A National Energy Program
The Apollo Program of Our Time
What, Why, When, How?

Overview of the NEP white paper

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OurEnergyPolicy.org

By Lawrence Klaus

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Presentation Outline

• Introduction: What is the Goal, Timeline and Methodology?
• Why Should America Achieve the Goal?
• How Will We Achieve the Goal?
• How Will NEP Operate?
• How Will We Pay for It?
• How Will We Start? NEP Planning Project
• Summary: Yesterday, Today and Tomorrow?
Introduction: What is the Goal, Timeline and Methodology?

• The goal is to achieve equality between U.S. oil consumption and production in a decade and position our nation for a sustainable energy future
  – “Apollo like” program planning and management achieves goal in a decade
  – Supply chains built during program position U.S. for sustainable future

• It’s not just about us
  – Our security and stability is becoming inextricably linked to security and stability elsewhere in the world - DOD 2013 National Security Strategy
  – By 2030 the world will require 118 MBD; may only be producing 100 MBD - DOD Joint Operating Environment (JOE) 2010 Report
  – “Business as usual” forecasts not real world
    • Risk of supply disruptions due to conflict and embargoes not considered
    • Conservative forecasts used to cover downside risk too often ignored
  – We must “do our part” to be able to lead and enable other nations to work with us to eliminate any global shortfall

• White paper presents goal, objectives and methodology “that works at scale” as a place to start for discussion to begin NEP planning project.
  – Plan available before Presidential election to impact new administration
  – Cover downside risk for “Greens” that Reagan will replace Carter again
Gap between domestic production and consumption projected to be 4-8 MBD by 2025 by accepted sources. Goal should be set nearer to high end to cover risk.
America is Living in Denial
Chasing rosy scenarios being run over by unforeseen events

Denial

More oil produced at home than we buy from the rest of the world – the first time that’s happened in nearly 20 years … The all-of-the-above energy strategy I announced a few years ago is working, and today, America is closer to energy independence than we’ve been in decades

- President Barak Obama, 2014 State of the Union Address

Reality

- IEA and EIA forecast U.S. oil production will peak in 2016-2020 and then decline without achieving independence from imported oil
- Severe energy crunch is inevitable without massive expansion of production and refining capacity

IEA Forecast of US Oil Production

America is Living in Denial
Conflating oil and gas – we have an oil crisis, plenty of gas

- America needs an open fuel standard to substitute gas for oil
  - GTL could compete in liquids market if Congress enacted an open fuel standard requiring new cars to run on all-alcohol fuels, including methanol – US Senate Hearing

U.S. natural gas production, 1990-2035
(Trillion cubic feet)

Source: DOE AEO2012 Early Release Review

Tight Gas
Tight gas is natural gas that has gathered in small, poorly connected cavities between the rocks (mostly sandstone). Because this rock is not very porous the natural gas cannot flow freely to the well. The technology for producing tight gas, called hydraulic fracturing, has been in use worldwide for 50 years.

Shale Gas
Shale gas has remained in the rock where it formed and has not migrated to more permeable rock. It is largely trapped in the surfaces of the rock particles. More procedures are needed to create the channels for the gas to flow through, and a much higher volume of fluids is required than from tight gas deposits.
Gazomotornoye Toplivo NGV “Program”
Consolidates Gazprom assets related to NGV fuel production and sales in 31 regions

- Creates infrastructure for NGV market development
  - Construction of CNG filling stations, cryogenic filling stations, NG liquefaction and other facilities

- Consolidates investment resources to create NGV market infrastructure

- Cooperates with regions to develop NGV market
  - The public, special purpose and municipal freight transport conversion

- Creates infrastructure to boost consumer demand, diversify NG powered machinery and equipment

- By 2020 planned proportion of:
  - CNG to conventional fueled vehicles
    - Public transport and municipal vehicles – 50%
    - Local freight transport and lightweight commercial vehicles – 30%
    - Private vehicles – 10%
    - Agricultural equipment – 20%
  - LNG to conventional fueled vehicles
    - Agricultural equipment – 20%
    - Long distance motor vehicles – 30%
    - Rail transport – 2%
Why Should America Achieve This Goal?
To Avoid Chaos

• Energy Security is National Security
  – “Arc of instability” from North Africa and Southeast Asia (the region) could become an “arc of chaos” involving military forces of many nations
    • Seven of top ten nations with largest proven oil and gas reserves in the region
  – Implications for future combat are ominous, if energy supplies cannot keep up with demand and should nations see the need to militarily secure dwindling supplies - JOE 2010

• Our leaders know Americans won’t fight for oil, use other rationales
  – American people not taking casualties see threat as price at pump
  – Gridlock and civil war between “greens and blacks” continues as our troops take casualties while two sides fight
  – The region, energy, national security inextricably linked in white paper
    • Shines light on relation of oil and our conflicts to make living in denial more difficult

• Politically: Why National Security?
  – In America, interests stop squabbling and pull together when national security is at stake (fear better motivator than logic)
    • Market forces haven’t gotten the job done since OPEC oil embargo of 1973
National Security – State Actors
Control of State Actors and Energy Supply Becomes More Difficult

- Our ability to defend oil supply shrinks as insolvency and chaos grow
  - Retrenchment in defense accounts means reduced force capacity; less likely operational tempo will decrease
    - DOD Capstone Concept for Joint Operations: Joint Force 2020
  - As America moves offshore access is not guaranteed once our forces complete withdrawal from conflicts and consolidate on the periphery
    - Colonel Michael Eastman, WSJ
  - Countries with high performance weapons could deny U.S. forces access into their countries and global commons at significant range from borders
    - JOE 2010
  - Potential for logistics disruptions is not simulated in war games and is a blind spot in planning future forces
    - Operational Energy Strategy: Implementation Plan, DOD

- America – another empire in decline as division and insolvency at home is reflected in growing conflict and chaos abroad
  - In America, history is the last election and the future the next.
  - We don’t learn from history and experience and repeat mistakes of the past

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...
  - Henry Kissinger, Foreign Affairs
National Security – Nonstate Actors
Invaders have to win, insurgents have to not lose until invaders leave

• We are going after a bunch of half starved beggars. The danger is that they can keep that up almost indefinitely - Robert McNamara

• Terrorists and organized crime intermingling enabling them to coordinate activities at global scale
  – Shadow markets currently $2-3 trillion are growing faster than legal and commercial trade
  – As these markets (supply chains) grow, adversaries will be able to generate attacks at higher level of rapidity and sophistication - JOE 2010

• The U.S is often dependent on the same nations that pose the greatest threats to our interests
  – Relationships between nonstate and state actors provide numerous benefits to both - Terrorist-Criminal Pipelines: Emerging Alliances, NDU
  – Ex: Wahhabi - Saud alliance older than U.S.

• Precision air strikes remain an option...unduly reducing American ground forces risks creating a vacuum - Colonel Mike Eastman, WSJ
  – Drones kill fighters not financiers
  – Paying for our funeral at the pump is national suicide
Where an increase in terrorist activity intersects energy supplies the need for immediate action may require significant conventional capabilities - JOE 2010

Oil wells ablaze in the East of Syria

Damage by Islamic militants at Tiguetone Gas Plant in Algeria

Huge Blaze Out of Control in Tripoli as Libya Slides Into Chaos, Reuters, 7/29/14
National Security – Energy Producers
Shortfall shifts power to producers with different interests

- Seven of top ten nations with largest oil and gas reserves in the region
- U.S. has losing record in wars in the region since WWII (1:3:1)
  - Future wars likely there as empire shrinks and energy scramble grows
- The ability to sanction and embargo will shift from U.S. to producers again in any global shortfall

![Bar Chart: Proved Oil Reserves by Country, 2013](chart)

Proved Natural Gas Reserves by Country 2013
Top 20 Countries

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Reserves (Trillion Cubic Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Russian Federation</td>
<td>1,680.00</td>
</tr>
<tr>
<td>2</td>
<td>Iran, Islamic Republic Of</td>
<td>1,045.67</td>
</tr>
<tr>
<td>3</td>
<td>Qatar</td>
<td>895.80</td>
</tr>
<tr>
<td>4</td>
<td>United States</td>
<td>304.63</td>
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<tr>
<td>5</td>
<td>Saudi Arabia</td>
<td>275.70</td>
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<td>6</td>
<td>Turkmenistan</td>
<td>265.00</td>
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<tr>
<td>7</td>
<td>United Arab Emirates</td>
<td>227.90</td>
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<tr>
<td>8</td>
<td>Nigeria</td>
<td>186.88</td>
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<td>9</td>
<td>Venezuela</td>
<td>178.50</td>
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<td>11</td>
<td>Iraq</td>
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<tr>
<td>12</td>
<td>Australia</td>
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<tr>
<td>13</td>
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<td>14</td>
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<td>15</td>
<td>Kazakhstan</td>
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</tr>
<tr>
<td>20</td>
<td>Kuwait</td>
<td>63.50</td>
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</table>

Source: United States Energy Information Administration
Natural Gas Proven Reserves Definition: The proved reserves of natural gas are the estimated quantities of natural gas which geological and engineering data demonstrate with reasonable certainty to be recoverable in the future from known natural oil and gas reservoirs under existing economic and operating conditions.
National Security – Energy Pipelines
Control of pipelines shifts power to nations with different interests

- **Russia, China sign 30 year $400 Billion gas/pipeline deal** - Reuters
  - Pipelines being built through deal + Altai Pipeline (100+ BCM)
  - Russia and China sign more than 30 agreements on energy, finance and high-speed rail cooperation - Reuters

- **Gas pipelines towards Russia, Iran, Turkmenistan and China draw gas from any of the fields** - Russia, China, Iran redraw energy map, Asia Times

- **Russia completes ESPO oil pipeline to China/Pacific Ocean (1.6 MBD)**
  - Largest infrastructure project since Soviet Union - Reuters

- **Russia cuts off gas supply to Ukraine**
  - Could cut gas supply to Europe as eastern pipelines network grow
Russia becomes increasingly able to shift energy exports out of E.U. to China/Pacific as East-West oil and gas pipeline networks grow. Part of New Silk Road: integrated infrastructure of roads, high-speed rail, pipelines, ports being built to connect China through Russia to Western Europe.
National Security - China’s “String of Pearls” Strategy
Protects China’s energy security, negates U.S. influence in the region and projects power overseas

• Chinese army personnel participate in overseeing energy and infrastructure projects - Washington Institute for Near East Policy
• In submarine warfare, space, and cyberspace, China can compete on nearly equal footing - JOE 2010
• Regional navies grow as U.S. Navy shrinks increasing instability
• U.S. pressure against China, Russia and Iran producing stronger economic and military ties between them

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.
Implications for future combat are ominous, if energy supplies cannot keep up with demand and should nations see the need to militarily secure dwindling supplies - JOE 2010

China is accelerating the expansion of its offshore oil fleet – and adding coast guard vessels to protect it – as it ventures farther into the sea, threatening more altercations with neighbors...Drilling in deep waters is in line with global trends in which easily extractable reserves have been depleted and energy companies are being forced into remote, sometimes politically tricky regions - China steps up expansion of offshore oil fleet, WSJ
America’s Choices - Denial and Reality
Force won’t change conditions – competent American leadership will

Denial

• Stumble into a war trying to cut China off from energy resources in the East and South China Seas
  – Growing tensions in the East and South China Seas have raised the risk of a “miscalculation” spilling over into a regional conflict
    – China encirclement could spark war, The Diplomat

Reality

• The US must work with China and nations in South Asia/Asia Pacific to secure adequate energy sources and reduce future demand
  – China will account for more than 30% of projected oil demand growth
    - International Energy Outlook 2011, U.S. EIA
  – The way to insure the peaceful rise of China is to insure access to adequate energy sources to fuel economic development
    - 2012 Energy Industry Study, NDU

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…

– Henry Kissinger, Foreign Affairs
How Will We Achieve the Goal?
Integrated Program and Supply Chain Planning and Management
Start by Ending Program/Project Confusion

President Obama mentioned “funding the Apollo projects of our time” in energy. He then mentioned electric cars and passenger rail in the same breath as Apollo as though all were projects. - 2010 State of the Union message

Apollo wasn’t a project. It was a program.

- Programs achieve “ends” - goals and objectives
  - Ends must be defined and agreed upon FIRST (go to the moon, build a national highway system, achieve oil equality and a sustainable future)

- Projects - “means” achieve ends
  - Means can then defined and ranked (Keystone Pipeline, cap and trade, electric vehicles, shale gas) in relation to achieving goals and objectives

- Placing means before ends = Gridlock since 1973 OPEC oil embargo
  - Can’t see forest for the trees
  - Each interest hugs its tree trying to cut down trees of opposing interests

Perfection of means and confusion of goals seem to characterize our times
- Albert Einstein
“Apollo like” Program Planning and Management

- Method to manage planning and implementation of defined goals and objectives from inception to completion

- Means (assembly elements) to achieve the goals and objectives are defined “in tiers” using a program breakdown structure (PBS)

- Assembly elements are related to performing organization using an organization breakdown structure (OBS)

- A cost/schedule system is developed to manage all assembly elements and means

- All of the above are structured within a management framework wherein a change in any assembly element immediately translates into impacts on all other elements

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 kind of work from the finest staff officers. This planning meant the toilsome drudgery of grinding countless unrelated facts into homogenous substance

- Dwight D. Eisenhower, Crusade in Europe
Approach – Define and Achieve Sector Objectives

Replace imported oil as part of total oil and other liquids used in each sector from other sources as required to achieve the goal

- Sectors and related objectives discussed in white paper
- Priority to each sector based on oil usage
  - Defense Sector gets top priority: if we can’t defend oil supply other sectors impacted
- Priority to means in sectors based on contribution to objective in timeline
- Energy Efficiency is a major energy source that reduces emissions
  - Estimate: U.S. wastes 58.1% of energy it uses - Lawrence Livermore National Laboratory

Energy Consumption by Sector and Energy Source, 2012

Source: DOE, EERE, Vehicles Technologies Office
National Energy Program to Achieve Goal
Program and Organization Breakdown Structures (PBS/OBS)
Five sectors + R&D objective
Supply Chain Planning and Management to Position America for Sustainable Energy Future

• **End to End Systems**
  – Approach for planning, implementing and controlling flow of information, materials and services from raw material to customer fulfillment

• **Cradle to Grave Operation**
  – Integration of processes for demand planning, manufacturing/operations planning and control, supplier relationship collaboration, product/service launch, customer order fulfillment and life cycle support.

• **Example: Transportation Sector Supply Chain Elements**

![Transportation Sector and Power and Fuels Sectors Diagram](image-url)
What is needed is an integrated, multi-pronged approach that cuts across Administrations and covers transportation fuels and vehicles
- Fuel Choice for American Prosperity, Institute for the Analysis of Global Security

Transportation receives top priority after defense based on oil usage
- 70% of all the petroleum used in U.S.
- 96% of energy used in the transportation sector is oil
- NEP will concentrate on motor vehicles
  - 59% of oil in sector used for light duty cars and trucks
- Blue Print for Securing America’s Energy Future, US Chamber of Commerce
Planning Transportation Sector Supply Chains
Prioritize and Plan Each Supply Chain
Based on Potential/Risk to Meet Sector Objective Within Timeline

• Make “apples to apples” comparison of each supply chain type
  – Gas, Electricity, Liquids, Hybrids
  – Each has different strengths, weaknesses, risk profile

• CNG uses existing gas production and distribution system
  – Need engine conversion and national fueling station network
    • Gas price so low no trucking company would use diesel if it could be used - NDU

• EV’s use existing power grid
  – Need “competitive” vehicle batteries and charging systems
  – Need national charging station network
  – “Buying new” costs more than conversion

• “Drop in” liquids use existing vehicles and gas stations
  – Need R&D, new plants, pipelines, freight transportation
    • GTL could compete in liquids market if Congress enacted an open fuel standard requiring new cars to run on all-alcohol fuels, including methanol – US Senate Hearing

• Hybrids are transitional vehicles
Transportation Sector Supply Chain Elements

- **End Use Vehicles**: All R&D with public sector “co-investment” licensed (WWII)
  - **Café Standards**
    - Multiplicity of Automotive industry R&D to meet standards
  - **Materials (Lightweighting) and Aerodynamics**
    - Ex: Ford F-150 made largely out of same aluminum alloys used in airplanes (cuts weight 700 pounds).
  - **Logistics**
    - Load matching, more efficient routing and scheduling, improved vehicle receiving policies, reduction of long-duration idling, and packaging materials, etc.

- **Interfaces**: 160,000 gas stations less than 10,000 all other fuels
  - DOE, Alternative Fuels & Advance Vehicles Data center
  - **Local Nodes**
    - Serves vehicles owned and operated by government, industry, institutions, etc. operating fueling stations at their own locations for “distance constrained” vehicles.
  - **National Core Network**
    - Strategically located fueling stations across the nation serving long distance vehicles. Sparse, provision to ensure vehicles don’t run out of fuel between stations.
  - **National Network**
    - Rollout national network serving light duty cars and trucks built on core national network

- **Power/Fuels**: Gas, Electricity, Liquids, Hybrids

- **One possible strategy**
  - **Begin with commercial Fleet**
    - Ex: Solve “chicken and egg” problem for NGV’s: get trucking, oil and gas, automotive, financial interests together to convert millions of trucks and build core national fueling station network
Transportation Sector Supply Chain
Integrate Military and Civilian Efforts

• Air Force flies, Navy sails, Army moves on land
  – Military transportation R,D&D should focus on US Army

• Over 70% of tonnage to position U.S. Army into battle is fuel
  – Number of convoys to transport an ever increasing requirement for fossil fuels is a root cause of casualties
  – Green versus black fuel not the issue, reduce tonnage of “all liquid fuels”
  – US Army needs best met through HEV/EV’s

Energy Use in Warfare: A Rising Trend
Historic Fuel Consumption

Transportation Sector Supply Chain
Integrate Military and Civilian Efforts

• US Army should have a leading role in HEV/EV as matter of national security
  – “Life and death” for US Army; price at pump for civilians
  – Base customer to build supply chains for transfer to America’s roads

• Example: Oshkosh Defense HEMTT A3 Diesel Electric Tactical Truck
  – Developed through “co-investment” with DOD
    • Aerospace model: Build for military and rollout to civilian markets
  – Improves fuel efficiency up to 20%
  – Delivers 100 kW of clean, exportable AC power, enough to run a field hospital
  – Single-unit, power-generating solution, eliminates need for additional vehicles

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
Transportation Sector Supply Chain  
Includes America’s Roads

• Gasoline tax becoming obsolete  
  - Must collect funds to rebuild and maintain roads by vehicle type, weight, and how much and where vehicles drive  
    • Example: Vehicle Mileage Tax  
    • Electric Cars don’t pay at the pump; must pay fair share

• America’s infrastructure crumbles as New Silk Road is built  
  - $3.6 trillion needed by 2020 to bring our infrastructure to good condition  
    - ASCE Infrastructure Report Card  
  - Projects inadequate: Need new programs with sound revenue streams  
    • Updated National Highways finance model adaptable to parts of our infrastructure  
  - Computers don’t pour concrete, people do  
    • Jobs for the 99%, productive investments for 100%
Integrate Program and Supply Chain Management


Vertical Objectives

1.0 R&D&D

2.0 Buildings Processes

4.0 Power

3.0 Transport

5.0 Fuels

6.0 Defense

Horizontal Objectives

7.0 Environment/Regulation

8.0 Training/Employment

9.0 Finance

10.0 Organization

Legislation
How Will NEP Operate?
Public/Private Sector Partnership – Not a Government Agency

- **Outside government, freed from political interference and earmarking**
  - A Business Plan for America’s Future, American Energy Innovation Council
  - Managed and operated by business and financial professionals
  - Public sector cuts red tape, provides capabilities, timely oversight and tailored investments to get deals done.

- **Private sector needs “real business” opportunities to participate**
  - Ex: SolarCity and BofA move forward on $1 Billion project to create 300 MW of solar generation capacity to power 120,000 military housing units
    - Bank of America
  - See white paper for real opportunities in Buildings and Processes Sector

- **Small government investments/projects + bureaucracy + regulation + inadequate supply chains + reliance on market forces = Hobby Shops**

As I understood my job, it wasn’t up to me to tell industry how to do its job; it was our function to show industry what had to be done and then to do everything in our power to enable industry to do it – including stepping in if the marketplace couldn’t deliver fast enough. - Donald Nelson, Director of the War Production Board, Freedom’s Forge, Arthur Herman
How Will We Pay For NEP?

- Stop using our children’s lives and treasure to pay for our addiction
  - Half of funds from tax expenditures, entitlements and subsidies cut from budget used for energy R,D&D, infrastructure and work force training.
  - Half of funds used to reduce budget deficit and pay down national debt.
  - Achieve better balance between national consumption and investment

- Pay as you go to defend imported oil
  - Real cost of oil = exploration, production, refining and delivery costs + hidden unfunded costs to defend imported oil and fight energy wars
  - Pay unfunded defense costs as “part of cost of good sold” at the pump
    - Patterned on British East India Company
  - Alternative: defense cuts unsustainable to maintain American interests

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.

- President Eisenhower, Farewell Address
How Will We Start? NEP Planning Project

• When President Kennedy set goal he turned to NASA for a plan
  – NEP planning project will produce a plan and draft legislation
    • Planning of each objective by stakeholders that must participate in implementation
    • Stakeholders will have incentive to work with Congress
    • Don’t approach Congress until “ducks are in a row”
  – Plan available before Presidential election to impact new administration
    • Activity begins before end of this year to “avoid missing window"

• NEP will operate on separate track from nation’s current track – gridlock and civil war
  – At a minimum, plan will be available when everyone can see the danger
  – President Roosevelt’s actions prior to Pearl Harbor an example
    • Saw danger and prepared for war as best he could in a nation living in denial
  – Hopefully, NEP won’t require another catastrophe to be implemented

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 foresee them, there is no remedy - Niccolo Machiavelli, The Prince
Summary: Yesterday, Today and Tomorrow?

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.

- Defense Secretary Robert Gates, Remarks at University of Chicago

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.

- Leslie Gelb, Foreign Affairs
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 that had 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 development 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 as 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. He was a consultant at Synergic Resources Corporation (now Navigant Consulting) working 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. Mr. Klaus holds a B.S, Bachelor of Architecture and M.B.A. from the City College of New York.

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