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Shale gas

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Introduction

The history of shale gas has begun with the first extraction realised in America in 1821.This gas resource has been abandoned with the development of oil, But, due to the actual crisis, the idea of the shale gas have been brought back as, maybe, an efficient solution.

I. Shale gas: general presentation

1) Formation and composition

There are two theories about the origin of natural gas. The less accepted advances that hydrocarbons were trapped in the rock during the formation of the planet Earth.

The second one advances that hydrocarbons have been formed by the deterioration of organic matter. The process starts with photosynthesis: the plants change the carbon dioxide and water into oxygen and carbon hydrates, thanks to the solar power. When plants or herbivorous decompose themselves and become sediments, as pressure and temperature are increasing with depth, the carbon hydrates resulting turn into hydrocarbons. The main part of natural gas, formed into the “mother rock” (which is shale) move to sediments more porous like limestone. The gas which remains is called shale gas.

On the contrary of the conventional natural gas, the shale gas isn’t concentrated in a little volume; it is present in a very large volume in little quantity.

As 95% of the natural gas, the shale gas is methane.

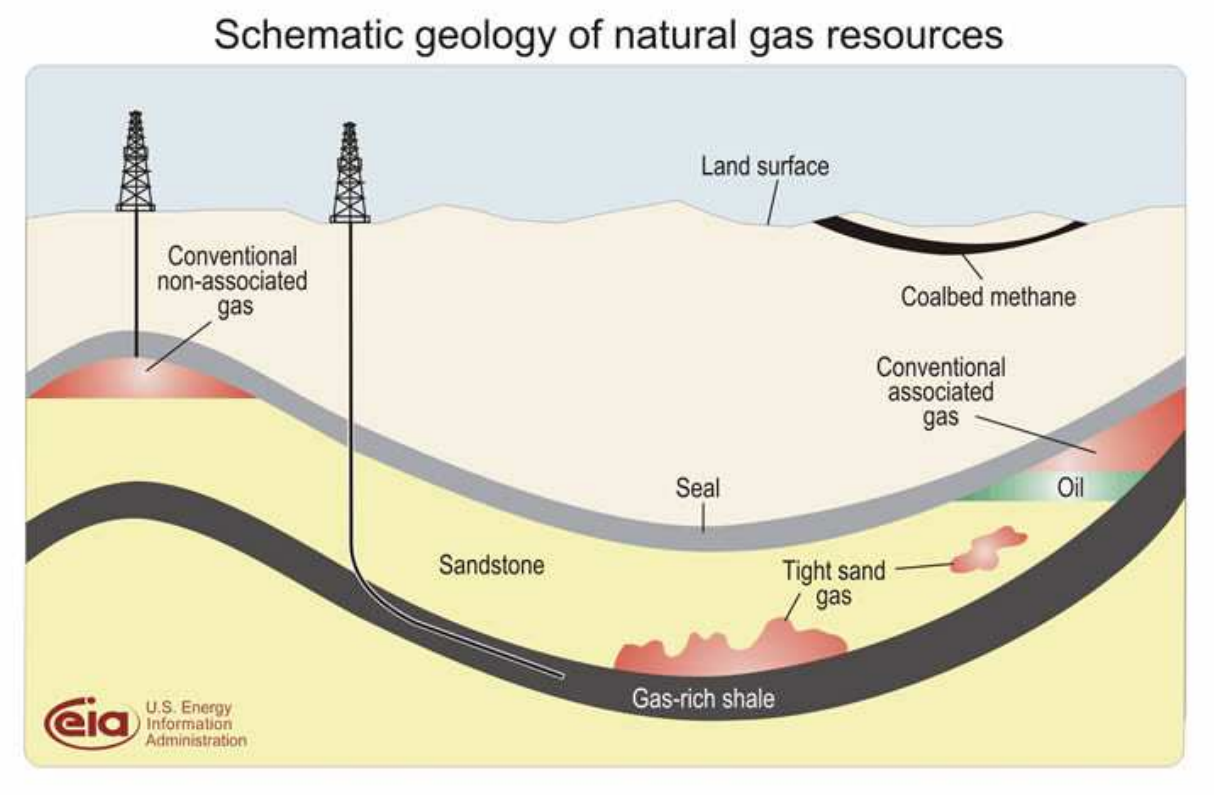
2) Extraction process

Even if the shale gas can be found between 1500 and 3000 meters under the ground, it is more difficult to extract than regular natural gas. Today, there is only one technique mastered to extract the shale gas: the hydraulic fracturing. This technique works in 4 stages.

First, the sediment level must be reached by vertical drillings, as in any gas extraction. Then, the different vertical drillings must be linked with a horizontal drilling, which cost 20% more than the vertical one.

The third and more important stage is the hydraulic fracturing: water, sand and chemical fluids (as acids) are injected, at very high pressure, into the sediment strata trough the horizontal drilling. The pressure and the acids create a web between all the micro reserves of shale gas by fracturing the rock. The sand and some other chemical products keep the fault open and help the methane to move in the web. Finally, the gas goes up and can be caught.

Another technique is experienced, it's called electric fracturing. The idea is to create a shock wave thanks to a strong electric shock. This wave would fracture the sediment strata and create a web like the hydraulic fracturing. Alas the technology nowadays is insufficient to improve this fracturing method, but should be able to use it in about 20 years.



II. Environmental impacts

1)Pollution

As one should have expected, the exploitation of the shale gas have an impact on the environment and on people health. The more interesting and revealing example is the USA, which is the only country directing shale gas extraction for the moment.

First, when using hydraulic fracturing, the shale gas tends to be dissolved in the ground water which is used by the local inhabitants. Tap water is gurgling and can be lighted (picture).

According to a study led by the Duke University, around the drills, ground water has a concentration of 17 times the average.

This implies that a huge part of the shale gas kept underground is freed, during the extraction, in the atmosphere, those gas being mainly methane which is a well-known greenhouse gas effect.

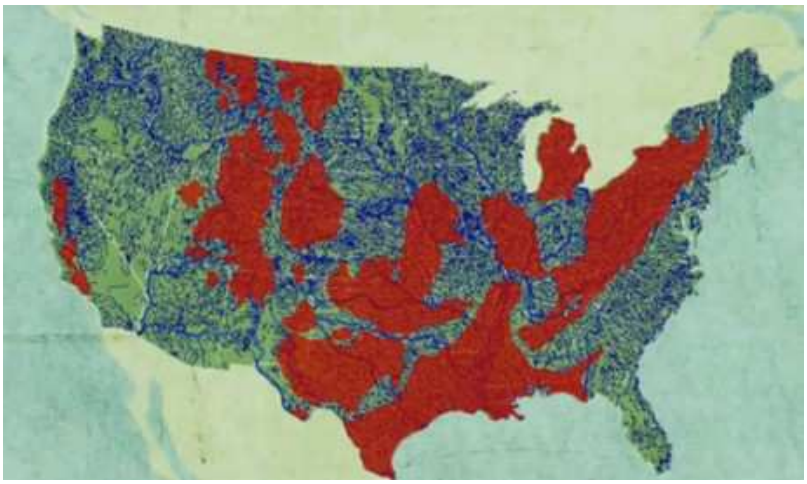
Then, there are the chemical fluids of the water, used to reach shale gas pocket. According to the documentary Gasland, those chemicals are filtering through earth and into the drinkable water. Still according to the documentary, firms responsible for the exploitation vaporize the used and polluted water and stocked it in basins (sometimes being non-waterproof), favouring the evaporation and filtration of those chemicals. They are making people and animals sick (headaches, skin diseases, even brain damage, lost of taste or smell...) and are notoriously highly carcinogenic.

And last but not least, there is the high consumption of energy to do all this working. To build a drill may need something like 1,150 truck trips, to transport the materials for the drill itself, the water (about 210 000 cubic meters), the sand....

What is interesting is the fact that this documentary has been denounced as propagandist and defamatory by some institution such as Energy in Depth (launched by the Independent Petroleum Association of America). In fact, gasland has been shoot has yellow journalism, with intense music for dramatic effects. EID quotes the documentary to establish his own truth on the subject, as a counter-attack. But if it denies many law interpretations made by Mr Fox (Gasland author), it never tackles the harmful aspect it seems to have on people health.

2) Risks of natural disaster

A huge part of America is concern with this kind of industry as show the map. The red areas indicate shale gas main pockets that the huge extracting companies (such as Cabot Oil and Gas or Halliburton) are aiming at.



The hydraulic fracturing, known as fracking is believed to be responsible for the awesome rise of earthquakes in some states such as Oklahoma. There, an average of 50 earthquakes a year turned into more than a thousand counted, with some quakes reaching 5,6 on the Richter scale.

The pollution due to the fracking could also be spread in the whole country and particularly upon New-York city, since the stream watering the city is running over one of the biggest gas pocket of the country. The extraction could be globally polluting the water resources of USA.
This pollution has reached the Atlantic Ocean and, during the last storms, such as Katerina, this polluted water (with heavy metals, sulphides and benzene) got back over the south shores of the country, polluting them and destroying drills in the same time.

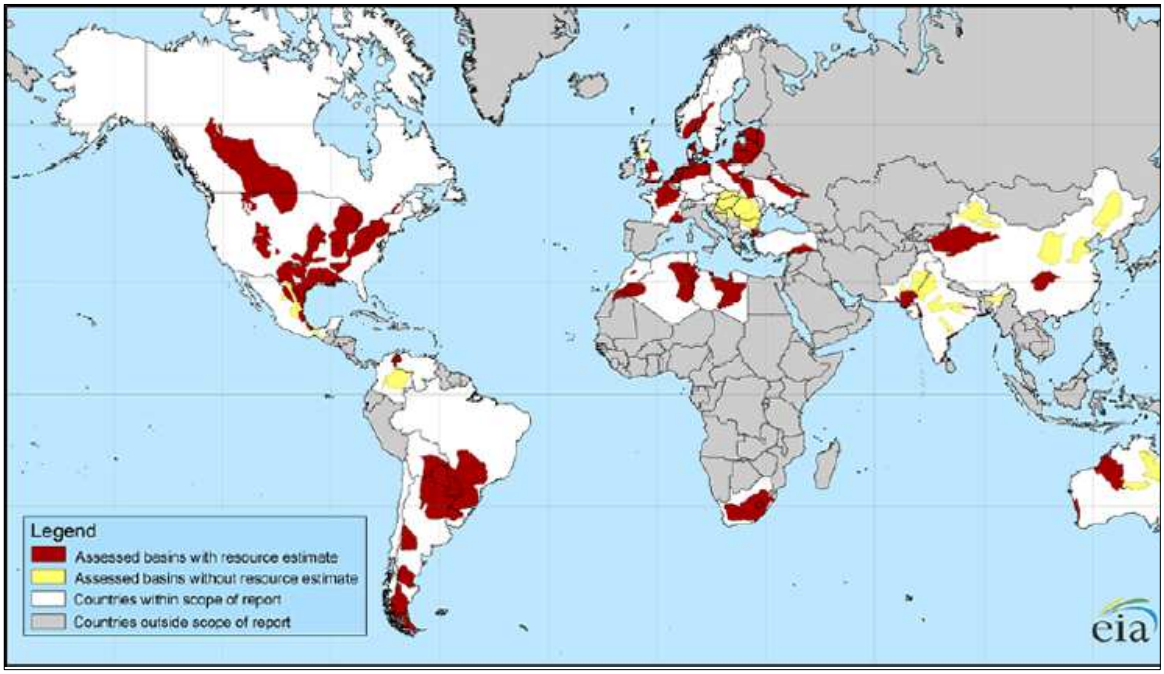
In certain area such as Forth Worth in Texas have heavily air polluted due to the important presence of drills. There is almost 100 000 drills in Texas for an amount of 500 000 drills over the whole country. Some places (such as in the south of the Yellowstone park, Jonah gas field) have been completely transformed because of the coming of the extracting industry, threatening local species.

And over that, one should not forget the huge quantity of shale gas rejected to the atmosphere with the worrying greenhouse impact that one knows.

III. Economic issues and policies

1) Economic issues

Today, natural gas represents 20% of the global energy consumption, so it's the third most used energy after oil (34%) and coal (30%). Nevertheless, the demand is increasing by 2.9% per year and the EIA foresees that gas will represent more than 22% of the global consumption in 2030.



Although the assessed reserves of non conventional gas were actually about 4% of the estimated reserves of methane, its consumption already represented 12% of the global gas consumption in 2008. The EIA has now defined a new world shale gas map which assesses 48 basins in 32 countries, in other words close to 5,760 trillion cubic feet (Tcf) of shale gas all around the world. Moreover, the main part of these basins hasn't been estimated. So current estimates judge the total reserves to be of 16000 Tcf, without adding the possibility of off-shore basins. In the end, the shale gas reserves would be about 4 times the conventional gas reserves.

Europe depends heavily on natural gas imports. The 27 members consume 17% of the global market, but half of it comes from Russia, Norway and Algeria. EIA estimates that Europe will import more than 65% of its gas needs in 2020 and more than 80% in 2030. So the new assessed basins in France and Poland should offset the increase.

Some traditional “coal countries” like China, India or Australia think about a way to promote their reserves too in addition to their current resources.
In the next years, these countries will probably be responsible for the increase of the global demand in natural gas, cheaper than coal.
But global natural gas demand shouldn't exceed coal demand.

2)American policy

In the US, shale gas has truly started to be extracted for internal use at the beginning of the 21st century.

Today, with over than 500 000 drills all over the country, the shale gas has become an important source of energy, providing 20% of America needs (over than 40% are awaited for the near future).
Even if some people, worried about the environment, make themselves heard on that point, the lobby action on shale gas is strong in the US and the activity is lucrative.
It also solved one of the biggest issue of the US government, meaning the provision of energy and the energetic independence of the country (which some see as a protection against terrorism).

3)French policy

After some geologist studies, it appears that France has one of the biggest underground stock of shale gas of EU.
Despite this impressive possibility, many laws have been enacted to regulate the extraction and the environmental impact, forbidding the fracking, considered as a highly polluting method. But even if other methods are allowed, and even if governmental authorizations for seeking have been given to American company, no drills have been build in France yet.

Indeed, citizens and mayors have been against this industry by fear of pollution of local water, such as sparkling water that France is massively exportating.

But such resources can not be ignored, when one knows that the French gas consumption is increasing, and when one knows that the actual amount of gas should be enough to cover the French needs in gas for a century.

Apart those two countries (which we chose for being the more representative), other drills have been build in the world, as in the UK (in Lancashire) or in Canada (Quebec).

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