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Game Changer: How Shale Is Transforming Global Energy--And Affecting Industries And Ratings

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Game Changer: How Shale Is Transforming Global Energy--And Affecting Industries And Ratings

The U.S. leapfrogged Russia in 2013 to become the world's largest combined oil and gas producer, evidence of the magnitude of the U.S. shale energy boom. And by 2015, the U.S. is likely to overtake Russia and Saudi Arabia to lead the world in oil production, according to the International Energy Agency (IEA). Beyond the shale energy revolution's major impact on the U.S. economy and its balance of payments--and on many industries and companies--surging shale energy output is increasingly having a transformative effect on global energy markets. Hurdles to the development of vast shale reserves outside the U.S. will delay bringing these resources on-line to a significant extent in the next few years, but Standard & Poor's Ratings Services expects that global shale production will accelerate after 2020--given that future oil and gas prices justify the extraction costs.

The U.S. is becoming increasingly self-sufficient in natural gas and light sweet crude. This is leading to a marked decline in its imports of light crude oil and liquefied natural gas (LNG), forcing producers for which the U.S. has been a major export destination to find alternative markets. It is also causing a significant falloff in Canada's natural gas exports to its southern neighbor. One area where the shale revolution is not having a significant impact is global heavy crude markets: U.S. shale reserves are predominantly light sweet crude so the country still needs to import heavy crude to support its refineries. The shale phenomenon has already led us to take ratings actions--positive and negative--on U.S. and Canadian companies operating in the energy and energy-intensive industries (see table 2).

Overview

- The U.S.'s increasing self-sufficiency in natural gas and light sweet crude, as well as its surging exports of refined products, are having a major impact on the competitive dynamics of global energy markets.
- Non-U.S. oil and gas shale reserves, which are much larger than those in the U.S., are likely to develop at a slower pace because of production challenges.
- However, we believe production of non-U.S. oil and gas shale reserves will likely become significant after 2020, as conventional reserves become depleted and economic incentives emerge.
- Development of non-U.S. shale reserves is likely to further affect credit quality, given that the current U.S. shale boom already caused us to change some ratings on U.S. and Canadian companies.

Outside the U.S., we think that massive technically proven undeveloped oil and gas shale reserves--which dwarf those in the U.S. (see table 1)--have the potential to further transform the global energy landscape beyond 2020, assuming that companies can overcome production, economic, and political hurdles. If this does occur, we believe it will likely affect credit quality of issuers in energy and certain industrial sectors. Major incentives for shale reserve development include energy security and the need to replace dwindling conventional reserves. Moreover, development of shale resources serves as an economic growth engine and is likely to trigger royalty revenues for sovereigns. And as environmental policies globally center on reducing carbon emissions and particulates associated with electricity generation, gas is seen as an easy solution, preferable to burning coal, and less expensive than renewable options such as solar and wind. However, evolving environmental regulations and public concern over hydraulic fracturing's impact

on water quality are still material challenges.

The export of U.S. crude oil is largely banned (under a 1975 U.S. law established for strategic reasons after the 1973-1974 oil embargo)--which is contributing to keep the price of domestically produced light crude relatively competitive versus imports. More favorable domestic natural gas and light crude prices than in many other parts of the world are also helping the U.S. become a major exporter of highly competitive refined products (see "The Shale Boom Drives Record U.S. Refined Exports, Shaking Up Global Fuel Markets," published Jan. 7, 2014). Changes wrought by mushrooming U.S. shale output are also affecting the market structure and competitive landscape in and outside the U.S. in petrochemicals, fertilizers, and petroleum product shipping. Because natural gas markets are considerably less globally integrated than the crude oil marketplace due to the infrastructure limitations and expense of long-distance intra-regional transportation, gas prices and producer profitability in the U.S. and Canada have been reduced substantially by the surge in U.S. production versus other regions of the world. As a result, further development of shale gas reserves has slowed significantly, with the industry now concentrating on investment in development of crude oil from shale. However, low natural gas and NGL prices are prompting U.S. and foreign petrochemical companies to build significant new U.S. capacity. They are also causing manufacturers in energy-intensive industries, such as steel, cement, and paper products, to relocate and expand capacity to the U.S.--and assisting in the move away from coal for electricity production in the U.S.

What Are The Prospects For Shale Development Globally?

The massive potential of overseas shale reserves is reflected in the U.S. Energy Information Agency's (EIA) estimates of non-U.S. technically recoverable volumes, which show that the U.S. currently only accounts for some 17% of global crude oil shale reserves and 9% of natural gas reserves (see table 1 for EIA's estimates as of June 2013).

Table 1

Technically Recoverable Shale Oil And Gas Resources					
Top 10 countries--recoverable shale oil			Top 10 countries--recoverable shale gas		
Rank	Country	Shale oil (billion barrels)	Rank	Country	Shale gas (trillion cubic feet)
1	Russia	75	1	China	1,115
2	U.S.	58	2	Argentina	802
3	China	32	3	Algeria	707
4	Argentina	27	4	U.S.	665
5	Libya	26	5	Canada	573
6	Australia	18	6	Mexico	545
7	Venezuela	13	7	Australia	437
8	Mexico	13	8	South Africa	390
9	Pakistan	9	9	Russia	285
10	Canada	9	10	Brazil	245
	World total	345		World total	7,299

Source: U.S. Energy Information Agency (EIA) rankings.

While it is important to emphasize that the EIA numbers are estimates and are liable to change, technically

recoverable global shale reserves projections have been climbing rapidly since 2009. The figures in Table 1 exclude offshore shale formations, some so-called "tight" plays (in sandstone and carbonate strata) which are often found adjacent to shale, as well as shale present in the Middle East and Caspian regions. Many of these other resources are only in early stages of exploration, yet point to the vast size of untapped shale and tight reserves. Tight oil plays are already a major contributor to output in the U.S.--with the EIA estimating that production from this source has grown from 0.2 million barrels per day (bpd) in 2000 to 2.2 million bpd at the end of 2012. Although the EIA has not published data for tight oil proved reserves, its current estimate of unproved U.S. tight oil resources is a substantial 58 billion barrels.

Another important consideration in evaluating the potential of shale resources is the difference between economically recoverable and technically recoverable reserves. Economically recoverable shale reserves are those that companies can produce at a profit under current demand, supply, and pricing. Technically recoverable reserves represent resources that producers can extract using current technology, without consideration of the cost of production. So, although great potential exists for future shale-derived hydrocarbon production, it remains to be seen what percentage of non-U.S. shale resources can be extracted at a profit.

To date, the U.S. is the only country to have developed a high level of oil and gas shale production. Some of the shale reserves outside the U.S. face greater development hurdles because of complex geology, lack of drilling and infrastructure resources, environmental objections, land ownership issues, government regulations and energy price setting, taxation of the oil production industry, and scarcity of water necessary for the fracking process. By contrast, the U.S. has benefited from major advantages in developing its shale resources, including its:

- Private ownership of hydrocarbon subsurface rights;
- A highly developed, flexible, and dynamic private-sector oil and gas industry--including leadership in fracking and horizontal drilling technology--and high numbers of independent drillers and service companies;
- Existing gathering, transportation, and refining infrastructure;
- Availability of water for hydraulic fracturing; and
- Advanced capital markets that have helped fund the boom.

In many other regions with significant reserves, it will generally take time to put in place the requisite government policies and regulations, drilling rights, infrastructure, technology, and financing--and address environmental concerns. Another factor holding back more rapid shale resource development in countries such as Russia and China is the existence of conventional reserves, which for now companies and governments are giving greater priority. Finally, companies are finding that the characteristics of shale can vary from country to country, so techniques and technology that work in the U.S. and Canada may need to be altered before full-scale development of shale can occur in some regions. Although these hurdles will slow shale reserve development outside North America--and in some instances may make production unfeasible--we expect that global shale production will become increasingly significant beyond 2020. This assumes the economics of extraction (wellhead prices, production costs, and volumes) make sense and no major fracking accidents occur, which could create additional significant environmental headwinds.

If global shale production burgeons in the longer term, the implications for oil and gas prices and ratings will depend on the degree to which global oil and gas demand keeps up with production from shale and conventional sources. With large mature economies such as the U.S., Canada, Europe, Japan, and Russia likely to experience slow, flat, or

declining demand growth in coming years, global energy markets will become increasingly reliant on Asia, Latin America, and Africa to grow sufficiently to absorb any significant supply increases in order to prevent material price declines.

Effects Of The Shale Revolution On U.S. And Canadian Ratings

To date, the credit impact of the shale boom has largely been on U.S. companies (see table 2). We have also downgraded some Canada-based entities due to low North American natural gas prices. We expect credit ramifications to become increasingly global in coming years.

Table 2

Shale's Impact On North American Sector Credit Quality		
Positive Impact	Mixed Impact	Negative Impact
Oil exploration and production	Gas exploration and production	Thermal coal miners
Oil equipment and services	Gas equipment and services	Coal-powered electric utilities
Oil refiners	Midstream energy (pipelines and storage)	Merchant electric generators
Petrochemicals	Freight railroads	Solar energy producers and equipment makers
Regulated electric utilities	Coastal and river barge tanker operators	Wind energy producers and equipment makers
Nitrogen fertilizer producers		
Energy-intensive manufacturers (e.g. cement, glass, paper)		
Steel and other metals		
Rail oil tank car builders		
CNG & LNG commercial vehicle and engine makers		
Express package deliverers		
Environmental service providers		

CNG--Compressed natural gas. LNG--Liquified natural gas.

The revenue, profit, and credit effects on U.S. industries have varied markedly--benefitting or hurting some, and having a mixed or little effect on others (see "Game Changer: Industry Winners And Losers From The U.S. Shale Revolution," published May 21, 2013). For example, the shale energy surge has propelled the output of oil and gas exploration and production (E&P) companies, with a mixed impact on industry ratings. Most E&P companies focusing on shale oil have benefited, though some smaller producers reliant on natural gas revenues have come under pressure and had their ratings lowered. This has been due to overproduction, which contributed to an 85% fall in U.S. natural gas prices between mid-2008 and mid-2012. As a result, we downgraded companies in the oil and gas sector on nearly 40 separate occasions from January 2011 until May 2013. With U.S. natural gas prices having recovered modestly in recent months, due in part to producers cutting back, pressure on North America gas producers ratings has abated somewhat. However, we expect natural gas producers to continue to face profit margin headwinds in 2014 at our expected price levels (see "Standard & Poor's Revises Its Crude Oil And Natural Gas Price Assumptions," published Nov. 20, 2013).

Meanwhile, relatively lower U.S. crude oil and natural gas prices (vis-à-vis international benchmarks) place American refiners at an advantage, because they can produce refined products (such as diesel) more cheaply than many overseas competitors--which is creating a surge in refined product exports. Lower natural gas and NGL prices also have materially benefited raw material costs and profit margins for petrochemical companies, nitrogen fertilizer producers, and energy-intensive manufacturers, including metals, cement, glass, and paper. North American petrochemical producers' costs have improved compared with those of other global producers, and this has played an important role in several of our recent upgrades, as did our belief that our ratings on these companies can withstand the industry downturn that we expect later this decade. Future trouble in this industry could result from the building of additional capacity as new capital rushes in, which we believe could begin to create overcapacity.

U.S. coal mining is the industry that has suffered most from cheaper natural gas. Thermal coal miners have been hit with sharp revenue declines and downgrades--as electric utilities have switched from coal to gas-fired plants because of lower costs and emission/regulatory reasons. Lower utility coal shipments have hurt railroad and barge company revenues also--although a rapid increase in shale oil traffic is partially offsetting this decline. Rail oil tanker car production is booming. Some U.S. merchant power companies have also suffered because natural gas prices often set the market price for electricity. Those with coal-fired plants face the greatest challenges due to low gross profits and increasingly stringent emission regulations.

The Impact Of The U.S. Shale Boom On Credit Quality Elsewhere

U.S. shale production, while having an increasingly negative impact on crude and LNG export revenues from the U.S., has not to date translated into significant downward rating pressure on these producers because they've up until now been able to find alternate growth markets such as Asia. For example, for Saudi Arabia and Gulf States--including Kuwait, Qatar, and the United Arab Emirates--we see limited near-term effects on ratings of oil producers (see "What Is The Significance Of The Shale Phenomenon For Gulf Oil And Gas Producers," published Nov. 18, 2013). U.S. shale oil is mainly light sweet crude. Saudi and Gulf producers have been successful in redirecting their light crude exports to other markets, and are continuing the export of heavy crudes, which are still in demand in the U.S. The immediate effects of the U.S. shale surge, in our view, center on global natural gas producers. Rising production has led to plunging U.S. natural gas prices, making imported LNG less competitive and significantly reducing U.S. LNG imports, although they were never large to begin with. Qatar, the most significant LNG exporter in the region, has exported no LNG to the U.S. since April of 2013 and is diverting production to other markets. In the medium- to longer-term, if significant volumes of crude from shale were to come on-line from other countries and swell worldwide supply, we consider that a 15%-20% fall in global oil prices would have to occur before the likes of Saudi Arabia and Qatar would record any financial deficits. However, one risk for LNG exporters globally is the potential for the decoupling of gas contracts away from being oil index-based to gas index-based in the longer term.

We believe that shale production in Latin America later this decade could be a positive for regional oil and gas producers' credit metrics. Development of these resources would benefit producers' business risk profiles by diversifying their hydrocarbon resources, in our view, and would significantly increase the amount of reserves. In the long run, it would also improve companies' cash-flow generation and profitability.

Latin America Holds The Highest Technically Recoverable Shale Reserves In The World

Although the shale energy boom in the U.S. has been the big story for the past few years, Latin America is sitting on some of the biggest shale resources in the world (see "Can Latin American Oil And Gas Companies Extract Profits From Unconventional Oil And Gas Resources?," published July 23, 2013). Latin America holds 1,975 trillion cubic feet (tcf) of shale gas resources and 73 billion barrels of shale oil, according to EIA estimates. Argentina, Mexico, and Brazil are among the 10 countries with the largest shale gas technically recoverable resources in the world and Latin America's shale gas resources are seven times higher than its conventional hydrocarbon reserves.

Yet despite this vast potential, the pace of exploration and development has been slow to date, as huge drilling costs and environmental concerns remain major obstacles. For example, Argentina has the largest shale gas reserves in the region. However, heavily regulated hydrocarbon prices, high inflation, foreign exchange controls, and unpredictable economic policy continue to be the main challenges in developing Argentina's unconventional hydrocarbon resources.

Another factor that will slow near-term development of shale reserves in the region is that countries like Brazil, Mexico, and Venezuela still have conventional reserves to develop, which will be the producers' main priority in the next few years. With mature basins, declining production, and no major conventional discoveries in recent years, Argentina appears to be one of the countries needing to more rapidly develop unconventional resources to stop continued production declines.

Development Of Asia-Pacific's Significant Shale Resources Is Likely To Gather Pace As 2020 Approaches

Asia-Pacific has the second-largest resources of technically recoverable shale oil and gas in the world. China alone possesses the world's largest shale gas resources, and its rapid economic growth is likely to increase energy consumption. However, due to high extraction costs, environmental concerns, and conventional reserves exploration currently having greater priority in some cases, development is likely to only slowly gather pace. We believe the region's robust energy demand, the need for energy security, and the push for lower emission fuel will spur commercial development of shale resources in the longer term, although it will take at least five years to get to this point.

Australia, too, is pursuing its promising shale prospects--and has been producing shale gas for some years. Currently the country's large conventional gas projects are deterring development of promising shale reserves. Australia has Asia-Pacific's second-largest shale gas resources that are technically recoverable and the sixth-largest shale oil resources in the world (see table 1), according to the EIA. Five or more years from now, an expected robust demand for LNG, most notably from China and Japan, could trigger commercial shale development in Australia.

Canada's Exports To The U.S. Are Suffering

Canada has the fifth-largest reserves of technically recoverable shale gas, and the 10th-largest for shale oil, according

to EIA estimates. Shale gas currently accounts for about 15% of Canada's daily natural gas production, versus 39% in the U.S. A major obstacle to further gas field development is the glut of natural gas in the U.S., which is the major market for any additional Canadian production, significantly undermining economic incentives to develop Canadian shale gas. In fact, Canada's conventional gas producers are already suffering from a marked fall off in exports to the U.S. due to competition from American shale gas. However, by 2020 production could become more attractive if Canada is successful in developing planned LNG export capabilities on its west coast or at delivering to U.S. LNG terminals to serve Asian markets. The question will be whether gas prices paid outside North America will remain as lucrative once LNG exports from North America increase. Canada's most significant shale oil deposits are large and located in Alberta. Shale gas deposits are significant in British Columbia, some dry and some liquids rich. The thick and geographically extensive siltstones of the Montney Formation are expected to contain 449 tcf of marketable natural gas, 14,521 million barrels of marketable NGLs, and 1,125 million barrels of marketable oil.

Europe Faces Major Hurdles To Develop Its Limited Shale Resources

Because of Europe's relatively smaller shale gas reserves compared to other major regions and significant hurdles in some countries to developing their resources, we do not expect that European shale production will become economically and industrially significant globally in the next five to 10 years. Low shale production could put some of Europe's industries at a disadvantage compared to regions that are able to develop their larger resources. The main barrier to shale development in Europe currently is environmental objections. For example, fracking bans are in place in France and Bulgaria. Recently, the chief executive of E.ON SE, the major German utility, expressed concern that European utilities and energy-intensive industries are likely to become increasingly disadvantaged by competition from cheap U.S. natural gas. As examples he cited petrochemicals and metals, which are relocating to the U.S. due to the availability of cheap shale gas. The head of Eni SpA, the largest Italian oil and gas group, has expressed similar views. In 2012, one conclusion of a European Commission report on the potential energy market implications of unconventional gas was: "Shale gas production will not make Europe self-sufficient in natural gas. The best case scenario for shale gas development in Europe is one in which declining conventional production can be replaced and import dependence maintained at a level of around 60%."

Poland, which along with France has the largest non-conventional hydrocarbon resources in the EU, currently appears closest to developing some of its estimated 187 tcf of technically recoverable gas reserves. However, legal, regulatory, and infrastructure prerequisites will take time to put in place. In the U.K., the government has proposed lower initial taxes on shale production after it lifted a ban on drilling in 2012, although recent drilling was accompanied by protests.

Outside the EU, Ukraine has meaningful shale gas prospects based on reserve estimates of 106 tcf. The country has recently signed two deals worth \$10 billion each with Shell and Chevron to begin development of its shale plays.

While the prospects for home-produced shale gas in Europe appear limited for the time being, not all European news has been negative on the shale front. Europe is buying LNG from the Gulf States that was previously destined for the U.S., providing welcome competition and a strategically important alternative source of supply to Russian natural gas. This is leading to lower natural gas prices and greater negotiating leverage with Gazprom, Russia's dominant state-controlled gas producer.

Russia Faces Enormous Challenges In Extracting Shale Oil From The Western Siberian Tundra

Russia is estimated to have the world's largest shale oil reserves and ranks ninth in shale gas resources, according to the EIA (see table 1). Currently, development of its unconventional oil resources is a much higher priority than its shale gas. This is because its conventional crude reserves are being depleted, while the country still has large supplies of conventional gas. Gazprom recently stated that "at the moment shale gas production in Russia would be inexpedient due to the abundance of conventional gas reserves with their recovery cost being considerably lower than the estimated cost of shale gas production." After the recent commissioning of the very large Bovanenkovskoye field, Gazprom has substantial excess capacity in conventional gas production relative to current demand on the domestic and export markets. Independent players such as Novatek and oil companies have substantial growth potential in conventional gas, too.

On shale oil, Russia has advantages including home-grown fracking technology and water available for the fracking process--which should facilitate the development of its vast Bazhenov shale oil deposits in Western Siberia. To speed that development Russian oil companies have begun working with international oil majors (e.g. joint ventures between Rosneft and Exxon and Gazprom neft and Shell) and top U.S. oilfield development and services companies to bring in equipment, technology, and drilling crews from the U.S.

Russia's reserves of conventional oil are also quite substantial, but its core oil provinces, such as Western Siberia, are mature. New conventional reserves often require large investments in infrastructure in new provinces, such as Eastern Siberia or offshore. A significant part of unconventional reserves, however, is located very close to existing conventional reserves where infrastructure already exists (notably Bazhenov). This could reduce infrastructure investment requirements and help support economic development and employment in Russia's numerous oil-focused "company cities" in the medium to long term.

Until recently, the key obstacles to investments in developing non-traditional oil were the abundance of traditional oil reserves and high taxes set in proportion to the oil price. The marginal tax rate at above \$25/barrel (bbl) exceeds 85%, which could make investments non-economical. Recently, the Russian government has created very favorable tax incentives for tight oil, in hope of spurring the production and export of shale oil, in contrast to high taxes paid on conventional production. The necessary transportation infrastructure and costly expansion of specialized rigs will require heavy investment and much time.

More difficult problems and uncertainty surround the nature of the strata and the quality of shale oil in Western Siberia. The type of shale rock there makes it difficult for oil to flow upwards. To date, oil flows and quality have been inconsistent between wells, with some producing weak flows and others an immature precursor of crude with little commercial value. So far, Russia's unconventional oil production is at a test stage, with limited commercial volumes.

What Are The Prospects For Production From Shale In The Gulf?

Saudi Arabia is currently at the forefront of shale gas development in the Gulf. Recent market estimates put Saudi shale gas reserves at about 600 tcf--more than double its proven conventional reserves. This estimate would rank the country as having the fifth-largest shale gas reserves in the world (not included in the EIA data). We understand that national oil and gas company, Saudi Aramco is in talks to secure 40 extra rigs to cover shale gas operations, indicating that the company expects large-scale production over the medium term. We expect extraction using fracking technology will remain expensive in the short term, at \$8-\$9 per million BTU (mmBTU), compared to our estimate of all-in finding, development, and production costs for more established shale plays of \$3-\$4 per mmBTU in the U.S.

Additionally, Saudi Arabia is preparing to be among the first countries outside North America to use shale gas for power generation and thereby save more of its crude oil for export. Saudi Aramco announced recently that it is looking to commit shale gas for the development of a power plant that will feed its phosphate mining and manufacturing sector. We anticipate that regulation and environmental hurdles may be less of an issue in Gulf countries than elsewhere due to the scarcity of population in areas where shale activities are likely to take place. We don't foresee a shortage of capital to fund shale exploration and production in the region, because the national oil companies that dominate conventional production are cash-rich.

In Africa, Algeria Offers The Greatest Potential

We believe that Algeria is the country with the greatest current shale gas potential in Africa. It's relatively stable, has large shale gas reserves (estimated at 707 tcf), and its government is taking measures including offering exploration rights and favorable taxation breaks to attract foreign oil company investment and technology. Its proximity to gas-hungry Europe is a major potential advantage. The other country in North Africa with major shale reserves is Libya. Although it is sitting on large shale oil resources, Libya will not in our opinion be in a position to consider attracting the foreign technology and capital necessary to develop its reserves until its political and security situation stabilizes.

South Africa has large shale gas reserves, which if developed could help move the country away from its heavy dependence on energy imports, and help boost its economy and employment. The country lifted a ban on fracking last year, which it had imposed because of concerns by the strong environmental lobby. The government has stated its intent to auction off exploration licenses in early 2014 covering reserves in the Karoo region.

Expected Growth In Global Shale Production After 2020 Will Further Affect Credit Quality

The U.S. shale boom is having a significant impact on global energy markets as well as on domestic corporate credit quality. Although we expect massive shale reserves outside the U.S. to face development hurdles, we anticipate that global shale production will become increasingly significant after 2020 and will have both positive and negative effects on different industrial subsectors--as has been the case in North America.

Related Research

- The Shale Boom Drives Record U.S. Refined Exports, Shaking Up Global Fuel Markets, Jan. 7, 2014
- Standard & Poor's Revises Its Crude Oil And Natural Gas Price Assumptions, Nov. 20, 2013
- What Is The Significance Of The Shale Phenomenon For Gulf Oil And Gas Producers, Nov. 18, 2013
- Asia's Tough Terrain Delays Shale Gas Progress, But Latent Demand May Ignite Growth, Sept. 12, 2013
- Can Latin American Oil And Gas Companies Extract Profits From Unconventional Oil And Gas Resources?, July 23, 2013
- Oil From U.S. Unconventional Resources Is Unlikely To Displace Canadian Crude Oil Exports Any Time Soon, June 17, 2013
- Game Changer: Industry Winners And Losers From The U.S. Shale Revolution, May 21, 2013
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- How Liquefied Natural Gas Markets Around The World Are Adapting To Changing Industry Dynamics, April 20, 2012

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