

Energy, Water and Transportation

Water, Power and Safety are all inter-related. The after effects of 9/11 and the resulting 15 years long war on terror are making fundamental changes in the way we look at all three.

High-tech societies face a cruel paradox: New Technologies may deliver wealth and prosperity, but they also leave rich nations vulnerable to crippling attacks. By relying on intricate networks and small clusters of vital assets, argues the path-breaking essay, advanced economies only amplify the psychological and financial destruction terrorists can inflict.ⁱ

As industrialized nations seek to shore-up safety issues in the present system of water and power distribution, the trend needs to be away from large scale intricate production and distribution networks which are vulnerable to the destructive power of a few terrorists. The nation should move toward onsite generation and self-contained industrial complexes.

Profound changes have been under way in the Production of heat and power for a number of years. Shipments of micro-turbines surged more than 300% in 2000ⁱⁱ and increases sharply thereafter. In the USA and around the world the growth of distributed generation technologies like micro-turbines and fuel cells are being restrained by obsolete laws and regulations. Using those same technologies could provide many safety advantages and save billions of dollars per year in wasted energy.

The world over, governments are beginning to look at energy policy in the light of new pressures. Fluctuating oil and gas prices and the post-9.11 political climate have highlighted the issue of energy security...ⁱⁱⁱ

Utilities: Water, Electricity, Heat, Cooling, Humidity Control, Air & Gas, need to be integrated to achieve optimal performance of the total building or process design with safety and security as priorities. Regulatory requirements for building construction and operation which are barriers to onsite production and generation need to change.

From Hospitals all the way to the largest power generation plant companies need to embrace the idea of systems integration for safety reasons. Optimal performance and waste minimization offer savings to payback the cost in minimal time.

Integrated systems using the Best Available Technologies will provide the maximum reuse and minimum waste of resources.

A self-contained secure building is the result of the above strategy. Makeup air purification and control along with onsite generation of power and water production will make the most critical buildings self-contained on site!

Integrated system approaches to building management should be encouraged. As an example, Fuel Cell Energy Systems, and Small Gas Turbine Products are being developed to provide shaft power for Generator, Chillers, Refrigeration and Air Compressor applications while also providing Thermal Load for hot water, steam, absorption Cooling and Air dryers, all by using waste methane gas.

End users are seeing the need for integration. Example Plastics plant outside of Rochester, New York has installed a new micro-turbine-based power, heat and chilling system to overcome the problems of power interruptions. They also integrated a desiccant system that controls humidity and eliminates a raw material drying process during humid summer months.

Most building and process design's fail to achieve optimal performance. Equipment is selected for a specific application with little regard for how it integrates with the complete process. Although techniques are available for optimizing individual components the process or design, optimizations strategies fail when applied to the large scale complex buildings and process systems. This is especially true where multiple design approaches appear to be equally feasible. Systematic approaches to optimizing, water use, environmental concerns, safety, building design and operational requirement would be of great value.

Transportation

The urgent reality is that if the U.S. government continues with its current fuel and transportation policies, it will undermine the social and economic security of our workforce and our nation. Traffic congestion in 2005 drained \$78 billion from our economy, according to the Texas A&M 2007 Urban Mobility Report and Appendices, adding 4.2 billion hours to Americans' commutes while wasting 2.9 billion gallons of gasoline. Change those figures to today's high cost of oil and then Imagine doubling the number of vehicles on the road and planes in the air over the next fifty years, the problem becomes unmanageable and the cost to our society a burden to heavy to bear. Yes, we have the best transportation system in the world but it cost too much to operate and the fuel basis of the system is no longer under our control. We spend the largest percentage of our energy use on transportation. To make matters worse traffic fatalities account for over 40,000 deaths per year according to DOT. How tragic not only for the families of the victims but for the nation as a whole.

Traffic and parking congestion require building more roads and parking facilities. At the present rate of growth by the year 2050 projected vehicle traffic will double. Is it possible to build an automobile road based

transportation system which could handle this amount of traffic? Our government thinks so, as an example the new NAFTA (North American Free Trade Association) transportation corridor project the most ambitious transportation project since the interstate highway system is still based on oil as the major fuel source even though it will not be fully operational for another 50 years.

The fundamental flaw is we still have a transportation system based on gasoline. A system with increased traffic congestion and increases crashes, at the same time increasing energy consumption and pollution, not too mention lost productivity due to longer commute times. What does the future hold? What are your ideas for protecting our economy? How would you change the transportation system so that it is not 100% dependent on oil?

Solving transport problems requires planning reforms with a vision to the future that increase transport options and provide market reforms that give consumers suitable incentives to choose the most efficient option for each individual trip. Why choose to use the automobile for a simple commuter trip if you will spend hours in traffic. Not all trips require the use of an individual automobile even for multiple stops.

Could commuter trips be handled with mass transit rail systems? Yes, but there are many infrastructure problems in achieving this service and when the system is in place you still don't have the complete package. You have empty tracks, not enough trains scheduled, and safety issues with rail freight and passenger traffic combined on the same lines. (see Amtrak NY-Washington issues) and missed schedules. Amtrak offers service to many cities today, there's one problem: You might not get back home the same day you leave, because Amtrak runs so few trains to the cities they service.

Even the best "rail based mass transit systems", mag-levs, have three problems. First limited ingress and egress points. Second, lack of and need of support transportation. Third, scheduling and safety issues which cause congestion at ingress and egress points and leave tracks idle and empty for a majority of time. Like the airports today passenger loading issues can take more time than the trip itself, and then try getting a cab.

How can we create a better vision for the future of transportation in our nation?

Start with a review of transportation history. Railroads went from moving people to moving freight for all the reasons discussed above. Building new rail systems today is not going to change the result. Amtrak has lived off tax money to stay in business for too many years to say otherwise.

Now we have the automobile which has come to the end of its useful life as a vehicle of mass transportation in the USA. Why? The internal combustion engine's reliance on petroleum fuel, congestion, limited speed and the number of traffic fatalities have all contributed to making the automobile too ineffective for all of our people transportation needs today.

The airplane as well has reached a critical junction in the ability to provide the needs of mass transportation between cities in the USA with all of the safety issues and congestion in the sky as well as at the hubs. As a result in many cases it now takes more time to fly than drive between some cities.

America is faced with a transportation system in transformation. We recognize that it cannot continue as it is now but no one wants to make the hard decisions required to face the challenges. America is sometimes slow to respond but respond we will when our backs are pushed against the wall we come out fighting. How far must we be pushed before we take action? What will be the damage to our society if we continue to delay? Gaining control of the fuel source or changing the fuel basis of our transportation system while improving safety should be addressed in rebuilding America's overburdened and, in many cases, obsolete transportation infrastructure. Fuel taxes can no longer cover the cost of maintenance. Land and money for expansion are almost non-existent.

Developing all of the oil resources available to us today is imperative if we are to continue as a free and independent country with a transportation system based on oil during the transition to a transportation system based on electrical power. Even though the internal effects of our energy dependency on oil are huge the effects on how oil usage is changing the balance of power around the world as the finite resource is divided is much more important.

The massive transfer of wealth to some of the world's least responsible nations should disturb us. We are losing control of our society. The entire nation can be held hostage once again by Barbary Coast Islamic Pirates and

policy decisions are made for many incorrect reasons. Some Congressmen have even called for the nationalization of our major oil companies like Venezuela. How absurd to do away with private property rights in a free society, it is bad enough that we will not allow them to operate in our waters and thus subject their assets to nationalization by foreign governments.

We have stood idly by for 40 years allowing the energy problem to grow worse. As a nation we should feel the urgency of the energy problem, it could wipe out life as we know it in the USA in a matter of days. The most important thing is to move forward make use of all known oil reserves and all other potential forms of energy available to us.

Enter the electric dual mode solution. An electric car designed to be recharged by the smart electrical / road system or your basic home outlet.

When the passenger vehicle is on the smart electrical road system the system controls the vehicle and provides power to recharge the batteries for powering the vehicle off trac. When the vehicle is off the smart grid road or entering / exiting the system it is electric driven. The size of the vehicle can vary and it may be designed for public or private transportation.

The smart grid dual mode system would replace the current HOV lanes going into major cities to spur the change over in vehicle design. Also, as an added incentive for the change over, the concept of rental vehicles could play a big part. By making electric transformer commuter vehicles available for rent with a credit card the number of vehicles required in major cities could be substantially reduced. Many additional features of a smart grid road and electric vehicle are available. Central business districts with automated electric cars using card swipe payment systems could reduce congestion and speed the introduction of new technologies thus serving as a building block for the mag-lev dual mode vehicle, know as the luge plane and lugeway.

All of the technology to design and build the above system exists today and is being used in various forms throughout the world. The smart electrical road would provide the rights of way for underground electrical power distribution and serve as the inductive charging power source for the on-board battery. No more overhead power grid.

We need to have a bold new vision for what we want our nation to look like in the future.

High population density areas offer the best opportunity to display the creative ability of the American people to provide answers to the challenges faced by transportation systems depend on oil. We should be spending the "TARP" transportation funds on projects that can transform our future into something better than the crowded dysfunctional cities we see around the world.

There are no issues too big to be resolved, only the lack of resolve to work together to arrive at the best solution. Is our memory so defective, and our conscience so easily drugged that we will allow future generations to experience again what we are experiencing today which should have been addressed in the late 1970's as a result of the oil related issues.

Misspent time and misused talents, omitted duties and committed sins of greed, lost opportunities and warnings rejected, are our material torments today. But is that worse than the moral torture of knowing from memory that we had the opportunity once before to address the issue of our dependence on oil and did nothing? In the future if we fail to act now there will be no expedient avail to banish and drown the remorse.

Where will the fuel supply come from? There is no short term replacement for petroleum products. If all the vehicles were converted to electric we would not have enough generation capacity and the CO₂ release levels might even become worse.

We must act now to increase domestic sources of petroleum. With the halt to offshore drilling the best short term solution is to encourage the oil industry to move toward horizontal drilling from onshore facilities. This would provide rapid improvements in horizontal drilling, enhance geosteering technologies and speed the development of an industry that has the potential to change the face of the American landscape.

Horizontal oil and gas well drilling is already one of the most valuable technologies ever introduced in the business. Directional wells are drilled to position a reservoir entry point where a horizontal well is commonly defined as any well in which the lower part of the well bore parallels the oil zone. The angle of inclination used to drill the well does not have to reach 90° for the well to be considered a horizontal well. It started as an enhanced oil recovery (EOR) or gas recovery method and is fast becoming more and

more popular for other applications including more complete exploitation of thin oil-rim reservoirs, avoidance of drawdown problems such as water/gas coning, and in the case of offshore wells the extension of wells by means of multiple drain holes. Horizontal wells can enhanced the production factor as much as 15 or 20 times, making them very attractive. On land it may cost 2-3 times more to drill a horizontal well but the effectiveness of horizontal drilling is much greater, the U.S. Department of Energy indicates that using horizontal drilling can lead to an increase in reserves in place by 2% of the original oil in place. The production to cost ratio for horizontal wells versus vertical wells would reduce substantially if the market were encouraged to move in this directional. Using this technique for near shore oil field development would be the first application.

Horizontal well drilling has also been used in these scenarios:

- under buildings, roads, and other surface obstructions

under active sites where surface operations precluded drilling equipment (Airports and Highways)

- to efficiently extract soil vapor
- to identify the causes of decreased well performance
- to place leak detection sensors beneath solid or hazardous waste landfills
- to install gas collection systems at landfills or similar waste dumps
- to stabilizing hillsides for mine waste dumps or other unstable granular soil masses
- to dewater hillsides where mudslides endanger housing developments
- to install groundwater collection galleries in shallow aquifers for private or public water supply
- to convey fluids between vertical wells and treatment facilities

Other applications that have not been considered for this technology to date:

1. In-situ conversion of shale oil deposits and coal for the in ground development of liquid hydrocarbons from solid feed stocks. CO₂ would be used to create an underground retorting chamber by freezing the perimeter of the conversion and extraction zone. The retorting chamber would have horizontal wells for freezing the outer zone to protect the water and environment, heating the inner zone for releasing the hydrocarbons (600-700 Degrees F required) and collecting the liquid. As the two zones meet methane hydrates created during the sequestration and storage of CO₂ in the outer zone are released creating pressure in the retort to force the displacement of liquid hydrocarbons and gases. Gas separation techniques using membranes can then be used to purify the gases creating methane for use as fuel.
2. The greatest benefits however could come in the construction of mag-lev transportation tubes which would take advantage of the BAT (best available technologies) in the world designed into a new system for optimum performance nationwide. More on this later.
3. Moving the national electrical grid underground for safety, rights of way issues, security, aesthetics and the electrification of the US national transportation system.
4. Creating the pipe network along the transportation corridor for the transportation of greenhouse gases (CO₂) which would also provide cooling for the electrical grid.

The big brother of horizontal drilling is tunnel boring, where active human control of the underground boring machine is used. Tunnel boring is used for large projects with machines capable of boring holes many feet in diameter. Projects include subway transportation tunnels. The potential for use on a new underground mag-lev dual mode transportation system is unlimited. Also, consider that planetary colonization which will require the use of underground construction could provide a new focus for world attention and cooperation.

In the long term electrification of the US transportation system will reduce petroleum use, improve our national security, reduce harmful emissions, reduce transportation related fatalities and reduce congestion on our highways. But it cannot be based on the electrical system we have today.

Nuclear power generating plants using the latest technology should be sited in remote areas, near oil shale and coal deposits would be great, along the

existing interstate highway system which will provide power for the smart grid road system and electrical power distribution. The use of interstate highway system for a new underground smart grid would provide control and allow for the isolation of any problem areas. All other forms of power generation would also be connected to the system and battery backup would be provided for load balance and voltage droop reduction in remote location with varying terminal voltage requirements. New power distribution rights-of-way issues would be eliminated as the land is already part of the national highway system.

The major national power grid should be underground and matched with load balance and battery storage systems to provide rapid isolation capability. Where possible on-site power generation connected to the grid for backup should be used for self-contained industrial complexes and critical industries such as food production and storage.

In order to shore-up safety issues in the present system of transportation and power distribution, we should move away from exposed large scale intricate networks, (such as air transportation) which are vulnerable to the destructive power of a few terrorists. Power and transportation should be integrated to achieve optimal performance. Major consideration must be given to safety. Thus, regulatory requirements for building construction and operation which are barriers to an integrated power and transportation systems need to be modified.

Integrated systems using the Best Available Technologies will provide the maximum reuse and minimum waste of resources while meeting the needs to reduce CO₂ release into the atmosphere. Base load should be provided by nuclear power plants which currently generate 20+ percent of the nation's electricity, while emitting no carbon dioxide or controlled pollutants.

A new integrated and yet self-contained secure transportation and industrial complex will use nuclear powered turbines, coal powered turbines, natural gas powered, wind turbines, Micro-turbines, anaerobic digesters both-single and two stage, photovoltaic, hydro- reservoir, run of the river and elevation type, thermal power and fuel cells for the generation of electricity.

Most transportation, power generation and distribution design's in use today fail to achieve optimal performance. The equipment and systems were selected for a specific application with little regard for how they integrate

with the complete process grid. The performance of each piece of equipment has been optimized, but not the grid. Although techniques are available optimization strategies have never been applied to the total transportation, power generation, and distribution systems in the United States of America.

This should be our objective as a nation on a complex by complex, industry by industry basis review and upgrade to achieve optimal performance and safety based on all of the new and exciting technologies we have available.

As a High-Tech society we face a cruel paradox. All of the exciting technologies deliver wealth and prosperity making us the envy of the world; but they also expose us to crippling attacks any of which can stop the country in its tracks as we saw on 9/11. National networks, clusters of vital assets and high density population centers only amplify the psychological and financial fear and potential destruction that terrorists can inflict. We live in an open society, which can't be ruled but can be broken by the burden of constraints placed on our lives in the name of safety in response to terrorist actions. These constraints allow terrorists to possess the ability to sense and manipulate the emotions of our society. The details of our response, our decisions, determination and how we function is available for the world to see. As a result our enemies have driven a wedge between our people, getting their fingers in our society, our financial and political systems-- in effect they control us for their benefit. This psychological control did not require a whip – fear, the yoke of oil, greed and our own need for pleasure did their work for them. They used the strength of our system of government against us.

These issues can be resolved, if we have leadership to focus the nation on a goal big enough and clear enough to bring all the resources we have together in order to arrive at the best solution. Let the world see leadership in action, a nation united with a new vision for transportation and energy that will provide the aspiration, ingenuity and the integrity to focus our efforts in ways that bring great joy to God.

Once again as a nation we will be a shining example, an inspiration to the people of the world. There is no reason to emulate the rest of the world when we have been chosen by Christ to lead if we will only follow Him. God has provided us with the resources and the knowledge to use them how we use them is up to us a nation and a people.

In the future if we fail to act correctly now there will be no expedient avail to banish and drown the remorse, we might not even exist as a free nation.

Who was pumping up the oil supply in 2015 and why? What will be the result of new price increases when they destabilize our shale oil industry?

The survival of our nation depends on Energy usage. The United States of America is the largest consumer of oil in the world, using more than we produce at an ever increasing rate. In effect we are borrowing energy from other nations at a rate that cannot be sustained without increasing worldwide turmoil. As a nation we have placed a moratorium on drilling near shore resulting in only two sources for oil: International Oil companies which take big risks, make big money, and play for keeps or National Oil Companies controlled by foreign governments. In that situation we could either make deals with national oil companies or expose ourselves to more risks (like the recent explosion in the gulf) paying higher and higher prices for oil from remote sources if we could gain access to them. Now with the addition of the recent moratorium on US drilling in deep water, offshore oil drilling in American waters has come to a complete halt. This must in the end reduce the US domestic oil supply. First pushing demand higher for National Oil Companies and then increasing exploration in other regions of the world that might be just as ecologically sensitive as US waters or even more so. Consider the effects, in the Gulf of Mexico a spill during a placid season in what is perhaps the best serviced marine environment on the planet could neither be prevented nor contained. What happens when oil companies start plumbing some of the roughest, coldest and least serviced oceans on the planet: at the polar caps, in the North Atlantic and deep offshore in International waters?

Just one day without oil will bring our industrial base to a standstill and create chaos throughout our society, yet:

Foreign national oil-states are becoming more in control of the world's fuel supply the latest news is Venezuela's has nationalized drilling rigs owned by American companies. This follows nationalization of multi-billion dollar projects in 2007. The effects on our internal financial structure, particularly as oil states change from transactions based in American dollars to other currencies over which they have more control, will be two fold; fuel and

money. This is not acceptable if we are to remain a free and independent nation.

Today the greatest control, influence, is maintained by Islamic nations, especially Saudi Arabia. The flow of dollars to these oil producing closed Islamic states, where the people do not participate in the increased riches results in a small number of Islamic leaders with control of large sums of money to accomplish their objectives, which have been clearly stated as a new one world Islamic state. The petro-dollars are not being invested in the once safe haven of the United States Treasurer bonds but rather in buying western companies, building Mosques in western countries including the USA and building infrastructure to create an Islamic homeland for the rich oil monarchs to live in style.

Our society functions based on the supply of oil, one major disaster or terrorist action creating an issue with the oil supply can and will bring our society to a standstill. With the exception of a few impoverished pirates why have the Islamic terrorist not attached the oil supply system? Money from oil is the only thing that keeps the Islamic leaders in power. Without money from oil and protection from the USA the leaders of Saudi Arabia would not be in power. Why have the effects of the environmental disaster in the Gulf of Mexico not been factored into the current cost of crude? Who is pumping up the supply and why?

The department of energy has failed to achieve its founding objective. We should have changed the fuel basis of our economy starting back in the 1970's with the creation of the department of energy. Forty years later the US government still has no plan to change our dependence on oil. We have reached a defining moment for the advancement of our society; the effects of inaction could be catastrophic.

ⁱ FP January/February 2002, The Rise of Complex Terrorism, By Thomas Homer-Dixon

ⁱⁱ Power Engineering March 2001

ⁱⁱⁱ COSPP Vol 2 issue 6 Nov-Dec 2001, Policies for a Micropower future, by Chris Hewett