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# Regional Energy Play Creates Potential Global Impact

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**Author's contribution**

*This whole work was carried out by the author JES.*

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## ABSTRACT

Energy has always been the essential, life-sustaining medium of exchange, in contrast to the notion that symbols of a monetary system, the effectiveness of influence peddling or even the application of force truly impact and direct social development. Starting with muscle power, which was used in earlier times and relied upon completely to provide for the essentials of life, we have slowly but continuously multiplied our efforts through the use of externally applied energy and thus have accelerated advancements in our social and technical make-up along with our abilities to enhance personal survival. As with any mature process though, there are ways of doing business that can become so ingrained that making a change becomes a major and heavily resisted effort. For example, in the case of the energy industry it has been assumed that the least expensive and most easily acquired form of energy is liquid based which primarily comes from very localized portions of the globe. The reality is that even the energy industry recognizes that change is necessary. Developing countries are requiring more energy and the producers' ability to sustain that increasing demand is becoming harder to maintain. More importantly the consequences of going offshore to receive energy, which is a major portion of the economy, has created a vulnerable situation for all regions and countries, both economically and diplomatically. On the home front the reliance on foreign energy producers has weakened the local economies and allowed the population to practice a false sense of security in a product that is fundamental to the very survival of its citizens. Fortunately, there is at least a short-term remedy to this situation and the energy producers and suppliers are moving very quickly to capitalize on the opportunity. The development of two technologies, horizontal drilling and hydro fracturing, plus the realization that energy reserves in the form of a gas, methane, are plentiful in almost

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every region of the world, has initiated a new look at energy, how we get it and how we use it. What was, and is needed, is a place to start the effort to reorganize and redirect our energy efforts to best utilize those technologies and the resulting energy reserves. That location was self-identified over the past few years as the northeastern portion of the United States, which has become a driving force in the recapitalization and restructuring of the affected region, soon the entire country and, as the technologies become monetized, the entire globe. This paper is a brief look at the potential impact of these two technologies along with the regional impact of the resulting activities and products, and the potential global needs and future consequences of these efforts that are just now being realized and understood.

*Keywords: Energy; energy self-sufficiency; methane; natural gas; energy reserves; globalization; hydro-fracking; horizontal drilling.*

## **1. INTRODUCTION**

Most people would agree that the trend in the acquisition and utilization of energy is a primary indicator of a country's net worth, affecting its gross national product, plus its collective ability to co-operate with and influence others. While the average consumer may find the energy situation to be local and quite transparent, the reality is that the "well-to-wheels" process has a global complexity and is not at all transparent. In fact the entire energy picture is one that is often considered too complex, confusing and, at times, misleading for almost any individual or small group to wrap their minds around. It is so complex and influential in potential life-sustaining effects that we, as both the provider and the user, often forget that we identified the need for energy and then derived the currently used solution, spawning the associated problems that come with its acquisition and utilization.

More importantly, we have committed so much of our collective personal energy to that total energy picture that we have forgotten that it was the "we" in past generations that prepared the original canvas of that effort, choose the brushes and paints, and imagined the subject of those efforts for that painting, which we still embrace today. Yes, it was all ours and for the good or the bad we received, we have had to live with the long-term consequences of that original but nevertheless evolving effort. It would appear that this original picture might be in need of change; at least some think it is about time.

The problem with large complex projects, especially those that are global in impact and application and particularly where lives, health, and standards-of-living hang in the balance, no matter how globally responsive the program could be the reality is that time tends to cement ideas and understandings into place. Even if a program is recognized as needing attention, the old adage of "if it isn't broke, why fix it" comes into play. Add to this that inertia against change grows with time, there are always leadership changes redirecting the agenda, and if you add the day-to-day problems that we must constantly solve called life, then what you have is a complex and often unmanageable decision tree. All of this tends to favor the system that has seemingly worked before no matter its need for repair, or even if there might be a better set of options.

Fortunately, no matter how good or bad the picture, or how ingrained the story there are always individuals who will take a step back and realize the original image isn't as attractive as it once was, or it doesn't describe the one needed, now. These few often called innovators but more often referred to as malcontents and troublemakers, continuously see

other opportunities. Even working against what would appear to be a monumental and engrained system, if given the time and resources, will try to change that original picture.

Because of the size and complexity of the energy program, plus the other opportunities that it represents, others will join the fray and in some cases the original edifice will come tumbling down. Whether it does or doesn't, innovation will start to change the picture and in some cases these changes will have profound impacts reaching beyond the initially impacted region and, for energy, it can't help but have global consequences.

This story is about energy for the United States and the consequences of the time honored belief that our energy needs could only be handled using large oil tankers originating from ports located half a world away. It is the story about how a few innovations in an initially small portion of North America have changed the energy picture for that US region, soon to become the rest of the country, and in a real sense the rest of the industrialized globe. It was through a relatively simple set of innovations that when linked together and driven by the right people had and will continue to have world changing consequences, the true definition and the desired impact of innovation and the people behind it.

## **2. ENERGY AND INNOVATION**

The medium, energy, and the driving force, innovation, have allowed for the robust human infiltration and alteration of the planet. It can be argued as to which is the most important of these two factors but like the chicken and the egg argument it takes both to create progress. It is through the use of energy and the path we as a species have embraced through innovation that has provided the current generation with the tools, luxury, and security that we enjoy and have learned to expect; but not without the need to make some serious decisions.

It is in the history of those decisions added to the growing recent opportunities that needs to be considered. What might be surprising is that the choices and the resulting costs are not just in the acquisition of energy, along with the mitigation of the results of that activity, or the preservation of the environment, or the motivation and rewards available through innovation. It turns out that we are the most successful macro-species on the planet, independent of our cultural or national heritage, and because of this we can and do demand things to change, hopefully for the better.

There are always those amongst us that see the future differently and have the inclination to move on that insight. Within them is a fire to always remain independent of everyone and any system constraints that might affect them. It is through the concept of "self-sufficiency" which has always provided them, and literally all of us, with the underlying structure for success, although these other requirements, energy and innovation, are key ingredients to ultimate progress.

Being self-sufficient is what made us the successful species we have become and what has driven us to be creative, to reward innovation, and to use energy to drive our social order forward. Let's face it: it is also what made America, America, along with numerous other countries and regions that have seen growth and continuous advancements. Plus, it is the same set of attributes the rest of the world will continue to favor to reach their highest standard of living. Ultimately it will be these same basic elements, with a focus on sustainability that will preserve our planet and push our personal growth into yet-to-be-identified goals and frontiers.

### **3. ARE WE SELF-SUFFICIENT**

Currently we, especially in the US, are significantly less than self-sufficient. In fact we are constantly being reminded that we need to pay the piper, high-lighted in non-domestic energy costs, environmental impact, lost jobs and skill sets, and a lack of a directed motivation in our youth.

The question might be what happened to us? The complete story is obviously too complex to cover in this piece. Suffice it to say that we jumped on whatever appeared to be a comfortable bandwagon moving down well-worn and seemingly safe paths with little regard to the fact that no future thought had been given to what's coming with regards to energy, its acquisition and use. Thus, we have been careening down a steep and slippery slope for decades. It was all of us settling for the next easiest, and not necessarily best, solution.

Now that we, or at least some of us, see the calamity approaching we are somewhat clueless and embarrassed as to what should be done, who should do it, and who the guilty parties are that we can hold responsible for the pending calamities. By the way, the answer to all these questions is the collective "us" and not "them". If any of these situations are to get fixed it will be us that does it, as it will in any region or country.

### **4. THE CURRENT US SITUATION**

For over 40 years, the issue of an energy policy in the US, or lack thereof, has been the subject of what seems to be limitless and ineffectual debate. The outcome that has resulted from this rhetoric is the adoption, and often threat of creation, of an ever-increasing set of regulations and laws. These in turn were created to address the after effects, or use, of the domestic and non-domestic energy resources by way or in the name of, global warming, environmental impact, carbon footprint, deforestation, ozone depletion and, a term from the past, smog.

None of this, of course, is directed at a well thought-out vision of a sustainable energy future and what it will take to become self-sufficient, productive and independent of the ever changing global issues related to the acquisition and utilization of energy. In some cases there is little or no technical basis for the information being used or what the problems truly are, or for that matter what the solutions should be.

Each state and federal agency concerned with energy and even our diplomatic core and military services are involved with managing the complex and often misunderstood energy acquisition and utilization picture. The perspective that each brings to the effort, while important, is individualized, vertically integrated, and often slanted to their needs or perceived issues not necessarily shared by the energy producer or user community.

This failure to create a clear and technically accurate energy picture has fragmented our understanding of the problems. It has further created a lack of confidence across all commercial and private sectors stemming from a systemic loss of our abilities to make the all important decisions regarding our energy future, which is a failure to address our need for energy self-sufficiency.

These issues, while important, also fail to address the supply-demand aspects of our energy needs. While there is a growing effort to look at the issues, it is clear that we are not

prepared for the consequences that will come, should any of our current energy forms become availability-limited, or the cost becomes too exorbitant for the consumer to absorb.

Fuel price, independent of the source, has a cascading effect on everything in our economy. A doubling of our transportation fuel costs doesn't just make us carpool or use mass transit more; it also increases the incremental costs in manufacturing, agriculture and the delivery of our consumer products, particularly food stuff.

It creates hardships for the low to medium wage earners that cascades into what they purchase, and where they go and what they do. It even affects the cost of producing other forms of energy since we transport the raw feedstock to the generation facilities. An appreciable increase in our electrical energy costs will create discomfort and hardships for work and play. It will increase environmentally induced dangers for a growing portion of our infant and aging population, such as adequate heating in the North and cooling in the South.

While all of this jockeying and indecision about an energy policy continues, the reality is that this country will require increasing amounts of energy, particularly for the transportation sector, the majority of which will continue to come, at least for the immediate future, from non-US based sources. While these remarks are directed at the US, it is clear that a growing number of the countries in the world are either in the same boat or are getting there quickly. We all need to take a hard look at self-sufficiency, particularly when it comes to a major portion of our economy, energy.

## **5. WHAT THE FUTURE WILL REQUIRE**

While it is believed by many transportation experts that the motive force of the future will be electrical power, until then the primary choices will continue to be petroleum based products or, in an accelerating way, natural gas. The use of natural gas will extend our domestic reserves of fossil fuels, hopefully to be used for other than combustion, thus reducing the resulting emissions. It will also provide a competitive price break for the consumer wherever domestically acquired natural gas is used and with a reasonable payback period for the added costs for vehicle conversions.

Until then we, like the rest of the globe, will need to continue on the current liquid energy diet. It turns out that this may become problematic and much sooner than we would like. For instance the increase in global energy consumption is projected to be 1.4% per year for all energy uses and 2.6% per year for the transportation sector through 2035 [1]. While these percentages seem to be insignificant in size, the reality is quite the opposite.

**Error! Reference source not found.** 1 illustrates the world projected energy consumption through 2035 where the bulk of the increases will occur with the non-OECD countries (Organization for Economic Co-Operation and Development). Fig. 2 represents the sector-by-sector delivered energy consumption, and Fig. 3 shows the world energy consumption by region. Note that in all cases the transportation and industrial energy projections are the most significant, but where the growth in all of the regions is overshadowed by the growing non-OECD Asia predictions. It is this region that is currently predicted to acquire a significant quantity of the reserves the rest of the globe desires, or currently uses.

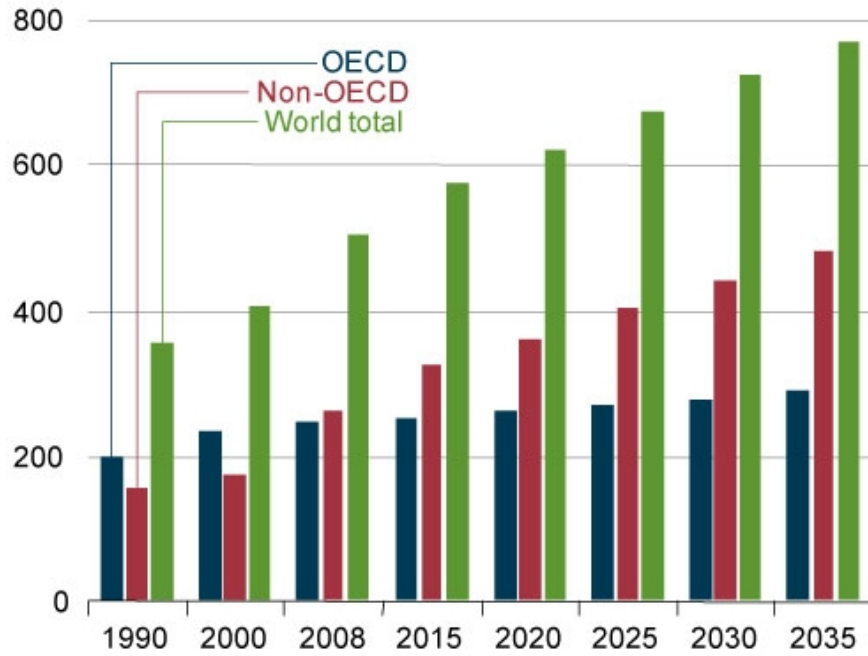


Fig. 1. World marketed energy consumption [2]

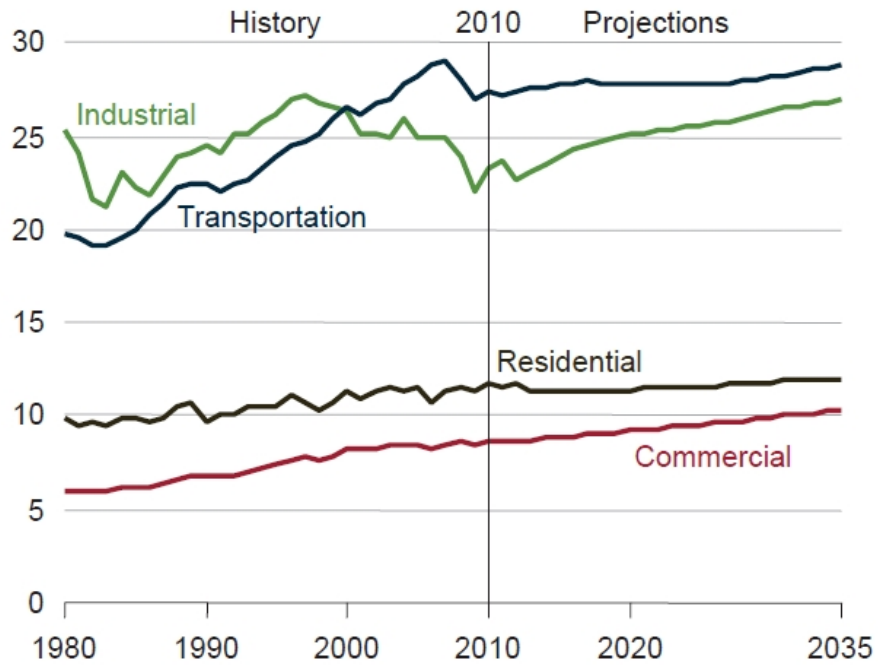
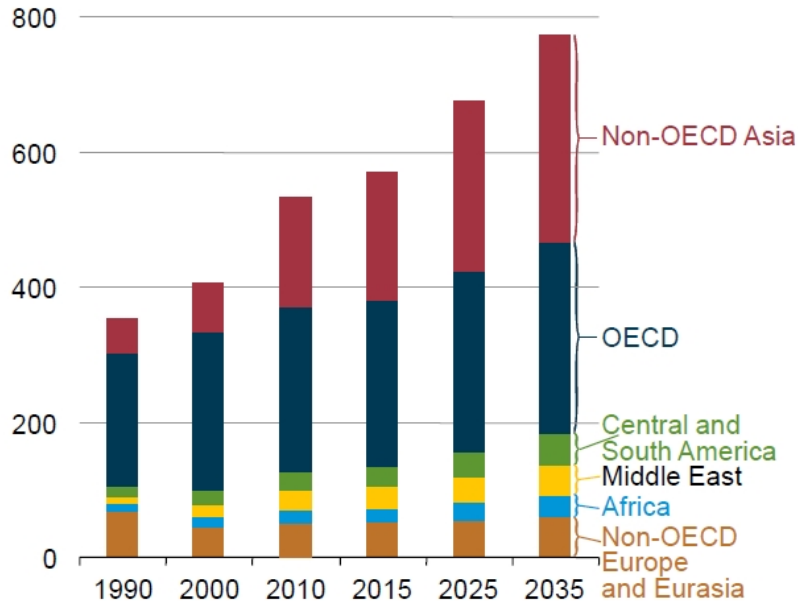
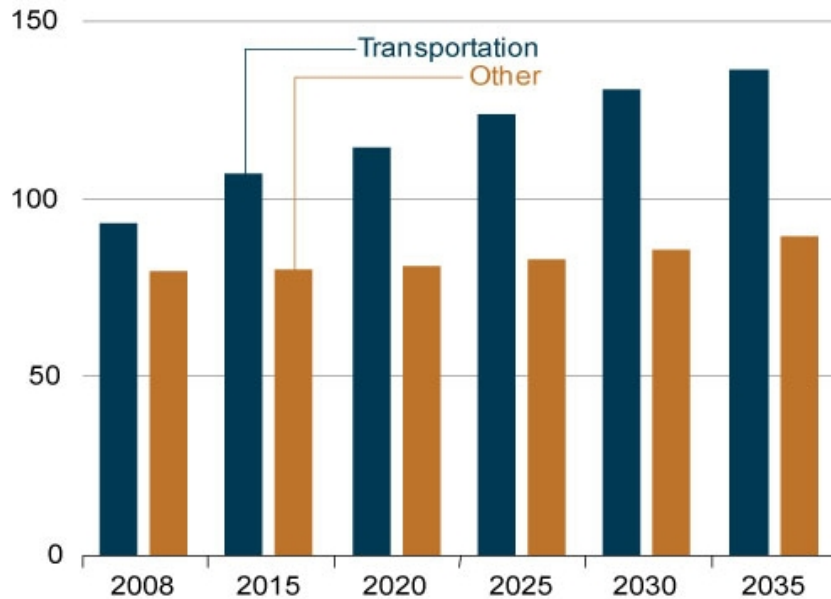


Fig. 2. Sector-by-sector delivered energy consumption [3]

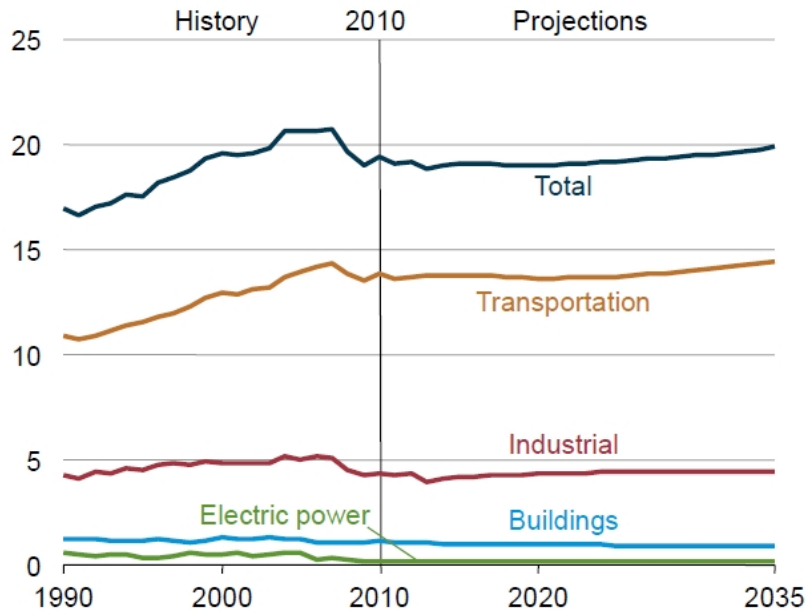


**Fig. 3. World energy consumption by region [4]**

Fig. 4 shows the predicted liquid fuels usage worldwide for the same period. Fig. 5 is a further breakout of the world liquids consumption by end-use sector. In all of these graphs, transportation is the major user and for most societies and countries it is the primary economic driver, Fig. 6.

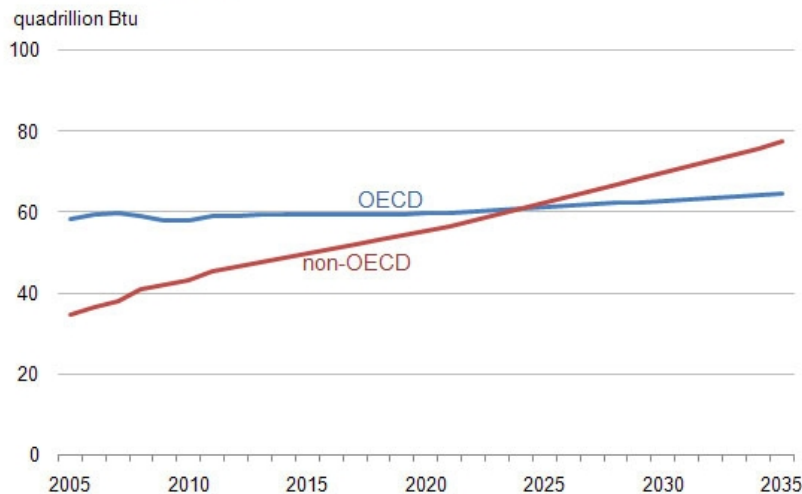


**Fig. 4. World liquids consumption by end-use sector (2008-2035) [4]**



**Fig. 5. Consumption of petroleum by sector (million barrels per day)[2]**

The uses of petroleum for other than transportation is expected to grow at a modest rate, while the anticipated increases in the transportation sector could be well over 30% as compared to the quantities being used today [1]. This data is better illustrated in Fig. 6, the world energy consumption for the transportation sector. Note again the accelerated increases in the non-OECD countries, which are reflective of their current industrialization efforts.



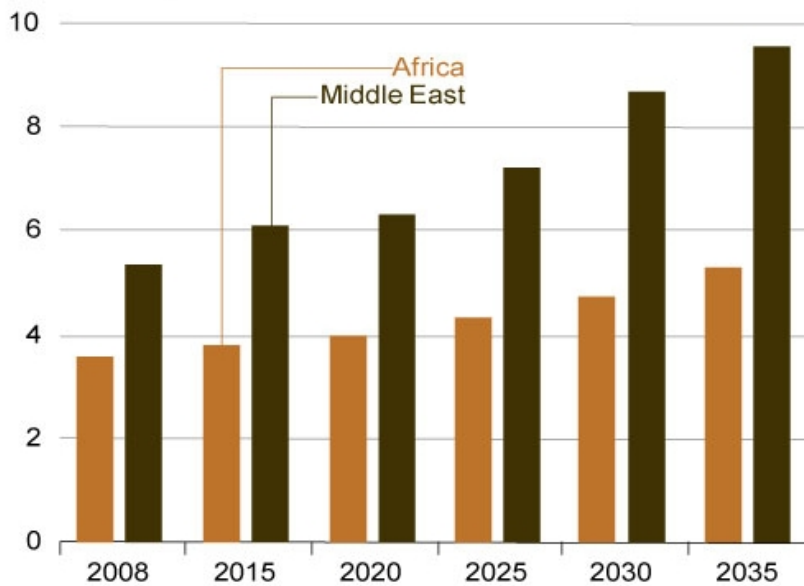
**Fig. 6. World delivered - in the transportation sector [1]**



These countries will continue to show these increases for decades to come. All of this, of course, begs us to assume that the supply-demand balance for crudeoil will remain relatively the same, which is most likely not the case, at least from countries and regions we are accustomed to receiving it from.

For example, the Middle East has continued to maintain a constant and in most cases a zero growth rate in new field exploration [5]. This, coupled with the retirement of some of their older fields and the reported water purging of under-producing fields to help maintain their contracted production levels, should be sending a strong message to their primary customer the US, and the rest of the globe.

At best, their current production rate is temporary while their internal fuel usage for transportation like the rest of the globe will continue to rise, as is illustrated in Fig. 7 and Fig. 8.



**Fig. 7. Middle East and Africa transportation energy use (2008-2035) [2]**

Energy costs are a significant percentage of industrialized nations' overall costs of living in addition to travel requirements, from the environmental controls in homes and businesses to the products that are built, transported and ultimately purchased. A lack of confidence in actual and future energy costs will continue to undermine their business and manufacturing environment. This will potentially lead to large swings in pricing and profitability, causing overt business stress due to under and over pricing, and a reduction of jobs leading to a loss in support for the local social infrastructure. This unintentionally provides an advantage to any global competitors who will then have better control over their economic futures; complimented by their own long-term energy strategy [6].

Even if the US and the rest of the world manage to better utilize their current fuel stocks through conservation and the incorporation of developing alternate fuel sources, it is clear

that the rest of the globe will need more liquid fuels and thus we will be competing with them for whatever may be available at whatever the price; clearly a seller's market.

All of this is also exacerbated by the double-digit growth rates in transportation systems and vehicles in Eastern Asia, particularly India and China, as was illustrated in Fig. 8 [1]. This should indicate that even if the supplies were available, the increasing demand from other than the US would have a growing financial consequence, possibly resulting in extraordinarily high prices at the pumps and/or the dreaded shortages that were witnessed back in the 70's of the last century in the US.

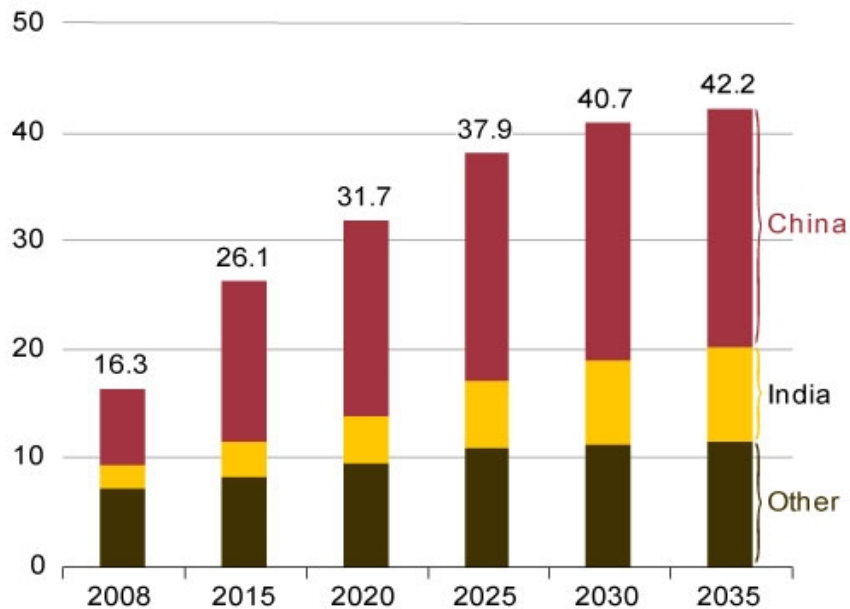


Fig. 8. Non-OECD Asia transportation energy use by country (2008-2035) [2]

What is most interesting is that, by not developing their own energy resources and strategy, relying on non-domestic energy, and not creating the innovative environment that results from self-sufficiency and the advancement of technology, the US has created a potential long-term economic crisis, the magnitude of which it has only started to witness.

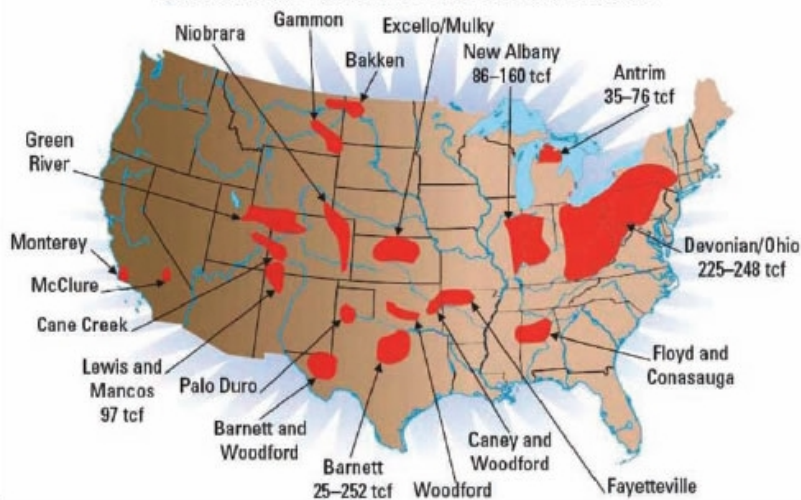
While we may all choose to disagree about the time scale and size of the economic impact, we should agree that the way we are currently receiving a majority of our energy is either quickly coming to an end or we will, at a minimum, start to see supply shortages and guaranteed elevated prices. Fortunately all of this has started to change with the opportunities being provided through natural gas exploration.

## 6. THE ECONOMIC UP-SIDE

Unlike most discussions on this subject, this document hopes to provide a different view: one of opportunity and turnaround. This non-domestic oil situation coupled with the recent natural gas, and yes even oil, reserve discoveries have turned this potential doom and gloom into a

regional opportunity with a long-term impact, even at the national level: a way to reverse the trends that have taken decades to ingrain.

The recent advances in directional drilling and the new hydraulic fracturing techniques are allowing access, at relatively inexpensive rates, to vast quantities of natural gas contained in the shale formations that are part of the shale strata almost everywhere around the world, with several deposits already identified in the US, see Fig. 9 [7].



**Fig. 9. Gas shale basins of the United States [7]**

As has happened so many times in the past, the US is in a pivotal position to capitalize on these new technologies and these gas reserves for our own use and for sale as an export commodity and capability. It is also a unique opportunity for the northeast region of the US with its transmission and exploratory infrastructure and manpower, skills and training, to be the first to take full advantage of this opportunity. As we have witnessed of late, the drilling of the regionally identified Marcellus and Utica Shale formations has resulted in record plays with a promise for even better and less expensive sites as the technology is refined and the experience of the exploration teams increases.

A recent report from the Energy Information Administration (EIA) suggested that the Marcellus find could be the second or third largest gas field in the world, with the equivalent energy content of 87 Billion barrels of oil [8].

This would represent 12 times our current total energy use for the US. Note also that the shale gas quantities in the formations below this seam could also be a magnitude higher than even the Marcellus, with the implication for a steady supply of natural gas at what have become economical prices, especially as the Middle East price-per-barrel might escalate [1].

This would create an energy supply base to support the region for several decades, some say a century into the future, clearly larger than the current crude oil supply that might come from the Middle East or from another as yet-to-be-identified and developed location.

## 7. A FUTURE OPPORTUNITY

An energy strategy must contain pro-active elements for the near-term and, more importantly, those necessary for long-term planning. Energy is the essence for a modern, industrialized society, which also provides the power to sustain the social fabric of any modern culture. Formerly, it was said that “time is money,” but instead, more recently, energy has become the discussed medium of exchange.

As the US and the rest of the world continue to industrialize, the acquisition and exchange of energy, and the services and products that result from the use of that energy, will become the recognized currency of the world. It is with the surplus or shortage of energy that most governments will be recognized for their perceived value, their ability to influence, and the willingness of other nations to trade and cooperate with them.

The US, and its current 50% and greater oil import requirement, is a clear example of a vulnerable energy situation, Fig. 10. Due in a large part to the US' slack of self-sufficiency, it is not only limited in its ability to compete on a global basis in jobs and manufactured goods, it is also under constant diplomatic scrutiny because of this non-domestic energy dependency.

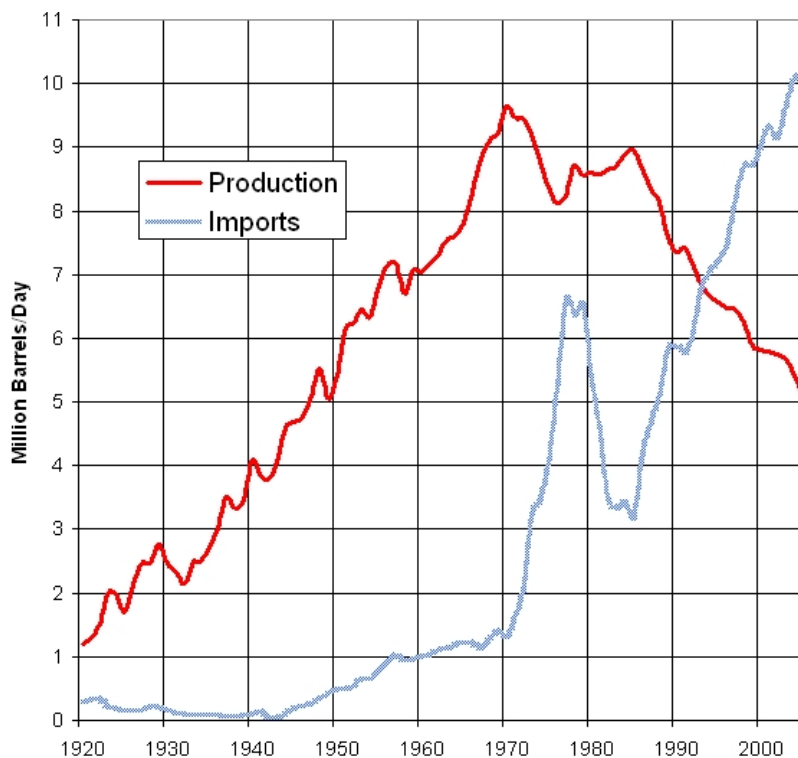


Fig. 10. US production and oil imports (1920 to 2005) [9]

The US's independence has always been its strength. Why did we allow the current offshore energy dependency to occur? It wasn't for a lack of resources or innovative capabilities. For those of you who want to blame governmental regulations, special interest groups and the

entities that support them, I provide the same answer as before; we, the citizens, got complacent and lazy, as has been the case in many other regions.

No organization or country, in this case, can continue to sacrifice an ever-growing percentage of its profits, gross national products, etc., paying for energy, the cost of which is not then directly re-invested back into the same economy it was derived from. The US plus each region of the globe must establish its own energy independence to insure that a similar dependency doesn't occur again.

If it does the economic drain becomes manifest through the loss of jobs, manufacturing capabilities, and in general, a loss of innovation and creativity. All systems in nature have a balance and for a prosperous US, as with any country in the world, that balance was, and must again become, self-sufficiency.

The recent gas plays are a long awaited answer to this continuing loss of economic stability and hopefully the US's ability to heal itself from many decades of indecision and neglect. The identified shale gas available in the Northern US region, and those reserves also discovered in other parts of the country, will easily provide the impetus for a revitalization of the impacted economies.

## **8. THE GAS RESERVES**

The gas reserves themselves are just that, reserves. To gain any value from them will require their exploration and acquisition. The gas needs to be transported and, before it is consumed in any of the work related processes, it needs to be stripped of the rich by-products inherent in the gas stream. Natural gas has value to the chemical, materials and pharmaceutical industries, plus others, but only if that remaining volume of gas then has a use after it has been stripped.

Delivering that gas at an affordable price will require the retooling of sometimes dormant or under-utilized raw materials and manufacturing industries. The chemical contents of the gas will also start or revive the chemical industry that for the US was so prevalent in the past century, thus providing in all cases a competitively priced feedstock for the other industries in our nation. This natural gas resource will most likely find its way, initially, into the transportation sector followed by increased usage in the residential, industrial, and power generation sectors.

This is only the start of this new economy. As the gas starts to flow, a new workforce will need to be trained and educated. The local societal infrastructure will need to be revitalized to handle the influx of a growing and locally re-employed workforce, and the list goes on and on. This seems like an obvious formulae but one we seem to have overlooked. Of equal significance will be the use of these same formulae for the rest of the globe once the technology is monetized and the infrastructure is established.

## **9. CONCLUSION**

The US finds itself in a unique position, one that has not been available for over a century. The advent of the recent gas finds of the Marcellus and Utica shale's coupled with the two continuously developing technologies of directional drilling and hydro-fracturing has provided

the region with the potential to significantly reduce its current dependency on non-domestically produced energy and to open a new era in energy self-sufficiency.

The decrease in this offshore reliance will improve our trade deficit, enhance the value of the US dollar, create a better diplomatic presence around the world and effectively revitalize our national economy. Clearly, this is a formula that is needed for any of the industrialized nations.

It is proposed that the initial use of this resource will be in the transportation sector to decrease the offshore expenditures for crude oil purchases, which will provide the regional funding to increase natural gas exploration, transmission and distribution of this gaseous fuel. These funds will allow for the expansion of these capabilities and to provide the confidence for the future investments in the large volumes of gas needed for the power generation sector; which, also, requires a longer lead-time for integration.

The US currently sends well over a \$1 billion a day overseas for its liquid energy resources, the majority of which is used in the transportation sector. The current US region under consideration uses about 7.7% of the total US consumption of petroleum. This offset of non-domestic petroleum with natural gas, if performed system-wide for just the three-state region, could result in a re-infusion of over \$77 million per day (\$28 billion per year) into the region's economy.

Even if the region converted only 5% of its vehicles during the first few years, starting with the commercial fleets, the reinvestment into the regional economy would be close to \$1.4 billion per year. Additionally, the cost to the user for this fuel would be about 50% of the current cost of petroleum, and the service life and cost for emissions cleanup would be less, all savings that could be passed on to the consumer.

The use of this abundant fuel source, natural gas, will reinvest its energy expenditures back into the region, rebuilding its manufacturing base and employing and re-employing a large segment of its current, and soon to be added to, work force.

It is estimated that the use of this fuel will add over a quarter of a million new jobs by the year 2020. This does not include all of the service and related jobs that will be created due to the influx of population, the employment of the currently out-of-work people and thus a reduction in social benefits support, and the added tax revenues that will be provided to the public works projects to keep pace with the increased social infrastructure that this growth will require.

Finally, while we have a lot to learn about how to minimize the cost of gas acquisition including the cost to the user and the environmental impacts, natural gas is clearly the fuel of choice for mobility and power production. The contents of the gas also represent a resource to re-establish the US's lagging chemical industry, plus as the gas-use proliferates, there is an expectation for an increase in the development of additional advanced technologies, which will add again to the growth of the region.

All of this will re-energize the work force and provide future generations with a positive and predictive vision for their energy future, along with the need to prepare themselves through education and training based on need, and not hope or rhetoric. It will also create the need, formation, and funding of research-rich development centers matched to innovative business environments: a location for investors and entrepreneurs to call home.

Taking the path of being pro-active and visionary, in contrast to reacting only when forced, will encourage and stimulate our intellectual and financial resources. It is through strong visionary leadership that innovation has a chance, and it is innovation that challenges our youth to continue to question the status quo. It is time for the US and the rest of the globe to become energy self-sufficient. The tools are at hand to create a much friendlier and safer global environment. It is time that we prepare a new canvas as a legacy for those that will soon follow us.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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