resource extraction and development. Moreover, the U.S. was in some ways poised for this boom because of a well-polished legal and policy environment after a century and half of domestic oil and gas development and production.

The culture of entrepreneurship is embodied in the story of the late George P. Mitchell, founder of Mitchell Energy. Mitchell is often regarded as the father of hydraulic fracturing. By the 1980s, many people in the U.S. oil and gas industry realized that drilling opportunities were on the decline, but they also knew about the potential resources of oil and gas trapped in shale deposits. Mitchell led a twenty-year effort to find an economical way to extract these vast resources (Tubb, 2013) and spent millions of his own money developing this highly prospective resource, until his team (with U.S. Department of Energy support) found a way to combine hydraulic fracturing with horizontal (or directional) drilling. But even after successfully developing these technologies, hundreds more exploratory wells were drilled before successfully extracting the shale gas resources in commercial quantities. Mitchell's efforts eventually set off a domino effect in the U.S. and reignited the floundering natural gas industry.

The culture of entrepreneurship is largely absent in Poland's energy sector given the role of the state in communist and post-communist eras. Prior to 1990 the energy industry, including oil and gas, was



controlled by central planners and all industry activity including resource extraction was coordinated by the state. In stark contrast to the U.S., there was no incentive for private industry to develop prospective and potentially lucrative energy resources since the central government owned all mineral rights. As a result, the oil and gas industry was left with an aging infrastructure with little or no equipment for drilling or exploration. Furthermore, Communist Poland had price controls on oil and gas that artificially distorted prices and led to perverse economic incentives not conducive to market-economy type extractive enterprises.

The time needed to support this shale play is manifested in Poland's current regulatory and tax hurdles. After the EIA and PGI reports in 2010, foreign companies with the necessary financial resources and hydraulic fracturing and horizontal drilling knowhow came rushing into the country. The authors' interview with gas industry personnel revealed that the industry is frustrated over uncertainties surrounding future tax policies, but the industry was most upset about the length of time required to receive and modify drilling permits. Particularly upsetting was the fact that Poland only granted permits to drill up to 5,000 meters; however, unlike the U.S., the shale formations are extremely deep in Poland. So developers had to reapply for a modification to the concession if the driller had to go deeper than the original 5K meters depth. In the U.S. modifications to permits vary by state, but the process generally takes no more two to three weeks. In Poland, industry representatives complained of modifications – sometimes requiring new environmental impact statements – taking as long as eight months to receive the necessary permits to drill deeper. The additional time and uncertainty are very costly for oil and gas development, and partially explain some companies' abandonment of operations in the country. In response to industry complaints, the Environmental Ministry pointed to the fact that many early permits had been granted without impact statements, which explained the “new” requirement, but also developed a new draft regulation to expedite the permitting process.

At the same time the EU has created new obstacles to streamlining this process. In the U.S., the State government is recognized as a sovereign authority over its territory, and as such is responsible for the oil and gas drilling permitting process and oversight. The federal government only gets involved if permitting is required to drill on federal lands. Otherwise, its major role has been providing research and policy guidance to state government. Poland, on the other hand, is a sovereign state, but as a member of the EU it must comply with EU rules. Despite Poland's support for this potential energy “revolution,” many EU countries are less than enthusiastic. For example, France, Bulgaria, Luxembourg, Germany, Romania, Czech Republic, and Ireland have all either declared a moratorium or are planning such against hydraulic fracturing due to uncertainties over environmental impacts. Therefore, several EU members are urging Poland to slow drilling activities to further assess these impacts. To this end, the Environmental Commission within the EU has accepted very restrictive draft regulations for hydraulic fracturing and

horizontal drilling that would require environmental impact assessments at every stage of investment and exploration. This could potentially create further delays in the permitting process in Poland and further reduce the profitability of extraction for foreign companies. However, the EU Environmental chief Janez Potocnik has announced that the organization will not impose a member-wide ban on hydraulic fracturing (Agence France-Presse, 2013a). Further, the European Commission (EC) maintains a position of neutrality toward fracking and horizontal drilling and has claimed that it will leave it to Member States to accept or reject these technologies (EC, 2012b).<sup>1</sup> However, the EC claimed that it would ensure compliance with all EU shale gas extraction legal requirements. Therefore, as Poland strives to put its own regulatory house in order, it also must balance its shale development with EU demands. This will not have a direct impact on extraction per se, but it will likely create further delays in a country already saddled with regulatory and tax hurdles.

The final difference that sets Poland apart, and a culmination of all the challenges listed above, is that to date only forty-four exploratory hydraulic fracturing and horizontal drilling wells have been drilled in the country since the shale gas was first discovered. In the U.S., since Mitchell Energy's first exploratory well in 1981 (National Energy Technology Laboratory, 2011), it drilled hundreds if not thousands more until it finally got the formula right and was able to extract the shale gas in commercial quantities. To our knowledge only one well has been successfully fracked in Poland. San Leon Energy announced in July 2013 that it had successfully completed a well in the Baltic Basin (near Gdansk) that was producing 120 barrels per minute at pressure (San Leon Energy). Only time will tell whether San Leon and others will develop this resource in commercial quantities. Given the ingenuity and technical knowhow of American firms in the region, it is likely that it will not take as much time to successfully develop this resource in Poland as it did in the early years of U.S. development. But if Poland wants to develop this resource in significant quantities it must remove the regulatory barriers to attract more foreign investment and allow for more exploratory wells in the country. This can only be done with significant regulatory reform in cooperation with the EU and European Commission. As Poland experimented with free-market reforms in the early years after the fall of communism, it must today take bold actions to entice foreign companies to help it develop this resource. Otherwise, it will continue to lose the support of foreign investors.

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<sup>1</sup> The European Commission is simply the executive body of the European Union.



## **5 Poland's Future Challenges to Unconventional Shale and Oil Development**

Shale gas holds the promise of contributing to the Polish economy while providing a bridge to a less carbon-intensive future. Poland's situation has much in common with similar developments in the U.S. However, these opportunities in Poland and other resource rich regions poised for development bring with them substantial challenges. To maximize the benefits and minimize the costs and disruption that can accompany these kinds of developments, Poland might do well to note the experiences of other regions that have undergone rapid development, often followed by rapid declines in economic activity once the resource extraction activities inevitably subside.

Whereas the resource curse phenomenon is most often associated with nation states, the boom and bust cycle "boom- town" model applies to localized consequences of resource based economic development. These terms refer to the situation in which smaller regional economies and communities are overwhelmed by rapid population growth and its various challenges. Few local governments are prepared to deal with the multitude of issues that accompany rapid growth of any kind, much less those specifically associated with energy extraction. Even those that excel in anticipating the impacts of rapid development often find, at best, that needed revenues for meeting new community needs lag behind the needs themselves or at worst, are lacking altogether (Jacquet, 2009).

Of course, some local area residents will benefit from the economic boom. This group includes those involved with construction, drilling, consulting, and environmental research companies, construction equipment suppliers, transportation services, law, well site operators, and business and professional services. There also will be job gains and economic growth for those who can participate directly in energy industry sectors, especially young and otherwise unemployed workers.

Likewise, the expenditures associated with the extraction activities and the associated workforce can be substantial, and have the potential to significantly benefit local economies. The scope of such impacts will depend in part on the extent to which local residents fill new energy sector jobs, vacancies left in lagging sectors as employment shifts to the leading energy sector, and the ability of the local workforce to meet new energy sector needs. Any imports from outside of the local region, such as materials, supplies, goods, and services, are expenditures not available for local economy recirculation (Kelsey et al., 2012).

When local communities are unable to satisfy industry and its workers' needs, neighboring communities and regions can also be affected. Positive impacts include new revenues to existing businesses. Negative impacts can include substantial stresses and inflationary pressures on transportation

infrastructure, housing, and various service sectors. Boomtown research (Jacquet, 2009; Longbrake and Geyler, 1979) has documented substantial increases in social problems, particularly those due to an influx of transient workers, including substantial increases in arrest rates and judicial system overloads. In cases where drilling sites are in neighboring jurisdictions, there can be a mismatch between the administrative units receiving severance taxes or impacts fees and those bearing the cost of providing additional services.

The temporal aspects of boom and bust cycles also present challenges. There can be increased needs during boom phases for public support infrastructure, including schools, health care facilities, emergency services, and the kinds of water, sewage treatment, and utilities infrastructure needed for supporting new residential areas. If communities have not diversified their economies in advance of the bust phase of the cycle, they can easily find themselves with excess capacity they cannot afford to continue supporting once economic activity declines to lower levels (Markussen, 1978).

Consistent with resource curse literature, resource rich regions tend not to diversify (Boettner and O’Leary, 2011). For example, in the energy rich U.S. State of West Virginia with its long history of extractive industries, fourteen coal-economy based counties have the least economic diversity of the fifty-five counties in the State. Indeed, the legacy of resource abundance appears to be lower median household incomes, higher family poverty rates, lower education levels, and poorer health outcomes. Thus, resource extraction does not appear to be a pathway toward long-term growth and prosperity (Markussen, 1978).

Despite the potential for negative impacts, energy prices will almost certainly reach levels that make the extraction of shale gas and oil economically feasible. The regions with these resource endowments have the potential for a large inflow of money, and following the natural cycles of its development, these regions will experience the transitory and fluctuating nature of extractive wealth (Kay, 2011). Anticipating this development, insightful policymakers will have planned for the long-term, well beyond the boom, and learned that growth and development are not always one and the same. Resources are a place-bound national inheritance, and although there are always political pressures to grow quickly, there can be substantial benefits to deferring extraction until the prices rise to levels that can generate enough revenues to leave the region better off than before the activity began. Controlled growth enables effective planning, policy, and programmatic implementation.

Communities can maximize the potential for long-run economic growth by first establishing a social license, and second, by investing portions of resource revenues wisely. Public campaigns to educate and inform local populations can facilitate the former, and the latter can be achieved by developing a gas revenue-based fund dedicated to promoting economic diversification and development, and reinvesting in physical and social infrastructure, especially focusing on the development of a highly educated and highly skilled workforce that can support comprehensive economic development.

While Poland might successfully develop its shale gas resource, it appears to be entirely unprepared to deal with the pending social and economic consequences identified by the resource curse and boomtown literatures. During the authors' visit to Poland, we were unable to identify anyone in the country, including the academic institutions, addressing the downstream public policy dimensions of rapid resource development. All of the emphasis appears to be on technical issues – which are sensible given the country's present lack of proven reserves, but thoughtful foresight and public policy planning can help the country avoid the curses that have affected the U.S. and other regions around the world. The ways in which current policy issues are resolved will say a great deal about how Poland's energy economy will function for decades to come.

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