3. **Comparison of shale gas in the US and CEE**

### 3.1. Geology

Preliminary studies suggest that there are more than 650 shale formations worldwide, in 142 basins. This amounts to 456 Tcm of shale gas, of which 40% is estimated to be economically recoverable. Geographically, the US and CIS countries are estimated to account for nearly 60% of available shale gas resources worldwide. Europe, however, accounts for a much lower 7% of global shale gas reserves, though these estimates are subject to change, as land surveys and exploration proceed.

In general, the properties and definition of a shale formation are similar in both the US and Europe, although characteristics such as depth, underground temperature, porosity, and clay content vary across basins and formations. While shale gas is an unconventional gas made up of coal-based methane, gas from tight sandstones and methane hydrates, it is usually located near conventional reservoirs, in old sedimentary rock which contains mainly clay and quartz.

Most shale formations in the US are spread over a large basin area, within which mining developments have concentrated on a number of “sweet spots”, sometimes referred to as “hogs”, which generally produce at least 4 Mmcf/day. This concept might encounter difficulties in Europe, which is more densely populated, as such developments would bring drilling rigs closer to inhabited areas. The lack of free land for drilling stations might become yet another issue for European shale gas developments. Furthermore, the fact that known reserves of shale gas in Europe are located 1.5 times deeper on average than similar formations in the US might raise a problem of increased temperatures. In some areas of Europe, the geothermal gradient is very high: for every 15-20 meters of drilling depth, the temperature rises by 1 degree Celsius (as compared to the worldwide average of around 33 meters).

Still, there are a number of promising opportunities in Europe, where no or only a few reliable resource assessments have been conducted. Some of these include the entire Baltic basin, where only Polish territories have been partially explored, the Lublin basin in Poland, the Pannonian-Transylvanian basin in Hungary and Romania, as well as the Carpathian-Balkanian basin of Romania and Bulgaria. In the US, exploration of the Marcellus, Barnett, and Haynesville formations, for example, has already been ongoing for years.

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51 Source: US Energy Information Administration, World Shale Gas Resources, April 2011
52 Source: World Energy Council, Focus on Shale Gas, 2010
53 Source: Gazprom Export, Shale Gas, May 5, 2011
Figure 5: Eastern European shale basins

Legend

Eastern Europe Basins
- Assessed Basins
  - No
  - Yes

Assessed Basins
- Non-Prospective
- Prospective

Source: Advanced Resources International

Figure 6: Polish shale basins

Legend

Eastern Europe Basins
- Non-Prospective
- Prospective

Source: Advanced Resources International
3.2. Technology

Shale gas development has been made possible through the combination of horizontal drilling and hydraulic fracturing technologies, successfully transforming the unconventional gas industry over the years. In short, the technology addresses the need to drill horizontally through the shale bed, thereby perforating the rock to release enclosed gas. Recently in the US, the expanded usage of pad drilling, whereby multiple wells are drilled from a single location, minimizes the operational footprint. In Europe, this technology could see further development due to issues related to scarce land resources and high population density. In addition, because many wells in the US produce steep output decline rates, the fracturing process is constantly being refined and increasingly utilized by drillers. Although the general design of rigs is expected to be similar in both the US and Europe, the equipment used in European shales should account for greater depths and possibly higher temperatures at the drilling depth.

Nevertheless, the availability of drilling and fracturing equipment in Europe is limited, as compared to the US. As of early 2012, there were nearly 2,000 land rigs available in the US, as compared to only 72 rigs in Europe. This situation is not likely to change soon. Apart from the difficulty and expense of transporting existing US rigs to Europe, the majority of the US rig fleet is already deployed domestically, with no spare capacity to be transferred to Europe. In order to develop shale gas resources, European drillers would therefore have to order new equipment, either from the US or local manufacturers, which in both cases is a lengthy (9 to 12 months per rig on average) and capital-intensive process. Market conditions in Europe may also present obstacles for the acquisition of financing and development of domestic shale gas infrastructure on a large scale.

Therefore, in order to acquire and transfer the technology, there has recently been strong appetite among European and other foreign companies to acquire equity positions in US shale gas developments. In CEE, too, there have been a number of acquisitions related to the development of the shale gas sector.

Table 2: Recent M&A activity in the CEE shale gas sector

<table>
<thead>
<tr>
<th>Country</th>
<th>Company</th>
<th>Acquired entity</th>
<th>Share acquired</th>
<th>Value ($)</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>Transatlantic Petroleum</td>
<td>Direct Petroleum Bulgaria(1)</td>
<td>100%</td>
<td>34.5 million</td>
<td>February 2011</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Tethys Oil</td>
<td>UAB Minijos Nafta(2)</td>
<td>25%</td>
<td>17.3 million</td>
<td>January 2012</td>
</tr>
<tr>
<td>Poland</td>
<td>LNG Energy</td>
<td>Kunagu Real Estate</td>
<td>100%</td>
<td>9.28 million</td>
<td>May 2010</td>
</tr>
<tr>
<td>Poland</td>
<td>LNG Energy</td>
<td>Joyce Podlasie and Maryani Podlasie</td>
<td>50%</td>
<td>4 million</td>
<td>February 2011</td>
</tr>
<tr>
<td>Poland</td>
<td>San Leon Energy</td>
<td>Realm Energy</td>
<td>100%</td>
<td>17.7 million</td>
<td>August 2011</td>
</tr>
<tr>
<td>Poland</td>
<td>Petrolinvest</td>
<td>Eco Energy(3)</td>
<td>40+48%</td>
<td>70.4 million</td>
<td>March 2012</td>
</tr>
<tr>
<td>Poland</td>
<td>Petrolinvest</td>
<td>Silurian</td>
<td>60%</td>
<td>25,000</td>
<td>December 2010</td>
</tr>
<tr>
<td>Poland</td>
<td>Eni</td>
<td>Minsk Energy Resources</td>
<td>100%</td>
<td>n/a</td>
<td>December 2010</td>
</tr>
</tbody>
</table>

Note: (1) As part of the transaction Transatlantic Petroleum acquired Direct Petroleum Morocco and Anschutz Morocco Corporation as well.
(2) As part of the transaction Tethys Oil bought 20% interest in UAB LL Investicijos.
(3) Petrolinvest acquired 88% interest in Eco Energy in two stages.
Source: KPMG analysis based on information by Platts Energy in East Europe, Natural Gas Europe, Infrastructure Journal, Mergermarket, LNG Energy Ltd

54 Source: KPMG analysis based on information by WTRG, Baker Hughes and Rigdata.com
Historically, there are fewer firms operating in natural gas exploration and production in Europe, as compared to the US, as the European oil and gas business has been reliant mostly on large, multinational corporations rather than small and medium-sized drillers. As such, the onshore drilling service industry in Europe is currently less developed as compared to that of the United States. On the other hand, the US shale industry has been continuously developing since the 1980s due to favorable taxation and regulation of unconventional developers. Europe could potentially skip this lengthy and capital-intensive process by partially adopting some solutions used by its overseas counterparts, and by basing its drilling capabilities on North American best practice.

3.3. Regulation

The European regulatory stance towards the development of shale gas resources varies greatly across individual countries. Even though Europe is considered to be a unified entity through the EU and other treaties, individual countries still have full authority to define a large portion of their national legislation. A perfect example of this national individuality can be drawn from countries such as France and Bulgaria, where temporary bans on hydraulic fracturing have been introduced due to concerns with the process’s environmental impact. A strong contrast may also be seen between France – a country characterized by strong local nuclear power producers, which have lobbied against shale gas developments – and Poland, where the shale gas industry lobby is arguably the strongest in Europe, thus making that country the regional pioneer in shale gas development.

Coordinating the interests of EU member states, the member states of the Energy Community, and other market players is a complex process. By contrast, the US allows more regulatory discretion at the state level, including on shale gas development.

Neither the EU nor the Energy Community has passed any trans-national legislation on shale gas, nor is there any draft legislation planned, as of 2012. At the same time, the EU’s Energy Roadmap 2050 only mentions shale gas as a potential energy resource to be researched further. Some individual countries, such as Poland, have argued against any EU-wide legislation on shale gas, citing each member state’s sovereignty over its own natural resource developments.

US legislation regarding land and mineral rights has played a major role in spurring the development of shale gas there. As such, the rights to natural land and their soil minerals are generally granted to the land owner, with the exception of some western states. In addition, many land areas are deemed public and federal, and therefore do not belong to a private entity, which complicates the local permitting process.

This is a major difference as compared to the permitting process of EU/Energy Community member states, where land ownership does not grant the automatic ownership of underlying minerals, as every ground resource, unless legally specified, is owned by the state. This, in turn, hinders the range of possibilities for private individuals to benefit from shale gas development, except through a land-leasing option – thereby providing less incentive for overall social approval of the exploration process.

With no specific regulations available for shale gas exploration and production, most European countries are currently guided by legislation for the regulation of conventional gas, and by EU-wide environmental directives. As a result, the
European Commission does not have power over laws on subsoil resources, leaving the development of those regulations to the national policies of member states.

Looking forward, it is reasonable to assume that any future regulation among EU/Energy Community member countries will be based on the provisions of the EU’s environmental policy, as per its Treaty articles (Article 174).

3.4. Taxation

There is currently no specific tax legislation for shale gas in any European country. In the majority of these countries, the only taxation that can be applied to shale gas-related activities is that of existing tax regulations governing conventional gas development. However, the principles related to conventional gas development are not always suitable for shale gas exploration, because of the distinct technologies used for extraction and inherent differences among the respective business models. The current tools for levying taxes on gas production in various countries include licensing fees, product sharing agreements, and special hydrocarbon taxes. As is common practice worldwide, such taxation methods are known to be applied through a combination of measures, as is shown in the table below.

<table>
<thead>
<tr>
<th>Country</th>
<th>Taxation and Value Derivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PL</td>
<td>Mining Usufruct Fee</td>
</tr>
<tr>
<td></td>
<td>Agreed upon between the exploration company and the Minister of the Environment</td>
</tr>
<tr>
<td></td>
<td>For sole exploration and exploitation: PLN 109.97/m²*</td>
</tr>
<tr>
<td></td>
<td>For joint exploration and exploitation: PLN 219.94/m²*</td>
</tr>
<tr>
<td></td>
<td>Concession Fee</td>
</tr>
<tr>
<td></td>
<td>Paid by concession holders intending to explore or extract mineral deposits</td>
</tr>
<tr>
<td>UA</td>
<td>Rent payment</td>
</tr>
<tr>
<td></td>
<td>Calculated by multiplying the base rate by a factor calculated as the average customs value of 1000 m³ of imported gas, divided by US $179.5</td>
</tr>
<tr>
<td></td>
<td>Subsoil use payment</td>
</tr>
<tr>
<td></td>
<td>Payment for exploitation of underground minerals</td>
</tr>
<tr>
<td></td>
<td>Production share payment</td>
</tr>
<tr>
<td></td>
<td>Determined by PSA</td>
</tr>
<tr>
<td>US</td>
<td>Royalty payment</td>
</tr>
<tr>
<td></td>
<td>Paid on the amount or value of gas production removed or sold from leased land</td>
</tr>
</tbody>
</table>

Note: *As of 2011 regulations.
DLA Piper, Polish shale gas from the tax perspective, 2012
In all cases, gas derived from shale is an energy product, and thus falls under the scope of the EU’s excise tax regime. Yet the excise is applied in the last phase of the development cycle of gas, and generally has more of an ultimate effect on end users.

As an acknowledged pioneer in European shale gas development, the Polish government started to work on new tax laws for shale gas exploration and production in December 2011, with the law to be presented during the first half of 2012. The government’s aim is to create a clearer environment for potential investors.

In order to encourage further investment in shale gas development within the CEE region, other countries will also need to refine their tax systems and take into consideration the particularities of the technologies used for shale gas exploration and production, as well as the local regulations that apply to the industry. While some governments have begun drafting relevant tax legislation, most CEE countries have not yet planned any change to their tax codes with respect to shale gas development.

3.5. Environment

Environmental concerns regarding shale gas extraction are one of the main questions facing the industry today, and they remain a strong obstacle for the expansion of the global shale gas business. The most salient issues in both the US and in Europe are similar, including concerns with ground water contamination, usage of scarce fresh water resources, the possibility of greenhouse gases escaping to the atmosphere, and potential provocation of seismic activity in regions where hydraulic fracturing is used. Political factors influencing governmental decisions on shale gas in various countries should also not be disregarded.

Some studies indicate that the drilling and fracturing of a single well in the US requires up to 17 million liters of fresh water. Given the nature of deeper shales and the higher geothermal gradient in Europe, the amount of water to be used is expected to be even greater. At the same time, the water which returns to surface after the fracturing process contains salt (depending on the shale salinity) and potentially, depending on the location, radioactive elements as well. Water management and the effective disposal of fracturing fluids are crucial issues to be addressed.

In addition to water resource management, a major public concern is the risk of groundwater contamination. As wells are drilled and the shale fractured, the water pumped into the opening is mixed with a number of chemical additives, some of which are toxic and can be quite harmful to health and the environment. Because companies are required to disclose chemicals used at differing times and degrees, depending on local regulations, the exact amount of potentially dangerous chemicals in hydraulic fracturing areas can be difficult to determine.

Experts suggest that it is unlikely that the water mixture can contaminate water aquifers directly through the drilling process, as long as the drilling is execute according to required quality standards.\textsuperscript{58} This is due to the fact that groundwater is located at a shallower level than shale gas. However, there are concerns about whether the flowback water may leak from wastewater pipelines, and thus pollute the environment and water supply.

In spite of these concerns, exploration and production companies claim that the majority of issues can be solved through technological advancements and operational improvements, as well as higher-quality execution, and stricter safety standards. These issues are likely to be more closely considered by regulators in the CEE region, compared with the US, and will require special consideration by potential developers.

### 3.6. Logistics

Once recovered, shale gas requires transmission infrastructure in order for it to be delivered to consumers.

Natural gas pipelines are the most common means of transporting fuel within the CEE region, both locally and over long distances. Pipeline infrastructure is undergoing significant development in CEE, while current capacities are sufficient to handle existing transmission volumes. The pipeline infrastructure would require significant investment, however, if significant quantities of shale gas supply were to come online.

Water usage related to shale gas exploration can become a logistics issue. Economically, it can strain a project’s rates of return, given the substantial additional cost of supplying water from distant sources. Currently, two options are used in the US to supply water to drilling locations—a tank trucks and, if the water source is available within two to three kilometers of the site, pipelines. The main sources of water are surface water, groundwater, municipal potable water, and flowback water from previously fractured wells.\textsuperscript{59}

Similar solutions are expected to be adopted in Europe, although the availability and impact of increased fresh water usage needs to be researched further, given the European realities of higher prices and environmental concerns. In addition, given that distances in Europe between potential shale gas formations and population centers are shorter, there is a risk of an emergence of competition for water resources which could effectively raise the cost of water even higher. It is therefore necessary to develop cost-effective solutions for the sourcing, disposal, and treatment of for scarce fresh water resources used during the shale gas extraction processes, to minimize the risk of hazardous leaks and address public concerns.

\textsuperscript{58} Source: Massachusetts Institute of Technology, The Future of Natural Gas, June 2011

\textsuperscript{59} Source: Office of Fossil Energy, United States Department of Energy, July 2010
4. Public acceptance of shale gas development

4.1. Overview

Public awareness of shale gas has gained momentum in recent years, particularly with regard to hydraulic fracturing and its highly publicized potential dangers. Environmental groups and civil opposition to shale gas have raised a number of concerns, while scientific study in support of hydraulic fracturing has been viewed with skepticism.

Social concern with shale gas drilling has encouraged governments to invest more efforts in scientific research, and European countries in particular have been keeping a close eye on public opinion, while endorsing the acceptance of new energy sources as possible solutions regarding energy security and greater independence from gas imports.

In light of this, some European countries have already developed strong stances on shale gas, giving rise to a palpable split between some EU countries. Whereas shale gas exploration has been indefinitely banned in Bulgaria because of bitter public opposition to hydraulic fracturing practices, Poland’s population is largely in support of shale gas because of its economic advantages and the energy independence it would bring.60

4.2. Country-specific views

Poland

The Polish political leadership has been actively supporting shale gas, emphasizing that it will bring economic growth and environmental progress (emission reduction) as well as increase energy independence.61

In highly gas-dependent Poland, the general population is well-aware of and keen on the benefits of shale gas. The nation’s long-standing mining tradition, supported by the fact that a majority of the country’s electricity is coal-based, also lowers its concerns about the safety of hydraulic fracturing. Organized opposition has therefore not been widespread in Poland, as the population has shown a preference for technologies perceived to be less harmful to the environment than coal.62

The Polish Geological Institute has conducted a study to test the safety of drilling, and concluded that hydraulic fracturing does not damage nature or the environment.63 Locally, the region of Pomerania has experienced public concerns regarding the negative effects of hydraulic fracturing, and the provincial government has agreed to conduct a survey of its effects, in the hopes of building up public confidence.64

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60 Source: Financial Times, Poland hopes to tap big reserves of shale gas, August 9, 2011
61 Source: Natural Gas Europe, Europe’s shale gas debate: enough gas for 60 years, October 5, 2011
62 Source: Spiegel Online, Poland hopes shale gas will free it from Gazprom, February 9, 2012
63 Source: The Wall Street Journal, Poland finds fracking safe, March 2, 2012
64 Source: Natural Gas Europe, Authorities hope documentary on shale will soften protests in Kashubia, March 6, 2012

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**Bulgaria**

Concerns have been raised over hydraulic fracturing in Bulgaria, however. After Chevron was granted a permit in May 2011 to explore shale gas in the country, Bulgaria’s nationalist party proposed a moratorium on shale gas exploration in November of that year, which was later rejected by the Parliament.65 Unfazed by this, protests by local citizens, non-governmental organizations, and opposition parties against shale gas drilling started during the summer of 2011, and heated up in January 2012.66

Exploration activity had just started when the government, citing environmental concerns, canceled Chevron’s shale gas permit.67 The next day, it also announced a ban on fracturing to explore shale gas, until environmental studies prove its security.68

**Other CEE countries**

Among other countries with shale gas potential, public opposition to shale gas-related activities has arisen, sometimes before any major exploration has even commenced.

In Romania, NGOs and citizen groups have begun to organize in the Bârlad area,69 coordinating with their counterparts in Bulgaria because of the large shale gas reservoir that straddles the border between the two countries.70 Romanian parliamentary opposition has recently proposed a ban on hydraulic fracturing, while local protests have been supported by members from both the governing and opposition parties.71

In Hungary, the first exploratory test drills by ExxonMobil started in 2008 in the Makó trough.72 As exploration efforts in Hungary have not resulted in any full-scale extraction possibilities, public opposition has remained relatively low. In the Czech Republic, some mayors and civilian groups73 of affected regions have started to oppose any shale gas activity, particularly the northern areas of Náchod, Trutnov, and Broumov.74 In March of this year, protests and petitions have been initiated against exploration in Basgas Energia Czech’s 777km² concession areas, citing concerns over groundwater contamination.75

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65 Source: Natural Gas Europe, Bulgarian MPs reject shale gas moratorium, November 22, 2011
66 Source: Natural Gas Europe, Analysis: Bulgaria shale gas and the wider geo-economic game, February 5, 2012
67 Source: Reuters, Bulgaria cancels Chevron’s shale gas permit, January 17, 2012
68 Source: Reuters, Update - Bulgaria bans shale oil and gas drilling, January 8, 2012
69 Source: Natural Gas Europe, Romania: Shale Gas Battle Set to Begin, March 20, 2012
70 Source: Natural Gas Europe, Analysis: Bulgaria shale gas and the wider geo-economic game, February 5, 2012
71 Source: Natural Gas Europe, Romania: Shale Gas Battle Set to Begin, March 20, 2012
72 Source: IHS, ExxonMobil drill second well in Makó trough, January 26, 2009
73 Source: Czech Position, Local Czech rally against shale gas drilling in Bohemia, March 6, 2012
74 Source: Energo, Energia Cesl podpisuje peticii proti taze brnlicového plynu, March 13, 2012
75 Source: Czech Position, Local Czechs rally against shale gas drilling in Bohemia, March 6, 2012

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5. Economics of shale gas

5.1. Investment/operation costs

Exploration cost structure
Drilling a shale gas well for exploration in the US typically costs anywhere between $376 and $10 million,\(^77\) depending on depth and location, whereby drilling at Haynesville can involve a depth of 1,200-1,800m.\(^78\) By 2010, all-in costs, based on the exploration, acquisition, and developing of new reserves and for proven and developed reserves, started at $223/Mcm.\(^79\) However, such figures pale at the cost of drilling a well in Europe, which can cost up to 40% more than one at Haynesville.\(^80\)
As a comparison, drilling costs in Poland lie in the area of $10-15 million.\(^81\)
Because of differences in the physical properties of the ground, more powerful rigs and pumps are required in Europe. For the hydraulic fracturing process, a larger supply of water is needed, which can cost up to 10 times as much as it does in the US.\(^82\) Moreover, there is 77% less renewable water per capita in Poland, for example, as compared to the US.\(^83\)
Among the total costs of shale gas exploration and development, activities related to the execution of drilling are estimated to account for 40% share, while completion and facilities represent the rest.\(^84\)

![Figure 7: Share of drilling capital expenditures in the US](image)

Source: IHS Global Insight Inc., December 2011

76 Source: IHS Global Insight Inc, The Economic and Employment Contributions of Shale Gas in the United States, December 2011
77 Source: Platts Insight, Prices and Profits: US Shale Gas, December 2011
78 Source: The Economist, Fracking here, fracking there, November 26, 2011
79 Source: Gazprom Export, Shale Gas, May 5, 2011
80 Source: Deutsche Bank, European Gas: A First Look at EU Shale-Gas Prospects, October 2011
81 Source: Polish Geological Institute, Shale Gas – Do Economics and Regulation Change at the German-Polish Border, December 12, 2011
82 Source: Oxford Institute for Energy Studies, Can Unconventional Gas be a Game Changer in European Gas Markets?, November 2, 2011
83 Source: Schlumberger Business Consulting, Unconventional Gas 2.0 Energy Perspectives, Summer 2011
84 Source: IHS Global Insight Inc., The Economic and Employment Contributions of Shale Gas in the United States, December 2011
Because there are fewer companies in Europe focused on unconventional gas development, the cost for their services tends to be higher, by approximately 20%, as compared to their North American counterparts.\textsuperscript{85} Also, there are a smaller number of rigs in Europe – 72 existed as of February 2012\textsuperscript{86} – only a handful of which could address European depth requirements.\textsuperscript{87}

**Comparison of exploration costs in the CEE region**

Exploration costs around the CEE region vary. In Poland, for example, a 2,000m deep well has been estimated to cost around $11 million, almost 3 times as much as drilling a well of that depth in the US.\textsuperscript{88} By 2010, PKN Orlen had spent more than PLN 100 million ($33 million) on the preliminary stage of exploration.\textsuperscript{89} In Hungary, a collaboration involving ExxonMobil and MOL spent an estimated $50 million on shale gas exploration in the Makó trough where it drilled three wells in 2009.\textsuperscript{90} In 2011, Ascent Resources raised £17 million ($26 million) to drill three exploratory wells at the Slovenian-Hungarian border.\textsuperscript{91}

5.2. **Comparison with other types of natural gas**

Production costs vary between conventional and unconventional gas resources, and among unconventional gas resources themselves.\textsuperscript{92}

![Figure 8: Production cost range of conventional and unconventional gas](image)

*Figure 8: Production cost range of conventional and unconventional gas*

*Note:* Estimated ranges for 2010 in the United States

*Source: IEA ETSAP, May 2010*

While the costs for unconventional gas production are expected to decline, the development of their production costs will depend greatly on the concurrent development of other energy sources, and, especially in Europe, the level of regulatory action.

\textsuperscript{85} Source: Oxford Institute for Energy Studies, Can Unconventional Gas be a Game Changer in European Gas Markets?, November 2, 2011

\textsuperscript{86} Source: Baker Hughes, Baker Hughes announces February 2012 rig counts, March 7, 2012

\textsuperscript{87} Source: Drilling Contractor Magazine, European Shale Gas: a long road ahead, July/August 2011

\textsuperscript{88} Source: Bloomberg, Shale-Gas Drilling Cost in Poland Triple US, Schlumberger Says, November 29, 2011

\textsuperscript{89} Source: PKN ORLEN SA, Shale Gas, July 2010

\textsuperscript{90} Source: Upstream, ExxonMobil, MOL pull out of Hungary team, February 19, 2010

\textsuperscript{91} Source: SmallCapNews, Ascent Resources cheered by gas flow rates from latest well in Slovenia, November 2, 2011

\textsuperscript{92} Source: IEA ETSAP, Unconventional Oil & Gas Production, May 2010
5.3. Cooperation and cost sharing

On both sides of the Atlantic, several large international oil and gas companies have entered into agreements concerning the exploration and development of shale gas. In particular, ExxonMobil paired with Hutton Energy in 2011 to agree to a 51%-49% share of four of its exploration areas in Poland. A number of other joint-ventures were formed over the course of 2011, with perhaps the most notable being one between Encana and PKN Orlen.

For their part, PGNiG and 3Legs Resources, both active in Poland, have sought to support their shale gas exploration activities by listing their shares.

Conclusion

The costs and financing associated with shale gas are influenced by a number of factors that prevent the North American experience from being easily replicable in Europe. Aside from the differences in the physical characteristics of rock, depth ranges, and water availability, these costs are also governed by particular market forces, such as the availability of specialists, necessary equipment used for exploration and extraction measures, and existing infrastructure.

Within the CEE region, exploration and extraction costs can vary significantly, with estimated break-even levels being higher than those in the US. On the other hand, it is expected that shale gas will nonetheless be produced at competitive rates, as compared to the importation of Russian conventional gas in the years to come.

Due to the higher costs and risks of E&P in Europe, more joint venture activity is likely, and locally tailored methods of financing will continue to be necessary to support CEE exploration projects. Such collaboration will be crucial to realizing regional and domestic plans for energy security, thereby providing a way for larger companies to enter local markets with capital and experience, while simultaneously giving domestic players the opportunity to contribute their local knowledge, and also satisfying their need for capital.

93 Source: Ernst and Young, Shale gas in Europe: revolution or evolution?, December 5, 2011
94 Source: Platts Energy in East Europe, Encana set for shale deal with PKN, September 23, 2011
95 Source: Platts Energy in East Europe, PGNiG to list drilling contractor, July 15, 2011
96 Source: Platts Energy in East Europe, 3Legs raises $102m in IPO, June 17, 2011