A National Energy Program

The Apollo Program Of Our Time

A White Paper on
Achieving Energy Independence
and National Transformation

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Preface

The goal of the national energy program is to eliminate the gap between U.S. oil consumption and production and significantly reduce green house gas emissions in a decade to place our nation on the road to a sustainable energy future. With domestic natural gas supply plentiful, eliminating the "oil gap" will achieve energy independence. The U.S. Energy Information Agency forecasts this gap to be approximately seven million barrels and day (MBD) in 2025. Forecasts vary from 4-7 MBD depending on source used. The goal is set near the upper end of the range to be at least six MBD. President Obama set a goal to reduce green house gas emissions to 26-28% below 2005 levels by 2025. This equals a reduction of at least 1,300 million metric tons of CO_2 equivalent. This goal will be used as a floor; not a ceiling.

America must treat energy independence as a matter of national security to avoid chaos. The "arc of instability" running through North Africa and Southeast Asia could become an "arc of chaos" involving the military forces of several nations. Seven of top ten nations with largest oil and gas reserves are in this region. Russia and Venezuela are also on this list.

Turmoil in energy producing nations is on the rise, with increased potential for future combat operations. The implications for future conflicts are ominous should states see the need to militarily secure energy resources. One implication no one considers is that energy market forecasts are based on being able to do business as usual for decades to come. This assumption is no longer valid. The very real risk of supply disruptions and lasting energy crises due to growing instability or conflict must factored in to energy forecasts and schedules to achieve the goal. We must frontload activity to avoid being blindsided by unforeseen events again.

It's not just about us. Our security and stability is becoming inextricably linked to security and stability elsewhere in the world. Our development of alternatives to imported oil to achieve the goal will significantly increase the scope of alternatives available in the marketplace. This will provide an example other nations will follow to reduce their demand to a greater extent using alternatives they buy from us.

The approaches used to plan and manage Apollo, finance and build the Interstate Highways and transform the nation during World War II are adapted to produce an overview of a strategy and plan to achieve energy independence in this white paper. These efforts were of necessity national undertakings; because, they were instituted to deal with national security threats. A National Energy Program focuses on a similar threat and will be planned and implemented accordingly.

Apollo was a race against time. NEP promises to be a similar race set in turbulent times replete with unexpected and increasingly volatile conditions at home and abroad. Americans of nearly every political stripe are waiting and wondering whether their leaders are prepared to let the nation that saved the world in the twentieth century sink into history in the twenty first. We stand at a crossroads. We simply can't risk going down the same path increasingly divorced from the real threats of today and the growing ones tomorrow. Will tomorrow belong to America? The genius of America is our ability to transform to meet changing conditions and new threats and become a better and stronger nation.

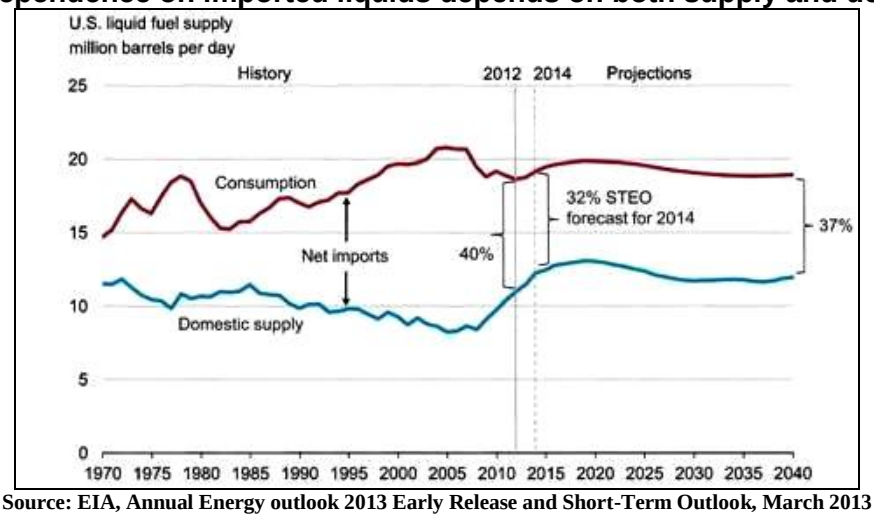
Achieving energy independence is the right place to start.

TABLE OF CONTENTS

Executive Summary: A National Energy Program – What, Why, When and How?

President Kennedy set a goal to send a man to the moon by the end of the 1960's. A National Energy Program (NEP) will also begin with a goal and timeline. **The goal is to eliminate the gap between U.S. oil consumption and production and significantly reduce green house gas emissions in a decade to place our nation on the road to a sustainable energy future.** With domestic natural gas plentiful, eliminating the "oil gap" will achieve energy independence. As shown in the chart below, the U.S. Energy Information Administration (EIA) forecasts the oil gap to be approximately seven million barrels and day (MBD) in 2025. Forecasts vary from 4-7 MBD depending on the source. However, current forecasts are "not real world"; because they are based on continuation of business as usual conditions in an increasingly unstable world. To cover "downside risk" the goal is set near the upper end of the range to be at least six MBD. President Obama set a goal to reduce green house gas (GHG) emissions to 26-28% below 2005 levels by 2025; which was 10% above the 2012 level. This equals a reduction of at least 1,300 million metric tons of CO_2 equivalent. (Emissions in 2012 are shown in the next chart).

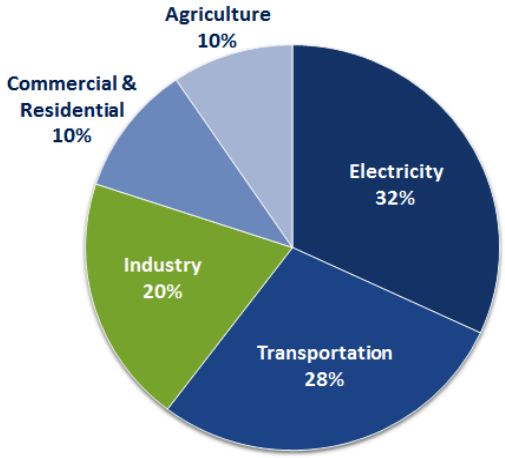
U.S. dependence on imported liquids depends on both supply and demand



Source: EIA, Annual Energy outlook 2013 Early Release and Short-Term Outlook, March 2013

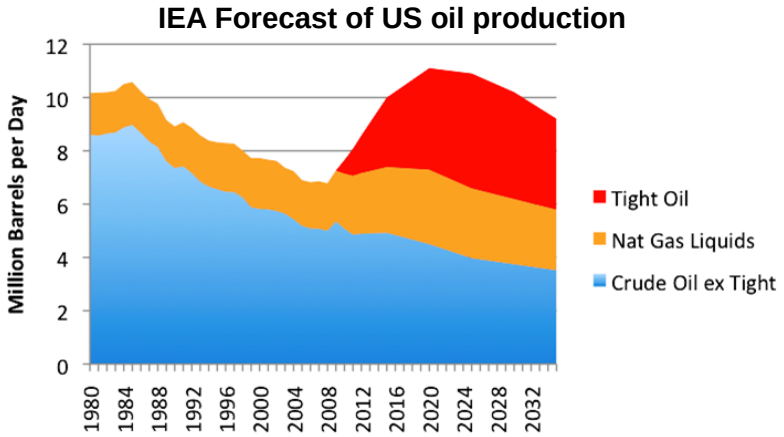
Total U.S. Greenhouse Gas Emissions by Economic Sector in 2012

6,526 Million Metric Tons of CO2 equivalent



Source: All emission estimates from the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012

In current market conditions with a domestic oil shale oil boom, some are saying that independence from imported oil will soon be achieved by our nation's oil and gas industry and market forces. October 2013 marked the 40th anniversary of the 1973 OPEC oil embargo. America's oil and gas industry and market forces haven't cured our addiction to imported oil in over 40 years and won't cure this addiction in the foreseeable future. This is illustrated in the International Energy Agency (IEA) chart below; which indicates that U.S. oil production will peak at 11.1 MBD in 2020 and then decline. The EIA forecasts a similar situation. The Obama Administration's short term energy euphoria ignores this longer term reality. We have been on the imported oil roller coaster too long to have learned nothing from the experience.

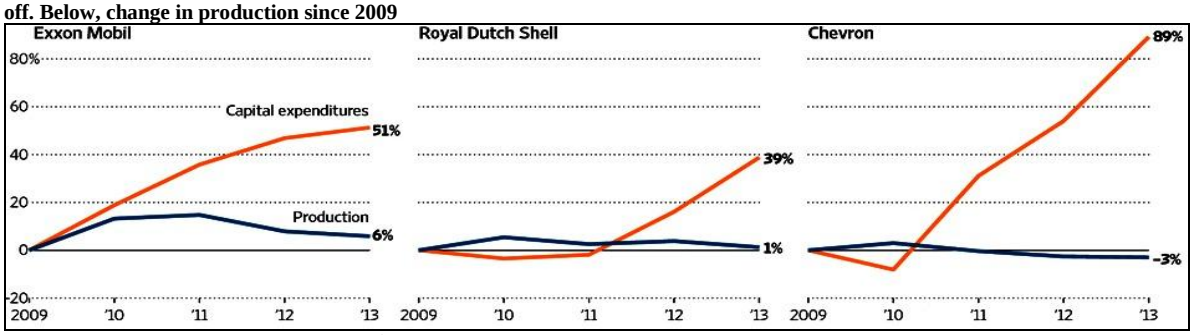


Source: Graphical depiction of IEA forecast of US oil production, Smart Planet

Energy Independence is not just about us. As discussed in the 2013 DOD National Security Strategy, our security and stability is becoming inextricably linked to security and stability elsewhere in the world. According the EIA, global energy demand will increase by one-third from 2011 to 2035 with more than 80% of demand growth in non-OECD countries. As illustrated below, the world's major oil companies all suffer from some version of the same problem: they're spending more money to produce less oil. The world's cheap, easy-to-find reserves are basically gone; the low-hanging fruit was picked decades ago. Not only is the new stuff harder to find, but the older stuff is running out faster and faster. Absent real change energy consuming nations will be dependent on imported oil from unfriendly and unstable nations for the foreseeable future.

Costly Quest

Exxon, Shell and Chevron have been spending at record levels as they seek to boost their oil and gas output. It has yet to pay off. Below, change in production since 2009

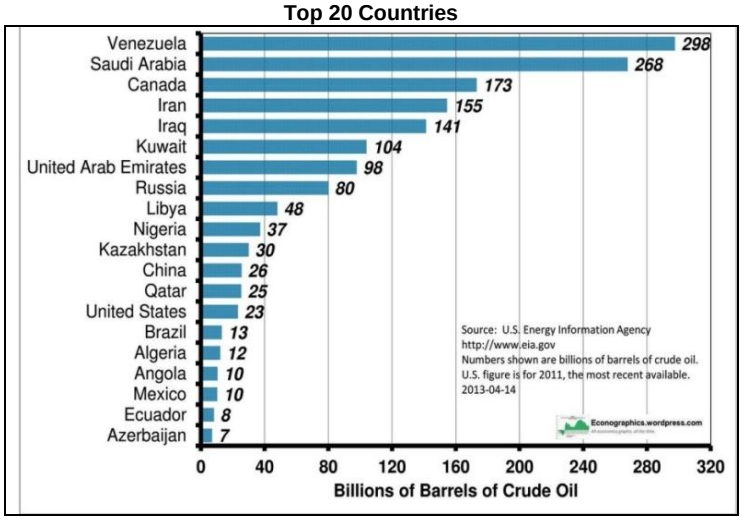


Note: Spending in 2013 reflects company estimates. Source: the companies. Wall Street Journal

America must treat energy independence as a matter of national security to avoid chaos. As discussed in the DOD Joint Operating Environment (JOE) 2010 report, the "arc of instability" running through North Africa and Southeast Asia (the region) could become an "arc of chaos"

involving the military forces of several nations. As illustrated below, seven of the top ten nations with largest oil reserves are in this unstable region. Turmoil in energy producing nations is on the rise with increased potential for future combat operations. The implications for future conflicts are ominous, should states see the need to militarily secure energy resources. One implication not considered is that energy market forecasts are based on being able to do business as usual for decades to come. This assumption is not valid. The real risk of supply disruptions and lasting energy crises due to growing instability and conflict must be factored in. To do this, we should frontload activity to achieve the goal to avoid being blindsided by unforeseen events *again*.

Proved Oil Reserves by Country, 2013
Top 20 Countries



It has been suggested that the goal should be "independence from oil imported from outside North America". In this case, oil from Canada we use would not be available to other nations. But, NEP isn't just about us. For example: China will account for more than 30% of the projected demand growth for oil that it must get from somewhere to avoid chaos. If Canadian oil went directly to China, or we passed through an amount equal to what we receive from Canada to world markets, it would reduce the potential need for China to go to war to militarily secure energy resources in the China Seas. The picture below indicates this war may have already begun.

Chinese Coast Guard vessels protecting an oil rig ram a Vietnamese vessel in disputed waters in the South China Sea.

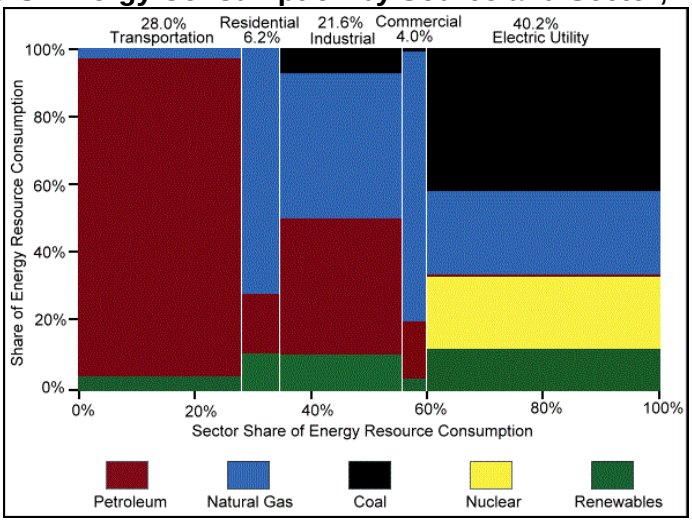
Force won't change conditions – competent American leadership will. Our development of alternatives is likely to vary in proportion to the size of the oil gap we close to achieve the goal.

Achieving the greater goal of closing the oil gap between domestic production and consumption will produce a greater amount of alternatives to imported oil and their exports to other nations. This will be seen as global leadership that will provide an example that other nations (including China) will follow to reduce demand to a much greater extent using alternatives they buy from us.

Colonel Michael Eastman, U.S. Army, was prophetic writing in the Wall Street Journal in 2012, "Prudence demands preparation for a possible challenge in the Pacific; but it's important to distinguish between threats that are the most dangerous and threats that are most likely. Especially during challenging fiscal times the U.S. should not tailor its military capabilities for the Pacific at the expense of the rest of the world – particularly the Middle East - where conflict is more likely…With numerous countries in political transition, the likelihood of future regional conflict is high. Precision air strikes remain an option; but unduly reducing American ground forces risks creating a vacuum". This vacuum contributed to instability and conflict that has produced attacks on and co-option of energy production, refining, shipping facilities by warring factions and terrorists. And, as our armed forces grow smaller, withdraw to the periphery and pivot to Asia, the constraint that kept war between Shiite and Sunni in check diminishes accordingly. Our national interest isn't Shiite or Sunni. It is protecting the oil supply. If proxy wars turn into regional war key energy facilities impacting oil market and global stability will be at risk. It is a mystery why Saddam Hussein didn't take Saudi oil fields and burn everything.

One thing is certain. Every barrel of oil America produces, conserves and replaces with alternatives to imported oil is a barrel of oil available on world markets we won't have to defend. Unfortunately, our civilian and military leaders focus on oil in terms of pump price disconnected from national security. This blind spot is remedied in the "Achieving Energy Independence" section in which the geo-strategic situation in the region, energy security and national security are inextricably linked. This discussion is broken down by sub-region - Middle East, South Asia, Asia-Pacific, Central Asia and North Africa. The relationship of the region and energy to Russia, China, Europe and the U.S. is also explored.

U.S. Energy Consumption by Source and Sector, 2012



Source: DOE, EERE, Vehicles Technologies Office

For planning purposes, energy independence will be achieved when the quantity of imported oil as part of total oil and other liquids used in economic sectors is replaced from other sources as required to achieve the goal. U.S. energy consumption by source and sector is shown in the chart above. Priority will be given to each sector based on comparative oil usage. Priority within

sectors will be given to each "means" based on its ability to achieve the sector objective. GHG emissions by sector are shown in a chart above and will be treated in a similar manner.

In the "Planning Energy Independence" section, the military oriented, performance driven, time bound program management system used for Apollo is adapted to define objectives and implementation scenarios in each sector to achieve the goal. Programs generally produce "one-off" results; such as landing a man on the moon. After this goal was achieved the Saturn V launch vehicle was put in mothballs and the Apollo infrastructure was adapted for the Space Shuttle. Achievement of energy independence is just a milestone on the road to a sustainable energy future to be accomplished though continuing operations. Supply chain management and logistics are used in the military and industry for such operations and will be used for NEP.

Program Management is a method used to plan and implement defined goals and objectives from inception to completion that contains the following steps:

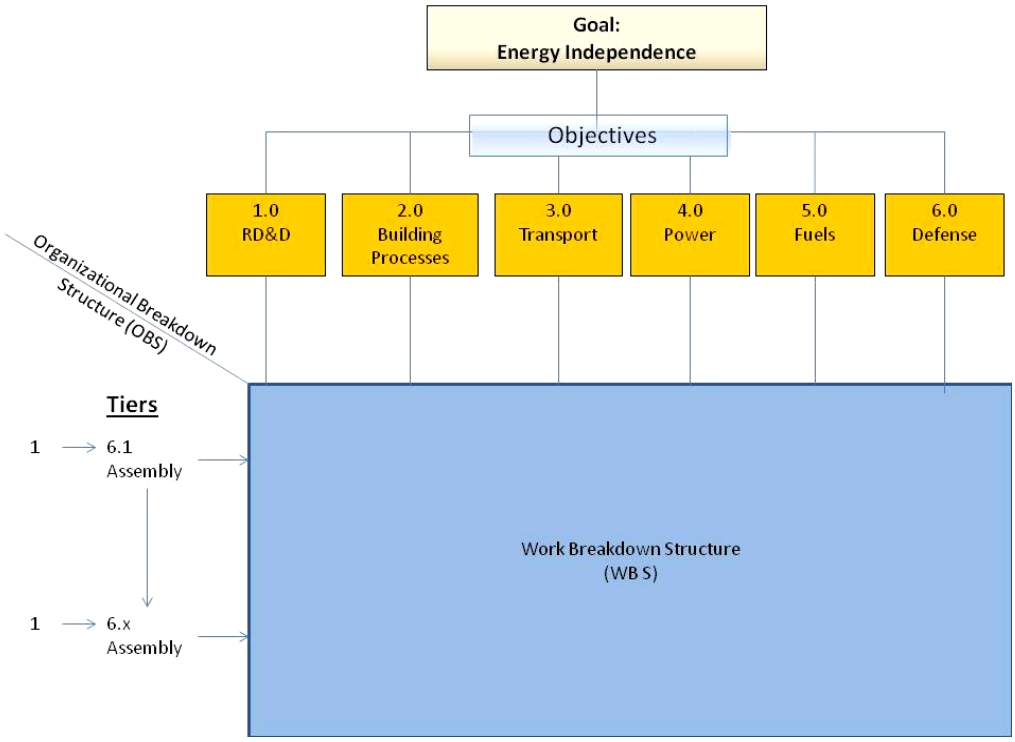
- The President sets a goal and timeline.
- Sector objectives to achieve the goal are defined by stakeholders that must be involved in implementation. Tradeoffs are made to resolve differences between stakeholders.
- Means – work elements (assemblies, tasks and projects) to achieve sector objectives are defined in tiers "down and across" elements in a work breakdown structure (WBS).
- Means are related to performing organizations – lead and supporting – in an organization breakdown structure (OBS).
- A cost/schedule system is developed to manage work elements down to the smallest means.
- All of the above are structured within a management framework wherein a change in any objective/work element immediately translates into impacts on all other work elements. This will enable introduction of new technologies to replace existing technologies as required.

Six top level objectives and implementation scenarios are presented in this white paper. A proposed Program Breakdown Structure (PBS) incorporating these objectives is presented below:

- **Building & Processes Sector:** Replace oil use and reduce emissions in energy efficient buildings and processes that meet end user needs and achieve the goal.
- **Transportation Sector:** Replace oil use and reduce emissions in a conventional and alternative motor vehicles fleet that meets end user needs and achieve the goal.
- **Power Sector:** Replace oil use in end user facilities and reduce emissions in an energy efficient, safe and secure power sector that meets end user needs and achieves the goal.
- **Fuels Sector:** Replace oil use and reduce emissions in a fuel sector that achieves the goal and will always be able to provide fuel for vehicles on our roads and tanks on the battlefield.
- **Defense Sector:** Replace oil use in an energy efficient U.S. military that has the operational energy security to go and win America's wars without initial access to theater bases and energy supplies.

- **Energy Technologies R, D&D:** Develop and deploy energy technologies in "rank order" based on ability to achieve sector objectives and the goal.

NEP Program Breakdown Structure (PBS)



When President Kennedy set the goal to send a man to the moon he turned to NASA to outline specifications for Apollo (13) and implement the program. In a similar manner, a planning project will be undertaken to plan NEP. This project could be implemented by request from Presidential Obama to appropriate agencies or by an independent entity. This should occur as soon as possible to be able to produce a plan that will be available in time to impact the new administration as it comes into office. The goal, objectives and scenarios in this white paper are not set in stone and should be used as a preliminary specification for discussion purposes to begin the project.

NEP will be operated by a public/private sector corporation – not a government agency - outside government, freed from political interference and earmarking. Government won't tell industry how to do its job. Government will work with industry to define what has to be done and then do everything in its power to enable industry to get the job done – including stepping in if the marketplace can't deliver fast enough. Consistent with this approach, the corporation will be managed by business leaders and professionals. The public sector will provide operating support, investment, facilitation and timely oversight. This approach produced victory in WWII and transformed our nation. It is needed just as much today.

A key question with any program is, "how will we pay for it? Financial mechanisms are proposed in the "Financing Energy Independence" section. Public and private sources/uses of funds will be defined and related to work elements using a financial breakdown structure (FBS). In general, public investment will be used to finance the difference between investments the private sector, financial community and investors will make using existing investment models

and the investments required. Where possible, taxpayers will receive a return on public investment commensurate with public investment and risk. Since NEP will be implemented as a matter of national security, uneconomic aspects of the program will be funded accordingly.

Half the funds from tax expenditures, entitlements and subsidies cut from the budget will be invested in NEP R,D&D. The other half will be used to reduce the budget deficit and national debt. The way out of our current crisis cannot be more borrowing and spending, especially spending that does not build lasting assets that will help future generations pay off debts they will be saddled with. As President Eisenhower stated in his Farewell Address, "We - you and I, and our government - must avoid the impulse to live only for today, plundering, for our own ease and convenience, the precious resources of tomorrow. We want democracy to survive for all generations to come, not to become the insolvent phantom of tomorrow".

The real cost of imported oil includes the cost of exploration, production, refining and distribution, plus hidden subsidies, costs to defend imported oil and pay for energy wars that are passed on to our children. These costs will be paid on a "pay as you go basis" at the pump. This will cost American taxpayers "net zero"; because revenues will be used to reduce the defense budget by an equal amount. The alternative, deep defense cuts are not in the national interest.

Discussing the stimulus program, President Obama stated "he couldn't find more than $50 billion in shovel ready infrastructure projects". The American Society of Engineers (ASCE) Infrastructure Report Card gave America's infrastructure a GPA of "D+" and indicates that $3.6 trillion in infrastructure investment is needed by 2020. National infrastructure programs with sound revenue streams adapted from the Highways Program model and other public/private mechanisms discussed in the white paper will finance this massive investment.

The "NEP decade" will be a transition period from dependence on imported oil to a sustainable energy future that is "win-win" for stakeholders, America and the World. Developing alternatives to imported oil as a matter of national security will increase domestic deployment faster than possible through market forces alone and increase our green energy exports. This will turn our capital outflow for imported oil into a source of domestic earnings and investment. Expanding domestic fossil fuel production and increasing refining capacity consistent with a sustainable energy future will contribute to eliminating the oil gap and reducing GHG emissions. NEP will create sound investments in energy infrastructure, green energy and fossil fuels for the financial community that will produce millions of new middle class jobs. This will provide investment that promotes broad growth and global stability as an alternative to investment and debt creation that is increasing the gap between rich and poor, promoting global instability. NEP will have an additional benefit - members of our armed services won't become casualties in wars that won't happen if America achieves energy independence and leads and enables other consuming nations to work with us to reduce their dependence on energy imports from the region.

Americans of nearly every political stripe are waiting and wondering whether their leaders are prepared to let the nation that saved the world in the 20th century sink into history in the twenty first. We stand at a crossroads. We simply can't risk going down the same path increasingly divorced from the real threats of today and the growing ones tomorrow. Will tomorrow belong to America? The genius of America is our ability to transform to meet changing conditions and new threats and become a better and stronger nation.

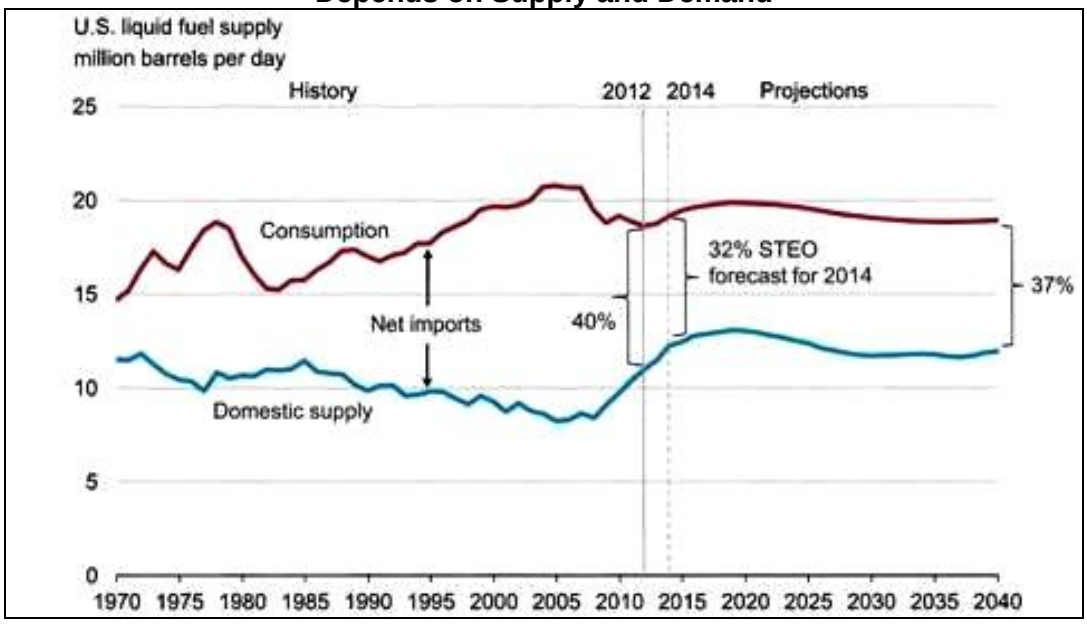
Achieving energy independence is the right place to start.

A National Energy Program

I. Introduction: Energy Independence - A Race Against Time

President Kennedy set a goal to send a man to the moon by the end of the 1960's. A National Energy Program (NEP) will also begin with a goal and timeline. **The goal is to eliminate the gap between U.S. oil consumption and production and significantly reduce green house gas emissions in a decade to place our nation on the road to a sustainable energy future.** With domestic natural gas plentiful, eliminating the "oil gap" will achieve energy independence. As shown in figure 1, the U.S. Energy Information Administration (EIA) forecasts the oil gap to be approximately seven million barrels and day (MBD) in 2025. Forecasts vary from 4-7 MBD depending on the source. But, current forecasts are "not real world"; because they are based on continuation of business as usual conditions in an increasingly unstable world. To cover "downside risk" the goal is set near the upper end of the range to be at least six MBD. President Obama set a goal to reduce green house gas (GHG) emissions to 26-28% below 2005 levels by 2025; which was 10% above the 2012 level (1). This equals a reduction of at least 1,300 million metric tons of CO_2 equivalent (2). This goal is set as a floor; not a ceiling. (Emissions in 2012 are shown in the next chart)

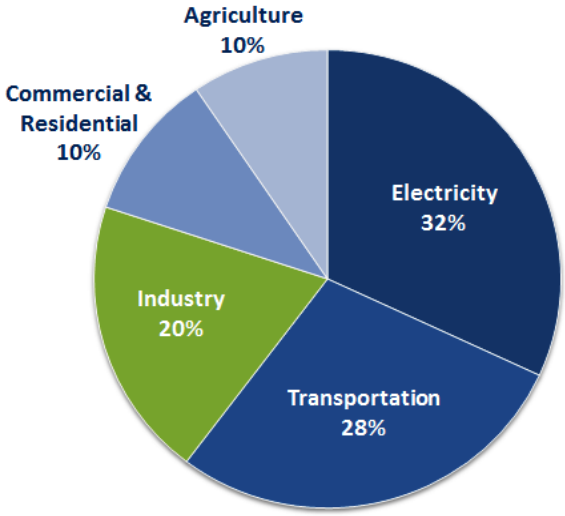
Figure 1: US Dependence on Imported Liquids Depends on Supply and Demand



Source: EIA, Annual Energy outlook 2013 Early Release and Short-Term Outlook, March 2013

Energy Independence is not just about us. Our security and stability is becoming inextricably linked to security and stability elsewhere in the world (3). Global energy demand is projected to increase by one-third from 2011 to 2035 with emerging economies accounting for more than 80% of net energy demand growth by 2035 (4). The world's major oil companies all suffer from some version of the same problem: they're spending more money to produce less oil. The world's cheap, easy-to-find reserves are basically gone; the low-hanging fruit was picked decades ago. Not only is the new stuff harder to find, but the older stuff is running out faster and faster (5). Absent real change, energy consuming nations will remain dependent on imported energy from unstable and unfriendly nations for the foreseeable future.

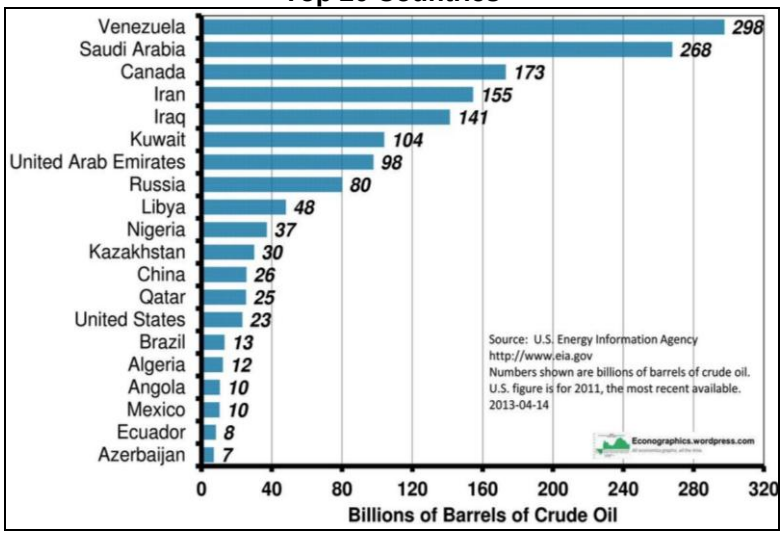
Figure 2: Total U.S. Greenhouse Gas Emissions By Economic Sector in 2012
6,526 Million Metric Tons of CO2 equivalent



Source: All emission estimates from the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012
http://www.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2014-Main-Text.pdf

America must treat energy independence as a matter of national security to avoid chaos. The arc of instability running from North Africa to Southeast Asia [the region] could become an "arc of chaos" involving the military forces of several nations… [As illustrated in Figure 3 below, seven of top ten nations with largest reserves of oil are in the region]... Turmoil in energy producing nations is on the rise…The implications for future conflicts are ominous, if energy supplies cannot keep up with demand and should states see the need to militarily secure dwindling [or disrupted] energy resources (6). One implication not considered is that energy markets forecasts are based on being able to do business as usual for decades to come. This assumption is not valid. The very real risk of supply disruptions and lasting energy crises due to instability and conflict must be factored in. To accomplish this, we must frontload activity to achieve the goal to avoid being blindsided by unforeseen events *again*.

Figure 3: Proved Oil Reserves by Country, 2013
Top 20 Countries



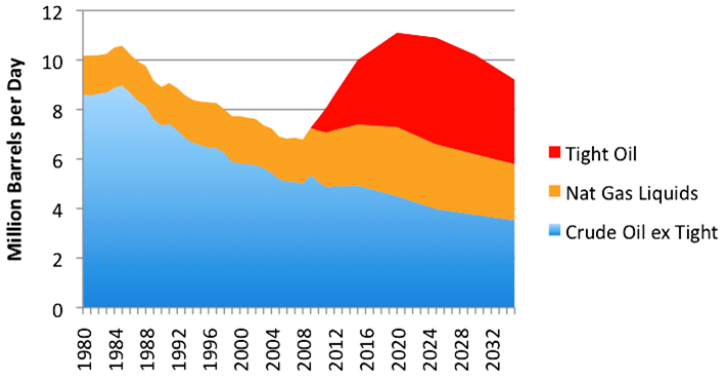
Force won't change conditions – competent American leadership will. America must lead by example to induce and enable other energy consuming nations to work with us to significantly reduce energy imports from the region to avoid new energy wars there in the future.

Every barrel of oil America produces, conserves and replaces with alternatives is a barrel of oil available on the world market we won't have to defend. Unfortunately, our civilian and military leaders focus on oil in terms of pump price disconnected from national security. This blind spot is remedied in the fuel and defense sections in which the geo-strategic situation in the region, energy security and national security are linked. This discussion is broken down by sub-region. The relationship of the region to Russia, China, Europe and the U.S. is also explored.

Machiavelli wrote, "When the evils that arise have been foreseen, they can be redressed, but when, having not been foreseen, they are permitted to grow in a way that everyone can see them, there is no longer a remedy" (7). It is unlikely that a real national energy policy and program will be developed until everyone sees the danger at which time the situation could be beyond remedy.

This whitepaper is derived from an unfinished work – Plan-B for the War and Home Front. The energy section was extracted and developed into a "Plan B for Energy" to run on a separate track from our current track – gridlock between green energy and fossil fuel interests. At a minimum, this track will produce an action plan that will be available should unforeseen events focus the nation's attention on the problem. With such a plan available the problem may be subject to remedy. President Roosevelt's actions prior to Pearl Harbor are an example of this approach. The Roosevelt Administration planned and prepared for the coming war as best it could; which is all that could be done in a nation living in denial and isolationism. When the war began the nation was ready.

Figure 4: IEA Forecast of US Oil Production



Source: Graphical depiction of IEA forecast of US oil production, Smart Planet

Figure 5: Change in Production

Source: EIA, Wall Street Journal

America has fallen into a familiar pattern for hegemonic powers: over consumption, over extension and over optimism (8). Some say that North America will become the new Saudi Arabia of oil and gas (9). On the other hand, October 2013 marks the 40th anniversary of the 1973 OPEC oil embargo. America's oil and gas industry and market forces haven't cured our oil addiction in 40 years and can't be relied upon to cure our addiction in the foreseeable future. As shown in figure 4, the IEA projects that total U.S. production will peak at 11.1 MBD in 2020 and decline thereafter (10). The EIA forecasts a similar situation. And, as shown in figure 5, the fact that the U.S. is responsible for all of the world's net oil production growth obscures the situation. The Obama Administration's short term energy euphoria ignores this longer term reality. We have been on the imported oil roller coaster too long not to have learned anything from the experience.

Prudence demands that we "hope for the best, but plan for the worst" to cover downside risk and stop chasing rosy scenarios being blindsided by unforeseen events. A rational scenario predicates that energy crises in the future will be caused by conflict and involve disruptions that are longer and more destabilizing than the OPEC and Iranian oil embargoes. This scenario is becomes more likely as potential enemies are able to deploy long range and more precise weapons…threatening the projection of our forces into a theater and the global commons (11). Waiting for energy crises to occur and trying to remedy them with another short term fix or energy war; instead of implementing long term solutions now will be no more successful in the future than in has been in the past.

Production during WWII and Apollo were races against time. NEP will be a similar race set in turbulent times replete with unexpected and increasingly volatile conditions at home and abroad. Most current policies and plans contain soft goals, few operational specifics, no firm evaluation measures and view energy without an integrated national and worldview. They mention soft timelines - or no timelines at all – oblivious to the darkening landscape abroad. We will get nowhere until we focus on the fact that our addiction to imported oil is a grave national security threat and use methods that have been successful in dealing with such threats in the past.

This white paper is divided in four parts:

- **Planning Energy Independence:** Outlines a project to produce a NEP plan and organization using a program planning and management approach patterned on the Space program.

- **Achieving Energy Independence:** Proposes objectives, implementation scenarios and methods to achieve energy independence patterned on the Space Program, Interstate Highways and WWII.

- **Financing Energy Independence:** Proposes national programs with sound revenue streams to replace inadequate and fragmented projects spending using variations of the self liquidating Federal-Aid Highway Act. Other public/private financing mechanisms will be defined and used as required.

- **Summary:** Hard Choices.

This white paper benefited from the views of civilian and military sources, energy experts and green energy and fossil fuels interests that provided review and comment on successive drafts, over a period of years. This is an on-going process that will culminate in achieving the goal.

II. Planning Energy Independence – NEP Planning Project

America dealt with an equally grave threat during our nation's "Sputnik Moment". If the Russians could build a rocket that could deliver a satellite into orbit they could deliver a nuclear weapon to the U.S. President Eisenhower placed part of the blame for America's lagging space program on inter-service rivalries. Each service was pursuing a separate space program…Over the next year, large changes in public policy were enacted…the job of sorting out the military's space program was given to a new organization, ARPA…the immediate effect was to transfer all military space projects to ARPA…ARPA spent seven months during which it had decision

making authority over the complete U.S. space program (before the formation of NASA) sorting through proposals and overlapping efforts to impose order to the Space Program (12).

When President Kennedy set the goal to send a man to the moon he turned to NASA to outline specifications for Apollo (13) and implement the program. In a similar manner, a project will be undertaken to plan NEP. This project could be implemented by request from President Obama to the appropriate government agencies or by an independent outside entity. This should occur as soon as possible in order to be able to produce a plan that will be available in time to impact the new administration as it comes into office.

This effort would normally be assigned to the agency with the energy charter – the Department of Energy (DOE). While DOE has "domain knowledge" to support this effort it lacks the program planning and management capabilities needed to lead; which is indicated by the fact that DOE hasn't achieved energy independence in the 35+ years of its existence and is unlikely to do so in the future. These capabilities reside in DOD and NASA. Both might participate with one or the other being the lead. This could be accomplished by expanding the DOD/DOE memorandum "Concerning Cooperation in a Strategic Partnership to Enhance Energy Security". The MOU defines specific activities; but, doesn't provide authority for DOD and DOE to work on NEP. This must be added by the Administration. The MOU in no way restricts the parties from participating in any activity with other public or private agencies, organizations, think tanks, or individuals (14). Therefore, the project could be implemented by an outside entity or entities with DOD, DOE and NASA participation.

As in the past, a national energy policy and program must have a unifying national goal to break the gridlock and achieve passage in Congress. If the goal presented in this white paper isn't acceptable, another should be chosen in during the project that can achieve a broad consensus. "Democratic command" won't work without stakeholders and the American people on board.

The project is divided in three parts:

- Program design
- Organization design
- Legislation

1. Program Design

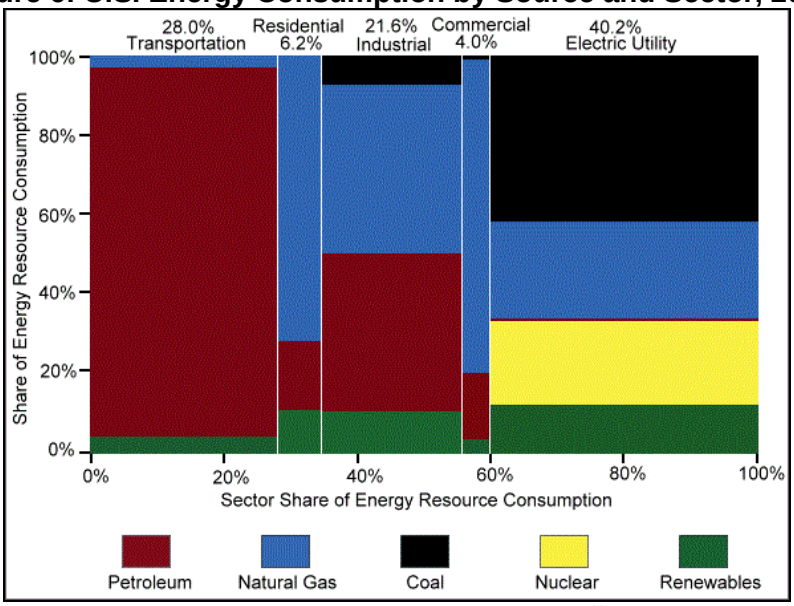
In the words of Dwight Eisenhower "the basic principles of strategy are so simple that a child may understand them. But to determine their proper application to a given situation requires the hardest work by the finest staff officers…this planning meant the toilsome drudgery of grinding countless unrelated facts into homogenous substance…everything remotely concerned…was grist to our planning mill" (15). Planning skills must be taught in public policy programs at our colleges to enable future leaders to solve long term problems that are as complex today as any faced by the greatest generation. (Making it up as we go along producing calamity must end)

At the most basic level, planning requires an understanding of the difference between a "project" and a "program" and the ability to define and achieve clear long term goals and objectives. President Obama mentioned funding the Apollo projects of our time in energy in his State of the Union message in 2010. He then mentioned electric cars and passenger rail in the same breath as Apollo as though all were projects. In so doing, he joined seven presidents before him that went on television to promise an energy independent future, short on details, promoting gridlock pandering to their green energy and fossil fuel constituencies.

Apollo wasn't a project; it was a program. Programs achieve "ends" - goals and objectives - sending a man to the moon, building the highways, achieving energy independence, etc. Ends, priorities and timelines must be defined and agreed upon FIRST. "Means" – work elements (assemblies, tasks and projects) – can then be defined and "rank ordered" to define the proper mix to achieve agreed ends.

Perfection of means and confusion of ends seem to characterize our age (16). Concentration on competition between means (ex: electric cars, passenger rail, Keystone Pipeline, shale gas, cap and trade, etc.) before defining ends has produced gridlock and green energy on fossil fuels since the OPEC Oil Embargo. We will remain in gridlock if we keep doing things backwards. We will get nowhere until we focus on the fact that our addiction to imported oil is a grave national security threat and use methods that have been successful in dealing with such threats in the past.

Figure 6: U.S. Energy Consumption by Source and Sector, 2012



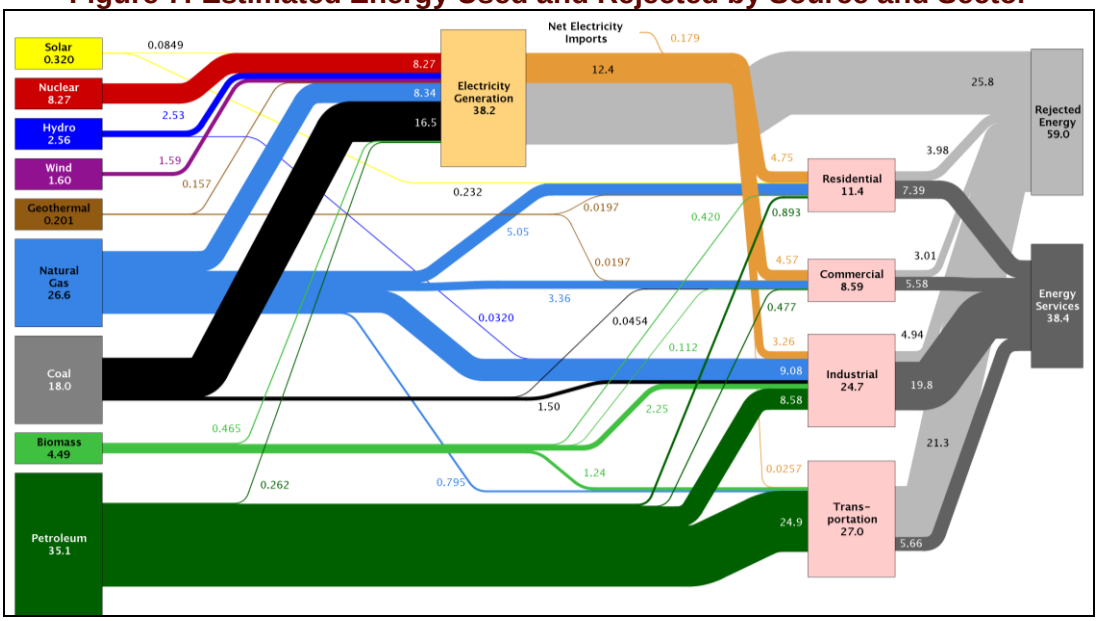
Source: DOE, EERE, Vehicles Technologies Office
http://www1.eere.energy.gov/vehiclesandfuels/facts/2013_fotw792.html

Energy independence will be achieved when the quantity of imported oil as part of total oil and other liquids used in economic sectors is replaced from other sources as required to achieve the goal. U.S. energy consumption by source and sector is shown in figure 6. Energy efficiency will be one of the largest sources for replacement and emissions reduction. Energy used and rejected by source and sector is shown in figure 7. Priority will be given to each sector based on comparative oil usage. Priority in each sector will be given to each means and supply chain based on the ability to achieve the sector objective. GHG emissions by sector were presented in figure 2 and will be treated in a similar manner. Energy consumption, production, waste and emissions profiles and trends for each sector will be developed to be used as a baseline for planning.

The military oriented, performance driven, time bound program management system used for Apollo is adapted to plan and achieve objectives in each sector and the goal. This approach is used to solve a problem in an energy domain that is generally viewed by most Americans as being domestic and civilian; but, is in fact more multidimensional - military, civilian, foreign and domestic. Energy is central to and interfaces with many other domains. These interfaces are defined to place energy in proper relationship with other domains in the wider world in this white

paper. The methods used to produce a solution in the energy domain will lead to cooperation, structures, experience and momentum that will be useful in finding solutions in other domains.

Figure 7: Estimated Energy Used and Rejected by Source and Sector



Source: Lawrence Livermore National Laboratory 2014. Data is based on DOE/EIA – 0035 (2014-03) March 2014
https://flowcharts.llnl.gov/content/energy/energy_archive/energy_flow_2013/2013USEnergy.png

Programs generally produce "one-off" results; such as landing a man on the moon. After this goal was accomplished, the Saturn V launch vehicle was placed in mothballs and the Apollo infrastructure was adapted for the Space Shuttle. NEP isn't a one-off. Achievement of energy independence is just a milestone on the road to a sustainable energy future that will have to be accomplished though a continuing operation. Supply chain planning and management is used for such continuing operations in the military and industry and will be used for NEP.

Program Management is a method used to plan and implement defined goals and objectives from inception to completion that contains the following steps:

a. The President sets a goal and timeline. The goal, objectives and scenarios presented in this white paper are not set in stone and should be used as a preliminary specification for discussion purposes to begin the NEP planning project

b. Sector objectives to achieve the goal are defined by stakeholders that must be involved in implementation. Tradeoffs will be made to resolve differences between stakeholders and secure buy in.

c. Means – work elements (assemblies, tasks and projects) to achieve sector objectives are defined in tiers - level by level – down and across elements in a work breakdown structure (WBS). As will be discussed in the transportation sector section, the transportation supply chain is an example of down and across element assemblies that consists of: motor vehicles (transportation sector); cross sector customer/system interfaces (charging/fueling stations); and energy sources (power and fuels sectors).

d. Means are related to performing organizations – lead and supporting – in an organization breakdown structure (OBS). Public and private stakeholders operations have different, often incompatible structures and implement many of the same means using different terms (the military and civilians in particular). Stakeholder efforts will be analyzed and sorted by grouping similar activities under NEP sector objectives and means using agreed upon language and terms.

e. A cost/schedule system is developed to manage work elements to the smallest means.

f. All of the above are structured within a management framework wherein a change in any objective/work element immediately translates into impacts on all other work elements.

The architecture of NEP, a public/private sector enterprise, will differ from Apollo and other space and military programs that are publicly funded. Public and private stakeholders use different funding sources that need to be integrated to finance different means. Therefore, the NEP finance system will be designed to facilitate tailoring and mass production of investments on a case by case basis using corporation and government resources to cover shortfalls from other available sources. This system will use a "one-stop service" to enable parties to navigate the maze of government funding streams, regulations, contract types and public utility relationships to secure financing. Grouping of NEP, public/private sector and utility financing and incentives will enable development of standardized applications and procedures that project developers/energy consumers, government staff and financial institutions can use to integrate all available financing, incentives and support services.

Financial institutions serve markets based on market size, structure and potential for profit. The NEP financial system must be designed to generate the structured flow of large projects needed to secure sufficient interest from financial institutions. For example: the announcement by Bank of America of the largest residential solar photovoltaic project in American history illustrates willingness of financial institutions to match financing with the opportunity size and demonstrates the benefits of job creation, market aggregation and economies of scale. SolarCity/Bank of America are moving forward with project SolarStrong, expected to build more than $1 Billion in solar projects…to create 300 MW of solar generation capacity providing power to up to 120,000 housing units…The project will allow privatized military housing developers to save money on energy costs that can be reallocated toward quality-of-life improvements and enhanced services for military families… SolarCity expects SolarStrong [will] create thousands of full-time and temporary jobs...help DOD secure more of its energy needs from renewable resources operated in parallel with the utility grid (17).

After the program begins, existing stakeholder experience currently available from multiple sources in fragmented form should be researched, grouped and archived for efficient retrieval. This will, for example, enable government staff working on the DOD/DOE MOU to rapidly find examples of similar projects from all sectors for use in specific current projects.

2. Organization design

Gus Grissom, Ed White and Roger Chaffee died in a fire in the command module while preparing for the first crewed Apollo flight. This tragedy triggered an exhaustive investigation of NASA's procedures after which the government asked Boeing to provide Apollo TIE (Technical Integration and Evaluation); because of its experience coordinating far-flung complex programs like Minuteman. Boeing then assigned 2,000 Boeing managers to the project. The TIE personnel ensured that everything worked in an integrated manner and daily monitored millions of pieces of

hardware so that all the components of the spacecraft were in perfect working order. They also saw that contracts were met on schedule (18).

It is proposed that the public and private sectors will assume roles they played during the later days of Apollo. This will be accomplished by focusing organizational design on a public/private partnership corporation managed and operated by qualified private sector professionals. The public sector will provide: support capabilities; enabling legislation; available civilian/military government financing to leverage private sector financing; necessary regulation/deregulation and timely oversight. This approach reflects the approach of the American Energy Innovation Council, a distinguished group of business leaders, which proposes that the program should be structured as a partnership between the federal government and the energy industry, and should operate outside the federal government…focused on technologies that can achieve significant scale, freed from political interference and earmarking (19). Focus on the corporate form should not preclude analysis of alternative structures. The final organizational model will be incorporated into the legislation.

3. Legislation

The capstone of the project will be drafting a proposed "National Energy Independence and Defense Act". A key output of the project will be securing the agreement between stakeholders required to induce them to work with their constituencies in Congress to pass the Act. Positions on energy are as fractured today as issues relating to space were in 1958. Congress was studying 29 different bills and resolutions dealing with space, spread between all three branches of the services, all with different plans. President Eisenhower harnessed the chaos by establishing a single space agency, a National Aeronautics and Space Administration (20). NEP will harness the existing chaos through securing consent of constituencies to establish an organization that will be able to manage achievement of energy independence.

III. Achieving Energy Independence – Objectives and Implementation Scenarios

Six top level objectives and implementation scenarios to achieve the goal are presented in this section. These objectives are incorporated in the Program Breakdown Structure in figure 8. The six objectives are:

- **Building & Processes Sector:** Replace oil use and reduce emissions in energy efficient buildings and processes that meet end user needs and achieve the goal.

- **Transportation Sector:** Replace oil use and reduce emissions in a conventional and alternative motor vehicles fleet that meet end user needs and achieve the goal.

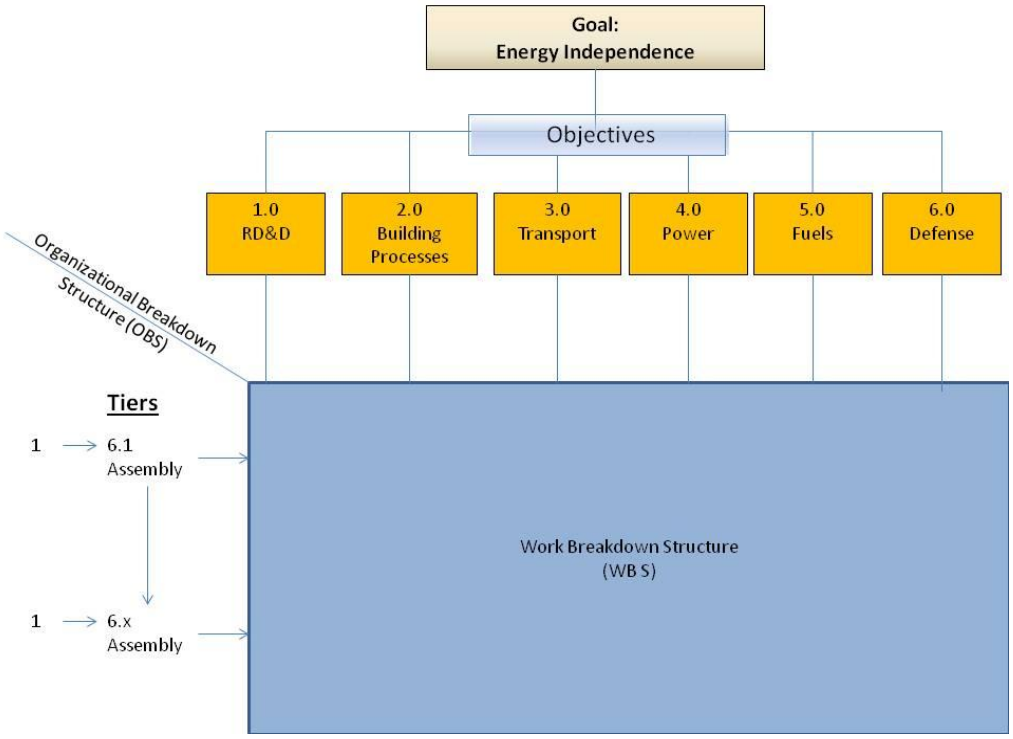
- **Power Sector:** Replace oil use in end user facilities and reduce emissions in an energy efficient, safe and secure 21st century power sector that meets end user needs and achieves the goal.

- **Fuels Sector:** Replaces oil use and reduce emissions in a fuel sector that achieves the goal and will always be able to provide fuel for vehicles on our roads and tanks on the battlefield.

- **Defense Sector:** Replace oil use in an energy efficient U.S. military that has the operational energy security to go and win America's wars without initial access to theater bases and energy supplies.

- **Energy Technologies Research, Development and Deployment (R, D&&D:** Develop and deploy energy technologies in "rank order" based on ability to achieve sector objectives and the goal in a decade.

Figure 8: NEP Program Breakdown Structure (PBS)



1. Energy Technologies R, D&D

Today, energy technologies R,D&D is conducted in a fragmented manner by industry, government, the defense establishment (DOD and vendors), laboratories and academia working at times separately, together and often in competition. Few projects cost $100 million with many large and needed projects not being undertaken properly or at all. There is no plan or timeline, minimal coordination, much duplication and waste, inefficient technology transfer and long time periods between research, development and deployment.

The problem here is that energy business R; D &D requires investments of capital at a scale beyond the risk threshold of most private sector investors. This high level of risk, when combined with existing market structures, limits the rate of energy equipment turnover. A slow turnover exacerbates the historic dearth of investments in new ideas, creating a vicious cycle of behavior [which may explain why]…the U.S. energy industry and the U.S. government together invest a mere 0.3% of total private sales in public and private R&D; which contrasts with 18.7% in the pharmaceutical industry and 11.5% in aerospace and space (21).

The current market based approach also doesn't consider the grave national security threat and short time line to eliminate it. Therefore, the approach used will draw on the experience of Apollo and WWII that dealt with time critical threats. R, D&D will be centrally managed to integrate the efforts of government, industry, laboratories and academia. Green energy and fossil fuel technologies will be developed in rank order based on potential to achieve the goal. Technologies

that produce the greatest results will receive priority, financing and crash development. There will be winners and losers – a common occurrence in both the public and private sector. Therefore, a portfolio of technologies will be developed; because some won't pan out and/or a mix will be required. Multiple vendors will be funded to insure that the timeline is met. Older technologies will be replaced as required to keep pace and the plan will be modified accordingly.

A brief recounting of R, D&D during Apollo and WWII provides an understanding of how the sector objective will be implemented. Apollo had an estimated cost of $181 billion (22) (All costs in this white paper are in 2011 dollars unless noted (23)). The largest project in the program was the Saturn V launch vehicle - one of the greatest R, D&D feats of the 20th century – that cost approximately $41 billion. The largest WWII projects were the Manhattan Project and B29 that respectively cost $32 billion and $37 billion. There were many smaller and less costly projects. All efforts were implemented largely to plan and on schedule.

The crash development approach that produced the Atomic Bomb from theory to delivery in five years could, for example, be used to develop and deploy a competitive, commercial vehicle battery, fast charging systems and core national charging network in a similar time frame. Such systems would reduce use of the internal combustion engine going forward. In a similar manner, rapidly developing and deploying other competitive alternatives to conventional fossil fuels during the "NEP decade" will increase their use to the greatest extent possible and, through export, change the world's energy use profile going forward.

Implementation of energy resources R, D&D will require a focused and well coordinated effort comparable to the similar efforts of the past. The current approach - business as usual, free market operation with minor additional support by government - hasn't worked since the energy crises of the 1970's and can't be relied upon to work now.

The corporation will request proposals to achieve sector objectives. Hard selection criteria will be used to evaluate proposals (ex.: cost/benefit; co-investment and ownership; deployment potential within timeline and out years; support, service and fueling infrastructure and costs; risk and profit sharing arrangements, etc.). R, D&D will be conducted as a continuous process to bring new products to market ASAP. Smaller businesses with technologies that meet program objectives will be incubated based on priority. Significant leveraging of the corporation's investment with private sector investment will be achieved. The potential for such leveraging was shown by the 2009 American Recovery and Reinvestment Act [that] appropriated $97 billion and mobilized roughly $100 billion more in private capital to invigorate energy related research and development (24). The corporation will receive an ownership interest for its investments with a good ROI for taxpayers. Revenues earned will be used to pay for NEP operations and reduce the national debt.

2. Buildings & Processes Sector

The buildings and processes work element is divided in three parts:

- Buildings;
- Commercial & Industrial Processes;
- Environmental Management and Useful By-products

a. Buildings

Advances in building envelopes, equipment and appliances, and integrated systems may make it possible to achieve a 70% reduction in building's energy use by 2025. With on-site energy

technologies, such as solar photovoltaics, it is possible that many buildings could become self-containing and even net energy producers. Smart building systems can integrate sensors, controls, and inputs from various building systems to inform an energy management system to optimize comfort and energy efficiency. Intelligent buildings can also communicate with the local utility to participate in peak shaving demand response activities to substantially reduce building owner's energy bills (25).

Existing utility based energy efficiency programs in buildings focus on electricity and natural gas, not oil (excluded by regulation) and only serve to achieve the goal peripherally when energy efficiency is produced in buildings using oil as the heating source. Government and utility programs tend to focus on providing fixed subsidies - rebates and tax credits - to install individual measures (e.g., Energy Star™ appliances, 30% solar tax credit, etc.), write checks or provide loans/loan guarantees, and lack back end delivery systems. They are also too fragmented to achieve national reach and economies of scale. And, there can be many dozens of independent, uncoordinated, uneconomic government and utility programs of varying quality in each state that sub-optimize the potential to leverage funds from the private sources.

The corporation will establish a national network of compatible state subsidiaries operating through regional and local offices. They will use a one stop shopping system to market, finance and mass produce customized energy efficient buildings solutions that reduce or eliminate oil use. Existing federal, state, local government and utility incentives and public/private sector financing will be packaged to provide customers with all available incentives and financing at the point of purchase. The corporation and its subsidiaries will not compete with local contractors and vendors or engage in anti-competitive practices as required by utility regulation. Their function will be to organize and manage a mass production and delivery supply chain to generate market growth and local employment. State subsidiaries will interact to share best practices and build larger markets to produce greater economies of scale and lower prices for consumers. The buildings component of this objective is divided in two parts:

- Conversion grants to replace imported oil use in buildings.

Replacement of imported oil is a matter of national security that should be paid for as we pay for defense when market forces won't suffice. A 100% grant will be provided to convert oil HVAC systems and make related improvements; because, conversion hasn't occurred, and won't occur at needed scale through market forces in a decade.

Conversion will be managed using an updated version of the mass production emergency repair grant program system a firm I owned used to manage repairs on tens of thousands of homes after declared national disasters under contract to the federal and local government. Emergency repair as performed by my firm and the proposed HVAC retrofit grant system are similar in that they install a limited list of work items using mass production methods. The difference is the list of items installed. Today, FEMA just writes checks, leaving homeowners to fend for themselves to find and manage contractors in a distressed situation. This approach fails in proportion to the scale of the disaster (ex: Hurricanes Katrina and Sandy).

State subsidiaries will work with utilities to schedule conversions to alternatives to oil on the customer side of the meter. Initial properties for conversion will be located in areas where utilities have adequate gas supply and delivery infrastructure. Installations will be "rolled out" as utilities build up this infrastructure. Property owners will be given a choice between geographically applicable green conversion alternatives where gas is unavailable. Existing conventional oil based

systems will convert to domestically produced, alternative drop in liquids as they become available. The program will:

- Act as the "customer's agent" to provide ease and convenience of installation (sign here and the job gets done for you free of charge);
- Arrange with suppliers for volume pricing, bulk purchasing of materiel, automated prepayment and logistics for contractor delivery or pickup;
- Recruit, screen and pre-qualify contractors to do installations and utility hookups;
- Arrange prices for installed items with contractors
- Coordinate with utilities to schedule properties for conversion;
- Prepare priced work orders for individual properties, packaged into blocks of multiple jobs based on contractor capabilities and transmit packages to contractors.
- Contractors pick-up pre-paid materiel, complete blocks, request inspection;
- Inspect blocks, certify completion to specification or produce punch lists;
- Owners sign-off on completed work. Disputes referred to arbitration
- Pay contractors through automated payment when blocks are certified complete.
- Contractors receive subsequent work blocks based on quality of work

- Energy Efficiency Purchase.

Giving money away is easy; selling a product customers will buy is hard. This requires delivery of a quality product at a good price and terms that are easy and convenient to buy. Longer term financing (Energy Savings Performance Contracts (ESPC's), Power Purchase Agreements (PPA's), Utility Energy Service Contracts, (UESC's), etc.) will be provided. Typical Non-recourse/Alternative Financing Structure is presented in Figure 9. Energy efficiency purchase should focus on installations with shorter term paybacks to generate volume. Example: the Empire State Building remanufactured its 6,514 windows onsite into "superwindows" which pass light but block heat. Requiring a third less air conditioning on hot days saved $17 million of the project's capital cost immediately, partly funding this and other improvements. In three years, energy savings above 40% will repay the owner's investment (26). Providing grants for conversion from oil will shorten paybacks and make installation more attractive.

A streamlined front end marketing, financing and sale system will be implemented to facilitate wider energy efficiency purchase. This system will be integrated with an expanded back end delivery system similar to the system discussed above. The front end system will:

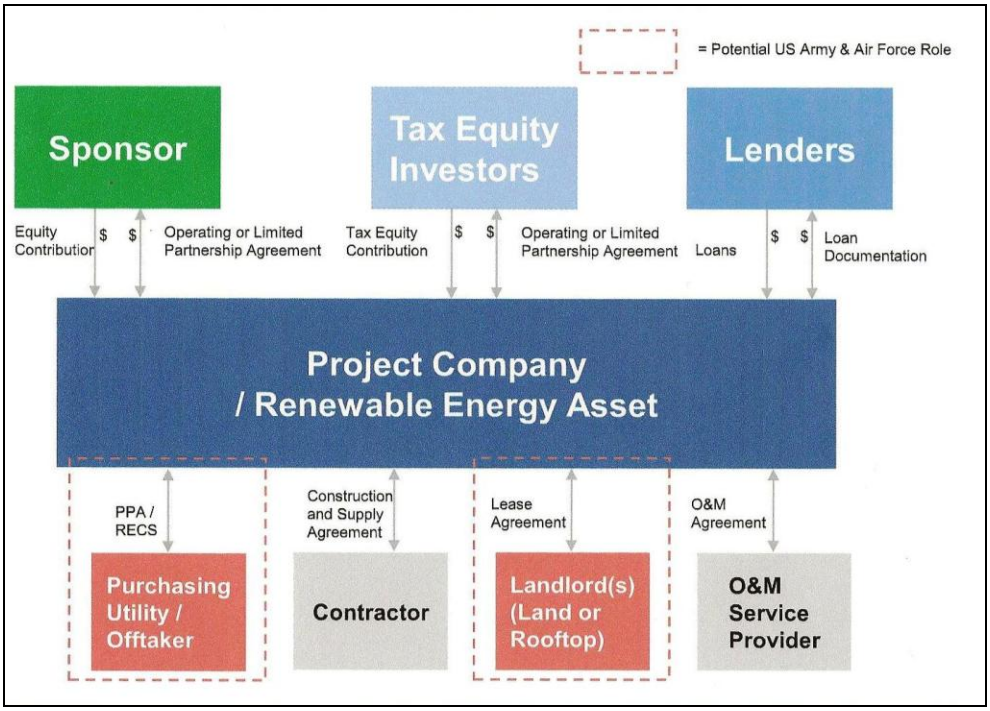
- Provide cost effective whole building installations tailored to individual customer needs;
- Use integrative factory to installation design;
- Wherever possible, provide financing with no up-front cost on terms that enable monthly payments for energy and improvements to be less than existing energy bills;
- Seamlessly integrate all available incentives to make retrofit a better deal;
- Provide good customer service and support;
- Make all systems and financing available through utilities, government programs and energy services companies.

The Buildings component will serve two markets;

- Mass market program – serves single family and small multifamily homeowners, multifamily housing owners of master metered buildings, and certain classes of small and mid-sized commercial customers that pay their own energy bills;

- Custom market program - serves all other residential, commercial, industrial and governmental customers;

Figure 9: Typical Non-Recourse/Alternative Financing Structure



Source: "Sources and Structures of Alternative Finance for Renewable Energy Projects on Military Bases", Extract from presentation at U.S. Army & U.S. Air Force Energy Forum by Jonathan Yellin, Managing Director Morgan Stanley Global Markets, July 2011, www.usarmyusairforceenergyforum.com

There will be differences in the mass and custom market programs. For example: custom projects will be larger, more complex and will be implemented on a one off basis rather than in blocks. Owner or renter paid energy bills must be handled differently. Solutions to many of these issues will require change in existing energy purchase/payment systems. However, certain principles will apply to across the board such as: national market development; integration of public/private sector activities; whole building solutions; seamless integration of incentives; quality installation; mass purchasing; and economies of scale, etc.

b. Processes

This component is divided in three parts:

- Buildings and structures that enclose commercial and industrial processes: will receive grant and purchase financing as defined in the buildings component above;

- Processes that use oil in business operations: will receive a flexible grant, financing, long term fuel purchase contracts, etc. on a case by case basis to make it attractive to convert processes from oil or make processes more energy efficient. Priority for grants will go to industries that use greater amounts of energy and applications that produce the greatest cost/benefit. Industries such as metals, petroleum refining, chemicals, fertilizers, glass, pulp and paper, and cement are very energy intensive, while others, such as automobile manufacturing, appliances, electronics, textiles, and food and beverages, are much less so…

- Processes R, D&D:…About 80% of industrial energy is used in motors, steam, compressed air, pumps, fans, process heating and combustion (27). Therefore, R, D&D in processes will focus of development of more efficient subsystems in rank order. The corporation will also provide support to industry to develop advanced technologies that change basic manufacturing, cost effectively convert from oil use and make processes more energy efficient. Revenues from processes developed will be used to pay for NEP operations and reduce the national debt.

c. Environmental Management and Useful By-products.

The economic value of America's wastes exceeds the GDP of many nations and contributes to degradation of land, water and air. While such profligacy was tolerated in better economic times, our nation's wastes constitute an untapped economic resource that is needed today. Wastes from buildings, commercial/industrial processes, waste treatment plants, etc. will be reprocessed as possible on a cost effective basis to produce power, steam, etc. for use in buildings, processes and other useful purposes. Best practices will be adapted across military and civilian lines as provided for in the DOD/DOE MOU. For example: the U.S Army "Net Zero" program that covers waste, energy and water could be tailored for cross market use. This program can best be described as an integrated process of design, decision making and operations that takes a "system of systems" approach… it is composed of three core components coupled in an enabling hierarchy:

- Net Zero Energy installations produce as much energy on site as they use;
- Net Zero Water installations limit consumption of fresh water resources and returns water to the originating watershed;
- Net Zero Waste installations reduce the amount of waste generated, reuse and recover waste streams and convert them into resources with zero landfill (28).

3. Transportation Sector

The transportation sector is responsible for about 70% of all the petroleum used in the U.S., and petroleum now supplies 96% of the energy used in the transportation sector. EIA projects that between 2005 and 2030 transportation sector energy use will grow about 18%, while petroleum use will grow 13%...Most of the energy use for transportation - about 59% - is used to power light duty cars and trucks (29). To achieve the greatest impact, this section focuses on motor vehicles and their supply chains. These supply chains will be built in "rank order" with the best potential to achieve the sector objective in a decade.

What is needed is an integrated, multi-pronged approach that cuts across Administrations and covers transportation fuels and vehicles (30) The scale and timing of the investment needed goes far beyond investment the automotive industry will make using a business as usual approach. No plan, timeline or sense of urgency that takes notice of the national security threat currently exists.

Sector transformation will require a public/private partnership and rapid, targeted investment such as occurred during WWII. President Roosevelt called Detroit the "Great Arsenal of Democracy". This arsenal integrated the effort of the defense industry and the automobile industry assembly line. Former automobile plants were retooled and new plants were built. These plants built everything from tanks to bombs to planes. Automakers and their suppliers produced approximately $400 billion worth of military equipment from 1942 to 1945 (31) using their own patents or licenses from other companies. This supply chain served 16 million members of our armed services and our allies around the world.

American automakers and producers of specialty vehicles will again be asked to retool their plants to incorporate technological advances as fast as they emerge from R&D. Industry conversion will be less complex than during WWII; because it will just focus on motor vehicles. The industry showed great versatility during the war and should participate in NEP in all areas where it can be effective. The aerospace industry, experiencing deep budget cuts, is a leader in environmental mitigation, lightweight/stronger materials, energy efficiency and alternative fuels. It also has key program management and information system skills. This industry should also participate in NEP in all areas where it can be effective.

We could not have won WWII without international cooperation and America can't achieve energy independence without similar cooperation today. Even with extremely ambitious programs no one country will produce the majority of innovation that the world needs. We need to learn from other nations and emulate their successes. Example: China mulls investments of up to $1.5 trillion over five years in seven strategic industries to accelerate the country's transition…to a leading purveyor of high-value technologies (32). NEP financing approach will produce a similar level of investment.

As previously discussed, programs generally produce "one-off" results; but NEP isn't a one-off. Achievement of energy independence is just a milestone on the road to a sustainable energy future that will have to be accomplished though continuing operations. Supply chain management is used for such operations in the military and in industry and will be used to manage continuing NEP operations. As defined in this white paper, supply chain management is an approach for "cradle to grave" planning, implementing and controlling flow of information, materials, products and services from raw material to customer fulfillment and life cycle support. In programs such as NEP, supply chain and program management are integrated.

Figure 10: Transportation down and across element supply chain

As discussed in the program design section: means are work elements (assemblies, tasks and projects) that are defined in tiers - level by level - "down and across" elements. Supply chains are an example of down and across element assemblies. As illustrated in figure 10, the transportation

sector supply chain consists of: motor vehicles (transportation sector); cross sector customer/system interfaces (charging/fueling stations) and energy sources (power and fuels sectors). Using a “net zero” approach, end of the life cycle incorporates reprocessing of scrapped, useful materials for use in new vehicles and for other useful purposes. Motor vehicles and customer/system interfaces are discussed in this section. Fuels are discussed in the next section.

a. Motor Vehicles

An alternative fuel vehicle is defined as a vehicle that runs on a fuel other than "traditional" petroleum fuels (petrol or diesel); and also refers to any technology of powering an engine that does not solely involve petroleum. Planning of alternative fuel vehicle supply chains will be conducted by making “apples to apples” comparisons to prioritize supply chains with respect to potential to achieve the sector objective. Profiles of each supply chain should be developed as baselines for planning. While many types of alternative vehicles exist - natural gas vehicles (NGV’s), all electric vehicles (EV’s), hybrids (vehicles using more than one fuel) - have the best potential to contribute to achieving the sector objective in a decade.

Natural gas is plentiful and has a lower cost and emissions than gasoline. NGV’s are similar to gasoline or diesel vehicles with regard to power, acceleration, and cruising speed. Their driving range is generally less than that of comparable gasoline and diesel vehicles because, with natural gas, less overall energy content can be stored in the same size tank as the more energy dense gasoline or diesel fuels. Existing vehicles will require costly engine conversion to compressed natural gas (CNG); which will be paid for by a grant for vehicles with adequate remaining useful life (This parallels payment for conversion of buildings in the buildings and processes sector section). Methanol is a version of gas-to-liquid (GTL) fuel that is ideal for transportation in large part because of its efficient combustion and low cost compared to all other fuels. Small modifications must be made to an engine to include methanol compatible components that generally cost less than 0.5% the cost of a new automobile (33). NGV’s can use cascade and buffered fast fill stations that provide a fueling time similar to conventional fueling (34). NGV”s require little R&D and use the existing natural gas production and distribution system; but will require integration into automakers assembly lines and supply chains and dedicated fueling stations. NGV’s should be fast tracked; due to the potential to convert a very large number of existing vehicles to natural gas in a short time period.

China’s growing appetite for methanol has ignited a renaissance in North America, where vast supplies of cheap natural gas from the U.S. shale boom are attracting Chinese investments into new methanol plants. The Chinese-fueled methanol resurgence can be seen in places like Texas City, that it is one of two Gulf Coast locations in the running for a $4.5 billion methanol manufacturing and exporting plant under development by a Chinese company. At full capacity, this plant would produce 7.2 million tons of methanol each year [170,000 bbls/day of oil equivalent] for export to China, making it one of the largest in the world (35). Large scale use of methanol on America’s roads isn’t happening; because America doesn’t have an open fuel standard requiring new cars to run on all alcohol fuels. It’s not just about us. If America won’t convert its natural gas surplus to Methanol, pass through to China is the next best alternative.

EVs use batteries that are charged by plugging the vehicle into an electric power source and take more time to charge than liquid fueled vehicles do to fill up. Currently available EVs have a shorter range per charge than most conventional vehicles have per tank of gas and have a very limited network of charging stations nationwide. These factors limit today’s electric vehicles to local uses sustained with longer charging times or overnight charging. The EPA categorizes all-electric vehicles as zero-emission vehicles because they produce no direct exhaust or emissions.

Because EVs use no other fuel, widespread use could dramatically contribute to reducing the oil gap and emissions. However, EV's will require extensive R&D to produce competitive batteries, fast charging systems (2-3 minutes) and a dedicated national charging network. Due to EV's great potential to contribute to achieving the goal, R, D&D will be fast tracked to enable deployment of the largest possible number of vehicles in a decade.

There are two main types of hybrids – electric and flex fuel. Hybrids contribute to achieving the sector objective by bridging the gap between today's conventional vehicles and tomorrow's completely alternative fueled vehicles. A conventional vehicle can be converted to a hybrid electric vehicle (HEV), a plug-in hybrid electric vehicle (PHEV), or an all-electric vehicle (EV). And, an HEV can be converted to a PHEV or EV. Such conversions provide options beyond what is available from original equipment manufacturers (OEMs). HEV/PHEV's reduce oil consumption and emissions. To the extent electricity replaces fossil fuel it should be paid for with a grant. Other than employing an ethanol-compatible fuel system and powertrain calibration, FFVs are similar to their conventional gasoline counterparts. The only perceivable difference is that the fuel economy is lower when FFVs run on blends above E10 (36). FFV's reduce emissions to the extent natural gas or other less polluting fuels replaces gasoline.

"Drop in "biofuels liquids" to be considered are ethanol and biodiesel. Ethanol is a renewable fuel made from corn and other plant materials. Ethanol use is widespread - almost all gasoline in the U.S. contains some ethanol. E10 (10% ethanol, 90% gasoline) is available at nearly every refueling station. The number of stations offering E85- a gasoline-ethanol blend containing 51%-83% ethanol, depending on geography and season - is smaller but continues to grow. However, biofuels require water – an increasingly scarce resource (America needs a national water program) - and should be prioritized accordingly. Biodiesel's physical properties are similar to those of petroleum diesel, but it is a cleaner-burning alternative and can reduce emissions. There are only a few hundred biodiesel stations in the U.S. (37). Based on type, drop in liquids require R&D, new plants, pipelines, freight transportation, and new fueling networks. This entails greater risk and should be prioritized accordingly.

Irrespective of engine and fuel type, reduction in oil consumption and emissions will be accomplished in all vehicles through: new Café standards, lightweighting, streamlining and improved logistics.

Existing CAFÉ standards will provide a 40% increase in the U.S. fuel-economy standard to 35 mph by 2020…Raising fuel economy by 10 mph nationwide will…save 1.1 million barrels of oil per day in 2020 - about half of U.S. imports from the Persian Gulf…and produce a reduction in greenhouse gases equivalent to taking 28 million of today's cars and trucks off the road…These savings will be largely negated in 2020 by increased driving (38). Strict new federal fuel-economy standards…set the equivalent of 54.5 mpg as the average the auto industry must achieve by 2025…the new rules derived from EPA regulation of pollution…set 163 grams of CO_2 emissions out of a car's exhaust that is directly linked to the amount of fuel it burns per mile as the target and that converts to 54.5 mpg (39).

A significant increase in fuel efficiency in motor vehicles will be accomplished through weight reduction. Two-thirds of fuel use is caused by weight, yet for the past quarter century, U.S. cars have gained weight twice as fast as their drivers. Now, lighter weight metals and synthetic materials are reversing automotive obesity. [Weight reduction of drivers would also improve fuel efficiency]…Rather than wringing pennies from old steel-stamping and engine technologies, automakers could exploit reinforcing advances in carbon fiber [and other lightweight materials] and its manufacturing (40).

12% of the petroleum used in the U.S. is used by commercial and freight trucks (41). In recent years, manufacturers have focused considerable attention on improving truck and tractor aerodynamics and have therefore achieved significant gains in fuel efficiency. For example: using a streamlined profile tractor with aerodynamic devices (roof fairing, cab extenders and side fairings) can reduce fuel consumption up to 600 gallons and eliminate five metric tons of green house gas emissions per year compared to a typical classic profile tractor [and advanced aerodynamics should be used for all vehicles going forward]…

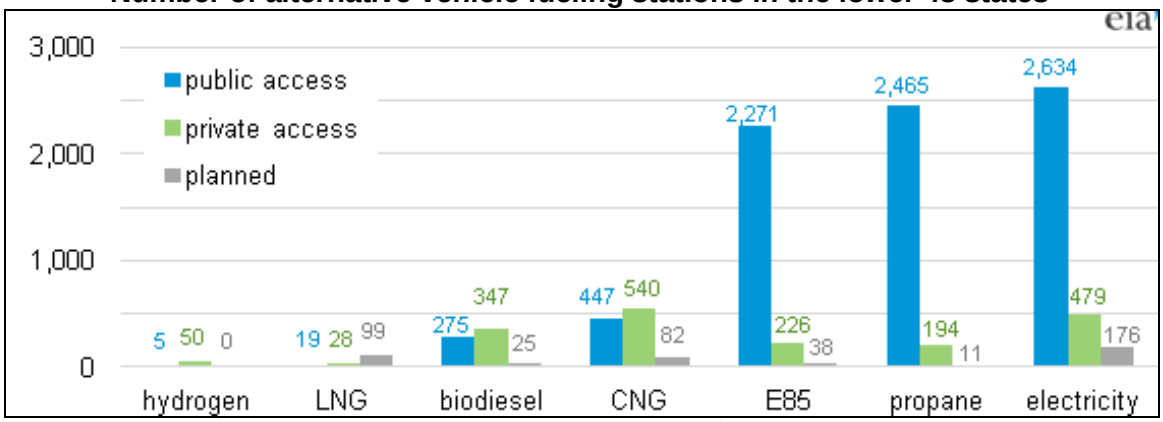
…One of the best ways to improve fuel efficiency is through efficient transportation management. Improved freight logistics can optimize trucking operation efficiency, saving fuel and increasing profits for trucking companies. Logistics strategies include load matching, more efficient routing and scheduling of vehicles, improved vehicle receiving policies…reduction of long-duration idling…and packaging materials (42).

Detroit has grown comfortable with the internal combustion engine business model. Without sharper market signals American automakers won't make the investments required on a schedule that will achieve the goal. Nations with sharper market signals lead in most areas. For example, Germany leads in "lightweighting". The corporation will make investments the industry wouldn't normally make using existing business models to induce integration of advances as fast as they emerge from R&D.

b. Fueling Stations and Infrastructure

The existing national network of gasoline stations exists; because, it was built up over more than a century in tandem with the growth of motor vehicles using the internal combustion engine and government investment in roads. In aggregate, there are currently only approximately 10,000 alternative fueling stations in the U.S., compared to approximately 160,000 gasoline stations in the country (43). Figure 11, indicates the number of existing and planned alternative fueling stations is inadequate to form the required national network.

Figure 11:
Number of alternative vehicle fueling stations in the lower 48 states



Source: U.S. Energy Information Administration, based on U.S. Department of Energy (DOE), Alternative Fuels & Advance Vehicles Data Center, as of March 27, 2012. Note: LNG is liquefied natural gas, CNG is compressed natural gas, and E85 is a type of gasoline-ethanol blend.

Maps of the location of these stations by fuel type (44) indicate that station building is so fragmented that an adequate, coherent, national alternative fueling station network won't be built

in the foreseeable future through market forces alone. Alternative fueled vehicles will not be produced at needed scale until the infrastructure and supply chains to support them are built.

To deal with this "chicken and egg" situation, alternative vehicles and supply chains will need to be built in tandem. This will be accomplished by investment in fueling infrastructure by the corporation as required to eliminate unacceptable private sector risk. Revenues earned will be used to fund NEP operations and reduce the national debt. The alternative fueling infrastructure and related dedicated fueling station network will be built in three stages:

- Local Nodes – to serve vehicles types owned and operated by government, industry, institutions, etc. that are able to operate fueling stations at their own locations for vehicles operating in urban and other distance constrained areas. Vehicle types will include: postal delivery vehicles, airport shuttles, construction vehicles, sanitation trucks, police cars, fire engines, utility and telecommunications service trucks, farm vehicles, etc.;

- National Core Network – to include strategically located fueling stations across the nation. This network will be sparse and provision will be made to ensure that vehicles don't run out of fuel between stations. This will require development of onboard systems to map all fueling stations, provide drivers with refueling warnings and location of stations within the driving distance of remaining fuel on board. Vehicles types will include: long distance trucks, recreation vehicles, inter-city buses, etc.;

- Complete National Network - build-out of a national network to provide fueling stations to serve all vehicle types.

Vehicles are of two types - fleet and consumer owned. Concentration should initially be placed on fleet vehicles. The concentration of buying power associated with fleet operators and fleet management companies represents a significant opportunity to assist early market development (45). The price of natural gas is currently so low that no trucking company would use diesel if their trucks could run on LNG.

Over the road trucking (OTR) fleets represent one of the greatest opportunities for natural gas to be used as a transportation fuel. These heavy-duty high-mileage trucks consume a lot of fuel and benefit from the lower cost of natural gas. Using natural gas in OTR applications reduces costs for shippers, carriers, as well as the end-user or consumer. Fleets are now deploying natural gas trucks that operate on either CNG or LNG; but, a large national fleet of NGV's will never come into existence until the fueling infrastructure to support them is built (46).

To rectify this situation, OTR fleet owners, oil and gas downstream operations, automotive industry and financial interests should work together for mutual benefit to plan to rapidly convert millions of trucks to natural gas and build a long range trucking NGV national core network. This will require the trucking industry to commit to conversion of an adequate number of trucks (possibly 1,000,000 trucks to start) to induce other stakeholders to finance, build and maintain the supply chain needed to support them. This effort could be economically viable. However, the corporation would make an investment to cover any shortfall between private sector investment and total investment required. (Government supported hobby shops won't get this job done).

Fueling stations can be standalone or integrated into company operations. For example: a leading third party logistics company, GENCO ATC, is partnering with customer Kimberly-Clark Corporation, Plug Power Inc., and the Aiken-Edgefield Development Partnership to launch the nation's first multi-use fueling station to supply hydrogen directly for industrial, commercial, and

government use. The station supplies hydrogen directly to Kimberly-Clark's 450,000 square foot distribution facility managed by GENCO ATC to be used with fuel cells powering Toyota forklifts…The supply chain industry estimates that annual greenhouse emissions created by an average 20 truck lead acid battery powered forklift fleet can be reduced by hundreds of tons a year simply by converting to fuel cell powered equipment (47).

Introduction of alternative fuel vehicles will run up against the declining ability of our crumbling highways to serve them. Alternative fuel vehicles will need to pay their fair share of the cost to build and maintain the highways; which is currently funded by a tax on gasoline. The gasoline tax is becoming obsolete as more energy efficient petroleum vehicles pay less at pump and electric cars and NGV's pay nothing. Going forward, drivers must be charged a Vehicle Mileage Tax (VMT) or other charge that reflects road usage and repair needs and apportions the real cost to rebuild and maintain our nation's roads by vehicle type, weight and how much and where vehicles drive. Systems exist to track mileage that would provide an accurate method to account and pay for road usage (ex: companies that monitor fleet vehicles now track cell phones and GPS devices in cars and trucks use mobile navigation programs). The cost to build the national fueling network for alternative vehicles could also be paid as an add-on in the VMT by vehicle type. This would eliminate the need to pay for this network in the purchase price of alternative fuel vehicles; lowering up-front cost and increasing market acceptance accordingly.

4. Power Sector

The power sector objective incorporates: creation of the 21st Century national transmission grid; optimized distribution grid and power production; energy safety and security systems adequate to deal with the current and future terrorist threat environment; customer/system interfaces and services; and, replacement of imported oil on the customer side of the meter. Fuels for power production are discussed in the fuels sector section. Replacing oil use on the customer side of the meter was discussed in the buildings and processes sector section.

a. National Transmission Grid

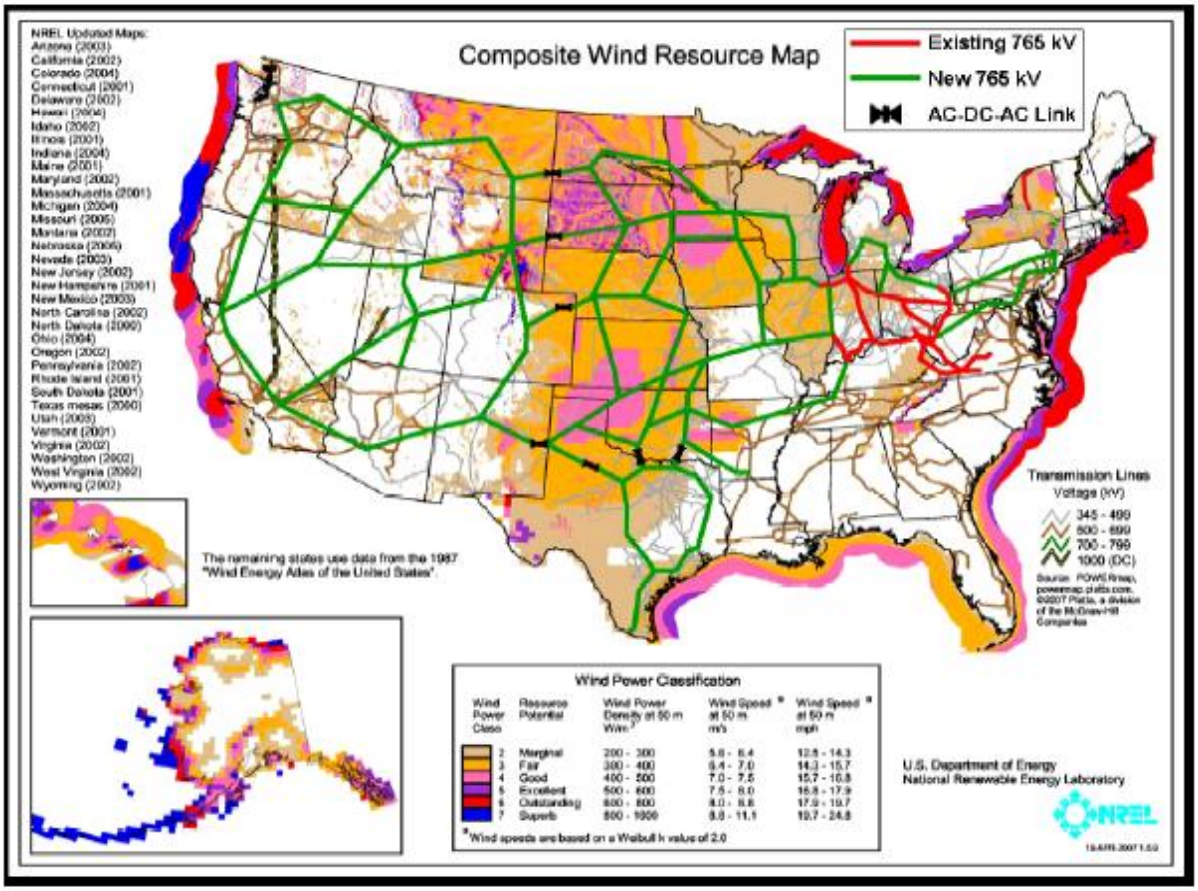
Rather than constituting a national network, the transmission grid is in effect a patchwork that is not subject to the jurisdiction of any common regulator - indeed, some areas are wholly unregulated at the federal and state level. This balkanized structure makes it difficult to both site and finance transmission lines (48). The real impediment to a national transmission grid is that state and regional regulators have jurisdiction over whether transmission is built, where it is built, and who pays for it. They are chiefly concerned with building transmission lines that benefit their state and typically neglect the national benefits of interstate projects (49). This stunts grid expansion to exploit opportunities presented by wind and solar energy, production of which is mostly in sparsely populated areas distant from significant electrical loads (50).

State and regional regulators also overlook limitations placed upon the current infrastructure to supply future demand. These limitations result from a decades-long lapse in regional transmission construction due to increased investment in gas-fired generation units close to load centers…until a federal entity has authority to site new transmission lines, conflicts between states and regions will continue to stifle progress toward a modern transmission grid capable of meeting 21st century energy demands…

…In 2008 American Electric Power working with DOE…designed a conceptual interstate transmission system illustrated in Map 1…This network of proposed transmission lines bears a striking resemblance to the layout of the proposed highways of the 1956 Eisenhower Interstate

Highway Plan…Whereas the highway plan focused on removing barriers to commerce by facilitating transit of goods and people, an interstate transmission network would remove barriers to commerce by facilitating the transit of energy (51).

Map 1: Vision of the Next Interstate at 765 kV



Source: "Interstate Electric Transmission: Enabler for Clean Energy", Michael Heyeck PE, American Electric Power, April 2008, p. 9. http://www.aep.com/about/transmission/docs/EnablerforCleanEnergy.pdf

It is important to do more than look at how energy is generated and consumed. Utilizing advanced transmission technologies can increase the efficiency and reliability of the energy supply chain. By viewing the system as a whole – including diverse generation, efficient delivery of energy and expanding smart grid initiatives – the maximum value of these efforts can be realized…We should be planning for an electric transmission system which meets the needs of the entire country rather than local fixes that compose the patchwork of today's transmission system… For example: A U.S. 765-kV transmission overlay illustrated in Map 1 would reduce peak load losses by more than 10GW and CO_2 emissions by 15 million metric tons annually (52).

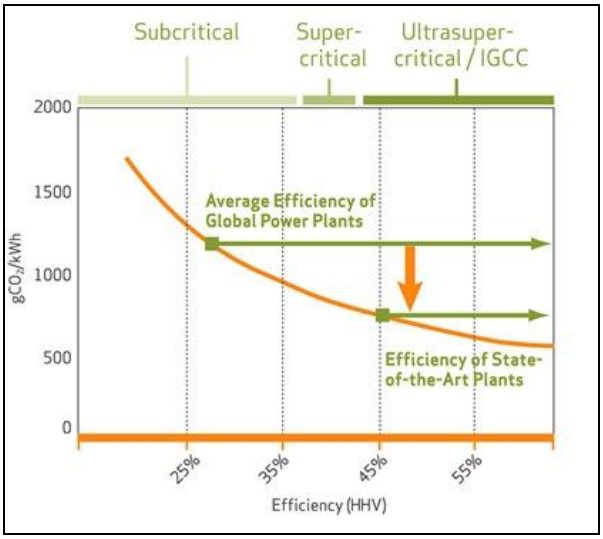
The justification for the interstate transmission system parallels the justification for the interstate highways. America's love affair with the automobile inspired President Eisenhower to launch what would become his principle domestic legacy. His justification to Congress was that he wanted more multilane highways to evacuate American cities in case of nuclear war (53). The same justification - national security – will be used to build the 21st century power grid; because this grid must be configured to be safe and secure from cyber attack.

The approach used to build the transmission grid will parallel the approach used to build the highways - central planning, self-liquidating national trust fund financing, eminent domain and local match (utility distribution grid level energy efficiency, GHG emissions reduction, safety/security, and customer fuel switching from oil to gas, other liquids and renewables). Priority in financing transmission grid improvements through NEP would be given to utilities based on the efficacy of their local match in achieving the power sector objective.

b. Power Production, Distribution and Environmental Management

Transformation of the power grid's antiquated plant and equipment is also required. This problem can't be solved through more of the same standard upgrades and inefficient power plants - the conventional utility approach. For example: in the U.S. the most efficient coal-fired plants achieve around 40% efficiency…while the U.S. is still debating whether to build a more efficient kind of plant that uses extremely hot steam, China has begun building such plants at a rate of one a month…construction has stalled in the U.S. on a new generation of low-pollution power plants that turn coal into a gas before burning it…20% to 30% of the power generated by a plant is currently used in Carbon Capture Systems (CCS) (54) making the process uneconomic and stunting deployment. [Converting waste heat to produce electricity will reduce this parasitic load and lower CCS costs]. As illustrated in Figure 12, a 1% improvement in efficiency of a conventional pulverized coal combustion plant results in a 2-3% reduction in CO_2 emissions. Highly efficient modern coal plants emit almost 40% less CO_2 than the average coal plant currently installed…deploying the most efficient plant possible is critical to CCS in the future (55).

Figure 12:
Improving the Efficiency of Coal-fired Power Plants Reduces CO2 Emissions



Source: IEA "Focus on Clean Coal (2006)
Note: 1% increase in energy efficiency = 2-3% decrease in emissions

Gas is the only fossil fuel set to increase its share of energy demand…The biggest advances in use of gas have been in power generation. A technological breakthrough, the combined-cycle gas turbine, a spin-off from the aviation industry, has transformed the economics of the industry. Not only has it made it cheaper to generate electricity from gas, but the process releases up to 50% less carbon dioxide than coal. As governments strive to cut greenhouse-gas emissions, replacing coal with gas will bring swift results. Already the share of gas in the overall energy mix, which remained at 16% from the late 1960s to the 1990s, has risen to 21%...Gas power stations are…

relatively cheap to build, beating nuclear power hands down in terms of capital costs, and in most cases they are also less expensive than renewables…And if gas is cheap enough and techniques such as CCS can be developed that make commercial sense, gas could thrive for much longer even in a world that had radically cut carbon emissions…

…Between 2006 and 2012 gas went from providing 20% of America's electricity to near 25%, mainly at the expense of coal. Cheap gas and environmental legislation under the Clean Air Act aimed at emissions of sulphur dioxide, nitreous oxide and mercury (but not carbon dioxide) from dirty coal plants accelerated a trend that is set to continue. For decades coal had provided well over half America's electricity. In 2011 coal-generated power was down to 42%, its lowest level since 1949, when records began. The EIA says the switch will speed up, with coal falling to just 36% of the total. Gas has wrought some remarkable changes. Over the past five years America has recorded a decline in greenhouse gas emissions of 450 million tons - biggest in the world (56).

The distribution grid's operating and telecommunication systems are antiquated. New planning and operating systems (new tools) that can produce a significantly more energy efficient power delivery system have been developed. They haven't been implemented and have fallen by the wayside; because they would have required real change in utility operations, culture and labyrinthine regulation. Their use will eliminate massive waste of money on unnecessary standard upgrades, line losses and customer losses from systems disruptions. Avoidance of these costs will help to pay to build the 21st Century Power Sector America needs.

The new tools will facilitate near real-time management and efficient interoperability of distribution systems with regional and national transmission. They will cost effectively resolve disputes between utilities and conservation/environmental movements and facilitate proper integration of standard upgrades, energy efficiency, renewables, production and emissions control in the distribution grid on an accurate, quantitative, cost/benefit basis. This is accomplished by:

- Grid optimization using multiple variables at the same time - power, voltage and emissions, etc. – to facilitate quantitative cost/benefit tradeoffs between conservation, production and emissions control;

- Enabling utilities to find 10% more power, not seen using existing archaic tools, without the need for hardware upgrades. This will enable utilities to meet existing energy efficiency performance standards at minimal cost. Energy efficiency is the cheapest and most cost effective way to produce new capacity and has the added benefit of zero emissions;

- Viewing the grid in its entirety, rather than in small sections using existing tools. This will prove that the avoided cost model (i.e., every MW in the grid has the same value regardless of placement) used by utilities to make investment decisions is wrong and that each asset has a definable locational marginal benefit (LMB). Use of LMB will enable placement of energy efficiency and renewables versus standard upgrades in the grid and buildings on a cost/benefit basis and significantly lower the cost to implement Renewable Performance Standards (RPS);

- Facilitating "generation to smart plug, light, and appliance" grid operation through integrated, intelligent, communications, command and control platforms that enable automated and wireless management of customer energy management systems and other building functions (i.e., cable, VOIP, safety, security, etc.).

c. Smart Grid, Grid Reliability, Safety and Security and end customer services

New technologies that allow each building or complex to be self sufficient for energy and load balance to meet available local generation/energy supply needs including the ability to auto source from numerous power sources simultaneously (i.e., solar, wind, diesel gen-sets, fixed/mobile distributed generation/cogeneration (DG), renewable energy and the local distribution grid) have also been developed. These technologies will provide sophisticated reporting and management of building security, environment (including air-borne bio and chemical hazards) lighting, communications, traffic patterns, and a host of other key services.

Defense Secretary Leon Panetta warned that the U.S. was facing the possibility of a "cyber-Pearl Harbor" and was increasingly vulnerable to foreign computer hackers who could dismantle the nation's power grid, transportation system, financial networks and government…He said he was reacting to increasing aggressiveness and technological advances by our nation's adversaries, which officials identified as China, Russia, Iran and militant groups (57). In particular, according to U.S. intelligence officials, both Chinese and Russian organizations have been attempting to map critical U.S. infrastructure, such as the electrical grid and pipelines (58). National security officials believe that cyberspies have penetrated the U.S. electrical grid and planted software programs that could be used to disrupt the system (59). Hopefully, a successful cyber attack on the New York City power grid won't happen before everyone sees the danger. New technologies and DG can provide workarounds of grid problems and secure islanding of strategic and critical loads after outages from cyber attack or naturally occurring events. However, DG on the customer side of the meter reduces utility revenues and appropriate regulation is required to enable utilities to participate in DG for strategic and critical loads on a profitable basis.

Attack on the grid is a key issue for homeland security today as it was in Iraq. Sabotage attacks cut the power flowing through more than 100 transmission lines that form the backbone of Iraq's electrical grid at the beginning of the American led invasion, and nearly 1,200 of the huge towers supporting the lines were toppled. Maintaining Iraq's power grid [then and is now is] fairly hopeless and DG – might have been a better option (60). I worked on a team that proposed a base load DG and microgrid (local power) system in Iraq in 2005 that wasn't implemented. This system would have deployed 2,000 MW of distributed power in 18 months operated from regional control rooms via an interactive C3 system using redundant wired and wireless encrypted communications. I also worked on the systems architecture of a power plant to smart appliance system using the new tools that integrated central and local power systems. At a minimum, such systems should be implemented in the U.S. in areas that are prime targets for cyber attack to securely island and keep strategic and critical loads in operation while the new tools provide rapid workarounds of outages. (Such systems in Iraq would have provided a pilot test of systems needed in the U.S.) Such systems could also avoid long wide area outages such as the northeast blackout of 2003 by rapid localization and automated reporting of outages.

The nation's electrical system is where telecommunications was 25 years ago (61). Utilities provide "dumb power" via one way synchronous connection through the grid central plants to "dumb customer loads" in much the same way mainframes provided data to dumb terminals in the 1980's. Utilities are beginning to implement the "Smart Grid" that provides two way asynchronous digital communications between utilities and smart meters (the new customer/system interface); which enable customers to manage load purchases and customer owned local DG as individual units and in microgrids.

Our utilities are museum pieces that operate as monopolies, as the phone company once did…They have no incentive to replace aging infrastructure (62) and face many obstacles to

modernization. Utilities will implement incremental changes, such as Smart Grid deployed on the customer side of the meter. Such changes are easier to implement than change on the utility side of the meter within the existing regulatory structure. Utilities haven't implemented real change that will transform the grid and eliminate vast waste. Supportive financing and regulation at the national level is required to cut through the labyrinth of state and regional regulation. Without such change the 21st Century Power Sector will not be built in the foreseeable future.

5. Fuels Sector

The fuels sector consists of exploration, extraction, refining, production, distribution and marketing of conventional and alternative fuels. Components will vary by fuel type and all components must be considered as parts of integrated supply chains when comparing and ranking the viability of fuels for R, D&D. The fuels sector element is divided into three parts:

- Alternative fuels
- Fossil Fuels
- Energy Crises of the Future.

a. Alternative Fuels

NEP will be able to develop alternatives to conventional fossil fuels on a much faster track as a matter of national security than is possible through market forces. This will be accomplished as part of the work element to achieve the Energy Technologies Research, Development &Deployment (R, D&D) objective**:** develop and deploy energy technologies in "rank order" based on ability to achieve sector objectives and the goal in a decade.

The Global oil market is the world's largest supply chain, and the scale of oil consumption is unprecedented: three billion gallons a day. The current system, which took over a century to develop, includes exploration, extraction, refining, production, distribution and marketing and at each point is under pressure to expand to meet anticipated growth in global demand over the decades ahead…Many opportunities exist for alternative fuels to alleviate some pressures on the system… [However] massive amounts of capital will be required to introduce new technologies and feedstock into the supply chain at significant scale… [This capital will be made available through the corporation working in conjunction with private sector and financial institutions].

New alternatives and supplemental fuels require infrastructure not limited to production facilities and a distribution network…Alternatives [to fossil] fuels also have a different risk profile than that of traditional petroleum business and the risk profile differs for biofuel and [other alternatives]. Biofuel supply will vary depending on weather, crop availability and political forces may limit its growth depending on reaction to cross sector economic impacts (including geopolitical issues related to cross border economics). The risk profile for [alternatives from fossil fuels] is similar to oil; but, the high cost of production could limit its viability at a time of lower oil prices and its often elevated environmental impact may make it vulnerable to shifting political winds…

…Even without consideration of new alternative fuels, the capacity of all freight transportation options is currently becoming constrained. Additional freight for biofuels will only strain the system. Significant strategic issues related to the dispersive nature of alternative fuels feedstock, processing facilities and demand centers remain to be addressed as the scale of alternative fuel production and use grows. With synthetics there is a strong case for manufacturing very near the resource base; because, while some of the new fuels, such as synthetic oil shale crude from

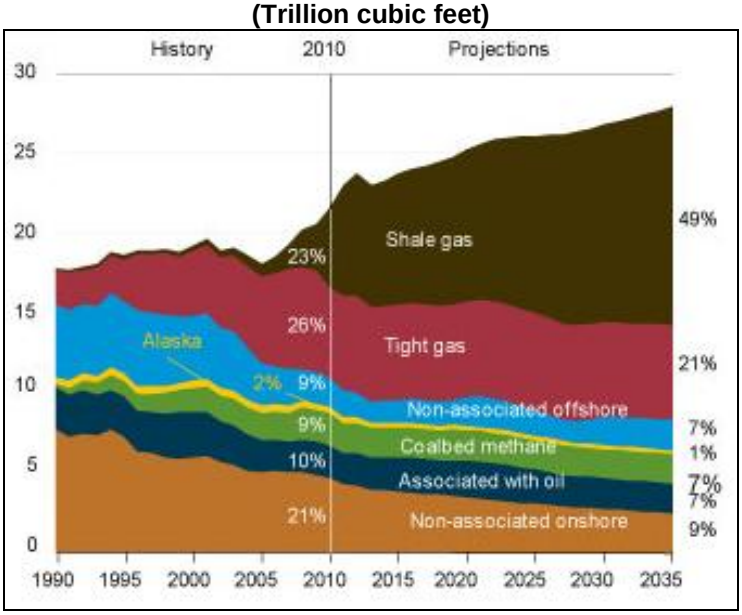
Alberta, are easy to plug into the system, others like biofuels may require entirely new production and distribution chains. For example: coal traditionally moves by rail to point of usage. If the production of coal doubles for CTL processing there will be an increased demand on an already strained railroad network to transport the resource from mine mouth to the processing facility. If CTL plants are built at mine mouths, there will be a need for more pipelines (63).

b. Fossil Fuels

Refusing to develop secure sources of domestic fossil fuel production has lead to an unnecessary over-reliance on imported oil… Though the U.S. will still require a significant amount of imported oil in the transportation and industrial sectors, a much greater portion of that oil will be produced within the U.S., preserving national wealth and reducing the amount of America's oil consumption that is directly vulnerable to a catastrophic oil supply disruption (64).

We must utilize our significant reserves of liquid fuels derived from coal, oil sands, and oil shale throughout North America…The U.S. Department of Interior estimates that the Outer Continental shelf contains 86 billion barrels of oil and 420 trillion cubic feet of natural gas…the U.S. has recoverable resources of coal equivalent in energy value to nearly 6 trillion barrels of oil; oil shale accounting to more than 2 trillion barrels of oil equivalent; and heavy oil and oil sands equal to another 154 billion barrels of oil equivalent, some portion of which can be converted to liquid fuels such as gasoline and diesel. Another potential source of significant amounts of domestic natural gas is methane hydrates, an ice like substance containing natural gas, found beneath the ocean floor and in the Arctic permafrost. The U.S. Geological Survey estimates there are some 317 quadrillion cubic feet of methane gas stored in hydrates in the U.S. This represents 1,600 times the amount of conventional natural gas reserves estimated in the U.S. (65).

Figure 13: Projected U.S. Natural gas production, 1990-2035
(Trillion cubic feet)



Source: DOE AEO2012 Early Release Review
http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2012).pdf

Projected U.S. natural gas production by type is presented in Figure 13. Shale gas - an "unconventional" source of methane, like coal-bed gas (in coal seams) and tight gas (trapped in rock formations) - has rapidly transformed America's energy outlook. At the same time

discoveries of vast reserves of conventional gas from traditional wells have pushed up known reserves around the world… IEA reckons that the share of gas in the global energy mix will rise from 21% today to 25% in 2035…over that period total global consumption will grow spectacularly. If the obstacles can be overcome, more gas and lower prices will mean a rise of 50% in global demand for gas between 2010 and 2035… Shale, along with new finds of conventional gas, will allow more countries to produce their own gas and make available gas for export from more places, many of which are less difficult to deal with than some oil-producing countries. Development of shale gas is vital to our national security; because, without shale gas, Russia and Iran will dominate the global gas market (66). Rapid conversion at scale from imported oil to domestic natural gas in buildings, processes and transportation will make a significant contribution to achieving the goal.

Natural gas is plentiful in America and worldwide. The key question is whether we will have enough oil at prices that will allow us to operate and grow the economy. We will never run out of oil, but rather soon the rate of extraction of oil priced to support economic growth will decline… "Peak oil" will occur when society is using – or the nations of the earth are extracting – oil at the highest rate ever, and at a higher rate than can be sustained in the future…For "peak oil" to be dead, as some optimists claim, the supply of affordable oil will have to continue to grow for decades (67). This is unlikely to happen. [As shown in a chart figure 1 and 4, EIA forecasts an oil gap of approximately seven MBD in 2025 in the U.S. This chart shows that while production of "tight oil" will grow, production from existing wells will decline, with the result that U.S oil production will peak by 2020 and decline thereafter]….

Tight oil (also known as shale oil or light tight oil) is petroleum that consists of light crude oil contained in petroleum-bearing formations of low permeability, often shale or tight sandstone. Economic production from tight oil formations requires the same hydraulic fracturing [fracking] and horizontal well technology used in the production of shale gas. The main source for tight oil extraction from shale deposits has mostly been in a few counties in North Dakota and Texas. While this oil has reversed the long trend of declining extraction rates, studies analyzing the histories of individual wells show rapid decline rates (often 40-60% per year, to a few percent for traditional wells) and relatively small areas (or "sweet spots") where fracking is economic, leading to the prediction that the shale oil boom will be short lived…

…The Canadian tar sands in Alberta currently yield about 1.5 MBD of bitumen - a product that can be refined into oil. However, the growth rate of extraction has been slower than forecast as the costs are rising, the environmental impact of tar sands oil production are substantial and the transportation and pipeline decisions can affect the economics of future production…

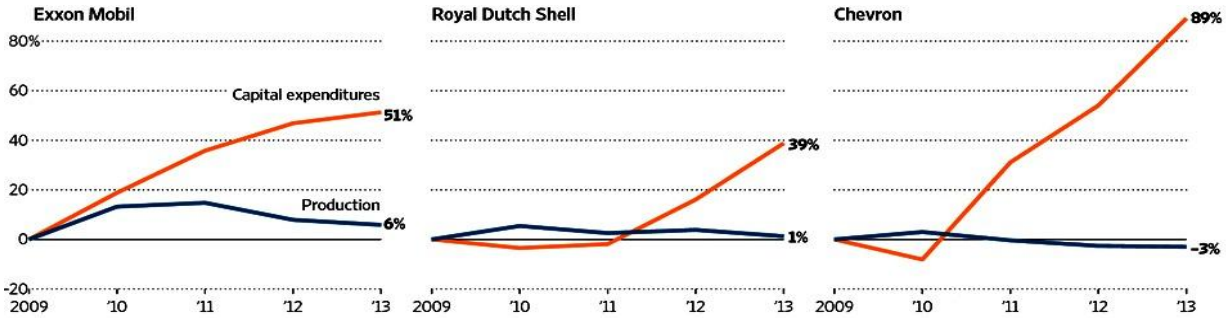
…Oil extraction from deep water resources, especially in the Atlantic Ocean near Brazil, and the Arctic is proving more difficult, more expensive and slower to happen than many expected (and promised)…It now looks doubtful that Brazil will ever become a net exporter of oil. After Shell's bad experience off Alaska, no major public oil company is currently drilling for oil in Arctic waters…[As was shown in figure 5] while oil extraction rates have increased in the U.S., this growth has largely been offset by declines in extraction and exports in other nations. Mexico's oil extraction is one-fourth lower today than in 2005. Brazil and Kazakhstan are having great trouble starting major new projects. Nigeria, Libya, Sudan and Iraq are all facing domestic unrest that challenges export levels…

…Oil exporting countries often increase their consumption levels faster than extraction rates, and consumption may continue to rise even if extraction falls. China, Indonesia, Great Britain, Egypt, Argentina and Malaysia have all changed from exporters to importers in the last twenty years (67).

Bottom line: as shown in figure 14, the world's major oil companies all suffer from some version of the same problem: they're spending more money to produce less oil. The world's cheap, easy-to-find reserves are basically gone; the low-hanging fruit was picked decades ago. Not only is the new stuff harder to find, but the older stuff is running out faster and faster (68). Absent real change, America and other energy consuming nations will remain dependent on imported energy from unstable and unfriendly nations for the foreseeable future.

Figure 14: Costly Quest for Oil

Exxon, Shell and Chevron have been spending at record levels as they seek to boost their oil and gas output. It has yet to pay off. Below, change in production since 2009



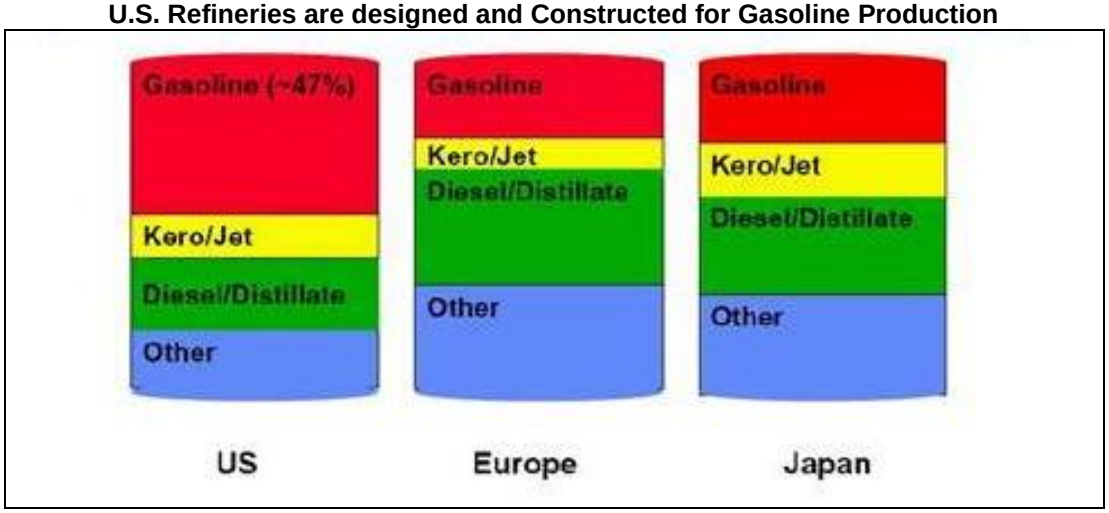
Note: Spending in 2013 reflects company estimates. Source: the companies. Wall Street Journal

Under the Net Zero approach, wastes from the energy supply chain will be turned into profitable by-products to lower the cost to meet emissions reduction targets. For example: CO_2 is a green house gas to be reduced and a valuable by-product for which demand exceeds supply. Captured CO_2 can be sold to assist in energy production; but, infrastructure must be built to move CO_2 from power plants and other locations where it is emitted to where it can be used. There will be enough CO_2 available to recover 210 billion additional barrels of oil from existing worn out domestic oil fields for 29 years of U.S. consumption. As a bonus, the same rock formations that trapped the oil can be used to store the CO_2. About one-third of the world's natural gas reserves are mixed with high levels of CO_2. For example: In Exxon's natural gas fields near La Berge about 65% of the gaseous mixture from the wells is CO_2. Natural gas is only 22%. Exxon currently captures four million metric tons of CO_2 at La Berge (69).

Refining capacity is a key constraint on supply … there is a significant mismatch between the product requirements of the world's consumers and refineries' capabilities… [requiring reciprocal] imports and exports of finished products. As shown in figure 15, Europe is emerging as a middle distillate [diesel] market and the U.S. remains firmly in the gasoline mode [as diesel demand has grown in Europe, gasoline became surplus and was exported - much to the U.S]… In the U.S. there is considerable capacity to convert middle distillate to gasoline. Converting light products to middle distillate is much harder and there are few processes available…other products include ethane, LPG and naphtha which are extensively used in petrochemical production. Total demand may exceed the refinery capacity…as condensate and LPG may not be processed in a refinery and are counted as other demand (70).

The world is not well equipped to deal with light sweet crude becoming much more expensive in coming years. When we are eventually forced to use heavy sour crude that requires more sophisticated and expensive refineries most countries will be caught off guard.

Figure 15: Refinery "Cut of the Barrel"
U.S. Refineries are designed and Constructed for Gasoline Production



Source: Jim Williams 2007 American Petroleum Institute Diesel Fuel, Use, Manufacturing and Supply, http://www1.eere.energy.gov/vehiclesandfuels/pdfs/deer_2007/session7/deer07_williams.pdf

On a global scale, as regional refining centers seek to optimally meet their respective demand for products there are supply/demand imbalances which drive inter-regional global trade. For example, as indicated in figure 16, under normal circumstances excess gasoline from European refineries will continue to satisfy U.S. demand. Similarly, as indicated in figure 17, refiners will compete to satisfy the shortfall in local European diesel supply. This situation may be marginally acceptable today; but, it could quickly become unacceptable during energy crises in the future.

It should be noted in figures 16 and 17, that Europe is dependent on Russia for diesel and gas oil. Our dependence on Europe for gasoline is dependence on Russia to maintain the flow of crude and refined oil to Europe. Russia's strategy of buying up European oil refineries could compromise the bloc's energy security and our security, should war between NATO and Russia occur. We must have oil for cars on our roads and on the battlefield no matter what happens.

Figure 16: Gasoline Refinery Supply/Demand Balance Comparison (MBD) (2009-2015)

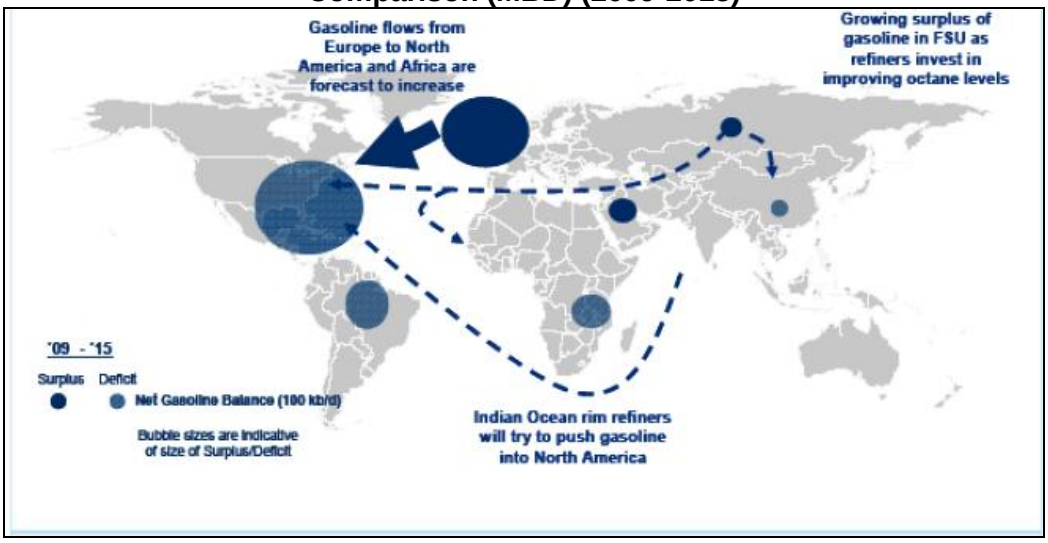
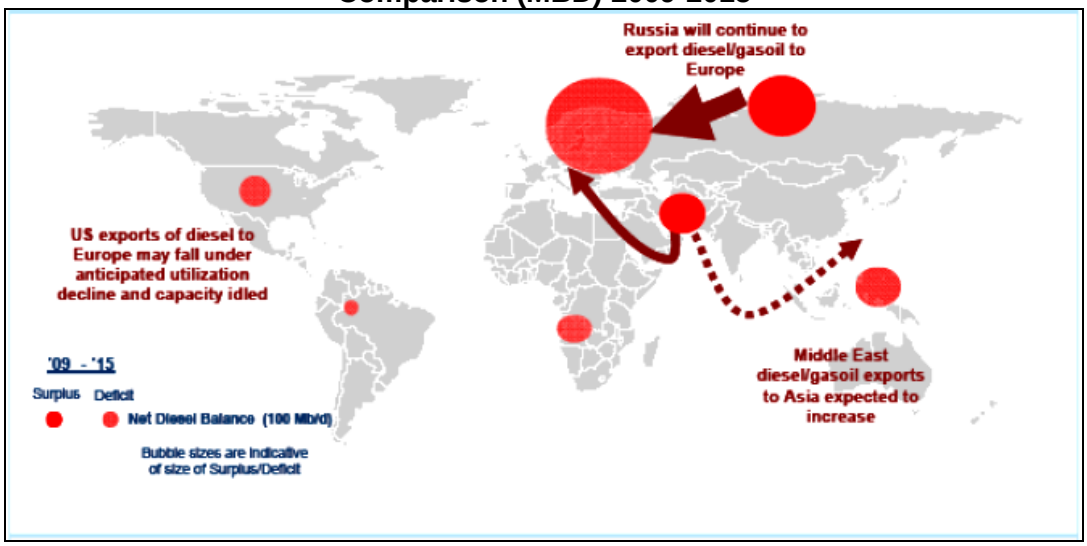


Figure 17: Diesel Refinery Supply/Demand Balance Comparison (MBD) 2009-2015



"Outsourcing U.S. Refining? The case for a strong domestic refining industry", American Petroleum Institute, June 2011, http://www.api.org/~/media/Files/Oil-and-Natural-Gas/Refining/API_Case_for_US_Refining_WoodMackenzieReport.pdf

c. Energy Crises of the Future.

I remember sitting in my car in a gas line during the OPEC Oil Embargo of 1973 thinking that if we were at war with nations that cut us off our crude oil our tanks would be in the same line. The Joint Forces confront problems associated with moving forces over great distances and then supplying them with fuel, munitions, repair parts, and sustenance…failure to keep joint forces supplied…could lead to disaster, not just un-stocked shelves (71). The Joint Forces must be able to domestically source all refined oil needs to deal with unforeseen contingencies.

Growing instability, unforeseen events, a severe energy crunch – individually or in combination – could lead to long term energy crises and chaos. Turmoil in energy producing nations is on the rise, with increased potential for future combat operations…The implications for future conflicts are ominous…should states see the need to militarily secure energy resources. A severe energy crunch is inevitable without a massive expansion of production and refining capacity (72)**.** With each passing year, the global oil trends now at work – rising consumption, reduced spare production capacity, politicized investment strategies, and high levels of instability in key exporting countries – all increase the likelihood of an oil crisis (73). And, bi-lateral deals make energy markets less flexible and able to deal with emerging crises.

To visualize the potential for such scenarios consider how the Persian Gulf War could have played out differently. Saudi Arabia's oil fields are in the east on the Persian Gulf and could have easily been taken by Iraqi forces. From the logistician's perspective, if Saddam had seized control of the major Saudi ports and airfields any subsequent effort to retake the Arabian peninsula would have been immeasurably more difficult and costly (74). Even with complete Saudi cooperation, excellent ports, bases and fill-up at local gas stations [and catered meals on wheels] it still took allied forces six months to move, supply and position forces to attack. Vulnerability to attack as we put our forces and logistics in place during Desert Shield was considered every day. What will we do if the Iraqis decide to attack today? This scenario was updated continually; as pertinent information became available…To this day it remains a mystery why Saddam Hussein didn't continue to advance through Kuwait and on through Saudi Arabia (75)**.**

Without access allied forces would have had to fight their way into Saudi Arabia over a long period of time with increased casualties. Saddam Hussein could have held the oil fields in Saudi Arabia and Americans in their cars in long lines at gas stations hostage for years to negotiate favorable terms. Without local filling stations and the world oil market in chaos, where would our tanks have gotten gas to fight? And, if Iraqis, in withdrawal, destroyed the oil fields of Kuwait and Saudi Arabia, a key portion of the world's oil supply would be out of commission for years.

In answer to a question from a reporter, General Norman Schwarzkopf said with a smile, "I hope you don't think Saddam Hussein is a good general. Above all, Americans must not allow themselves to be deluded into believing their future opponents will prove as incompetent as Saddam Hussein. Luck isn't an acceptable military strategy.

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Iraq was created as lines drawn on a map by the British colonialists to maintain lines of communication to India, extract oil wealth and maintain control through compliant Sunni despots. America's real interest in Iraq has always been oil. Our presence began with an oil find that resulted from the 1928 "Redline Agreement" by the "Seven Sisters" to carve up the oil wealth within a line drawn on a map to include the entire ex-Ottoman territory in the Middle East including the Arabian Peninsula (plus Turkey) but excluding Kuwait. The power struggle that ensued after the British puppet King Feisal II was assassinated resulted in government takeover by the Baath Party led by Saddam Hussein. A coalition led by the U.S. overthrew Saddam Hussein and there was an opportunity to establish a democratic state.

Over and over in Iraq, and in the Mideast, bewildered Arabs repeated this mantra in the 2000's: "We thought you Americans could do anything. How did you make such a mess in Baghdad?" (76) Iraq was lost when Nuri al-Maliki formed a Shiite dominated government with Muqtada al-Sadr shutting out the Iraqiya coalition and the Sunnis. Today, Iraq is breaking down along predictable lines and is descending into chaos. Syria is already there. And, both are suffering the fate of other nations created by colonial powers to serve their interests that made no sense as nations and could only be held together at gunpoint. Iran won, China got a cut of Iraqi oil and America was squeezed out.

As America's footprint shrinks in the Middle East, Sunni and Shiite ratchet up a conflict to determine the successor to Muhammad that dates back to the 7th Century. Iran's alleged aim to develop nuclear weapons, interference with Shiite populations in the Gulf States and in Iraqi, Syrian and Lebanese politics and growing conflicts feeds fears in friendly Sunni states that Iranian ascendancy might tip the balance of power towards Shiite domination of the Middle East. The origin of these events is blowback from C.I.A overthrow of Iran's democratically elected government to protect Britain's oil monopoly from nationalization and America's installation of the Shah to serve its interests (77). With nationalization intact, a consortium of foreign oil companies marketed Iran's oil, with Britain surrendering a large share to American oil companies for services rendered. After 25 plus years of wealth extraction, the Shah was overthrown and replaced by an Islamic Republic. Iraq invaded Iran with support from America and Gulf States and the ensuing war produced one million casualties. After 30 plus years of U.S. sanctions and frozen relations, the Iranian regime sees America as an unrelenting threat and acts accordingly.

Saudi Arabia is aware that China and Asia are the markets that drive demand and may be less compliant to our needs in the future. More than half of Saudi oil now flows to Asia, compared with the 14% that flows to the U.S. In February 2012, China imported 1.39 MBD from Saudi Arabia. That was 39% higher than in February 2011…In what Riyadh calls "the largest expansion by any oil company in the world", Sinopec's deal with Saudi Aramco will allow a major oil refinery to become operational in the Red Sea port of Yanbu by 2014 (78). China and Saudi Arabia

are also building a refinery in Kunming in Yunnan Province in China. This refinery will be served by pipelines running through a transportation corridor through Burma that originates at a Chinese base at Sittwe on the Bay of Bengal. China's investment in oil infrastructure and refining capacity is unparalleled. It executes a consistent strategy of developing world-class refining facilities in partnership with OPEC suppliers. Such relationships mean economic leverage that could soon subordinate U.S. relations with the same countries. China is also buying up energy resources eliminating their availability to world markets. It is likely that China will act in its own interests, not world interests, during future energy crises making matters worse.

U.S. dependence on the long-haul Middle East has fallen sharply …since oil is a global market, the relevant measure for that vulnerability is not U.S. dependence, but world dependence on Middle East oil - and that has not shrunk… Demand among the developed countries in the OECD has already peaked, but non-OECD developing countries want more oil to fuel their burgeoning auto industries caused by a growth in wealth (79). Global energy consumption will grow 53% from 2008 to 2035 with the majority of the consumption, 83% occurring in non-OECD countries (80). China alone will account for more than 30% of the projected demand growth and will soon supplant the U.S. as the largest consumer of the world's energy resources (81).

Prudence demands preparation for a possible challenge in the Pacific; but it's important to distinguish between threats that are the most dangerous and threats that are most likely. Especially during challenging fiscal times the U.S. should not tailor its military capabilities for the Pacific at the expense of the rest of the world – particularly the Middle East - where economic, demographic and political trends make conflict more likely …As recent events have demonstrated, predictions of Middle Eastern democracy are premature at best. But, political change is frequently accompanied by violence. With numerous countries in political transition, the likelihood of future regional conflict is high (82).

Focus on the Middle East is also necessary because its energy resources are as vulnerable as they are critical. The Strait of Hormuz is the world's most important oil chokepoint due to its daily oil flow of almost 17 MBD in 2011… The Strait is only part of the chokepoint at the entry to the Persian Gulf. Tanker channels extend nearly 100 miles to the West part of the Iranian and Iranian held islands…As is the case in the rest of the Gulf which is never deeper than the length of a nuclear submarine – current and depth affect mine operations and "noise" can conceal submarines and submersibles… The military geography of the Gulf extends beyond the coastline and includes civil as well as military and petroleum facilities… [Example:] Saudi Arabia's Ras Tanura is the world's largest offshore oil loading facility [and]…provides a larger area target and a facility where a precision attack, sabotage [or Iranian ground to ground missiles] could do major damage…conflict can occur anywhere in the Gulf and even low-level threats and "wars of attrition" can affect petroleum cost and tanker movements…any serious interruption in the Gulf supply will affect roughly 30% of World liquids production through 2035…Asian states are exceptionally dependent on Gulf exports. Any contingency would so threaten the global economy that it would almost certainly lead to a massive military response to secure Gulf exports (83).

Prudence demands that adjustments be made in the fuels sector as soon as possible to avoid destabilizing long term disruptions at home and abroad that could accompany a conflict or terrorist attack on key facilities in the Persian Gulf or elsewhere. Our military will then be free to deal with any such scenarios; because civilian leaders won't have to choose between supplying cars on our nation's roads and tanks on the battlefield.

As supply/demand conditions tighten as the world economy rises from the U.S. sub-prime debacle, Saudi Arabia's ability to act as a "swing producer" to increase output during crises to

stabilize energy markets will decline. The main risk to Saudi exports may come from rising domestic demand unless the Saudis establish fair market prices for their own use of oil and gas (84). Removal of subsidies is unlikely and is part of a growing trend. King Abdullah recently pledged $131 billion for public sector jobs and large wage hikes for government employees to keep dissent at bay (85) and continue to keep his people living in the past. The Wahhabi - Saud alliance that united the country in 1924 is older than the U.S. (This alliance captured Mecca and Medina briefly in the early 19th century before being driven out). Today, Wahhabi fundamentalism is a trace element in Islam and wouldn't be noticed without financing from Saudi Arabia and the Gulf States. Nearly 13 years after the 9/11 terrorist attacks, the extent of Saudi involvement in the deaths of almost 3,000 people remains unclear. Information about this has been suppressed ever since the publication of a 2002 congressional investigation into the plot. The U.S. is often dependent on the same nations that pose the greatest threats to its interests

Our stability and world stability very much depend on stability in Saudi Arabia until America and other energy consuming nations become independent of oil from the Middle East. This stability is not assured. To the extent NEP rapidly closes the oil gap it reduces our dependence on Saudi Arabia and provides new capacity that can replace Saudi spare capacity and buy time to make other adjustments in the fuel sector. For example: in the U.S…no new refineries have been built in more than 30 years…A shortage of refining capacity, particularly acute in the U.S. but also prevalent in many nations throughout the world, is a key cause of the global supply crunch…to ensure the efficient operation of the global oil market, it is vital to have the right amount and mix of refining capacity so that supply can adequately meet the wide range of consumer demand (86).

6. Defense Sector

The energy required to conduct military operations, or "operational energy", is essential to DOD's core mission to protect the security of the nation. In current operations, for example, deployed forces and fixed installations that directly support military operations require a steady supply of energy for mission success. In an increasingly complex and dynamic security environment, future U.S. forces will also require a reliable supply of operational energy in order to be able to rapidly respond to a range of contingencies around the world (87).

The battle for access may prove not only the most important, but the most difficult…[This is becoming clear as] countries with high performance weapons develop capabilities to deny our forces access to theater based energy supplies… combinations of regional powers with sophisticated capabilities could band together to form a powerful anti-American alliance…to deny U.S. forces access into their countries [and] prevent American access to the global commons at significant ranges from their borders …

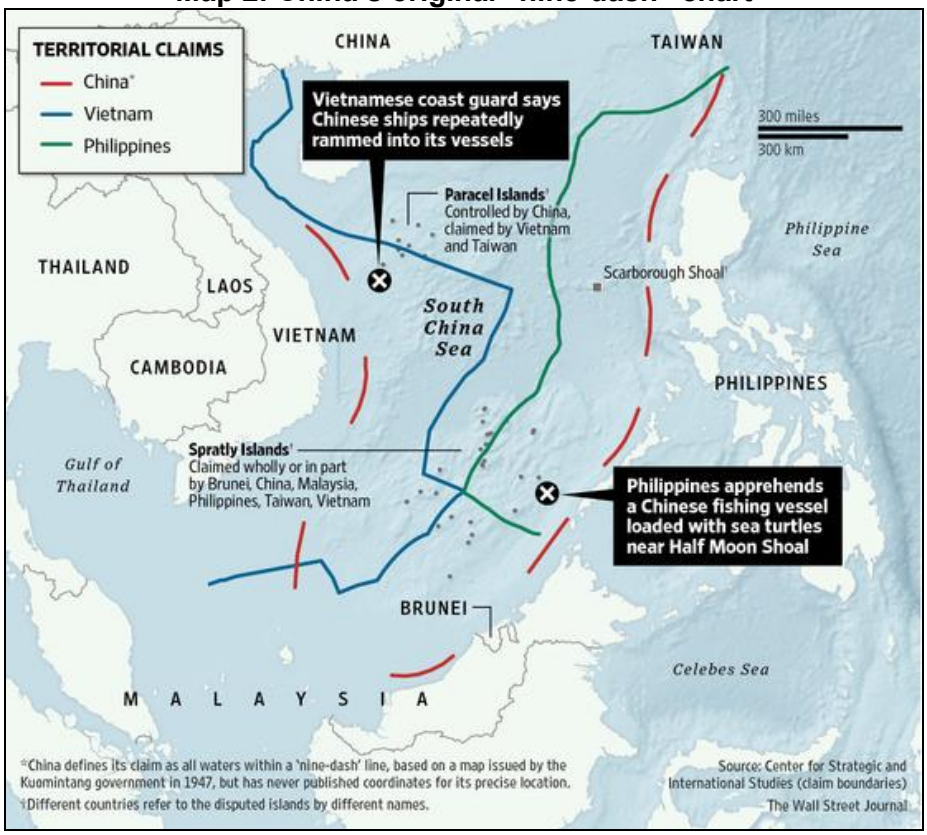
…The buildup of Navies has implications for how the U.S. develops its strategy as well as deployment of its naval forces… there is a sense that in certain areas such as submarine warfare, space, and cyber warfare, China can compete on a nearly equal footing with America (88). In response, India is developing a blue-water navy and shifting much of its navy to the Bay of Bengal (89). This will make India the dominant player in South Asia and the Middle East (90).

Empire shrinks as insolvency grows. The U.S. Navy is the foundation of our national presence in the world …Naval readiness is highly fragile. In order to meet current operational requirements, the shrunken fleet stays deployed longer and gets repaired less. There is now a serious shortage of Navy combat aircraft, and for the first time since WWII there are essentially no combat attrition reserves. But, the biggest effect of budget cuts will be on naval

shipbuilding…It is far from certain that the administration's budgets will sustain building eight ships per year, and even if they do, the U.S. is headed for a Navy of 240-250 ships at best (91).

While the U.S. will continue to contribute to security globally… [current defense policy predicates] rebalance to the Asia-Pacific region (92). Unfortunately, as we transition from past conflicts in part or whole over energy to potential new conflicts over energy in the Asia-Pacific, our civilian leaders waste precious time squabbling over green energy versus fossil fuels making vague references to energy security; but, don't grasp the centrality of energy independence to our national security. Our dependence on, and vulnerability to oil imports from the Middle East has been well known since President Roosevelt hosted Saudi King ibn Saud aboard the U.S.S. Quincy in 1945 and was discussed in the last section. The problem extends to the entire region and involves many energy consuming nations. Other parts of the region - South Asia, Asia-Pacific, Central Asia, and North Africa – in which energy is a driving force are discussed below. The interrelationship of the region with Russia, China, Europe and the U.S. is also discussed.

Map 2: China's original "nine-dash" chart



Energy is a driving force in the South Asia/Asia-Pacific. With its strategic position and potential value of its energy resources, the South China Sea has become an area of tension and conflict both for coastal states and the U.S. Energy is a key issue, because the sea floor is believed to be the repository of large amounts of oil and gas, making jurisdiction an interest of all the coastal states and a security interest of China's energy and resource hungry industrial sector. In addition, 50% of the world's crude oil and 66% of its natural gas transit through the sea…China has argued that the United Nations Convention on the Law of the Sea (UNCLOS) prohibits foreign military operations within its Exclusive Economic Zones (EEZ), a contention found nowhere in the text …[Map 2 is adapted from] China's original "nine-dash" chart and

illustrates China's perceived territorial claims including the EEZ it has claimed around the "rocks" of the Spratley and Paracel islands, where the Chinese harassed U.S. surveillance vessels (93). China has taken other actions. For example: China has warned India against collaborating with Vietnam over oil and gas exploration in the South China Sea where Indian companies are heavily invested and want to expand. The Central Military Commission, China's most powerful military body, has approved the deployment of a garrison of soldiers from the People's Liberation Army to guard disputed islands claimed by China and Vietnam in the South China Sea (94).

The way to ensure the peaceful rise of China is to ensure its access to adequate energy sources to fuel continued economic development (95). Every barrel of oil America produces, conserves or replaces with alternatives is a barrel of oil available on world markets to move China away from oil producers Iran and Russia and closer to us. Conversely, to the extent China sees America's "pivot to Asia" as a threat it will move closer to Russia and Iran. It is worth noting that coinciding with Xi Jinping's first visit to Russia, Beijing and Moscow signed the largest weapons procurement contract in the past decade (96) and China and Russia pledged to expand energy cooperation in projects of oil and gas supply, nuclear energy and renewable energy (97).

In any event, the "coalition of the willing" in South Asia/Asia Pacific for conflict with China is small. The attitude in Southeast Asia was expressed by a senior Indonesian official: don't leave us, but don't make us choose (98). China-ASEAN trade reached a record high in 2011 totaling $292 billion, up 37.5% from the year before (99). And, India - China trade is expected to touch $100 billion by 2015 (100).Conflict would be very bad for business.

Map 3: TAPI and IPI Pipelines

Source: "TAPI and IPI - Pipelines for Good", Daily Outlook Afghanistan, October 2011, http://outlookafghanistan.net/topics.php?post_id=2209

In Southwest Asia, Pakistan and India are disinclined to follow the U.S. lead in Iran…India has gained strategically pivotal access to Central Asia by constructing a road from Iran's Chabahar port on the Arabian Sea to western Afghanistan. This road, along which India is constructing a railway…is primarily aimed at accessing Afghan and Central Asian natural resources (101). India will not halt imports of Iranian crude oil (102). The Reserve Bank of India (RBI) worked out special payment channels for the Iranian oil imports as restrictions were imposed on dollar trade with Tehran (103). Pakistan let it be known…it is intent on proceeding with Iran-Pakistan-India (IPI) pipeline…if Pakistan doesn't complete the Pakistan section by the

end of 2014 it will have to pay financial penalties to Tehran (104). Iran has completed its link to Pakistan (105). Gas starved Pakistan could have gas quickly by completing its section; but is stopped due to sanctions. America is supporting an alternative Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline – an American pipedream without security in Afghanistan and for other reasons. TAPI and IPI pipelines are shown in Map 3.

Pakistan faces daunting problems, including a bloody fight with armed groups, sluggish economic growth, high inflation, a crumbling currency, the threat of a balance of payments crisis, and crippling electricity shortages. This threatens our tenuous supply corridor into Afghanistan, destabilizes the India/Pakistan relationship and has ripple effects in surrounding nations and throughout South and Central Asia...

… There are an estimated 10,000 Chinese and more than 120 Chinese companies in Pakistan, many working on infrastructure and energy projects… trade between China and Pakistan hit a 12-month figure of $12 billion…up 18% on the previous year (106). China has backed Pakistan, its largest export market for arms, as a strategic counterweight to India. Beijing has been given sovereign rights to a port it built at Gwadar near the Strait of Hormuz as part of plans to develop a transport corridor from China's northwest through Pakistan to the Arabian Sea. [IPI could be extended to China through this corridor.]

Gwadar is part of a "String of Pearls" strategy, [illustrated in Map 4] in which China strengthens diplomatic ties and builds naval bases along the sea lanes from the Middle East to the Asia-Pacific. This strategy is designed to protect China's energy security, negate U.S. influence in the region and project power overseas (107). In many cases, China's growing economic foothold has translated into a military foothold, given the large-scale participation of Chinese army personnel in overseeing energy and infrastructure projects and the "strategic partnerships" that Beijing has formed with key states (108). Adding these partnerships to China's relationships with Russia and Iran, conflict with China could spread in an increasingly unstable region.

Map 4: China: "String of Pearls" Strategy

Source: Juli MacDonald and Bethany Danyluk, Energy Futures in Asia, Booz Allen Hamilton Report sponsored by the Director of Net Assessment, November 2004, P. 17.

Energy is a driving force in North Africa; which presents a unique set of challenges, including economic, social, and demographic factors, exacerbated by conflict, corrupt and criminalized

states, interference and exploitation by external powers, health crises, deteriorating environmental conditions and growing presence of terrorist networks dedicated to government overthrow and eliminating the influence of external powers. North Africa is a major niche supplier of oil and gas to Europe. Libya and Algeria have enough proven oil reserves to give them the potential to grow their production significantly and Algeria has a major reserve of gas. North African oil and gas reserves are at risk (109). Damage to energy facilities in North Africa by insurgents or terrorists would lead to supply disruption, primarily in Europe. Example: a massive oil fire at Libya's largest oil port shown in figure 18, resulting from a civil war, destroyed more than 1.8 million barrels of crude oil; significantly reducing oil exports from Libya for the foreseeable future.

Figure 18: Fire at Libyan oil port of Es Sider

Source: Reuters, http://www.reuters.com/article/2014/12/30/us-libya-security-oil-idUSKBN0K810S20141230

There are many terrorist and insurgent groups in North Africa and their numbers grow are rapidly growing. Example: the stated goal of al Qaeda in the Islamic Maghreb (AQIM) is to overthrow the Algerian state and at a broader level, to follow al Qaeda strategy of attacking the West, particularly Europe…the central aspect that binds AQIM to other terrorist and criminal networks, which is the bulk of nonstate armed actors, is the informal series of overlapping pipelines [supply chains] that these operations use to move products, money, weapons, personnel and goods… relationships between nonstate and state actors provide numerous benefits to both (110). The line between insurgency and organized crime will continue to blur…growing convergence will make them more dangerous and effective [ex: AQIM and West African criminal syndicates]…

…These networks are intermingling to construct their own "shadow globalization" building micro markets, and trade and financial networks that will enable them to coordinate nefarious activities on a global scale. The current size of these shadow markets is already $2-3 trillion and is growing faster than legal and commercial trade; it has the potential to equal a third of global GDP by 2020…As they grow, these markets will allow adversaries to generate attacks at a higher level of rapidity and sophistication beyond law enforcement's capability to interdict …Where an increase in terrorist activity intersects with energy supplies or weapons of mass destruction, Joint Force commanders will confront the need for immediate action that may require employment of significant conventional capabilities (111). Unfortunately, as the Arab spring turns into winter and the threat grows, our military hasn't developed a strategy adequate to deal with the threat.

China's String of Pearls strategy extends to Africa. President Hu Jintao recently said that - China would lend $20 billion to African governments for infrastructure and agriculture in the next

three years… and signaled that China was pressing ahead with aid programs in African nations with abundant energy and mineral resources but with more focus on grass-roots projects. China's aid to Africa has expanded in the past decade as the continent has become a major source of oil. China's projects - roads, pipelines, and ports - have focused on benefiting its extractive industries, not African people (112).

Developing countries…are growing resentful of China's domination over their economies, as some are looking to diversify their relationships – an opportunity the U.S. should exploit. In many cases of natural resource investments, state-owned Chinese companies' motive was not to make money; it was for the Chinese government to capture valuable resources to fuel the country's economic rise… Sometimes the attractive economic terms offered by Chinese businesses in Africa and elsewhere turn out to be illusory. As a result, operations will end up extracting less oil than the Western one would have and sometimes will permanently damage the reservoir... Chinese companies take longer to extract resources than their counterparts…saving the resource for later, when Chinese demand for it has increased… The 20% royalty rate applies to a smaller pie - and may come at a higher cost…China also has earned a reputation for not hiring locals, ignoring environmental considerations, and employing subpar technologies (113).

Map 5: Eastern Siberia-Pacific Ocean (ESPO) oil pipeline

Energy is a driving force in Central Asia. Russia, China and Iran are acquiring the energy resources of Central Asia and the Caspian area. Turkmenistan is a pivot in Eurasia's great energy game. The Dauletabad-Sarakhs-Khangiran (DSK) pipeline connects Iran with Turkmenistan's vast gas field…The massive Turkmenistan-China pipeline will carry natural gas from eastern Turkmenistan through Uzbekistan and Kazakhstan to China's far west… Moscow and Ashgabat agreed to build jointly an east-west pipeline connecting all Turkmen gas fields to a single network [connecting nations with the world's largest, second and fourth largest gas reserves, with the potential to create a natural gas cartel. This network also enables] pipelines toward Russia, Iran and China to draw from any of the fields (114). Russia has just agreed to supply China with natural gas, a deal which could see China surpass Germany as the largest importer of Russian gas (115). [As shown in Map 5] Russia has completed its largest infrastructure project since the Soviet Union by expanding its eastern oil pipeline…from East Siberia to the Pacific Ocean…Transneft has said Japan bought a third of ESPO exports this year followed by China with 24% and the U.S. with 22% (116). Beijing is considering infrastructure projects that would eventually link China and Iran via pipelines, railways, and roads, allowing the People's Republic to import Iranian energy sources overland in case maritime routes in the unstable Persian Gulf region are threatened (117).

The 1689 Treaty of Nerchinsk between Russia and the Manchu-Chinese Ch'ing Dynasty, effectively partitioned Central Asia between the two powers [closing the Silk Road that had at times existed as a vast free trade and travel zone]…In the 19th Century the Russians conquered the Caucuses and the last remaining Central Asian khanates …in all of Central Eurasia only the Kingdom of Afghanistan survived as a fully independent state - a buffer between the Russians, Manchu-Chinese, and British India …[With the Soviet Union's demise] the newly independent states of Western Central Asia…mostly fell prey to rapacious politicians [Stans despots] who kept them poor, weak…prey to fundamentalism and home of terrorists…Central Eurasia will only recover if and when a relatively coherent unifying political system develops there…like the benevolent influence once exercised by the nomadic empires…

… Prospects for recovery look slim (118). The Russians will fight to the last American in Afghanistan; but otherwise want America and NATO out of Central Asia. The manner in which Russian "peace-keeping" forces were mobilized in the Georgia war made a deep impact; heightening the sense of vulnerability (119). Stans despots see American forces as a counterweight to Russia trying to maintain hegemony; while America ignores the oppression of Central Asian and North Caucasus peoples to maintain access to Afghanistan through the Northern Distribution Network (NDN) – the bi-directional system of air, land and sea supply routes that support the war in Afghanistan from the north.

In the West, one makes money in the market, and uses it to buy or influence power. In the East, one seizes power, and uses it to make money (120). Foreign energy companies pay large bribes that American companies can't pay (ex: It has been reported that President Berdymukhamedov of Turkmenistan received a €60m yacht from the Russian gas and resources company Itera). Stans depots also appreciate the large sums of money that has poured in to secure…basing, access and transit rights [that] usually have lined the pockets of…the region's elite. As Western militaries prepare to pull out heavy equipment, they expect Central Asian agencies and border officials to extort even greater payments as reverse transit takes place (121). As our footprint shrinks in Central Asia, our smaller forces that remain to train Afghan forces after 2014 will provide little counterweight to Russia and have less money to spend on the NDN and pay bribes. Our access to Central Asia and its energy resources will diminish accordingly.

Afghanistan ranks last on Transparency International's Corruption Perception Index (122). Going forward, our smaller forces, reduced spending and bribery will diminish our influence accordingly. The C.I.A. is plying the presidential palace with cash…with little evidence that the payments bought influence the C.I.A. sought. Instead, some American officials said, the cash has fueled corruption and empowered warlords, undermining Washington's exit strategy from Afghanistan (123). Defections from the Afghan Army will grow as U.S. forces withdraw and the equipment, supplies and air support they provide diminishes. Infiltration and attacks by the Taliban will grow accordingly, filling the void left by our drawdown. This void will also be filled by neighboring nations. Example: Iran is funding aid projects working with Afghans…and is expanding intelligence networks across Afghanistan - [assets] Iran could wield against American interests should the U.S. military strike Iran's nuclear program (124). Afghanistan won't be a typical training and transition mission. If our forces remain in small numbers after 2014, they must have adequate force protection and logistics for a safe and rapid withdrawal in place to avoid a repeat of the British experience in the first Anglo-Afghan War.

Energy is a driving force in Europe. In February 1997, George Kennan wrote on The New York Times that the Clinton administration's decision to back an enlargement of NATO to bring it to the borders of Russia was a terrible mistake….expanding NATO would be the most fateful

error of American policy in the entire post-cold war era. Today, Russia views America and NATO closing in as a threat and wants to push both away from its border. The Russians also see deployment of an ABM system in Eastern Europe ostensibly proposed to protect them from nuclear attack by Iran as a reprise of "missiles in Turkey" pointed at them.

Map 6: Nord Stream, South Stream and Nabucco Pipelines

Source: South Stream making progress, DeepResource, July 2012, http://deepresource.wordpress.com/2012/07/01/south-stream-making-progress/

In some European countries, energy imports [oil, gas and coal] from Russia topped 80-90% and the E.U. imports 27% of its crude oil and 31% of its natural gas and 30% of hard coal from Russia (125). As shown in Map 6, Russia is building South Stream and Nord Stream pipelines to provide an alternative to pipelines through Eastern Europe. (Prior to Nord Stream 80% of Russian gas exports to the E.U. flowed though Ukrainian pipelines). Disputes with Ukraine in the winters of 2006 and 2009 showed that Russia will wield gas as a weapon to keep Eastern Europe in check….Only a handful of countries in Eastern Europe were affected, but the sense of insecurity spread across the continent (126). The U.S. and E.U advanced the Nabucco pipeline as an alternative to South Stream. However, Turkmenistan is able to commit its gas exports to China, Russia and Iran [and] has no need to connect to Nabucco (127). Without gas supply Nabucco is an American pipedream. And, as illustrated by ESPO, Russia is building pipelines in a manner that creates a powerful leverage for oil and gas flow switches from East to West and vice versa, sending a warning signal that Russia can cut oil and gas supplies to the E.U. (128).

The U.S. has enduring interests in supporting peace and prosperity in Europe as well as bolstering the strength of NATO (129). Going forward, Russia's ability to squeeze NATO/E.U. by shifting its crude oil and natural gas exports to other countries via East-West pipelines will grow enabling Russia to limit European cooperation with the U.S. Oil exports and the Marshall Plan facilitated reconstruction after WWII enabling Europe to become our partner in NATO to contain the Soviet Union. America must provide greater green energy and fossil fuel exports to Europe and work in partnership with Europe to significantly reduce reliance on energy from Russia and the region as a matter of European and American security.

As America moves offshore, access is not guaranteed once American forces complete their withdrawal from current conflicts and consolidate in smaller numbers on the periphery… Precision air strikes remain an option… [but] unduly reducing American ground forces risks

creating a vacuum (130). The cumulative impact of retrenchment in defense accounts will be reduced capacity in terms of force structure. While the armed forces are likely to grow smaller, it is less likely their operational tempo will decrease…the capability advantage that U.S. forces have over many potential adversaries may narrow in the future (131).

In conflict scenarios involving energy crises of the future, America will need to be self sufficient in crude oil and refined products to insure that we will always have gas for cars on our roads and tanks on the battlefield. Overall, if we achieve the goal it will go far to enabling America to maintain control of world events long term. To accomplish this, NEP will facilitate integration of civilian/military government and industry efforts to promote rapid development and deployment of energy products and services across all markets at home and abroad. Revenues earned through DOD efforts will be used to pay defense costs.

According to the Defense Science Board Task Force on DOD Energy Strategy, DOD is the largest single consumer of energy in the U.S. (132). In 2011, the department consumed 116.8 million barrels of fuel at a cost of $17.2 Billion ($3.51/gallon) (133). DOD should use its market leverage to shorten the road from research to deployment by partnering with industry and serving as a "base customer" to grow businesses at scale. Components of existing DOD energy delivery systems are fragmented across the armed services, headquarters and bases. Pulling DOD components together on an intra or inter service basis will be difficult in such a vast organization. A Defense Operational Energy Board (134) has been established to address this problem. As a compatible program management oriented organization with funds to invest the corporation will be able to work seamlessly with this Board, DOD components and public/private sector to integrate military and civilian efforts to achieve the goal and stakeholder objectives. Cross market operations will vary by sector as follows:

The Buildings & Processes sector is an example of the potential for complete compatibility. DOD's built infrastructure contains 2.2 billion square feet of space in 307,295 buildings (135) that mirror civilian space. Since 1985, DOD has decreased energy consumption per building square foot by 30%. Over the past decade, its Energy Conservation Investment Program (ECIP) financed more than $440 million worth of energy efficiency improvements through innovative third-party financing mechanisms… To continue these efforts and deploy successful initiatives across installations, DOD has initiated the Installation Energy Test Bed Program that has more than 45 demonstration projects underway and hopes to reduce demand by 50% in existing buildings and 70% in new construction (136). DOD programs, public/private sector and NEP operations should be integrated to form cross market end to end buildings & processes sector delivery systems.

The Power Sector is an example of the potential for complete compatibility with DOD in its domestic uses of power. Theater applications will also have compatible civilian application. The military is implementing applications to reduce energy costs, lower emissions, and become more independent of the power grid. For example: the Soaring Heights community at Davis-Monthan Air Base, Arizona… will rely on solar power for 75% of its residential needs… the Air Force leads all federal entities in clean power purchasing with 37 bases meeting some portion of their electrical requirements with renewable sources (137). Dr. Robyn, Deputy Under Secretary of Defense for Installations and Environment announced that she had been given the authority to approve long term contracts (up to 30 years) for PPA's for all electrical energy sources (138) enabling investors to implement utility scale projects. Microgrids can shrink the amount of fossil fuels consumed to create electricity by networking generators as a system to maximize efficiency. Microgrids also enable military bases – both stationary and forward operating bases – to sustain operations, no matter what is happening in theater. Over 40 DOD military bases either have currently operating microgrids, planned microgrids, or have conducted studies or demonstrations.

The Transportation Sector is an example of moderate compatibility. A Prius sputtering out on a highway back home is inconvenient; an armored vehicle stalling out in the Mesopotamian desert or Hindu Kush can be deadly …Through the Tank Automotive Research and Development Center (TARDEC) in Warren, Michigan, the Army is experimenting with new energy-efficient technologies that could be embedded into different vehicles. These include lightweight transmission and composite moldings as well as research into hybrid vehicles…DARPA is exploring different processes for making titanium [40% lighter than steel and has better strength and flexibility] affordable (139). Titanium could reduce fuel usage. If it becomes cost competitive with steel it will have significant cross market application. Because defense and commercial industrial bases are closely aligned, technological advances will have cross market application …Moreover, efficiency gains in electric vehicle deployment in civilian markets can also relieve DOD's burdens associated with securing oil transport routes and the impacts of climate change (140). Breakthroughs in battery and fast charging technology could decrease use of the internal combustion engine in new military vehicles, reducing the size of supply trains to haul liquid fuels and be readily transferable to our nation's roads.

The corporation will "co-invest" with companies to develop technologies to achieve the sector objective and all investors - public and private - will receive returns accordingly. An example of DOD use of co-investment arrangements in the transportation sector is the HEMTT A3 Diesel Electric Hybrid vehicle (141) shown in Figure 19. This vehicle has versatility and may be useful across military and civilian markets. Such technologies in which DOD invests will be licensed and revenues earned will be used to fund the defense budget.

Figure 19: HEMTT A3 Diesel Electric Heavy Expanded Mobility Tactical Truck

Off-road hauling capability and self-contained ability to generate 100 kW of clean exportable AC power

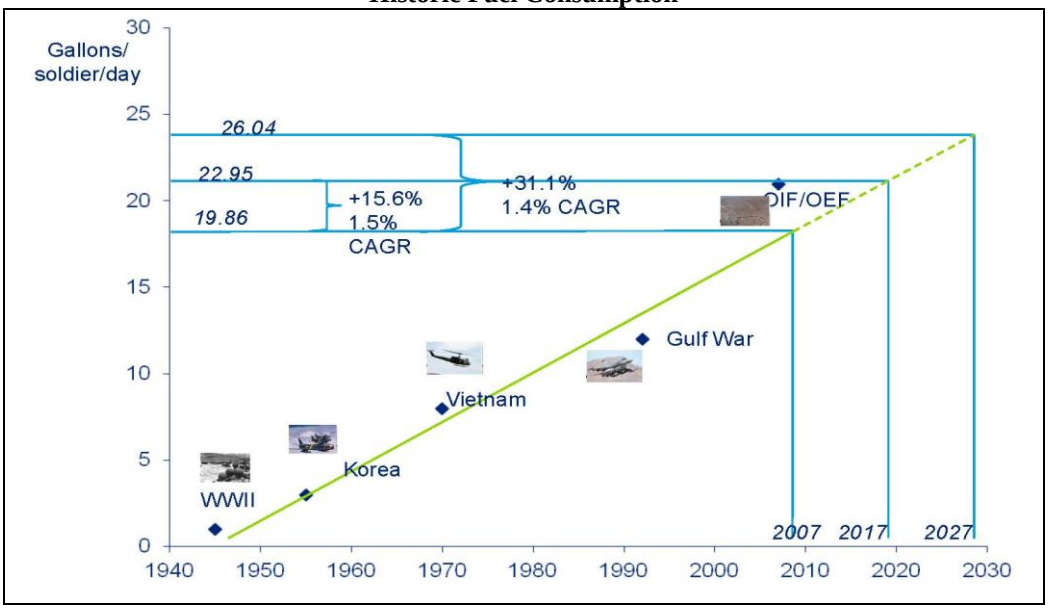
The Fuels Sector is an area of almost complete compatibility. The military should develop its own dedicated fuel supply to be able to operate free of the marketplace in conflicts involving supply disruptions that cause shortages in the homeland for an extended period of time. In so doing, the military will become a base customer and build new businesses for developing and producing alternative fuels for its own use and civilian markets. The fuels now being pursued by the military and commercial transportation industries are drop-in substitutes for petroleum fuels (142). For example, blends of up to 50% petroleum-based jet fuel and 50% sustainable bio-fuels have been tested and will be used in commercial and military aircraft. CTL is also a potential area for development. However, the Energy Independence and Security Act of 2007 [limits] federal agencies from purchasing synfuels whose life cycle green house gas emissions exceed those from conventional crude oil, thus limiting the use of CTL fuels (143). Exemption should be made for military use. R, D&D to enable CTL to meet environmental standards should be undertaken to facilitate wider use of our nation's abundant coal resources.

Many efforts will be unique to the military. For example: only the U.S. Navy operates aircraft carriers. Navy Secretary Mabus' idea is to turn one of the [carrier strike groups] into an environmentally friendly armada by 2016 to demonstrate that the military's biggest gas guzzlers don't have to stay that way (144). Climate change is included as one of the ten trends most likely to impact the Joint Force (145). Retreating ice creating access to previously unavailable natural resources and is one example of potential security challenges that did not exist in the past (146).

Over 70% of the tonnage required to position today's U.S. Army into battle is fuel…and the number of convoys required to transport an ever increasing requirement for fossil fuels is itself a root cause of casualties, both killed in action and wounded (147). Green energy versus fossil fuels isn't the issue; it is reducing the tonnage of "all liquid fuels" on the battlefield. Unfortunately, the trend is going in the opposite direction. Figure 20, illustrates the progression of fuel use from the early 1940's through the Middle East wars, and the increasing numbers of gallons required per U.S. soldier per day from WWII, to the Korean conflict, to Vietnam, the Gulf War, to Operation Enduring Freedom (OEF) in Afghanistan, and Operation Iraqi Freedom (OIF). It is estimated that as of 2007, average consumption per U.S. soldier per day was 22 gallons…it is predicted that there will be a 15.6% increase in gallons consumed per soldier per day by 2017, for a 1.5% compounded annual growth rate (CAGR) (148). This growth rate will be unsustainable from a cost standpoint during energy crises and on the battlefield from an access/logistics standpoint.

Figure 20: Energy Use in Warfare: A Rising Trend

Historic Fuel Consumption



Source: Energy Security – America's Best Defense: A study of increasing fossil fuels in wartime, and its contribution to ever higher casualty rates, Deloitte LLP, p. 3.
http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/AD/us_ad_EnergySecurity052010.pdf

However, the potential for logistics disruptions is not simulated and remains a blind spot in war games and planning future forces. One possible reason is that the military has been successful throwing mass and money at logistics problems over the past 12 years and sees no need to change its approach in the future. This is indicated by the fact that current requirements development and acquisition processes do not adequately analyze the ability of adversaries to interdict energy logistics, the effects of attrition on force effectiveness, or the effects of containment demand on force capability and effectiveness (149).

Going forward, the military will have less mass and money to throw at problems and potential adversaries will be more able to deny access and interdict supply lines. The region is becoming increasingly unstable. A conflict that starts in one nation could spread and involve state and non-state actors and WMD. It may also be fought in cyber space – on the battlefield and in our homeland - and could involve disruption of energy supplies to the military, homeland and our allies. DOD should develop a series of planning scenarios to game out fuel needs against different potential combat concepts, absolute shortages of energy, major price spikes (150) and generally higher energy costs.

"Less Fuel, More Fight": Reduce the demand for energy in military operation (151). Green energy versus fossil fuel isn't the issue; it is reducing tonnage of all liquid fuels on the battlefield. Reductions on the battlefield should be rapidly translated into reductions at home. "More Fuel, Less Fight": The more fuel available in world energy markets the less need to fight for it.

America needs a long term program to eliminate its oil addiction and the loss of lives and treasure that flow from it. We will get nowhere as long as the American people continue to live in denial and see our current danger in terms of swings in the price of gasoline at the pump; rather than as the grave national security threat that it is.

III. Financing Energy Independence – Through Public and Private Investment

a. Financial Principles

While NEP will adapt methods used in aerospace and military programs that are publicly funded, as a public/private enterprise the corporation will be financed accordingly. The NEP financial system will use generally accepted accounting practices; rather than the corrupt government practices that are leading our nation to insolvency using the following principles:

- Americans will pay the real cost of what they get, stop using their children's credit cards and lives to pay part of the cost and pay down the national debt. We - you and I, and our government - must avoid the impulse to live only for today, plundering, for our own ease and convenience, the precious resources of tomorrow. We cannot mortgage the material assets of our grandchildren without risking the loss also of their political and spiritual heritage. We want democracy to survive for all generations to come, not to become the insolvent phantom of tomorrow (152);

- NEP will begin America's movement from a consumption based economy to an economy that strikes a proper balance between austerity and growth. Half of the funds from tax expenditures, entitlements and subsidies cut from the budget will be invested in energy R, D&D. The other half will pay down the national debt. The way out of this crisis cannot be more borrowing and spending, especially spending that does not build lasting assets that will help future generations pay off debts they will be saddled with (153);

- Public investment will be used to finance the difference between investments the private sector, financial community and private investors are willing to make using existing risk and investment models and the investments required. Profits won't be privatized and losses socialized. Public investment will be repaid with a good ROI to tax payers based on investment and risk. Since NEP will be implemented as a matter of national security, uneconomic aspects of the program will be funded in the same manner as national defense.

- Development of domestic green energy and fossil fuels to eliminate the oil gap and for export will turn a massive capital outflow to pay for imported oil into massive capital source available for domestic investment. The U.S. is spending approximately $1 billion a day overseas on oil instead of investing this money at home (154). Each day, the U.S… loses $4 billion indirectly to the macroeconomic costs of oil dependence, microeconomic costs of oil volatility, and cost of keeping military forces ready for intervention in the Persian Gulf (155);

- Americans will pay the real cost of imported oil at the pump, rather than adding currently unfunded energy costs to the national debt**.** Nations with higher pump prices more in line with the real market price are developing green technologies and exporting them to America adding to our trade deficit. For example: Analysis of [the stimulus package indicates that] of $2 billion in grants to wind power companies $1.7 billion - 85% - was awarded to foreign firms (156). This market will be served. The difference will be the nations that capture this market and its millions of jobs.

- NEP will use variations of the self liquidating Federal-Aid Highway Act applicable in today's environment. National infrastructure programs with sound revenue streams, adapted from the Highways model, will be used to finance the massive investment required, replacing fragmented projects spending that won't get the job done. Quants don't pour concrete. Infrastructure investment will provide jobs for the 99%; sound investment for 100%. The challenge ahead is the challenge of sharing prosperity.

America's infrastructure has received a GPA of "D+" on the American Society of Civil Engineers (ASCE) infrastructure report card (157). Today, planning, siting, regulation of many elements of interstate infrastructure are controlled by state and local governments. This system in relies on fragmented government funded projects, labyrinthine regulation and in many cases lacks eminent domain authority. President Obama proposed an Infrastructure Bank to receive federal money, $60 billion over 10 years, to provide financing to transportation infrastructure projects across the nation (158). This sum is miniscule compared to the $3.6 trillion needed by 2020 to bring our nation's infrastructure up to good condition (159). And, this infrastructure will be inadequate to a population projected to grow to 392 million by 2050 (160).

President Eisenhower achieved passage of the "The Federal-Aid Highway Act of 1956" (popularly known as the National Interstate and Defense Highways Act). The Highway Act adapted the WWII military command system for domestic use by giving the Bureau of Public Roads authority to overcome state and regional interests to plan and place the new, interstate highways…in a manner that best served the nation using eminent domain (161). NEP will adapt the central planning, management, eminent domain and self liquidating trust fund financing that built America's highways to achieve energy independence. With budget cuts on the horizon the current system based on government bureaucracy, influence, earmarking and fragmented project spending is drying up. In future, state and local governments will have the choice of supporting national approaches analogous to the approach that built our nation's highways or seeing the infrastructure cities, states and America needs not be built.

b. Financial Accounts

The NEP finance system will contain two accounts:

- An account to fund energy production, energy efficiency and alternative energy technologies RD&D that will have the following sub-accounts:

- Production of conventional domestic fossil fuels (i.e.; coal, natural gas and oil) – Investment to plan will be provided by the corporation and energy producers with the corporation taking an investment position and getting paid back via surcharges on products produced and deployed. Regulatory and other impediments will be reduced shorten implementation time and in other ways lower project costs. Investment should be focused in areas in which energy producers would not make the needed investments to achieve the goal using existing business models. For example: oil refining has historically been a low margin environment.

  Investments made by the corporation in foreign fossil fuels production should be integrated with U.S. foreign aid and infrastructure projects to meet national goals and objectives. Regulations will be reduced or rewritten to enable American energy producers to be more competitive with foreign producers. The U.S. has long lacked even the semblance of a strategy for competing with China in emerging markets…Not only does the government offer minimal help; at times, its own excessive regulations and reporting requirements actually discourage U.S. firms from entering new markets…. China subsidizes its state owned companies in their bids for natural resources…and bundles major infrastructure investments with natural resource bids. Brazil, India, and Russia also regularly throw their political weight behind their state-owned companies …Emerging markets offer high returns and access to crucial natural resources the U.S. cannot afford to pass up, as well as promising opportunities to deepen relations with strategically important countries (162).

- Production technologies to develop alternatives from domestic fossil fuels (i.e., coal gasification, CTL, gas liquification, fracture gas, etc.) – Investment will be provided by the corporation and industry partners with the corporation taking an investment position and getting paid back via surcharges/licenses on products deployed. The corporation will provide venture capital for R&D by early stage companies without industry partners.

  Development of certain alternative fuels may adversely affect the environment. People can live without alternative fuels; but not without clean water. Drinking and waste water get the poorest grades (163). America is now in the midst of the nation's most widespread drought in 60 years, stretching across 29 states and threatening farmers, their crops and livestock. But there are other risks as water becomes scarcer. Power plants may be forced to shut down, and oil and gas production may be threatened. About half of the nation's water withdrawals are for cooling power plants. The oil and gas industries use tens of millions of gallons a day, injecting water into aging oil fields to improve production, and to free natural gas in shale formations through hydraulic fracturing (164).

  Studies by government and utilities agree that cities and towns will need to spend $250-$500 billion more over the next 20 years to maintain drinking water and waste systems…in a country accustomed to paying about $2.50 per 1,000 gallons – the lowest tap price in the world…A major problem is that utilities haven't been charging customers the true cost to provide water but instead subsidize the services with other revenues (165). Water wars in our western states; which are looking as far afield as the Great Lakes indicate that the days of cheap water are just about over. Overall, adequate water supply is a prerequisite for a secure future at the national, regional and global levels.

- Production technologies to develop alternatives to fossil fuels (i.e., solar/geothermal/wind power, bio-fuels, etc.) – Investment will be provided by the corporation and industry partners

with the corporation taking an investment position and getting paid back via surcharges on related power production, products/licenses. The corporation will provide venture capital for R&D by early stage companies without industry partners.

- Buildings technologies to develop alternatives to fossil fuels (i.e.; energy efficiency, solar, bio-fuels, etc.) - Investment will be provided by the corporation and industry partners with the corporation taking an investment position and getting paid back via surcharges/licenses on products deployed. The corporation will provide venture capital for R&D by early stage companies without industry partners;

- Power grid technologies (i.e., energy efficiency, renewables, DG, new tools, etc) to replace standard upgrades in the power grid (i.e., central power plants and wires) – An RPS should be legislated at the national level to be adapted on a state by state basis as required. Energy efficiency, renewables, etc. will be financed and installed on a quantitative, cost effective $/kW basis with standard upgrades based on LMB with utilities able to make their accepted profit margin on such activities. Utility infrastructure development will be implemented as a standard utility investment where conversion from oil to gas in buildings produces adequate revenue for utilities. Investment beyond this level will be provided by the corporation. Costs on the customer side of the meter to convert from oil will be paid for by a grant.

- Vehicles technologies (i.e., new materials, electric and natural gas vehicles, etc.) – Investment will be provided by the corporation and industry partners with the corporation taking an equity position and getting paid back via surcharges/licenses on products deployed. Venture capital for R&D of technologies by early stage companies without industry partners will be provided. A grant will be provided to convert vehicles with adequate remaining useful life from gasoline to other energy sources if required.

- An account to build, operate and maintain the national energy infrastructure that will have two sub-accounts:

- An account to build the national alternative vehicles fueling stations network - will be financed via an up front charge in the purchase price of alternatively fueled vehicles or as part of a vehicle miles traveled tax (VMT).

  The financing system used to build our nation's roads based on the gasoline tax and highway tolls is becoming obsolete as revenues decrease as more fuel efficient vehicles pay less at the pump, electric cars pay nothing and the Highway Trust Fund becomes insolvent. Going forward, drivers should be charged a VMT or other charge that reflects road usage and repair needs and apportions the real cost to rebuild and maintain our nation's roads by vehicle type, weight and how much and where vehicles drive. Systems exist to track mileage and location of usage that would provide an accurate method to account for road usage (ex: companies that monitor fleet vehicles now track cell phones and GPS devices in cars and trucks use mobile navigation programs). The cost to build the alternative fueling stations network could also be paid in the VMT on vehicles that use the network. This would eliminate the need to pay for the network in the purchase price of alternative vehicles; lowering up front cost and increasing market acceptance accordingly.

- An account to build the "21st Century" national transmission grid - the real cost to build this grid includes the cost to deliver power, maintain the existing grid and build the national transmission grid America will need in the future. The existing power grid receives a grade of D+ (166); because, Americans pay the cost to deliver power and only part of the cost to

maintain, replace and expand the existing patchwork grid. Transmission investments will be financed through a surcharge on transmission charges on customer electricity bills. A local match will be provided through utility distribution level investments to meet the power sector objective.

Imported oil is another example of Americans not paying the real cost. The real cost of imported oil includes the cost of exploration, production, refining and distribution; plus hidden unfunded subsidy costs to develop and defend imported oil. Subsidies for fossil fuels development totaled approximately $72 billion from 2002 to 2008 (167). The ongoing cost to protect chronically vulnerable infrastructure in hostile areas and patrolling oil transit routes are between $67.5-$83 billion annually; plus $8 billion in military operations (168). Today, the U.S. military's nine combatant commands must protect oil assets and transportation routes…The U.S. Army would love Mission Unnecessary in the Persian Gulf; the U.S. Navy would not need to worry as much about conflicts from the Arctic to the South China Sea (169).

Currently unfunded annual costs of $85-$100 billion to produce imported oil and defend it will be paid on a "pay as you go" basis as part of the cost of goods sold. This will cost American taxpayers "net zero" because revenues will be used to reduce the defense budget and national debt going forward by an equal amount. In 2011, the U.S. consumed about 134 billion gallons of gasoline (170). If all unfunded costs were paid at the pump this would add 65-75 cents to the price of a gallon of gasoline. Spreading the cost to other oil based products would reduce the pump price. The alternative, deep defense cuts are unsustainable; because it will limit our ability to defend our oil supply and other vital interests.

This approach is patterned on the East India Company charter for Britain's Asia trade…the English Crown did not care to commit its resources to so uncertain an undertaking …[and gave the Company] the right to arm its vessels to fend off interlopers …the Company's naval prowess encouraged the Mughals to grant trading rights, having no Navy of their own…by 1678 Company exports from India to Europe met the pay bill of 17,000 cavalrymen…[and reached] 2 million pounds in 1740 (171) enabling the Company to pay its defense costs as a cost of good sold. Britain's symbiotic relationship with the Mughals resembles America's relationship with the Saudis today. The Persian Gulf War of 1990-1991 resembles the Company's conflicts; because, America's costs were paid for by Saudi Arabia's out of oil revenues as a cost of goods sold.

IV. Summary – Hard Choices.

America's major conflicts since WWII - Korea, Vietnam, Afghanistan and Iraq - were fought in the region and we have taken great losses in lives and treasure when our strategy was based on muddled objectives, unsupported assumptions, rosy scenarios, refusal to learn from history (ours and theirs) and lies told to the America people by their leaders to justify wars they wanted to fight. These factors must be considered as America rebalances its military forces to the Asia-Pacific, so that we don't repeat the mistakes of the past.

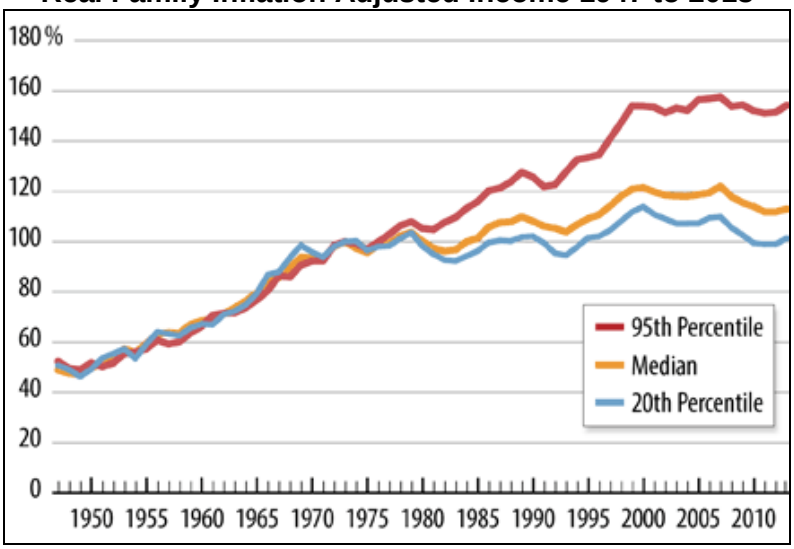
As we should have learned in Korea, basing strategy on the unsupported assumption that China wouldn't fight when threatened led to disastrous consequences. Today, America has the choice to work with China and other nations in South Asia/Asia Pacific to secure adequate energy supplies or threaten China again through our "pivot to Asia" and risk stumbling into war trying to cut China off from the energy resources of the East and South China Seas.

The U.S. must take care not to repeat in its China policy the pattern of conflicts entered into with vast public support and broad goals but ended when the American political process insisted on a strategy of extrication that amounted to abandonment, if not complete reversal of the country's proclaimed objectives…We would then be obliged to face anew the very task that confronts us today - the construction of an international order in which America and China are significant components …The rise of China is less a result of its increased military strength than our own declining competitive position, driven by factors such as obsolescent infrastructure, inadequate attention to R&D, and a seemingly dysfunctional government (172).

America and China share a common goal – avoiding chaos. This has been a key goal in China for more than 3,000 years and could form a basis for understanding and cooperation between our two nations. It becomes evident that a dynasty has lost the "Mandate of Heaven" and nothing could save it when it becomes profligate and the nation descends from prosperity and harmony into calamity and chaos. This is a factor in Chinese politics today (173) and needs to become a factor in American politics. Rent seeking and corruption in the Capital were as endemic in many failing Chinese dynasties as they are in Washington DC.

Today, America has cut investment in our nation's crumbling infrastructure to 2.5% of GDP (174), disinvests in R&D and education and uses homes as ATM's. The government prints money increasing debt, primarily benefiting the top 1%, Big Banks and corporations; while the underlying problem - division of society between rich and poor - grows as savers are decimated, median income remains stagnant and low income workers lose ground (175). While this produces growth of a sort, it won't serve as the engine to produce the broad growth needed to pull the world from the grips of the financial calamity we caused. And, Congress passes laws to transfer responsibility to pay the bill for the Big Bank's risky practices back onto the backs of middle class taxpayers and our children, removing moral hazard and insuring another crash. America experiences chronic and debilitating warfare with no good end in sight.

Figure 21:
Real Family Inflation Adjusted Income 1947 to 2013



Source: Center on Budget and Policy Priorities: http://www.cbpp.org/research/poverty-and-inequality/a-guide-to-statistics-on-historical-trends-in-income-inequality

In contrast, an America in depression and beset by division in 1940 as great as we face today, came together to win WWII and build the economic engine that transformed America and the

World. While it is little recognized today, WWII couldn't have been won without the massive production enabled by the infrastructure America built during the great depression. This infrastructure was augmented after the war. By 1960 the interstate highways were being built, the power grid was growing and U.S. federal public spending on infrastructure was 5% of gross GDP. America made a conscious choice between providing millions of jobs to build this infrastructure and returning to the financial corruption that led to the great depression. Passage of the Glass Steagall Act of 1933 (177) that separated commercial and investment banking insured that the Crash of 1929 wouldn't be repeated as long as this legislation remained in force. Sound investment and banking practices contributed to U.S. GDP growth of 261% from the beginning of 1940 to the end of 1960 (178). By the time the original "GI Bill" ended in 1956, 7.8 million of 16 million WWII veterans had participated in higher education or training programs (176). This produced a skills upgrade that helped to create the American Middle Class. As shown in figure 21, this upgrade enabled income gains to be widely shared during this period; but not since then.

America faces a hard choice. We can apply lessons learned from our "greatest generation" or continue on our current course with historically predictable results.

The "NEP decade" will be built on these lessons. This decade will be a transition period from dependence on imported oil to a sustainable energy future that is "win-win" for stakeholders, America and the World. Developing alternatives to imported oil as a matter of national security will increase domestic deployment faster than possible through market forces alone and increase our green energy exports. This will turn a capital outflow for imported oil into a source of domestic earnings and investment. Expanding domestic fossil fuel production and increasing refining capacity consistent with a sustainable energy future will contribute to eliminating the oil gap while reducing GHG emissions. NEP will create sound investments in energy infrastructure, green energy and fossil fuels for the financial community that will produce millions of new middle class jobs. This investment will promotes broad growth and global stability as an alternative to investment and debt creation that is increasing the gap between rich and poor, promoting global instability. NEP will have an additional benefit - members of our armed services won't become casualties in wars that won't happen if America achieves energy independence and leads and enables other consuming nations to work with us to reduce their dependence on energy imports from the region.

In current market conditions with a domestic oil shale oil boom, some are saying that independence from imported oil will soon be achieved by our nation's oil and gas industry and market forces. Short term energy euphoria ignores long term reality. The IEA forecasted that U.S. oil production will peak at about 11.1 MBD in 2020 and decline thereafter. EIA forecasts a similar situation. October 2013 marked the 40th anniversary of the 1973 OPEC oil embargo. America's oil and gas industry and market forces haven't cured our addiction to imported oil in over 40 years and won't cure our addiction today. We have been on the imported oil roller coaster too long to have learned nothing from experience. Unfortunately, in an America whose forte is finance, history is the last quarter and the future is the next.

Americans of nearly every political stripe are waiting and wondering whether their leaders are prepared to let the nation that saved the world in the 20th century sink into history in the twenty first (179). We stand at a crossroads. We simply can't risk going down the same path increasingly divorced from the very real threats of today and the growing ones tomorrow (180). Will tomorrow belong to America? The genius of America has been our ability to transform to meet changing conditions and new threats and become a better and stronger nation.

Achieving energy independence is the right place to start.

Footnotes

1. FACT SHEET: U.S.-China Joint Announcement on Climate Change and Clean Energy Cooperation, http://www.whitehouse.gov/the-press-office/2014/11/11/fact-sheet-us-china-joint-announcement-climate-change-and-clean-energy-c
2. This white paper is the document published on the EV World website in March 2014 http://evworld.com/library/Revised_NEP_white_paper.pdf with the following changes. The GHG emissions reduction goal set by President Obama on November 2014 is incorporated into the NEP goal. The discussion of program and organization design is expanded. These changes required a rewrite of the executive summary and introduction, expansion of program design and transportation sector sections.
3. "National Security Strategy 2013", Department of Defense, p. 14, https://www.utexas.edu/lbj/sites/default/files/file/news/National%20Security%20Strategy%202013%20(Final%20Draft).pdf
4. IEA World Energy Outlook 2013, http://www.worldenergyoutlook.org/media/weowebsite/factsheets/WEO2013_Factsheets.pdf
5. "Big Oil Has Big Problems", Matthew Philips, January 2014, Bloomberg Businessweek, http://www.businessweek.com/articles/2014-01-31/big-oil-earnings-reports-reveal-big-production-problems
6. "Joint Operating Environment 2010 Report" DOD Joint Forces Command, p. 26, 27, http://www.fas.org/man/eprint/joe2010.pdf
7. "The Prince", Niccolo Machiavelli, Borders Classics, p. 13.
8. "The Wisdom of Retrenchment", Parent and MacDonald, Foreign Affairs, November/December 2011 p. 36. http://www.foreignaffairs.com/articles/136510/joseph-m-parent-and-paul-k-macdonald/the-wisdom-of-retrenchment
9. See for example, "North America is the New Saudi Arabia, Natural Gas is the Future of Energy", The Market Oracle, November 2010, http://www.marketoracle.co.uk/Article24319.html
10. "IEA Pegs U.S. as Top Oil Producer by 2020", Benoit Faucon and Sarah Kent, Wall Street Journal, November 2012, http://www.wsj.com/articles/SB10001424127887323894704578114492856065064
11. Op. cit., JOE 2010, p. 63.
12. DARPA's Space History, http://globalgulag.freesmfhosting.com/index.php?topic=176.0;wap2
13. Boeing archives, http://www.boeing.com/history/bna/apollo.htm
14. "DOE/DOD MOU Concerning Cooperation in a Strategic Partnership to Enhance Energy Security", http://www.energy.gov/news/documents/Enhance-Energy-Security-MOU.pdf p. 1, 5.
15. "Crusade in Europe", Dwight D. Eisenhower, Doubleday and Company, Inc., 1949, p. 36.
16. Albert Einstein, Brainy Quote website: http://www.brainyquote.com/quotes/quotes/a/alberteins165192.html
17. "SolarCity and Bank of America Merrill Lynch Move Forward With Project SolarStrong, Expected to Build More Than $1 Billion in Solar Projects", Bank of America Press Release, November 30, 2011, http://mediaroom.bankofamerica.com/phoenix.zhtml?c=234503&p=irol-news&nyo=0
18. Op. cit., Boeing Archives.
19. "Business Plan for America's Energy Future", American Energy Innovation Council, p. 8. http://www.americanenergyinnovation.org/the-plan/
20. Op. cit., Boeing Archives.
21. Op. cit., American Energy Innovation Council, p. 4, 6.
22. "Apollo program", Knowledgerush, http://www.knowledgerush.com/kr/encyclopedia/Apollo_program/
23. All costs calculated with an inflation calculator using mid point of expenditure. Example: Apollo cost $25.4 billion. Mid point of expenditure used is 1965.
24. "The U.S. stimulus program: Investing in Energy Efficiency", Scott Jacobs and Rob McNish, The McKinsey Quarterly, http://www.mckinsey.com/insights/energy_resources_materials/the_us_stimulus_program_investing_in_energy_efficiency
25. "Blue Print for Securing America's Energy Future", US Chamber of Commerce Institute for the 21st Century, p. 9. http://energyxxi.org/reports/Blue_Print.pdf
26. "A Farewell to Fossil Fuels", Amory Lovins, Foreign Affairs, March/April 2012, p. 139.

27. Op. Cit., Blue Print for Securing America's Energy Future. p. 8.
28. "U.S. Army Energy Security and Sustainability", AUSA Torchbearer National Security Report, April 2011, pgs. 8-10, http://www.ausa.org/publications/torchbearercampaign/tnsr/Documents/TB_Energy_web.pdf
29. Op. cit., US Chamber of Commerce Institute for the 21st Century. p. 41.
30. Fuel Choice for American Prosperity, Gal Luft and Ann Korin, Institute for the Analysis of Global Security, 2013, http://www.iags.org/fuelchoices.pdf
31. "Willow Run and the Arsenal of Democracy", Jenny Nolan, The Detroit News, January 1997, http://apps.detnews.com/apps/history/index.php?id=73&category=locations
32. "China Mulls $1.5 Trillion Boost for Strategic Industries", Benjamin Kang Lim, Reuters, March 2012, http://www.reuters.com/article/2010/12/03/us-china-economy-investment-idUSTRE6B16U920101203
33. Methanol Institute, Methanol Transportation Fuel, http://www.methanol.org/Energy/Transportation-Fuel.aspx
34. DOE, "Alternative Fuel News", Volume 7-No.1, 2003, p. 7. http://www1.eere.energy.gov/cleancities/pdfs/afn7_1.pdf
35. "Growing Chinese appetite ignites U.S. methanol renaissance", Rhiannon Meyers, Fuel Fix, August 2014, http://fuelfix.com/blog/2014/08/29/growing-chinese-appetite-ignites-u-s-methanol-renaissance/
36. DOE alternative fuels data center, Electric vehicles, Hybrid electric vehicles, http://www.afdc.energy.gov/fuels/electricity.html , http://www.afdc.energy.gov/vehicles/electric_basics_ev.html
37. DOE alternative fuels data center, Bio diesel, ethanol, http://www.afdc.energy.gov/fuels/biodiesel_locations.html, http://www.afdc.energy.gov/fuels/ethanol.html
38. "The New CAFE Standards", Peter Fairley, MIT Technology Review, January 2008, http://www.technologyreview.com/energy/20067/
39. "Government sets strict fuel-economy goal of 54.5 mpg by 2025", James Healey, USA TODAY, August 2012, Section B, p. 1-2, http://www.usatoday.com/money/autos/story/2012-08-29/fuel-standards/57383050/1
40. Op. cit., Amory Lovins, p. 136, 137.
41. "Reducing America's Energy Dependence", National Resources Defense Council website: http://www.nrdc.org/air/transportation/gasprices.asp#note1
42. "The 2011 North American 3PL (Third Party Logistics) Market: A strategic analysis of the latest market opportunities and trends", eyefortransport, April 2012, p. 17, http://www.nation2nation.net/logistics/download-the-north-american-3pl-market-analysis-pdf/
43. "Access to alternative transportation fuel stations varies across the lower 48 states", DOE, EIA, April 2012, http://www.eia.gov/todayinenergy/detail.cfm?id=6050#tabs_AltTransportFuelStations-7
44. Ibid
45. "Fleet Electrification Roadmap", Electrification Coalition, November 2010, p. 42. http://www.electrificationcoalition.org/sites/default/files/SAF_1213_EC-Roadmap_v12_Online.pdf
46. "Final Report, Energy Industry Study", The Industrial College of the Armed Services, National Defense University, Spring 2012, p. 33, http://www.ndu.edu/es/programs/academic/industry/reports/2010/pdf/icaf-is-report-energy-2010.pdf
47. Op. cit, eyefortransport, p. 25.
48. "A National Strategy for Energy Security", Energy Security Leadership Council, September 2008, http://secureenergy.org/policy/national-strategy-energy-security p. 52.
49. "For Secure Energy Future, Obama Must Be Like Ike", Leon Steinberg, Renewable Energy World.com, http://www.renewableenergyworld.com/rea/news/article/2009/10
50. Op. cit., Energy Security Leadership Council. p. 52.
51. Op. cit., Leon Steinberg.
52. "Interstate Electric Transmission: Enabler for Clean Energy", Michael Heyeck PE, American Electric Power, April 2008, p.1, 8-10. http://www.aep.com/about/transmission/docs/EnablerforCleanEnergy.pdf
53. "Ike's Bluff: President Eisenhower's Secret Battle to Save the World", Evan Thomas, Little Brown and Company, September 2012, p. 167.
54. "China Outpaces U.S. in Cleaner Coal-Fired Plants", Keith Bradsher, New York Times, May 2009, http://www.nytimes.com/2009/05/11/world/asia/11coal.html

55. World Coal Association website, http://www.worldcoal.org/coal-the-environment/coal-use-the-environment/improving-efficiencies/
56. "An Unconventional Bonanza", Special Report on Natural Gas, The Economist, July 2012, p. 3, 5, 6, http://www.economist.com/node/21558432
57. "Panetta Warns of Dire Threat of Cyberattack on U.S.", Elisabeth Bumiller and Thom Shanker, New York Times, October 2012, http://www.nytimes.com/2012/10/12/world/panetta-warns-of-dire-threat-of-cyberattack.html?_r=0
58. Electricity Grid in U.S. Penetrated By Spies", Siobhan Gorman, Wall Street Journal. April 2009, http://online.wsj.com/article/SB123914805204099085.html
59. Ibid
60. "Sabotage Attacks Have Cut the Power Flowing Through More Than 100 Electrical Lines", James Glanz, New York Times, June 2004, http://www.nytimes.com/2004/06/11/international/middleeast/11POWE.html
61. "Are We Headed Toward a Green Bubble", Julie Bennett, Entrepreneur Magazine, April 2010, http://www.entrepreneur.com/magazine/entrepreneur/2010/april/205494.html p. 54.
62. Ibid, p. 52, 54.
63. "Alternative Transportation Fuels and Vehicles Technologies", Douglass Arent, Frank Verrastro et al, Center for Strategic and International Studies, August 2009, pgs. 21, 22. http://csis.org/files/publication/090811_Bovair_AltTransportFuels_Web.pdf
64. Op. cit., Energy Security Leadership Council, pgs. 27, 28.
65. Op. cit., US Chamber of Commerce Institute for the 21st Century. p. 25, 27.
66. Op. cit., An Unconventional Bonanza, p. 3, 4, 17.
67. "Oil abundance? – not so fast: Drilling holes in the energy boom story", Richard E. Vodra, ASPO-USA 2014 update, p. 4,6,7, http://peak-oil.org/2014/10/not-so-fast-drilling-holes-in-the-energy-boom-story/
68. "Big Oil Has Big Problems" Matthew Philips, BloombergBusinessweek, January 2014, http://www.businessweek.com/articles/2014-01-31/big-oil-earnings-reports-reveal-big-production-problems
69. "Exxon Could Benefit From Emissions Work", Russell Gold, Wall Street Journal, December 2008, http://online.wsj.com/article/SB123024642660134159.html
70. "Global Refining Capacity", Joules Burn, The Oil Drum, March 2011, http://www.theoildrum.com/node/7641
71. Op. cit., JOE 2010, p. 63.
72. Ibid, pgs. 26, 28.
73. Op. cit., Energy Security Leadership Council, p. 116.
74. "Moving Mountains: Lessons in Leadership and Logistics from the Persian Gulf War", Lt. General William G. Pagonis (U.S. Army, Retired), Harvard Business School Press, 1992, p.104.
75. Ibid.
76. "Last week: From overseas, a dim view", Trudy Rubin, Philadelphia Inquirer, September 2012, p. C6.
77. "A Concise History of the Middle East", Eighth Edition, Goldschmidt and Davidson, Westview Press, 2006, p. 241,242.
78. "Saudi oil refinery deal shows close ties", Hu Yinan, ChinaDaily.com, January 2012, http://www.chinadaily.com.cn/cndy/2012-01/16/content_14449867.htm
79. "Global Oil Demand Harms U.S. Security and Economy", Center for American Progress http://www.americanprogress.org/issues/2010/04/oil_quench.html
80. "International Energy Outlook 2011", U.S. Energy Information Agency, Washington, DC, http://www.eia.gov/forecasts/ieo/index.cfm
81. "World Energy Outlook", http://www.worldenergyoutlook.org/docs/weo2011/factsheets.pdf
82. "The Risk of Exaggerating the China Threat", Colonel Michael Eastman U.S. Army, The Wall Street Journal, Thursday, April 19, 2012, p. A11. http://online.wsj.com/article/SB10001424052702303816504577312111808129918.html
83. "Energy Risks in North Africa and the Middle East", Anthony Cordesman, Center for Strategic and International Studies, May 2012, p. 74-77, http://csis.org/files/publication/120524_MENA_Threat_Brief.pdf
84. Ibid, p. 56.

85. "OPEC's gift to oil sands producers: high oil prices", Yadullah Hussain, Financial Post, July 2012, http://business.financialpost.com/2012/07/06/opecs-gift-high-oil-prices-2/?__lsa=2306-10dc
86. "Globalization 101", A project of the SUNY Levin Institute, http://www.globalization101.org/a-refining-challenge/
87. "Fiscal Year 2012 Operational Energy Budget Certification Report", ASD (OEPP), January 2011, p. 2.http://energy.defense.gov/FY12_Operational_Energy_Budget_Certification_Report_FINAL%208%20JUN.pdf
88. Op. cit., JOE 2010, p. 26, 50, 62, 63.
89. "Commentary: The Elephant and the Dragon", Neil Padukone, The National Interest, May 2012, http://nationalinterest.org/commentary/the-elephant-the-dragon-6845?page=1
90. Op. cit., JOE 2010, p. 63.
91. "The Seas Are Great but the Navy is Small", former Secretary of the Navy, John Lehman, Wall Street Journal, April 27, 2012, p. A15, http://online.wsj.com/article/SB10001424052702304811304577365570199853412.html
92. "Sustaining U.S. Global Leadership: Priorities for 21st Century Defense", DOD, January 2012, p. 2. http://www.defense.gov/news/Defense_Strategic_Guidance.pdf
93. "Creeping Jurisdiction Must Stop", Caitlyn L. Antrim and Captain George Galdorisi, U.S. Navy (retired), Ocean Law.org, April 2011, p. 67. http://www.oceanlaw.org/downloads/Antrim-Galdorisi%20Proceedings%20April%2011.pdfT
94. "China Sends Troops to Disputed Islands", Jane Perlez, The New York Times, July 2012, http://www.nytimes.com/2012/07/24/world/asia/china-sends-troops-to-disputed-islands.html?_r=1&src=me&ref=world
95. Op. cit., Energy Industry Study, p. 7.
96. "China-Russia Ties Deepen", By Mu Chunshan, The Diplomat, September 2013, http://thediplomat.com/2013/09/china-russia-ties-deepen-2/
97. "China, Russia to expand energy cooperation", Xinhuanet.com, October 2013, http://news.xinhuanet.com/english/china/2013-10/15/c_132801297.htm
98. "The future of U.S – Chinese Relations", Henry Kissinger, Foreign Relations, March/April 2012, P. 47, http://www.foreignaffairs.com/articles/137245/henry-a-kissinger/the-future-of-us-chinese-relations
99. "China-ASEAN 2011 bilateral trade to hit record high", ASEAN-China Center, November 2011, http://www.asean-china-center.org/english/2011-11/17/c_131252005.htm
100. "India, China trade expected to touch $100 billion by 2015", Business Standard, Press Trust of India / New Delhi, October 2012, http://www.business-standard.com/india/news/india-china-trade-expected-to-touch-100-bn-by-2015/193041/on
101. Op. cit., Neil Padukone.
102. "Report: India to Continue Oil Imports from Iran Irrespective of Western Sanctions", Fars News Agency, April 2013, http://english.farsnews.com/newstext.php?nn=9107162334
103. "India will not cap oil imports from Iran", Indian Defense Forum, April 2013, http://defenceforumindia.com/forum/subcontinent-central-asia/50002-india-not-cap-oil-imports-iran.html
104. Op. cit., Neil Padukone.
105. "Pakistan Begins Construction Of Pipeline Link With Iran", Scott Neuman, NPR, March 2013, http://www.npr.org/blogs/thetwo-way/2013/03/11/174003303/pakistan-begins-construction-of-pipeline-link-with-iran
106. "Chinese premier begins Pakistan visit", Aljazeera.com, May 2013, http://www.aljazeera.com/news/asia-pacific/2013/05/20135224581824859.html
107. IntelliBriefs, http://intellibriefs.blogspot.com/2007/04/china-string-of-pearls-strategy.html
108. "The New Silk Road: China's Energy Strategy in the Greater Middle East - An Increasing Footprint", Christina Lin, The Washington Institute for Near East Policy, July 2012, http://www.washingtoninstitute.org/policy-analysis/view/the-new-silk-road-chinas-energy-strategy-in-the-greater-middle-east
109. Op. cit., Anthony Cordesman, p. 43.
110. "Terrorist-Criminal Pipelines and Criminalized States: Emerging Alliances", Douglas Farrah, National Defense University, PRISM 2, no. 3, pg. 2, http://www.ndu.edu/press/emerging-alliances.html
111. Op. cit., JOE 2010. Pg. 61, 68.

112. China plans to loan $20b to African countries", Jane Perlez, New York Times, July 2012, http://articles.boston.com/2012-07-20/world/32744643_1_china-plans-african-countries-african-leaders
113. "How to Succeed in Business and Why Washington Should Really Try", Alexander Benard, Foreign Affairs, July/August 2012, p. 95, 97. http://www.foreignaffairs.com/articles/137684/alexander-benard/how-to-succeed-in-business
114. "Russia, China, Iran redraw energy map", Ambassador M. K. Bhadrakumar, January 2010, Asia Times online, http://www.atimes.com/atimes/Central_Asia/LA08Ag01.html
115. "Russia and China in Major Natural-Gas Supply Pact", James Marson, Wall Street Journal online, March 2013, http://online.wsj.com/article/SB10001424127887324557804578376510628682312.html
116. "Russia completes Asia oil link as Europe frets", Reuters Edition: UK, December 2012, http://uk.reuters.com/article/2012/12/24/russia-espo-launch-idUKL5E8NL49Y20121224
117. Op. cit., Christina Lin.
118. "Empires of the Silk Road: A history of Central Eurasia from the Bronze Age to the Present", Christopher Beckwith, Princeton University Press, 2009, p. 232, 308, 312.
119. "Central Asia's Northern Exposure", Andrew Kuchins and Thomas Sanderson, New York Times, August 2009, http://www.nytimes.com/2009/08/05/opinion/05iht-edkuchins.html?_r=0
120. "What Went Wrong? The Clash Between Islam and Modernity in the Middle East", Bernard Lewis, HarperCollins Publishers, p. 63.
121. "Afghanistan: Don't Overlook the Other Regional Casualty", Alex Cooley, EurasiaNet.org, May 2012, http://www.eurasianet.org/node/65448
122. Transparency International Corruption Perception Index: http://cpi.transparency.org/cpi2013/results/
123. "With Bags of Cash, C.I.A. Seeks Influence in Afghanistan", Matthew Rosenberg, New York Times, April 2013, http://www.nytimes.com/2013/04/29/world/asia/cia-delivers-cash-to-afghan-leaders-office.html?pagewanted=all&_r=0
124. "Iranians Build Up Afghan Clout", Maria Abi-Habib, Wall Street Journal, October 2012, http://online.wsj.com/article/SB10001424052970204076204578078564022815472.html
125. Eurostat, European Commission, http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Energy_production_and_imports "EU-Russian Gas Relations in Perspective: Challenges and Opportunities", European Dialogue, http://www.eurodialogue.org/EU-Russian-Gas-Relations-in-Perspective-Challenges-and-Opportunities.
126. Op. cit., Russia completes Asia oil link as Europe frets
127. Op. cit., M.K. Bhadrakumar.
128. Op. cit., An Unconventional Bonanza, p.12.
129. Op. cit., Defense Strategic Guidance, p. 3.
130. Op. cit., Michael Eastman.
131. "Capstone Concept for Joint Operations: Joint Force 2020", DOD Joint Chiefs of Staff, September 2012, p. 2-4, http://www.defenseinnovationmarketplace.mil/resources/JV2020_Capstone.pdf
132. "The US Department of Defense: Valuing Energy Security", Drexel Kleber, Journal of Energy Security, June 2009, http://www.ensec.org/index.php?option=com_content&view=article&id=196:the-us-department-of-defense-valuing-energy-security&catid=96:content&Itemid=345
133. "Energy Investments for Military Operations", Department of Defense: For Fiscal Year 2013, June 2012, cover letter, http://energy.defense.gov/FY13_OE_Budget_Cert_Report.pdf
134. Defense Operational Energy Board, http://energy.defense.gov/DOEB_Charter.pdf
135. "Installation Energy Test Bed", presentation by Dr. Jeffrey Marqusee at Army/Air Force Energy Forum, July 2011.
136. "From Barracks to the Battlefield: Clean Energy Innovation and America's Armed Forces", The Pew Project on National Security, Energy and Climate, 2011, p. 9. http://www.pewenvironment.org/uploadedFiles/PEG/Publications/Report/DOD-Report_FINAL.pdf
137. "Reenergizing America's Defense", The Pew Project on National Security, Energy and Climate, April 2010, p. 18. http://www.pewclimatesecurity.org/reenergizing-americas-defense/
138. DOD Energy Blog: https://mail.google.com/mail/?shva=1#inbox/131b1aa82479eeb4
139. "Conservation, Innovation Fuel Defense Energy Efforts", Robert Ackerman, SIGNAL Magazine, February 2007, http://www.afcea.org/content/?q=node/1261
140. Op. cit., From Barracks to the Battlefield, p. 27.

141. Oshkosh Defense website: http://www.oshkoshdefense.com/products/12/hemtt-a3-diesel-electric
142. Op. cit., From Barracks to Battlefield, p. 35.
143. Op. cit., Deloitte, p. 23.
144. "Green Monster", Noah Shachtmen, Foreign Policy, May/June 2010, http://www.foreignpolicy.com/articles/2010/04/26/green_monster
145. Presentation by Admiral Titley at the American Meteorological Society considering the impact of climate change on future Navy missions and force structure: http://www.ametsoc.org/atmospolicy/climatebriefing/titley.html
146. Op. cit., JOE 2010
147. "Energy Security – America's Best Defense: A study of increasing fossil fuels in wartime, and its contribution to ever higher casualty rates", Deloitte LLP, p. 16, 18. http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/AD/us_ad_EnergySecurity052010.pdf
148. Op. cit., Deloitte, p. 3.
149. "Operational Energy Strategy: Implementation Plan", DOD, March 2012, p. 19, http://energy.defense.gov/Operational_Energy_Strategy_Implementation_Plan.pdf
150. "Fueling the Future Force: Preparing the Department of Defense for a Post-Petroleum Era", Christine Parthemore and John Nagl, Center for a New American Security, September 2010, p. 13, 21. http://www.cnas.org/node/5023
151. Op. cit., "Energy Investments for Military Operations", p. 5,
152. President Eisenhower's Farewell Address, January 1961, http://www.ourdocuments.gov/doc.php?flash=true&doc=90&page=transcript
153. "The True Lessons of the Recession: The West Can't Borrow and Spend Its Way to Recovery", Raghuram Rajan, Foreign Affairs, May/June 2012, p. 77.
154. "Oil Dependence Is a Dangerous Habit", Center for American Progress, http://www.americanprogress.org/issues/2010/01/oil_imports_security.html
155. Op. cit., Amory Lovins, p. 134.
156. Op. cit., Julie Bennet. P. 54.
157. "America's Infrastructure Report Card", American Society of Civil Engineers, http://www.infrastructurereportcard.org/
158. The Obama-Biden Plan, Change.Gov, http://change.gov/agenda/economy_agenda/
159. Op. Cit., America's Infrastructure Report Card.
160. "Population Profile of the United States", U.S. Census Bureau, http://www.census.gov/population/www/pop-profile/natproj.html
161. Op. cit., Leon Steinberg.
162. Op. cit., Alexander Benard, p. 91, 92, 95, 96.
163. Op. cit., American Society of Civil Engineers.
164. "Will Drought Cause The Next Blackout", Michael Webber, New York Times, July 2012, p. A19, http://www.nytimes.com/2012/07/24/opinion/will-drought-cause-the-next-blackout.html
165. "A National Water Crisis is on the Verge of Gushing", Marianne Lavelle, U.S. News and World Report, May 2007, http://www.usnews.com/usnews/biztech/articles/070527/4water.htm
166. Op. cit., American Society of Civil Engineers.
167. "A Taxpayer-Funded Sucker Play for the 21st Century", Jeff Siegel, Energy and Capital.com, http://www.energyandcapital.com/
168. "Imported Oil and U.S. National Security", Keith Crane, Andreas Goldthau et al, RAND Corporation, 2009. p. 74. http://www.rand.org/pubs/monographs/2009/RAND_MG838.pdf
169. Op. cit., Amory Lovins, p. 144.
170. "Frequently Asked Questions", U.S. Energy Information Administration, http://www.eia.gov/tools/faqs/faq.cfm?id=23&t=10
171. "A Concise History of Modern India", Second Edition, Metcalf and Metcalf, Cambridge University Press, 2009. p. 44 – 47.
172. Op. cit.; Henry Kissinger, pgs. 47-51.
173. "China: A New History, Second Enlarged Edition", John Fairbank and Merle Goldman, The Belknap Press of Harvard University Press, 2006, p.48.
174. Enotes, Encyclopedia of Business: Infrastructure: http://www.enotes.com/biz-encyclopedia/infrastructure

175. "Median Pay in U.S. Is Stagnant, but Low-Paid Workers Lose", by Floyd Morris, New York Times, April 2013, http://www.nytimes.com/2013/04/27/business/economy/wage-disparity-continues-to-grow.html?_r=0
176. "The GI Bill's History", U.S. Department of Veterans Affairs, http://www.gibill.va.gov/benefits/history_timeline/
177. Glass Steagall Act of 1932, https://www.csbs.org/bankinglaw101/BL101%20PDF/Glass-Steagall_Act.pdf
178. "US Real GDP by Year", U.S. Bureau of Economic Analysis, http://www.multpl.com/us-gdp-inflation-adjusted/table. Dollar figures are presented in "chained dollars"; reflecting dollar figures computed with 2005 as the base year. This is a method of adjusting real dollar amounts for inflation over time, so as to allow comparison of figures from different years.
179. "GDP Now Matters More Than Force", Leslie Gelb, Foreign Affairs, November/December 2010, p. 43. http://www.foreignaffairs.com/articles/66858/leslie-h-gelb/gdp-now-matters-more-than-force
180. Defense Secretary Gates' remarks at a meeting of the Economic Club of Chicago", http://www.defense.gov/transcripts/transcript.aspx?transcriptid=4445

About the Author

Lawrence Klaus began his career as an architect in the offices of Emery Roth & Sons working on projects including working drawings for the World Trade Center. As a research engineer in the Boeing Aerospace Group (ASG) he designed and implemented automated business systems concerned with the design, manufacture, test, delivery, and installation of major military missile, space, and associated programs. He also participated in internal business planning to define ASG program management and information systems capabilities with civilian applications. At Peat Marwick Mitchell (now KPMG) he designed PPB and management and reporting systems for federal government agencies. This included projects such as design of a program planning system for regional plans for the Public Health Service. He founded and was president of Development Management Consultants Inc. and planned and managed company operations on dozens of projects working with utilities, lenders, contractors, non-profit organizations and government. This work included projects such managing local and federal disaster rapid emergency mass home repair. As a manager in the network systems group of Unisys Corporation he worked with company engineers to design networked PC to mainframe systems that integrated company and vendor software and hardware. This included projects such as the user friendly IDEAS online education system for the Air National Guard. As a consultant at Synergic Resources Corporation (now Navigant Consulting) he worked on energy efficiency projects for utilities such as MidAmerican Energy. As an independent consultant has worked on projects related to energy policy, networks and distributed generation.

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