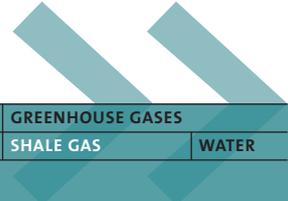




oil & gas



	EXTRACTION	HYDRAULIC FRACTURING	GREENHOUSE GASES
CLIMATE CHANGE		EMISSIONS	SHALE GAS
			WATER

## extractive industries: blessing or curse?

# Unconventional, and unfounded

## The myth of cheap and abundant shale gas in the US

The hype surrounding shale gas in Europe is founded in the American shale gas boom, where ‘cheap and abundant’ energy appear to provide energy security. However, a closer look at the US boom reveals an economic system based on shaky foundations, that side-lines health and the environment, and is reliant on unsustainably low prices driven by speculation and industry overestimates. In short, an economic and environmental bubble fit to burst. For Europe, the US scenario should be a warning, not an example.



Drilling activities along both sides of the Colorado River.

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Commercial evaporation pits that accept fluids from independent truckers for a fee.

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Two drill rigs working on a pad where ten wells have been previously completed

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### Introduction

Shale gas proponents in Europe have heralded the shale gas boom in the United States (US) as an unqualified success story. Cited as a cheap and abundant energy source, it promises to enhance energy security, and supply the US with natural gas for 100 years.<sup>1</sup> Why not repeat this in Europe?

The answer is simple: shale gas poses a real and serious threat to the climate, the environment and local communities. The extraction of shale gas leads to ground-water contamination, serious health impacts, and significantly higher carbon emissions than other fossil fuels. These aspects are consistently downplayed. In addition, recent analyses of the US scenario show that shale gas is neither as cheap nor as abundant as originally thought.

Shale gas reserves in the US have been grossly overstated and the current price for natural gas is unsustainably low – falling significantly below the cost of production. The combination of overestimated reserves and unsustainably low prices will lead to significant price volatility, resulting in an unavoidable rise in gas prices in the near future.

The myth of shale gas as an abundant and cheap energy source is perpetuated by vested interests from the industry and political sphere, eager to open a European market. However, the US example should act as a warning, not an example, for European decision makers. Experts have long pointed out that the situation in Europe is entirely different from a geological, geographical, economic and political point of view, creating a much less favourable starting point than in the US. But, if the cheap and abundant energy supply in the more favourable US setting is a myth, shale gas development in Europe in its entirety is called into question.

### The myth of abundance and a practice of overestimating reserves

“We have a supply of natural gas that can last America nearly 100 years” - Barack Obama<sup>1</sup>

#### Resources, reserves and current estimates

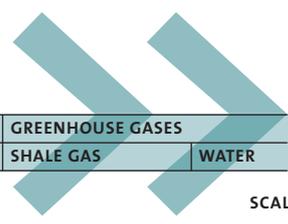
Much of the confusion about the potential of shale gas stems from disregarding the difference between resources and reserves:

- A resource is the total amount of a specific hydrocarbon that exists in a certain area. A stated resource is no indication whatsoever of how much of it can be economically extracted (e.g. it is possible that more energy is needed to extract a resource than what is contained in the resource).<sup>2</sup>
- A reserve is defined as “[a] deposit of oil, gas or coal that can be recovered profitably within existing economic conditions using existing technologies.”<sup>2</sup>

SCALE

IMPACTS

RESERVES



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SCALE

The official forecasts produced by the US government are from the federal Energy Information Administration (EIA), which has a history of optimistic estimates and of persistently overestimating production capacity for oil and gas.<sup>2</sup> For example, every single oil production forecast from the EIA since 2000 has overestimated actual production.

In its flagship publication Annual Energy Outlook, the EIA revised its estimate of “unproved technically recoverable shale gas resources” downward by 42% in 2012 in comparison to its 2011 report.<sup>3</sup> The reserves currently estimated by the EIA would be enough to supply the US with gas for only 24 years at current consumption rates.<sup>2</sup> Despite this significant downward revision the current estimate is still called an “extremely aggressive forecast” by renowned independent petroleum geologist David Hughes.<sup>2</sup>

However, the optimistic estimates by the EIA are often surpassed by the shale gas industry. Once field estimates could be confirmed by actual production numbers, reserves proved to be much lower than previously estimated by the industry. Investigations by the gas analyst Deborah Rogers show that the industry overestimated their reserves “by a minimum of 100% and up to 400%-500%”.<sup>4</sup>

RESERVES

## European shale gas potential – plummeting estimates

### Netherlands

- In 2009 the Dutch research institute TNO published a report, claiming that the retrievable reserves of shale gas in the Netherlands were about 5.6 trillion m<sup>3</sup>.<sup>5</sup> However, a peer-reviewed scientific paper investigating the claims by Rien Herber, Professor for Geo-Energy at Groningen University and Jan de Jager, former Shell exploration geologist and Professor for Petroleum Geology at VU Amsterdam, found them to be “unrealistically high” and revised the estimates down to 10-20 billion m<sup>3</sup>, roughly 0.2% of the original estimate.<sup>6</sup>
- The Dutch economic affairs minister Henk Kamp recently admitted that yearly shale gas production would reach 2-4 billion m<sup>3</sup> at best, representing only 5% of the current natural gas production in the Netherlands.<sup>7</sup>

### Poland

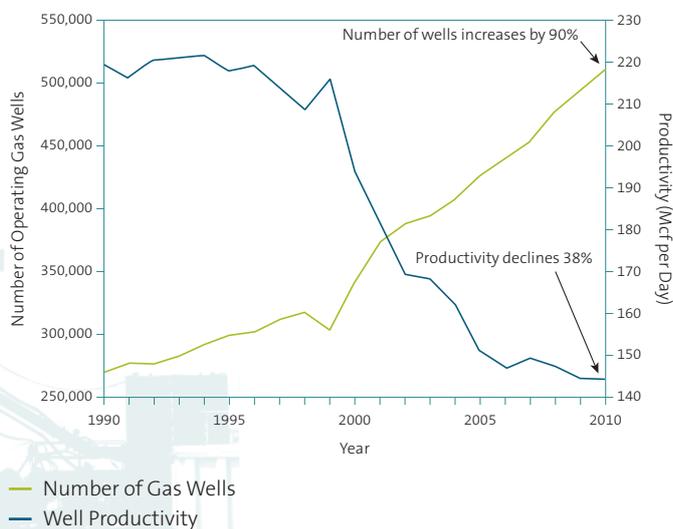
- The initial US EIA figure of 5.3 trillion m<sup>3</sup> of gas had to be revised down by the factor of 10 after new estimates by the Polish Geological Institute and the US Geological Survey were published.<sup>8</sup>
- No better estimate can be given, but oil and gas giants Exxon Mobil and ConocoPhillips, very recently followed by Talisman Energy and Marathon Oil, have already withdrawn from Poland – blaming reserve size, geological difficulties, disappointing test drillings and lack of infrastructures.<sup>8, 9, 27</sup>

EUROPE

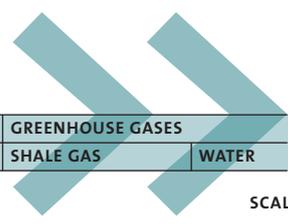
## Low well productivity and recovery rates

The shale gas industry has overstated reserves significantly due to huge overestimations of the amount of very productive wells (sweet spots). This is partly due to more relaxed reserve accounting rules adopted by the Securities and Exchange Commission (S.E.C.) after intense pressure from the industry.<sup>4, 10, 11</sup> Well performance and reserves were based on company estimates, before actual data about output became available. The actual data showed very disappointing results for the industry: for the five biggest US shale gas plays – or fields whose source is the same reservoir – well productivity declined between 63% and 80% in the first year. In other words, after only one year, wells only produced 20% to 37% of their initial output, with production declining throughout the entire lifespan of a gas well (see Figure 1).

**figure 1 U.S. operating natural gas wells versus average well productivity, 1990-2010<sup>2</sup>**



PRODUCTIVITY



	EXTRACTION	HYDRAULIC FRACTURING	GREENHOUSE GASES
CLIMATE CHANGE		EMISSIONS	SHALE GAS
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SCALE

Because of the massive divergence between the actual data and the company estimates, the S.E.C. started a probe to investigate if shale gas companies have knowingly misled investors about their reserves.<sup>2,12</sup> In 2012 several companies, among them BP, BHP Billiton and Chesapeake, had to reduce the book value of their shale gas assets by several billion dollars.<sup>13</sup>

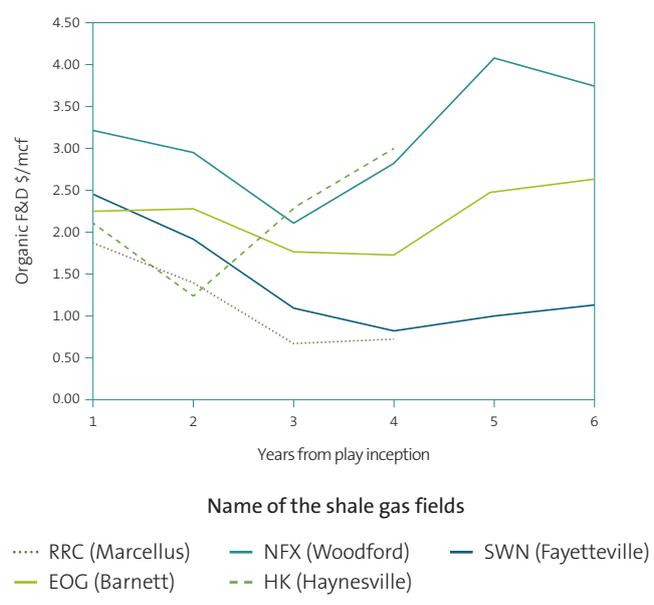
Recovery efficiency of the shale gas plays is also much lower than presented by industries and the EIA. Data shows that only about 6.5% of resources can actually be recovered. This contrasts starkly with the 13% usually used by oil and gas companies and the International Energy Agency (IEA) for forecasts and reserves' estimates for shale gas and with a recovery efficiency of 75% - 80% of conventional gas fields.<sup>14</sup> The low recovery efficiency means that the US will run out of shale gas much quicker than currently predicted.

## Highly concentrated production

Shale gas production is highly concentrated in a few areas: 88% of US shale gas is produced in just 6 fields. Production in most fields is now plateauing: four plays, which account for 68% of the total shale gas production in the US, are late-middle aged and production is already starting to decline.<sup>2</sup> It will be very difficult to maintain production at the current high level due to the early drilling in the now depleting sweet spots and to the further increasing costs of future drillings (see Figure 2).<sup>2</sup>

Low well productivity and recovery efficiency, as well as maturing gas fields, make it very unlikely that shale gas production can be maintained or even increased. Production appears to have plateaued at the end of 2011 and is set to decline in the near future. The myth of an abundant resource, with a lifespan of 100 years has started to unravel and is being widely discredited by independent experts.<sup>2,4,15</sup>

**figure 2** Rising costs of finding and development activities for major shale gas fields in the US<sup>19</sup>



PRODUCTION

## Artificially low prices

*"What I can tell you is the cost to supply is not \$2.50. We are all losing our shirts today, we're making no money. It's all in the red"* - Rex W Tillerson, CEO and chairman Exxon Mobil Corporation<sup>16</sup>

*"The whole industry is unprofitable today"* - Aubrey McClendon, CEO Chesapeake Energy<sup>17</sup>

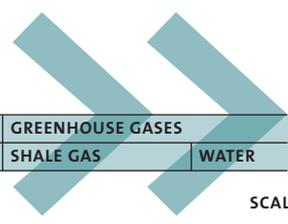
Low gas prices are commonly cited as the most important advantage of indigenous shale gas production. But, a closer look at the numbers reveals that there is a glut of shale gas supply, making shale gas production unprofitable and foreshadowing a significant rise in prices in the near future.

## An over-supply leading to gas prices far below the production costs

The price for natural gas in the US declined steeply from \$10.4/mcf (thousand cubic foot) in 2008 to a low of \$1.89/mcf in April 2012, because of a glut in supply coming from shale gas operations.<sup>18</sup> With current breakeven prices for shale gas estimated at about \$8-\$9/mcf, this leaves the question why the supply was not cut to raise prices. There are three reasons why supply has not been falling: shale gas operators were able to hedge against low prices through financial instruments, ensuring acceptable prices in future markets that left them relatively unscathed from plummeting spot prices; there was a backlog of uncompleted drills that kept up supply as they were progressively completed; and land lease contracts often force operators to start drilling within five years or lose their leases.<sup>19</sup> For example, one of the largest US shale gas companies Chesapeake undertook 50% of their drillings simply to keep their licences alive, to keep valuable assets on the balance sheet and avoid bankruptcy.<sup>20</sup>

But since investments, land lease contracts and drillings decisions had been made with the assumption of extremely high 2008 prices as the new norm, operators, such as Total,<sup>21</sup> Statoil<sup>22</sup> and Chesapeake, are currently facing huge losses: low prices have led to a net loss of at least \$9.3 billion for all shale gas extraction companies from their extractive activities in 2012.<sup>2,4</sup> The wave of mergers and acquisitions as well as the entrance of major oil and gas companies has injected more cash into the industry, enabling more drillings at unprofitable prices.<sup>19</sup>

GAS PRICES



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SCALE

The industry is acutely threatened by the low prices. That's why shale gas operators have been fiercely lobbying to approve and build export terminals for liquefied natural gas (LNG) to export the excess gas to markets in Europe and East Asia, where much higher prices are being paid.<sup>23</sup>

## Low prices make it impossible to drill at a rate that would keep up production in the medium term

Shale gas companies are in an exploration treadmill: because the average production per well declines rapidly (between 79%-95% in the first 36 months) and the most productive places have been exploited already in many plays, an increasing number of wells must be drilled to maintain production, some of which have been sold in advance to finance new loans.<sup>2, 24</sup> But because of low prices, the shale gas industry is unable to invest in shale gas infrastructure to keep up current production rates in the future. Thus, shale gas production has been flat since the end of 2011, after rising continuously for 10 years.<sup>2, 12</sup>

Once this treadmill can't be maintained, there will be a very steep decline in US gas production, possibly from 2015 onwards, with steeper decline rates than in conventional gas production.<sup>25</sup> The decline will most likely be accelerated by increasing production costs. Since the most productive spots are quickly depleting, the number of wells and capital input required to maintain production will therefore be even higher in the future, making a steep decline even more likely.<sup>7</sup>

## Large oil companies are buying up the leases to add to their reserves and offset the decline of their conventional reserves

Gross overestimation of real reserves has been used to inflate the price of shares and keep shale gas companies solvent. The objective is not to sell gas but to sell inflated land leases and entire companies. But the low prices of gas are taking their toll on small and medium sized shale gas operators. They have to sell their assets, mainly land leases to avoid bankruptcy.<sup>4</sup> Indeed, selling land leases has become more profitable than drilling for gas at current prices. The CEO of the second largest shale gas operator Chesapeake said: "I can assure you that buying leases for x and selling them for 5x or 10x is a lot more profitable than trying to produce gas at \$5 or \$6 per mcf."<sup>17</sup> Chesapeake has transformed itself into America's largest leaseholder, with drilling rights to 15 million acres of land.<sup>24</sup>

Multinational oil and gas companies and international investors with deep pockets buy up the land lease contracts, but for very different reasons: They want to maintain their reserve-replacement ratio at high values, something most of them would have failed to do without the additional shale gas reserves. Because new oil reserves are difficult to find and often under the control of the state on whose territory they are found, shale gas reserves offer an exceptional chance to easily fill up depleting oil reserves. Not long ago, 80% of the US gas supply was produced by relatively small, independent companies, but within three years Exxon Mobil has become the largest gas producer in the United States and BP, Shell, ConocoPhillips and Chevron are among the top ten.<sup>6, 11, 26</sup>

MULTINATIONAL COMPANIES

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