

# Shale Gas: Energy Policy for the Next Wave of Globalization

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## Keywords

Shale gas, globalization, energy policy

## Abstract

*This article argues that the globalization framework since 2001 has created unsustainable fundamentals in crude oil markets, which is reflected in crude oil prices since 2001. Further, this accelerated globalization (as we define it), has created unsustainable environmental trends, which is reflected in CO<sub>2</sub> emissions from China. As a result, the current wave of globalization has to evolve into the next, a more sustainable wave of globalization. We believe that the vast global reserves of shale gas and the recent technological advances in hydraulic fracturing (fracking) to recover those reserves, can be used to frame a new global energy policy, which can lead to a new sustainable globalization framework. Specifically, given the more-less even global distribution of shale gas reserves, many regions can aim for energy self-sufficiency by producing shale gas, which could ease the geopolitical tension with respect to crude oil supplies and ease the price of crude oil as the supply of energy increases. Further, given that natural gas is cleaner than crude oil, the global production of shale gas would remove some of the environmental excesses as well.*

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## Introduction

Crude oil prices have been remarkably stable from 1986 to 2001, right around \$20/barrel, with a brief spike in 1991. Since 2001, the price of crude oil has not been only rising, but also rising with high volatility. The price of crude oil reached nearly \$150/barrel in mid 2008, and collapsed back to near \$30/barrel by the end of 2008, which some defined as the 2008 speculative oil bubble (Masters, 2008). However, crude oil prices (Brent) are nearing their 2008 highs again in 2012, which suggests that oil prices have been reflecting market fundamentals, which are clearly unsustainable. In support, many authors that examined the 2008 oil price spike generally find that, in 2008, the fundamentals had a significant role as the price of crude oil was rising, while speculation had only a minor role at best (Buyuksahin and Harris, 2012; Cifarelli and Paladino, 2010; Hamilton, 2009; Kaufmann and Ullman, 2009; Irwin and Sanders, 2010; OECD, 2010; Sanders and Irwin, 2011; Sanders and Irwin, 2010; Stoll and Whaley, 2011; Till, 2009; Tokic, 2011; Tokic, 2012; and United Nation, 2011).

In this article, we also partially debate the 2008 oil price spike, but we take a much broader longer-term view on pricing of crude oil based on global-macro variables. Specifically, we discuss the global-macro energy policy as it relates to the specific globalization framework. First, we argue that the globalization framework in place since 1980 (or the third wave of globalization) evolved into the fourth wave of globalization, which was primarily triggered by the 9/11 related U.S. macro-global policies (such as the export-led recovery, global economic growth decoupling and easy credit). Second, we suggest that these policies accelerated some of the key economic and political trends from the previous globalization framework. Specifically, virtually all emerging countries embraced the swift market reforms, in accordance with the U.S. policies, which eventually produced serious global economic and environmental “excesses”. Additionally, the geopolitical tensions in the Middle East significantly increased after 2001. In

our view, crude oil prices have been reflecting these “accelerated” trends, which are inherently unsustainable (see also Tokic, 2010). Accordingly, the current wave of globalization will have to evolve into a new, more sustainable, globalization framework.

In this article we also discuss the energy policy that can lead to the next, a more sustainable, wave of globalization, specifically focusing on global reserves of shale gas. The recent technological advances in hydraulic fracturing have significantly increased the global technically recoverable shale gas resources, which many call a “game changer” in energy industry (Rogers, 2011). In this paper, we view the shale gas reserves as a strategically important resource, which can be used to frame a new energy policy for the next, fifth, wave of globalization.

Specifically, since shale gas reserves are geographically more-less evenly distributed, the energy self-sufficiency could become a real possibility for many regions. Thus, as a result of: 1) higher energy supplies; and 2) easing of the geopolitical tensions as many regions become energy independent; crude oil prices would likely decrease and become less volatile. Further, since natural gas as energy source is much cleaner than crude oil, some of the ecological “excesses” would also be removed. Consequently, the global shale gas production, as a macro-global energy policy, presents an opportunity for the current wave of globalization, which is unsustainable, to evolve in a new more sustainable wave of globalization, characterized with super-regional energy self-sufficiency.

In the next section, we outline the link between globalization and energy policy. Afterwards, we briefly discuss the historical background on globalization, with emphasis on energy policy. The subsequent section presents the arguments supporting our view that the current wave of globalization is unsustainable. The final section shows how, in our view, exploration of shale gas resources, as a possible global-macro energy policy, enables a transition to a new, more sustainable wave of globalization.

### **The link between energy policy and globalization**

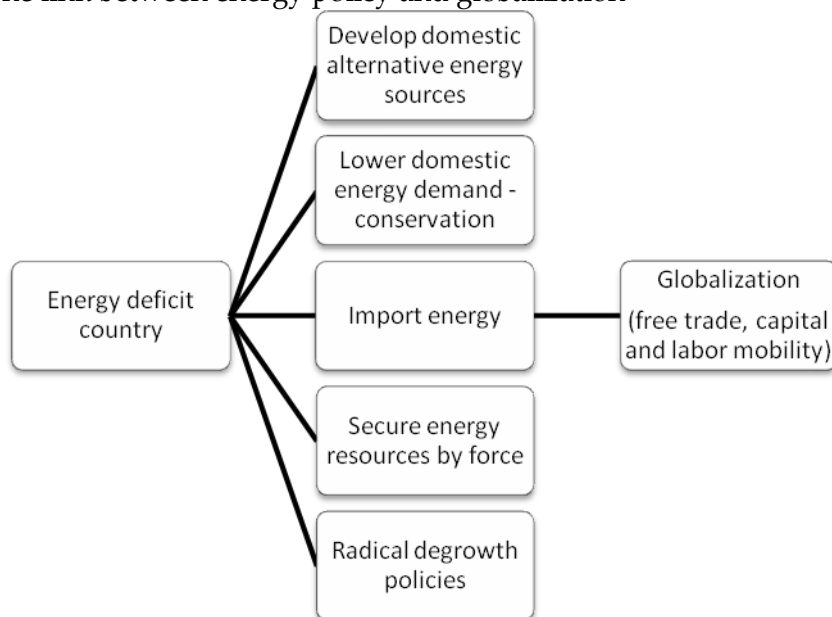
The link between energy policy and globalization is based on a simple fact that the traditional energy resources (fossil fuels) are geographically unevenly distributed. As a result, some countries have control over proven energy reserves well in excess of their domestic energy needs, while, on the other hand, some countries have very little or none of the domestic traditional energy resources. Yet, all the countries have domestic demand for traditional energy resources, which can vary based on the size, level, and structure of their economic activities. Thus, countries whose energy demand is greater than their domestic energy supply, which we define as the energy deficit countries, have to either: 1) import energy from the energy surplus countries; 2) find an alternative domestic source of energy; or 3) reduce the level of economic activity or restructure the domestic economy to lower the domestic energy demand. These energy policy options for energy deficit countries are not mutually exclusive; in fact, an effective energy policy has to address all of these issues.

Nevertheless, the energy deficit countries have historically relied mostly on energy imports to satisfy their excess domestic energy needs. Redistributing energy supplies through international trade has been the most efficient and effective global-macro energy policy, considering all the cost and benefits. Thus, it was absolutely necessary to develop a global economic/political system to ensure: 1) the liberal global trade in goods, such as crude oil; 2) the

liberal global financial flows, so international payments can be processed and global energy companies can directly invest in energy sectors in energy producing countries; and 3) the liberal global labour mobility, so global energy companies can move their employees around the globe as needed. Thus, the issues of global-macro energy policy and globalization have been inseparably intertwined.

Hence, it is important to understand that a system that discourages or impedes the global trade can potentially lead to a radical form of global-macro energy policy, in which an energy deficit country forcefully overtakes the energy resources from an energy surplus country. Alternatively, an equally radical policy of economic degrowth can develop, which can lead to an energy policy whereby the domestic economic activity is purposely (and significantly) reduced to minimize the energy consumption, accompanied with isolationist and protectionist policies. These extreme policies would have far-reaching consequences on global political, economic, social stability. Thus, the issues of energy policy and globalization will continue to be inseparably intertwined.

Exhibit 1. The link between energy policy and globalization



### Globalization and energy: a brief historical background

Masson (2001) defines globalization as the increased integration of economies reflected by increases in trade, capital, investment and migration flows. We identify potentially four different waves of globalization: the first wave (1870-1914), the second wave (1945-1980), the third wave (1980-2001), and the fourth wave of globalization (2011-current)

#### a. 3.1. *The first wave of globalization (1870-1914)*

The first wave of globalization was triggered around 1870 as the European superpowers engaged in quest for commodities during the Age of High Imperialism. The European superpowers of the late 19<sup>th</sup> century (Britain, France, Spain, and Germany) were in the midst of the Industrial Revolution and demanded large quantity of raw materials and commodities, which they were unable to supply from their domestic resources. Nearly 10% of global population migrated during this period as many Europeans left to work on an abundant land in countries such as the United States, Australia, New Zealand, and Argentina, which became

among the richest countries in the world by exporting primary commodities and importing people, institutions and capital.

Thus, a broad commodity policy during the first wave of globalization has been based on free trade, labour and capital mobility. Specifically, commodities were imported from (then) emerging countries to support the merchandise production in developed European countries. During this period of time, energy was not a primary trade commodity; however, falling transportation costs due to the innovations in steam-ships, and the development of railroads significantly contributed to the first wave of globalization.

**b. 3.2. *The 1914-1945 period***

The first wave of globalization ended with the beginning of the World War I. During the period from 1914-1945, most countries reverted to nationalism, protectionism and isolationism. From a broad commodity policy point of view, we view this period as a radical expansionary commodity policy, whereby a country forcefully takes over resources of another country.

**c. 3.3. *The second wave of globalization***

The end of World War II marks the beginning of the second wave of globalization, which was partially triggered by the Marshall plan (Kunz, 1997). The United States financed the rebuilding of the European war-torn infrastructure, which initially significantly increased the capital flows from the United States to the Western Europe and eventually resulted in the increased trade in merchandise goods between all developed countries. Other several key international organizations were created post WWII, such as the United Nations, the World Bank, and the International Monetary Fund. Also, the Bretton-Woods agreement created the global monetary system in which the U.S. dollar was set as the global reserve currency, and all commodities, including crude oil were priced in the U.S. dollar. Further, the U.S. dollar was fixed to the price of gold at around \$35/ounce, and other participating currencies were fixed to the U.S. dollar.

The globalization system during the second wave of globalization, also known as the Golden Age of Capitalism, was based on the trade of merchandised goods primarily between developed countries. The role of the developing countries was still limited to commodity exports (Figure 2). As a result, during this period of time, the developed countries in Europe and the United States became increasingly energy dependant on crude oil imports from Middle East. Thus, since crude oil had become the primary source of energy to support the economic growth in developed countries, and since the U.S. oil production peaked in 1960s (see Figure 3), the geopolitical importance of energy exporting countries significantly increased in 1970s, which was validated during the 1973 and 1979 oil crises.

In 1973, the Organization of Arab Petroleum Exporting Countries (OAPEC) countries proclaimed an oil embargo from October 1973 to March 1974 due to the United States' support for Israel during the Yom Kippur war. As a result, the price of crude oil significantly spiked and caused serious political drifts among developed countries and the first major stock market crash since the Great Depression. The Iranian revolution in 1979 caused the second major spike in crude oil prices, as the production of crude oil in Iran significantly dropped, which caused a widespread global panic and another stock market crash followed by a stagflationary recession.

Macro variable such as the stagflation, the reoccurring recessions, and the stock market crashes during the 1973 and the 1979 crude oil crises, clearly indicated that there was a need for change in the globalization framework, and consequently, the global macro energy policy, which essentially ended the second wave of globalization.

Figure 2. Globalization framework during the second wave of globalization

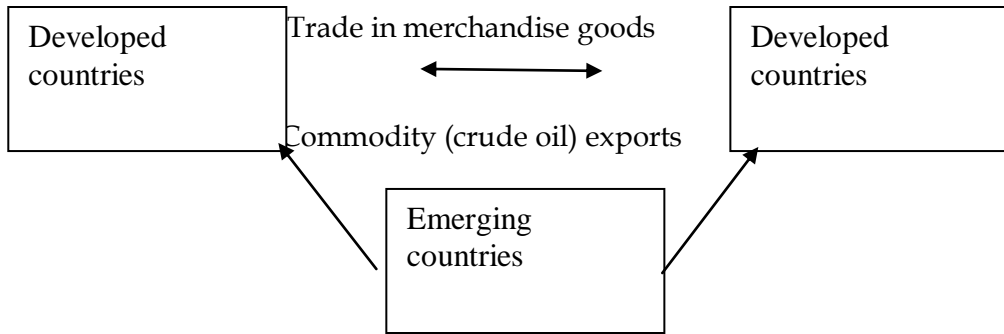
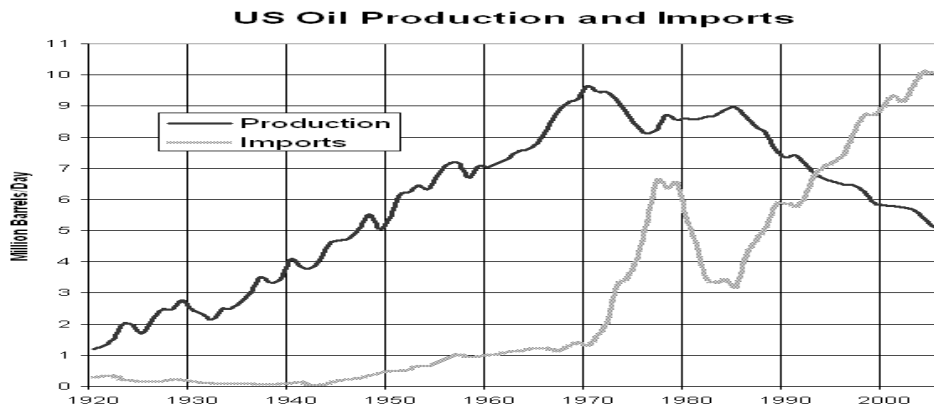


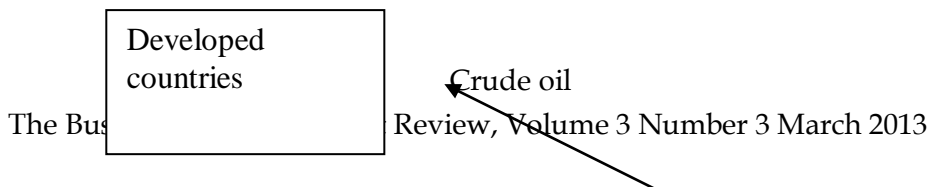
Figure 3. The U.S. oil Production and Imports.

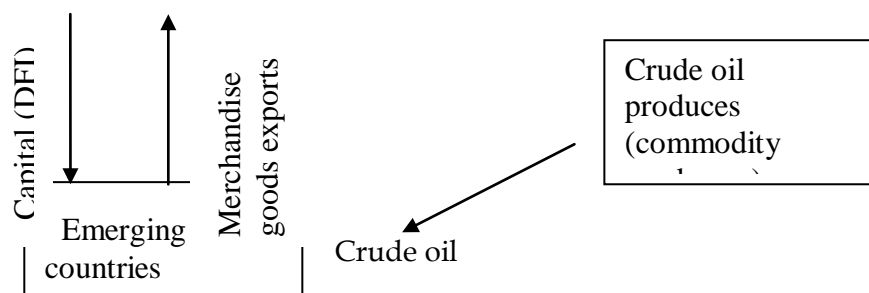


**The third wave of globalization**

The second wave of globalization evolved into the third wave of globalization in early 1980s with the key change in the globalization framework. Specifically, the developing countries were for the first time allowed to participate in production and trade of manufacturing goods. In 1980, only 25% of the exports of developing countries were manufacturing goods, by 1998 that had risen to 80%. Essentially, the developed countries, such as the United States, decided to restructure their domestic economies and shift from domestic production (manufacturing based economy) to mostly a service-based economy, in order to lower their overall demand for crude oil and reduce their reliance on imported crude oil. Further, since the Bretton Woods agreement was abandoned, the United States was able to increase the money supply (U.S. dollars) and finance the manufacturing projects in emerging countries. Crude oil, as well as other commodities, was still priced exclusively in U.S. dollars ensuring the global reserve currency status of USD.

Figure 4. The globalization framework during the third wave of globalization





During the period from 1980 to 2001, the global economy was steadily growing, while the inflation and the interest rates were falling, the stock markets were rising, and the new breakthrough technologies emerged. The price of crude oil was remarkably stable during the entire period. During early 1980s, the “Oil Glut” emerged which depressed oil prices (see Gately, 1986). The only brief oil price spike was the in 1991 with the first Gulf War. Yet, despite the soaring stock markets and the steadily growing global economy, the price oil remained stable during the 1990s, which validated the new globalization framework as a success. Also, the geopolitical situation was relatively benign, as the Soviet Union collapsed. However, this “new” globalization framework changed or evolved in 2001, which led to the fourth (current) wave of globalization.

### 3.5. *The fourth wave of globalization*

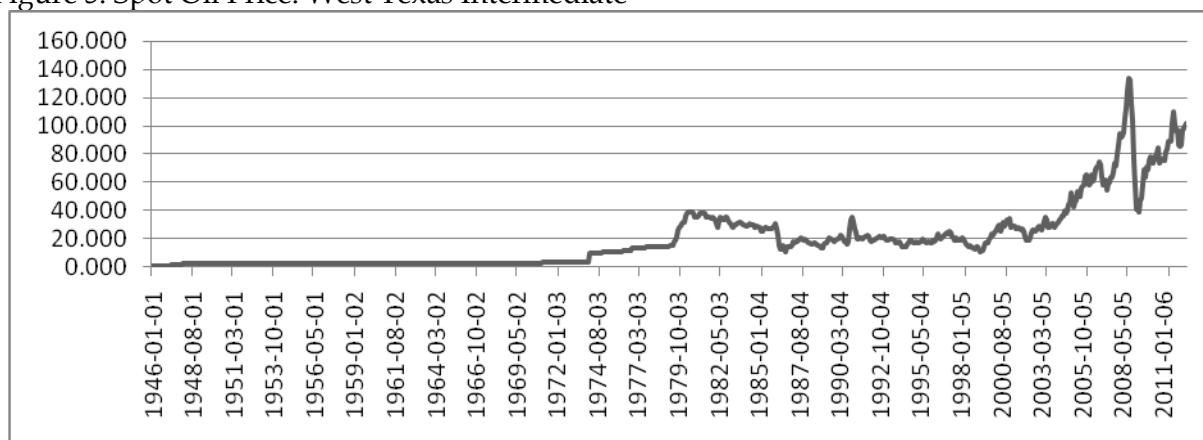
Some authors still view the current wave of globalization as the second wave of globalization (Matutinovic, 2006). Other authors realize that the second wave of globalization evolved in the third wave of globalization, which they view as the current (World Bank, 2002; Tokic, 2006). We are not aware of any other prior studies that suggest that the third wave of globalization evolved into the fourth wave of globalization in 2001.

However, it is clear from the price of crude oil (as well as prices of other commodities) that “something” had changed in 2001. As illustrated in Figure 5, the price of crude oil entered into a major bull market cycle in 2001, rising from around \$20/barrel to near \$140/barrel in 2008 (spot price). Many authors have prematurely branded the oil price action in 2008 as a bubble because the price of crude oil collapsed to near \$30/barrel by the end of 2008 (see Masters, 2008). Unfortunately, the price of crude oil is yet again approaching the 2008 highs in early 2012, suggesting “something” more fundamental has been affecting crude oil prices. That “something” that changed in 2001 and commenced a major bull market in crude oil prices is exactly what will come to define the current fourth wave of globalization.

Specifically, there are several variables that changed in 2001 and possibly triggered the fourth wave of globalization. First, China was admitted to the WTO, which might explain a fundamental increase in crude oil demand. Second, the terrorist attacks of 9/11 significantly changed the geopolitical situation, specifically with the subsequent U.S. invasion of Iraq. Third, the stock market crash in 2000/2001 started a series of financial bubbles and bursts accompanied by an unprecedented expansion of credit, which affected the value of the U.S. dollar and possibly a debasement of all paper currencies. Fourth, in the aftermath of the 9/11, the U.S. policies encouraged virtually all emerging countries to (prematurely) adopt the swift market reforms, which contributed to a potential crude oil supply/demand imbalance and also the subsequent financial crisis. Fifth, the international trade framework itself became unsustainable and unbalanced as emerging countries, such as China, experienced potentially irreversible trade surpluses versus the developed countries, such as the United States. The combination of all of

these variables, in our view, created the “accelerated globalization”. The price of crude oil clearly supports our view that the stability of the third wave of globalization has evolved into the “panicky” and unsustainable fourth wave of globalization.

Figure 5. Spot Oil Price: West Texas Intermediate



### 3. Why is the current wave of globalization unsustainable?

As previously explained, one can only look at the price of crude oil since 2001 (Figure 5) and conclude that the crude oil price fundamentals are clearly unsustainable, and thus, the current globalization framework is also unsustainable. In this section, we discuss the reasons why we think these fundamentals are unsustainable. But first, we define the term we use to describe the current wave of globalization – the accelerated globalization.

#### 4.1. *The accelerated globalization*

The accelerated globalization, in our view, has its’ roots in the period post 9/11 when the global economic policy became the issue of U.S. national security. Specifically, the U.S. policies post 9/11 directly encouraged the swift global market reforms in virtually all countries, which eventually led to the emerging market stock market frenzy in 2004/2005. The global economic growth, led by emerging markets, was indented to cause the “export-led” recovery of the U.S. economy and the “economic growth decoupling”. Further, a significant credit was extended, first to the U.S. consumer and businesses, and then to all global consumers and businesses, which eventually led to a series of bubbles and busts globally. In our view, these exact U.S. policies of “export-led recovery”, “economic growth decoupling”, and the “easy credit” significantly accelerated all the economic trends of the third wave of globalization, and produced the new accelerated globalization trend, which we view as inherently unsustainable.

#### 4.2. *Peak oil theory and oil supply/demand imbalance*

The proponents of the peak oil theory argue that the global production of crude oil will eventually peak, as it had peaked in the United States in 1970. As a result, this anticipated supply/demand imbalance is likely to support the high level (and rising) of crude oil prices in

the future. However, the markets were aware of the peak oil theory in 1990's and, yet, the price of crude oil remained remarkably stable during that period. Given the oil price action since 2001, the market now perhaps anticipates that the peak oil is actually approaching much sooner than initially expected, and/or that the future demand for crude oil has been underestimated.

It is our view that the globalization framework established in 1980, which was accelerated in 2001, is approaching its' limits, at least with respect to the energy resources. Specifically, the developing (or emerging countries) of early 1980's are now almost-developed countries due to their steady development over time, which created an increasing number of middle class households in emerging markets able to enjoy higher standard of living. The BRIC countries (Brazil, Russia, India, and China) in particular have significantly grown in (economic) size. As a result, the demand for energy from these large near-developed countries has dramatically increased (Apergis and Payne, 2009; Belke et al., 2011; Huang et al., 2008; Sadorsky, 2010; Moshirian, 2008).

Whether the BRIC countries can still be defined as "developing" or "near-developed" countries as we propose (given their manufacturing production capacities) might still be questionable (given that many citizens of these countries are still not able to afford a western-style standard of living, which is reflected in comparably low GDP per capita statistics). However, the real sustainability question arises: are there are currently sufficient traditional energy resources for the most of the citizens of the BRIC countries to enjoy the western-style consumption based high standard of living? The answer is clearly no, and perhaps the price of crude oil reflects that.

Yet, if the current "accelerated" global macroeconomic trends continue, more and more global citizens will be joining the middle class and enjoying the "improved" standard of living, especially with the continuation of the U.S. policies of "export-led recovery", "economic growth decoupling" and the "easy credit". Thus, to accommodate this extraordinary future demand, the market perhaps views that the peak oil is approaching much faster than initially expected. To point out again, the markets were aware of the crude oil supply/demand fundamentals in 1990's, but it was very difficult for anybody to anticipate the political and economic dynamics of the recent "accelerated globalization".

#### **4.3. *Alternative energy and accelerated globalization***

The key implication from the previous section is that the non-renewable traditional energy resources are limiting the future economic growth (see also Ehrenfeld, 2005; Lawn and Clarke, 2010). Thus, it is clear that the development of an efficient and effective renewable alternative energy is critical to preservation of capitalistic society, whose survival heavily depends on perpetual economic growth. In our view, the market had expected during the 1990's that the oil peak would eventually occur, but as long as the society had sufficient time to prepare for it via the development of alternative energy sources, the price of crude oil had no reason to significantly rise.

The meteoric rise in crude oil prices since 2001 perhaps reflects the market opinion that the accelerated globalization trends since 2001 not only brought the global peak-oil closer, but more importantly, the society would not have time to sufficiently prepare for it via the development of alternative energy. In other words, the society can plan for the oil peak to occur in 2050 by slowly developing alternative energy sources, but not if the oil peak occurs in, for



example, 2020. Klessman et al. (2012), for example, discuss the renewable energy policy and the EU 2020 targets.

#### 4.4. *The oil geopolitics*

The sustainability of the current wave of globalization is also affected by the geopolitical variables related directly to crude oil. As previously discussed, the fourth wave of globalization has started after the 9/11 with the implementation of the 9/11 related policies. The U.S. invasion of Iraq is definitely one of the key variables that ignited the tensions with respect to the stability of Middle Eastern oil supplies. Similarly, the U.S. policy of the swift global market and democracy reforms in virtually all emerging countries, which accelerated the globalization trends, also reached the Middle East. As a result, in 2011 the youth in many Arab countries “tested” the democracy, what is now known as the Arab Spring, and completely unexpectedly changed the political dynamics, in some key Middle Eastern countries, including the key oil producer Libya. While the Arab Spring can be viewed positively from social point of view, it also introduced a new type of volatility in crude oil markets. The third variable and perhaps the most important one with respect to the oil geopolitics, is the development of nuclear Iran, which directly affects crude oil supplies, risks the closure of the straits of Hormuz, risks direct war in the region, and creates a possible nuclear arms race in the Middle East.

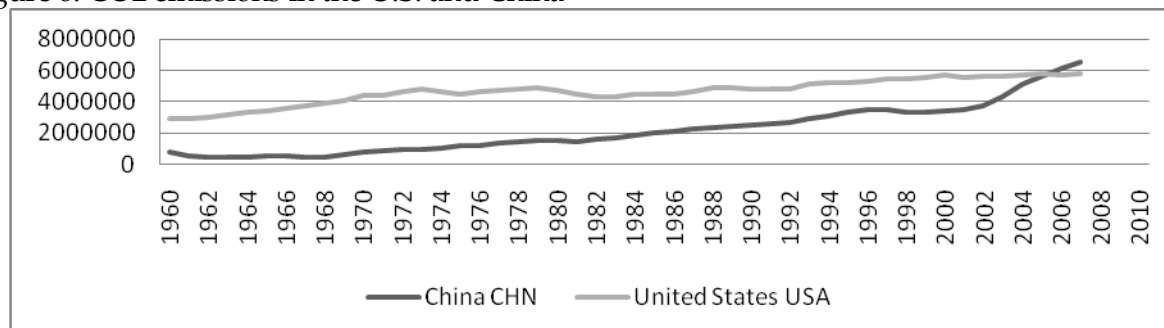
The key point we try to convey is that the fourth wave of globalization has been characterized with severe geopolitical tensions with respect to the Middle Eastern geopolitics and crude oil production. Clearly, one can expect that these tensions can only grow stronger if no radical changes with respect to the energy policy and the globalization framework are implemented, which also implies that the current wave of globalization is unsustainable.

#### 4.5. *Ecological concerns*

The “accelerated globalization” or the fourth wave of globalization is not obvious only by looking at crude oil prices. One can also look at Figure 6, which plots the historical CO<sub>2</sub> emissions from the U.S. and China, and see that the trend on CO<sub>2</sub> emissions from China turned parabolic in 2001 after a relatively stable long term uptrend. As a result, the CO<sub>2</sub> emissions from China nearly doubled from 2001 to 2007 and exceeded the CO<sub>2</sub> emissions from U.S. in 2005.

We view this parabolic rise in the uptrend of CO<sub>2</sub> emissions from China as clearly ecologically unsustainable. If one was looking at Figure 6 and told that these were the plots of stock prices, one would most likely say that the “China” plot is a growing bubble. However, these plots don’t represent the stock prices and, thus, this “pollution bubble” will not burst by itself, it will only grow bigger. As a result, the ecological footprint will continue to exceed the Earth’s carrying capacity, as many ecologists suggest, which will foster the climate change and increase the disaster risk (Baek et al, 2009; IPCC, 2011; Ewing et al, 2010; Curtis, 2009).

Figure 6. CO<sub>2</sub> emissions in the U.S. and China



Source: World bank.

#### **4. Shale gas production as the energy policy for the next wave of globalization**

As we've previously discussed, the globalization framework in place since 2001 is clearly unsustainable, and thus, it will have to evolve into a new framework that removes some of the excesses created by, what we define, the accelerated globalization. Specifically, the rising trend and the high level of crude oil price potentially reflects the excess demand in the face of the sooner-than-expected peak in the global oil production capabilities, insufficiently developed alternative energy sources, and serious geopolitical tensions in the major oil producing countries. Thus, the key challenge of this new globalization framework will be how to remove these excesses, without significant social, economic, and political consequences.

The "easy" policy seems to be to simply "degrowth" the global economy to an economically and ecologically sustainable level (Van den Berg, 2011; Martinez-Alier et al. 2010; Levallois, 2010; Kallis, 2011; Douthwaite, 2006; Alcot, 2008). However, the idea of degrowth would require the policy of negative economic growth with protectionism and general anti-globalization, which potentially carry high economic costs with severe geopolitical uncertainty. Thus, degrowth might not be the desired policy of the new wave of globalization. Ideally, the new globalization framework would be able to remove the "excesses" without scarifying the economic growth.

The only viable long term solution to the limited traditional energy resources is the development of an effective and efficient renewable alternative energy, which is able to fully meet all energy needs. The current wave of accelerated globalization, perhaps, shortened the time needed to develop this type of alternative energy. Thus, the new energy policy will have to find a way to give a society more time to develop the renewable alternative energy, while maintaining a continuous global economic growth, which directly addresses the economic, geopolitical, and ecological concerns. Otherwise, we could witness a severe and persistent spike in crude oil prices, which could cause serious global economic and political consequences.

##### **5.1. *Shale gas: a bridge to an alternative energy***

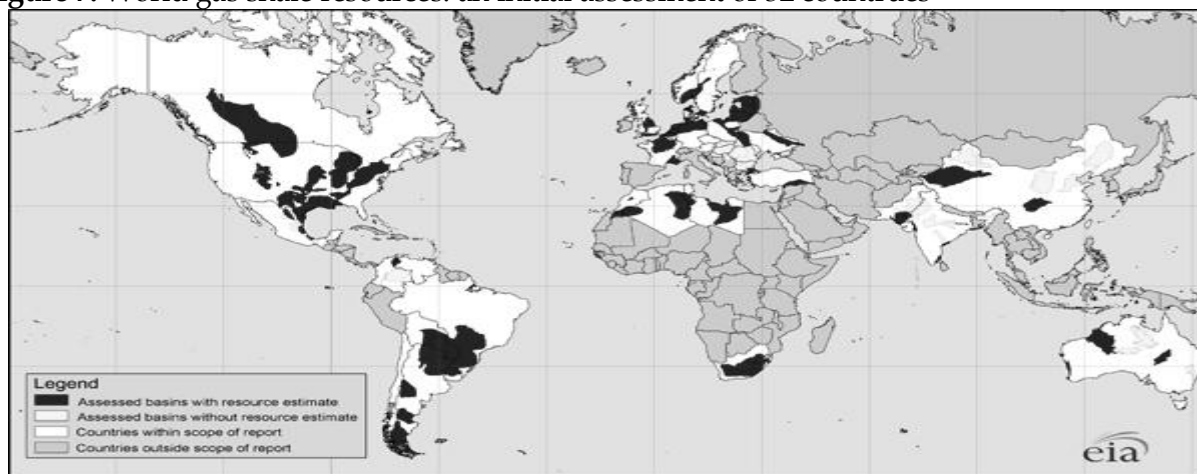
Only until recently (2008/2009), it was really difficult to meet this challenge of neutralizing the "excesses" of the fourth wave of globalization, without sacrificing the economic growth or geopolitical stability. Then, in late 2000s, the energy industry experienced perhaps a major breakthrough, the shale gas production by hydraulic fracturing or fracking.

Hydraulic fracturing is a method of horizontal drilling that releases gas (and oil) trapped in rocks several thousand miles below the surface. It is not a new technology, however, it went thru a major technological improvement and gained the capability the efficiently extract shale gas, which, as the U.S. EIA estimates, are globally abundant. As a result, the shale gas extracted with fracking can provide sufficient energy supplies for a considerable period of time to supplement the traditional crude oil and natural gas supplies, until the renewable alternative energy sources gain the capability to satisfy the majority of energy needs. Thus, shale gas potentially solves the key challenge of getting more time to develop the renewable alternative energy, while maintaining a continuous global economic growth. In other words, shale gas production can be viewed as a bridge to an alternative energy world.

## 5.2. *How plentiful are shale gas supplies?*

U.S. Energy Information Administration released a study (EIA, 2011) in which it provides an initial estimates on technically recoverable shale gas resources in 14 regions and 32 countries, as shown in Figure 7.

**Figure 7.** World gas shale resources: an initial assessment of 32 countries



Source: EIA (2011)

EIA (2011) summarizes: "...Although the shale gas resource estimates will likely change over time as additional information becomes available, the report shows that the international shale gas resource base is vast. The initial estimate of technically recoverable shale gas resources in the 32 countries examined is 5,760 trillion cubic feet. Adding the U.S. estimate of the shale gas technically recoverable resources of 862 trillion cubic feet results in a total shale resource base estimate of 6,622 trillion cubic feet for the United States and the other 32 countries assessed. To put this shale gas resource estimate in some perspective, world proven reserves of natural gas as of January 1, 2010 are about 6,609 trillion cubic feet, and world technically recoverable gas resources are roughly 16,000 trillion cubic feet, largely excluding shale gas. Thus, adding the identified shale gas resources to other gas resources increases total world technically recoverable gas resources by over 40 percent to 22,600 trillion cubic feet."

Figure 8 lists the data on shale gas resources on an individual country basis. Notice, the EIA (2011) initial assessment of World shale gas resources does not even assess shale gas reserves in the Middle East and Russia. Thus, the world shale gas resources could be potentially much higher with addition of other regions. The point is, based on EIA (2011), the world shale gas resources are "vast". Further, the improvement in hydraulic fracturing technology has made it possible to recover these shale energy reserves. As a result, shale gas production can be a bridge to an alternative energy world, as we've previously discussed. Note that some ecological economists argue that the economic impact of shale gas is overstated (Kinnaman, 2011).

Figure 8. Estimated shale gas technically recoverable resources for select basins in 32 countries, compared to existing reported reserves, production and consumption during 2009. (EIA 2011)

	2009 Natural Gas Market <sup>1</sup> (trillion cubic feet, dry basis)			Proved Natural Gas Reserves <sup>2</sup> (trillion cubic feet)	Technically Recoverable Shale Gas Resources (trillion cubic feet)
	Production	Consumption	Imp. (Exp.)		
<b>Europe</b>					
France	0.03	1.73	98%	0.2	180
Germany	0.51	3.27	84%	6.2	8
Netherlands	2.79	1.72	(62%)	49.0	17
Norway	3.65	0.16	(2,156%)	72.0	83
U.K.	2.09	3.11	33%	9.0	20
Denmark	0.30	0.16	(91%)	2.1	23
Sweden	-	0.04	100%	-	41
Poland	0.21	0.58	64%	5.8	187
Turkey	0.03	1.24	98%	0.2	15
Ukraine	0.72	1.56	54%	39.0	42
Lithuania	-	0.10	100%	-	4
Others <sup>(3)</sup>	0.48	0.95	50%	2.71	19
<b>North America</b>					
United States <sup>(4)</sup>	20.6	22.8	10%	272.5	862
Canada	5.63	3.01	(87%)	62.0	388
Mexico	1.77	2.15	18%	12.0	681
<b>Asia</b>					
China	2.93	3.08	5%	107.0	1,275
India	1.43	1.87	24%	37.9	63
Pakistan	1.36	1.36	-	29.7	51
<b>Australia</b>	1.67	1.09	(52%)	110.0	396
<b>Africa</b>					
South Africa	0.07	0.19	63%	-	485
Libya	0.56	0.21	(165%)	54.7	290
Tunisia	0.13	0.17	26%	2.3	18
Algeria	2.88	1.02	(183%)	159.0	231
Morocco	0.00	0.02	90%	0.1	11
Western Sahara	-	-	-	-	7
Mauritania	-	-	-	1.0	0
<b>South America</b>					
Venezuela	0.65	0.71	9%	178.9	11
Colombia	0.37	0.31	(21%)	4.0	19
Argentina	1.46	1.52	4%	13.4	774
Brazil	0.36	0.66	45%	12.9	226
Chile	0.05	0.10	52%	3.5	64
Uruguay	-	0.00	100%	-	21
Paraguay	-	-	-	-	62
Bolivia	0.45	0.10	(346%)	26.5	48

Total of above areas	53.1	55.0	(3%)	1,274	6,622
Total world	106.5	106.7	0%	6,609	NA

## How shale gas production addresses the problems associated with the fourth wave of globalization?

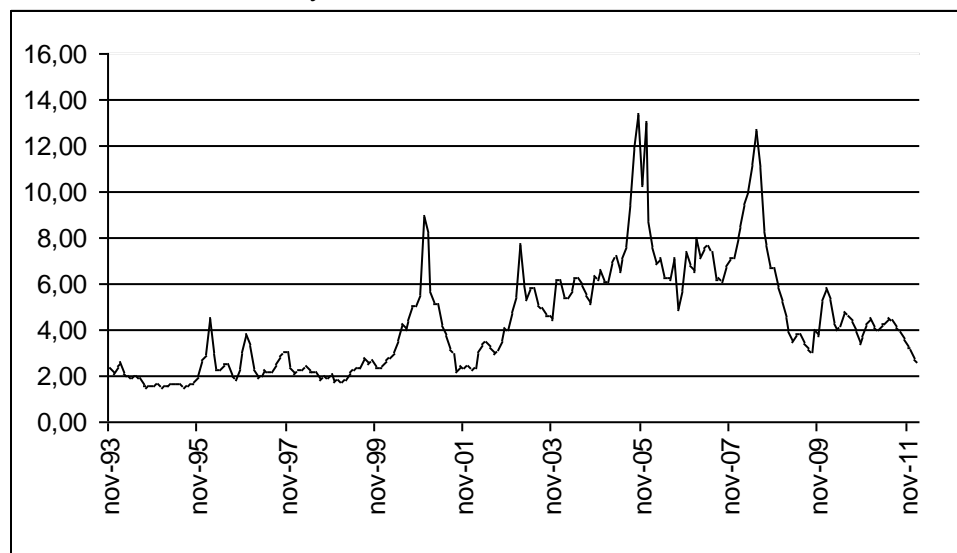
As we've previously argued, the key challenge of the new globalization framework will be how to remove excesses created by the fourth wave of globalization, without significant social, economic, and political consequences. In this section, we discuss how shale gas production, suggested as the energy policy for the next wave of globalization, addresses these excesses.

### 1. *Shale gas and the peak oil theory*

We previously argued that the U.S. policies since 2001 (export-led recovery, economic growth decoupling, easy credit) accelerated the global economic trends, and thus, caused a sharp increase in expected global crude oil demand. As a result, the peak in global oil production may be much closer than initially expected.

As a welcomed relieve to global energy markets, the production of shale gas (and shale oil) can significantly increase the traditional energy supplies, as estimated by EIA (2011), and thus, delay or push back the peak in global energy production (see Pool, 2011). Notice, even though crude oil prices re-approached their 2008 highs in 2012, the price of natural gas is at multiyear lows (Figure 9), possibly reflecting the increased shale gas production by fracking in the United States. In our opinion, once some crude oil consumption is substituted with natural gas consumption, and/or more shale oil (tight oil) is recovered, the price of crude oil will likely collapse as well. Thus, as Orsag (2012) argues, fracking boom could finally cap myth of peak oil.

Figure 9. Natural Gas Prices: Henry Hub, LA



### 2. *Bridge to alternative energy*

The accelerated globalization since 2001 also gave society less time to develop an efficient and effective alternative energy to permanently substitute the traditional fossil fuels energy, which is possibly the only viable long term energy policy. As we also previously argued, the production of shale gas gives society the necessary time to adequately prepare to the inevitable

peak in traditional energy resources, by developing alternative energy resources capable to eventually permanently replace the fossil fuels.

### 3. *Shale gas and the oil geopolitics*

Shale gas reserves appear to be more evenly distributed globally, as illustrated in Figure 7. Further, many currently energy deficit countries have considerable reserves of shale gas and, as a result, may become energy self-sufficient and energy independent. Countries particularly rich in shale gas resources include, according to Figure 8, the United States, China, Argentina, Australia, Brazil, France, Poland, and South Africa. These countries were natural gas net-importers in 2009, but in future all of them can rely on domestic reserves to satisfy their domestic natural gas needs. Further, assuming some substitution of crude oil consumption with natural gas, these countries could become completely energy self-sufficient, and more importantly independent of Middle Eastern oil supplies. For example, Miller (2012) estimates based on British Petroleum Energy Outlook, that U.S. could become energy independent by 2030.

Self-sufficiency and energy independence of large countries such as the United States and China can reduce the geopolitical tensions with respect to the Middle East in several ways. For example, the Middle Eastern oil producing countries are likely to become less strategically important, less economically important, and less likely to engage in nuclear arms race simply due to their dwindling fiscal budgets as oil prices drop and demand for Middle Eastern crude oil diminishes.

### 4. *Shale gas and ecological concerns*

Natural gas is the cleanest of all the fossil fuels, according to the EIA (1998) study. Due to the fact that natural gas is composed primarily of methane, the main products of the combustion of natural gas are carbon dioxide and water vapor. Coal and oil are composed of much more complex molecules, with a higher carbon ratio and higher nitrogen and sulfur contents. Thus, when combusted, coal and oil release higher levels of harmful emissions, including a higher ratio of carbon emissions, nitrogen oxides, and sulfur dioxide. Coal and fuel oil also release ash particles into the environment, substances that do not burn but instead are carried into the atmosphere and contribute to pollution. The combustion of natural gas, on the other hand, releases very small amounts of sulfur dioxide and nitrogen oxides, virtually no ash or particulate matter, and lower levels of carbon dioxide, carbon monoxide, and other reactive hydrocarbons (EIA, 1998).

Figure 9. Fossil Fuel Emission Levels - Pounds per Billion Btu of Energy Input

<b>Pollutant</b>	<b>Natural Gas</b>	<b>Oil</b>	<b>Coal</b>
Carbon Dioxide	117,000	164,000	208,000
Carbon Monoxide	40	33	208
Nitrogen Oxides	92	448	457
Sulfur Dioxide	1	1,122	2,591
Particulates	7	84	2,744
Mercury	0.000	0.007	0.016

Source: EIA - Natural Gas Issues and Trends 1998

As a result, the energy policy based on the global shale gas production, and some substitution of crude oil consumption with natural gas consumption, can have a positive effect of global environment. However, it is also important to understand that the shale gas production, as energy policy, is only a bridge to an effective alternative green energy.

Unfortunately, the process of hydraulic fracturing has also raised some serious environmental and health hazards, including the methane leaks, ground water pollution, and earthquakes (see Finkel, 2011). These concerns have caused some policymakers, for example the State of New York, France, etc, to place moratoriums on fracking until more evidence is available on these environmental and health hazard associated with fracking. As a result, regulation of fracking remains an important issue (see Rahm, 2011 and Willie, 2011).

### **The next wave of globalization**

As previously stated, shale gas reserves are more evenly geographically distributed, thus many regions will be able to become energy self-sufficient or near self-sufficient. For example, within the North American region, including the U.S., Canada and Mexico, all countries have rich reserves of shale gas. Within the European Union, France and Poland can become the leading regional energy producers. In Asia, China has highest reserves in shale gas globally, as currently estimated, and not including regions outside the EIA (2008) scope. In Latin America, Brazil and Argentina can become leading regional energy producers due to their reserves on shale gas. In Africa, South Africa, Algeria and Libya have the highest shale gas reserves in the region.

As a result, the next wave of globalization could potentially be characterized by super-regionalization, as these super regions became more energy self-sufficient. However, it will be very important that these super-regions become more politically and fiscally integrated. For example, the European Union has been on the verge of collapse since the sovereign debt crisis started in Greece in 2009, and, as many experts argue, the only solution to its' debt problem is the fiscal integration. As another example, the Keystone XL pipeline from Canada to the United States has not been passed by the U.S. policymakers, which were concerned with the related environmental issues. The regional energy self-sufficiency will greatly depend on political integration between the U.S., Canada, and Mexico, so the important energy issues such as the Keystone XL pipeline are mutually agreeable on.

Note that shale gas is only a bridge to a renewable alternative energy, which will be in some form perfectly distributed globally (wind, sun, ocean power, bio, geothermal, etc.) Thus, in this mature stage of the next wave of globalization, all countries are likely to be energy self-sufficient as fossil fuels are entirely phased out. Thus, from the standpoint of energy policy, countries will not have to rely on trade to obtain energy. However, energy is not the only tradable commodity, and comparative advantages will always lead to some trade.

Finally, the trend of super-regionalization, which is currently underway in the E.U., is leading towards the ultimate form of globalization within large geographical areas. As a result, within these super-regions, there will be full labour mobility, completely free capitals flows, and completely free interregional trade in all goods, including the commodities such as energy. In direct comparison to other waves of globalization, these super regions are likely to be self-sufficient in many different segments of economy, including the energy. However, the

comparative advantage will still lead to inter-regional trade, but in our view, energy will become less important in the future globalization frameworks, and shale gas is only a bridge to that word. Nevertheless, these super-regions might not be self-sufficient in all commodities. For example, fresh water might replace crude oil as the next key strategic resource.

## Conclusion

We made an argument that the third wave of globalization (in place since 1980) evolved into the fourth wave of globalization in 2001, primarily triggered by the 9/11 related U.S. macro-global policies, such as the export-led recovery, global economic growth decoupling and easy credit. These policies accelerated some key economic and political trends from the previous globalization framework and, thus, created serious global economic and environmental “excesses”, in addition to a hostile geopolitical situation in the Middle East. In our view, rising and volatile crude oil prices have been reflecting these “accelerated” trends, which are inherently unsustainable. Thus, in our view, the current wave of globalization has to evolve into a new, more sustainable, globalization framework.

In this paper, we view shale gas reserves as a strategically important resource, which can be used to frame the new energy policy for the next, fifth, wave of globalization. Shale gas reserves are geographically more-less evenly distributed, which makes it possible for many regions to become energy self-sufficient. As a result, these regions could become energy independent. Within this scenario, crude oil prices would likely decrease and become less volatile as the supply of energy increases and the geopolitical tension ease. Further, natural gas as an energy source is much cleaner than crude oil, which would likely remove some of the ecological “excesses”. The key point we make in this paper is that global shale gas production, as an energy policy, presents an opportunity for the current wave of globalization, which is unsustainable, to evolve in a new more sustainable wave of globalization.

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