Energy Strategy: Planetary Transformation of AN ERA

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ABSTRACT
Energy is a critical enabler. The history of civilization is a history of energy transformation. Every advanced economy has required secure access to modern sources of energy to underpin its development and growing prosperity. In the early 1970s, oil powered the global economy. Almost four decades after, energy security is no longer only about oil. And industrialized nations are no longer the only major consumers of energy. Climate change driven by greenhouse gas emissions – 70% of which are derived from energy production or use – is a growing threat. So energy policy followed by appropriate strategy was tasked with a new objective: to cut greenhouse gas emissions while maintaining economic growth. On the other hand, contemporary energy systems are still away from being sustainable. After decades of work to advance sustainable energy solutions, an energy gap is growing as energy systems around the globe are put under significant strain by the rise in energy demand, and the unpredictable changes in energy supply. The Energy Trilemma has also passed through transformation. From the old one, which included decarbonization, energy security and affordability, to the new one, structured by energy security, social impact, and environmental sensitivity. History shows that there is no single preferred method for achieving a balance across all three dimensions. Energy Efficiency and Energy Security are the two most developed dimensions of modern energy strategies. Energy efficiency improvements over the last 25 years saved a cumulative USD 5.7 trillion in energy expenditures. This virtual supply of energy generates multiple benefits for governments, businesses, and households, including greater energy security from reduced dependence on energy imports, and billions of tons of greenhouse gas emissions reductions. Strengthening our understanding of the energy efficiency market and the prospects over the medium term is becoming increasingly important for the process of creating one sustainable energy strategy.

Key Words:
Energy Strategy, Energy Security Strategy, Energy Efficiency, Energy Productivity

"World leaders are convinced that energy is the golden thread connecting economic growth, increased social equity and a healthy environment, but we still need to enforce more ambitious goals to improve energy productivity."
Kandeh Yumkella, UN Under-Secretary-General & CEO of Sustainable Energy for All
"The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil."
James Canton

I. INTRODUCTION

The way we create, use, and manage electricity is finally changing, and the implications go far beyond the utility sector. Several coincident, significant transformations are causing a revolution in the way electricity — the vital fuel of global commerce and human comfort — is produced, distributed, stored, and marketed. A top-down, centralized system is devolving into one that is much more distributed and interactive. The mix of generation is shifting from high carbon to lower carbon, and, often, to no carbon. In many regions, the electricity business is transforming from a monopoly to a highly competitive arena. We have entered an age in which the technology-powered push and the customer-driven pull have beneficially collided. This has led to a paradigm shift within the power industry, from a premium on rigid capacity to a focus on flexibility.

The root causes of the transformation of the sector are a unique conjunction of global megatrends. Concerns over emissions and climate change are bringing heavy political and social pressure to bear on providers — pressure both to change the mix of fuels they use and to encourage efficiency. According to *PwC's 2015 Global Power & Utilities Survey*, the falling costs of renewables such as solar energy, breakthroughs in large-scale and smaller-scale energy storage, and new energy-efficient technologies, are catalyzing greater distribution of generation. This momentum is not confined to mature power markets. In the face of all this change, companies that have been in the business, public and private ones, and wish to remain so in the future clearly need to rethink their strategy. But the revolution carries implications for all businesses, whether they are part of the electricity sector and its supply chain or interact with it primarily as customers. In short, it is now possible — even imperative — for a much broader range of leaders to think strategically about electricity, to imagine new possibilities, and to consider whether their capabilities match emerging demands.

The characteristics which make significant differences between the basic strategic dimensions of

defining energy strategies of the 1980's and the modern strategies are:

- Markets are changing rapidly
- New Participants in a transformed world
- Integral and Sustainable strategic approach
- Interconnections, Interrelations and Inter-locations
- 3C-golden rule of an energy strategy: Communication, Cooperation, Coordination
- Energy efficiency as a driving force of country sustainable development
- Multi-level dimension of the energy security: from country based to people based models.

We can see notable differences in the very perception of energy. They directly dictate the models of behavior on the market, the strategies that define future methods, and the means to produce, transport, distribute, and finally, use electric energy in the most effective and most efficient way. And, of course, making profit still remains the strategic goal No. 1. Creating policies that simultaneously deliver secure, affordable, and clean energy, is one of the most important challenges facing policymakers today. Energy security refers to the effective management of primarily energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand.

1	2
"CLASSIC" ENERGY	RENEWABLE ENERGY
■ Municipal utilities ■ International utilities ■ Network operators ■ Energy sales & trading companies ■ Mining companies ■ Power plant manufactures ■ Oil & gas companies	■ Solar module manufactures ■ General solar equipment manufactures ■ Wind power plant manufactures ■ Storage equipment companies ■ Cleantech companies (energy efficiency) ■ Smart grid equipment manufactures

Table 1: Strategy, M&A and Transformation for the energy sector, source: Goetze Partners

Today, important notions in the structuring of energy strategies have appeared, such as:

- "Thirstier" Energy - Water is essential for energy production: for power generation, for extraction and processing of oil/gas/coal, for transport, and increasingly for crop irrigation to produce biofuels. "The projected rise in water consumption of 85% over the period to 2035 reflects a move towards more water-intensive power generation and expanding output of biofuels."[1] In sum, "energy is becoming a thirstier resource," and water is growing as a criterion for assessing the viability of energy projects.

Energy productivity - defined as the output and quality of goods and services per unit of energy input. It means we can produce more of the same things (or have bigger profit) using the same amount of energy. This differs from energy efficiency, which means using less energy to deliver the same service. However, energy efficiency can actually improve energy productivity for companies and countries. On an economic level, energy productivity is the GDP countries produce for every unit of energy they consume.

Energy signature - The energy signature is a moment-in-time view of the energy data from an individual process, system, or component, which provides a view of its current state and performance trends. Like an MRI or EKG[2], the energy signature serves as an important diagnostic tool to assess the process, system, or component operating health (in other words, is it running efficiently/to specification). Best-in-class companies monitor such energy signatures on a regular basis and understand what they should look like under various load and environmental conditions, to identify and even predict inefficiencies and failures that are precursors to quality issues and downtime. Applying advanced analytics to correlate the energy signature to other metrics drives improved processes, workplace quality, and employee productivity, as well as reduced maintenance costs.

Experience curve – An analytical tool often required to resolve energy dilemmas. Experience curves demonstrate that investment in the deployment of emerging technologies could drive prices down so as to provide new competitive energy system for stabilizing concentration of CO_2. This process of technology 'learning' requires long-term, stable policies for energy technology. It is rather long-term strategic then a short-term tactical concept. It represents the combined effects of a large number of factors, so it cannot be used reliably for operating controls or short-term decision making.

Also, several societal Megatrends[3] coupled with the transformation of the energy industry have raised the profile and importance of energy, making it an executive imperative. This leads to changing energy landscape. Broad Business Megatrends are: technological breakthroughs, radical transparency, demographic shifts, and climate change. On the other hand, Energy-Specific Megatrends are new and emerging energy technologies, and, evolution of energy markets. Megatrends' significant challenges and opportunities are:

[1] World Energy Outlook 2012, International Energy Agency, Paris, Nov 2012, p.29

[2] Magnetic Resonance Imaging (MRI) and ElectroCardioGram (ECG or EKG)

[3] Energy Strategy for the C-Suite: From Cost Center to Competitive Advantage, An Introduction to the Unified Approach to Energy Transformation, 2016 PwC, enernoc.com

- The growth of big data and analytics, cloud computing, and digitization and connectedness of physical assets (e.g., Internet of Things)
- Rising pressure from governments and society to reduce carbon emissions and to demonstrate resilience
- Rising expectations for transparency from corporations— including investor interest in non-financial information
- Emergence of sustainability-minded Millennials as the largest consumer and employee cohort
- Renewables becoming cheaper and easier to integrate on and off-site
- Growth in distribution, self-generation, and the emergence of smart grid, energy intelligence platforms, and energy storage
- Structural changes in base load power mix, and increased volatility due to emerging dominance of natural gas and pressures on coal
- Increasing customer choice and flexibility in energy procurement and use
- Rapid evolution and increasing complexity of tariffs, incentives, and financing.

If we analyze the period from 1975 to 2035, we will notice that global demand for energy will rise by over one-third by 2035, and fossil fuels will remain dominant in the Global Energy Mix.

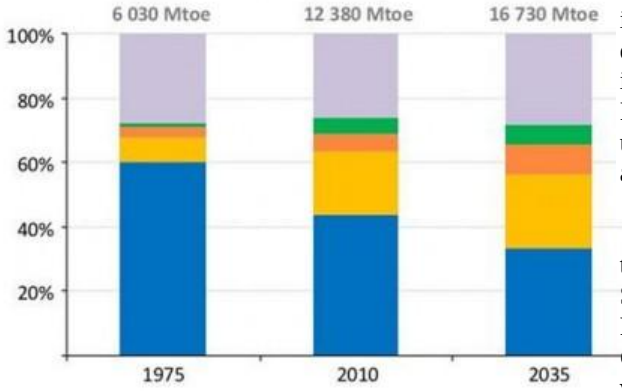


Table 2 – Global energy demand rises by over one-third in the period to 2035, underpinned by rising living standards in China, India & the Middle East.
Source: World Energy Outlook, IEA, 2012

II. ENERGY EFFICIENCY

"There is no process which is not operated. There is no process that does not require time." Mirjana Prljevic

The WEO 2012[4] highlights the key role of energy efficiency in the coming decades. Some of the major energy consumers, China, US, EU, and Japan, have already taken important actions in this regard, but the energy efficiency potential, for the most part, remains to be exploited. Simply breaking down the existing barriers that hinder the implementation of sustainable measures at the economic level, the growth in global demand for primary energy by 2035, could be halved, and energy savings equivalent to nearly a fifth of the global energy demand in 2010 could be achieved. The potential energy efficiency is therefore important, but it must be seized and exploited by taking appropriate measures. The report shows that we are increasingly moving away from the direction that would limit emissions of greenhouse gases to the level of concentration needed to maintain the rise in global average temperature below 2° C compared to pre-industrial levels. Furthermore, the effects on the climate are already evident. Timely policies to promote energy efficiency, such as those that the European Union is applying under the "European Resource Efficiency Platform" with the aim of promoting sustainable growth, are winning policies on three grounds: mitigation of climate change, economic, and energy security. Similarly, policies that aid in the transition to renewable energy will help not only to create a more sustainable growth, but also a strong reduction of the energy poverty in the world, and will consequently establish a more balanced growth. It is evident that the demand for energy will increase, mitigated only by the increase in the energy efficiency mentioned above. It is also evident that it will particularly increase in newly industrialized countries and in developing countries. It is therefore necessary to help developing countries use more efficient technologies in terms of energy and that are less based on fossil resources.

In January 2013, when the representatives of the powerful organization, The European Alliance to Save Energy, spoke to the European Commission President José Manuel Durão Barroso with a letter on *Global competitiveness*, they expressed their visionary attitude on why and how the future competitiveness on the global market should be viewed through the prism of energy efficiency:

- According to recent analysis, Energy efficiency (EE) can lead to reduced global expenditures on coal, oil, and natural gas, amounting to € 525 billion by 2020 and € 1,270 billion by 2030. In addition, a reduction of global energy demand will have a decreasing impact on global energy prices reducing energy costs even further.
- Decreased fuel prices will lead to an additional decrease of the global energy bill by € 900 billion by 2020, and € 1,050 billion by 2030. Therefore, EE can reduce global fuel bills by € 1,424 billion per year in 2020, and by € 2,323 billion in 2030. In addition, it can save on capital costs; for example, EE improvement can economize € 937 - 1,873 billion in

[4] World Energy Outlook 2012, International Energy Agency, Paris, Nov 2012, p.29

capital investments in power production infrastructure by 2030.

- In a world where demand for energy is increasing, to deliver products and services with less energy will be a competitive advantage for EU industries over regions of the globe that remain crippled by their ever-increasing energy needs and, in turn, can impact positively on matters related to the economic and political security of the EU.
- In the past ten years, there has been a substantial improvement in global industrial competitiveness due to investment in EE services, innovative products, and processes. This improvement is due to the attractive long-term cost savings that EE solutions provide to their end users and to the ability to reduce production costs for exports, thereby improving the price flexibility and stability of EE products in the global marketplace. In addition, as globalization has increased, the amount of foreign-sourced energy in all exports has also increased. This trend reveals a competitive advantage (lack of supply vulnerability) for countries which have massively invested in EE measures - such as the US, which is currently forecasted to increase by 45% its self-sufficiency through improvements in EE.
- EE solutions can provide an important field-levelling effect for global regions that are not able to satisfy their energy needs primarily through domestic production - such as the EU. The EU has a predominant market share in the segment of innovative EE solutions. An estimate for geographical segmentation is: EU (27%), China (23%), and US (20%). This is proof that innovators introducing energy savings solutions on the global market are more successful and enjoy higher sales compared to conventional innovators. This reflects an important competitive advantage.

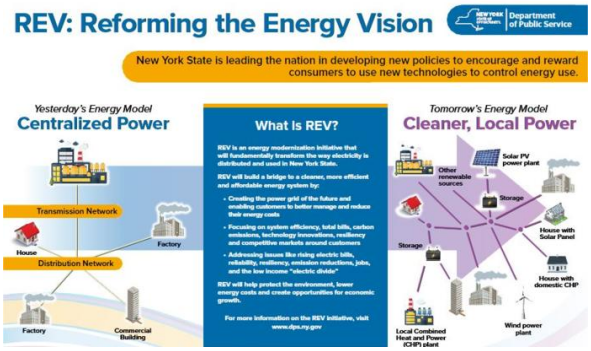
EJ per Year	2000	2010	2020	2030
Crude oil	155	168	195	197
Natural gas	87	114	146	169
Coal	96	149	184	193
Nuclear	28	32	41	56
Biomass	42	55	59	61
Solar	0	1	6	20
Wind	0	1	4	10
Other renewables*	13	17	23	28
Total Primary Energy Demand **	422	536	659	734

Table 3. Current projected primary energy demand (per year) - 2000-2030

Source – Shell International, projections under current and expected policies. * Other renewable include hydro-electric, geothermal, tidal, and waste ** Totals may not sum owing to rounding

There are many examples that go in favor of what was mentioned. From private to governmental initiatives, some of the most efficient ones are: REV - Reforming the energy vision of the New York State, The Rockefeller Brothers Fund as a member of Divest-Invest Philanthropy - a movement launched in 2014 by the Wallace Global Fund, consortium EnerNOC, PwC and Winston Eco-Strategies, the Global Economic Symposium (GES), and other. After the global financial crisis, and then the world economic crisis in 2008 – 2010, facts speak in favor of the notable worldwide change in perception regarding energy and energetics. Today, the cities themselves are the true engines behind the new conception of planetary transformation of energetics perception. In the 1980's, these engines were big industrial enterprises, industrial and economic concerns, and manufacturers of advanced technologies.

In the beginning of 2015, Governor Cuomo unveiled New York State's new energy plan: Reforming the Energy Vision - REV, a joint effort between the Public Service Commission, NYSERDA[5], and state and local governments. REV is a strategy to build a clean, resilient, and affordable energy system for all New Yorkers. This comprehensive strategy will spur clean energy innovation and investment through promoting energy efficiency, electric vehicles, microgrids, wind, solar, and energy storage. By 2030, the 50 % renewable mandate will be a critical component in reducing greenhouse gas emissions by 40 % (from 1990 levels), and by 80 % by 2050. REV is an energy modernization initiative that will fundamentally transform the way electricity is distributed and used in New York State.



REV will build a bridge to a cleaner, more efficient and affordable energy system by:

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- Creating the power grid of the future and enabling customers to better manage and reduce their energy costs;

[5] NYSERDA - New York State Energy Research and Development Authority

- Focusing on system efficiency, total bills, carbon emissions, technology innovations, resilience, and competitive markets around customers;
- Addressing issues like rising electric bills, reliability, resilience, emission reduction, jobs, and the low income „electric divide".

REV will help protect the environment, lower energy costs, and create opportunities for economic growth. That which provides the aspect of integrity to this initiative are the seven pillars that give the most important dimension of success of a strategic initiative – the dimension of sustainability. Those are: Clean Energy Fund, Clean Energy Standard, NY-Sun, K-Solar, NY Prize, NY Build Smart, and NY Green Bank[6].

III. ENERGY SECURITY

Energy security is a sphere of social relations that is very important for maintaining overall stability, regarding both domestic, and international political, economic, and military security scene. Every violation of energy security as a worldwide, regional, or local act, can be violent or non-violent in its character, but it is nevertheless illegal, and represents the social and practical form of endangering the overall safety of a society or country. Substantial understanding of energy efficiency is very complex, because it is a process which doesn't have a constant, but is rather prone to daily changes which are affected by the turbulences on the energy market. The problem of energy security is a multidisciplinary and complex one, as it consists of multiple interconnected causal factors, which altogether form an elaborate whole. All important subjects are interested in the question of energy security – governments, international organization, military-political alliances, multinational companies, and others. The imbalances in opposed interest are the cause of conflicts and crises in this domain. Therefore, it is not unreal to say that the 21st century will be marked by struggle for energy resources, in which the means and methods will not matter as long as the goal is accomplished.

The matrix of energy security spans across three levels (triads) of basic co-operations in a security sense:

- The first triad consists of the national security level, in which the state apparatus in the service of security of all its citizens sets up a national strategy. This matrix is made by the interaction of: national security – which focuses on national interests and internal security of energy resources that are the strategic key of economic diplomacy; economic security, which, nowadays, is greatly dependent on the energy policy of the state, including the fiscal policy and the strategy of fuel prices in the export–import system; and environmental security, which focuses on the sustainability of eco-systems, thus stepping into the matrix of sustainable development of the planet, and being one of the main factors of destabilization of certain regions.

The second triad includes the coordination within statal security structures and their energy efficacy regarding the matrix of sustainable development, the communication on the level of international security structures (Europol, Interpol, IPSA, etc.), and the last, but not less important, is the component of anti-monopoly policy within economic alliances between states through the micro plan of legislative, executive, and judicial authorities.

The third triad is the key to maintaining the matrix of energy security. It refers to the redistribution of energy resources, with reference to new energy sources and accumulative policy through the model of energy efficacy. The components of the mechanism of the third triad represent the primary base of world peace, and are reflected in energy resources: 1) constant (sunlight, wind, watercourses, etc.); 2) renewable (microorganisms, fungi, flora and fauna – eco system, with reference to biomass); 3) fossil fuels (coal, gas, oil), which, until 2010, represented the economic power of every country.

Therefore, only a stable and independent country can become the foundation of energy security in service of world peace. The question of energy conditions the creation of new strategic doctrines expressed in the sequence "energy – economy – politics – military operation". From the aforementioned comes the conclusion that the state of economic and political relations depends on the way the energy needs are secured.

On the internal level, the general ascertainment is that the energy security and national security and causally connected into one concrete system. Primarily, it is necessary to define fuels, their geopolitical and technological aspect, through the symbian platform of functioning. First is the geopolitical aspect, which includes the analysis and systematization of data on fuels as a strategic resource. The indicated data on their representation, leading manufacturers, distributors, and consumers, are the frame of this construction. The second aspect refers to the technological analysis, i.e. presenting the basic technological character data on fuels which are mostly used today. Then, it is necessary to deal with energy security in the turmoil of social crises and conflicts; through recent history, but also through the one that is centuries away, this will show us the immediate cause of every serious conflict on the

[6] https://www.ny.gov/programs/reforming-energy-vision-rev

planet, but also, it will show us the bigger picture regarding energy destabilization which leads to the escalation of uncontrolled conflicts, presenting a threat to world peace, and complete security violation of the regions in which these types of conflicts take place. It is known that various forms of social crises and conflicts have a negative influence on energy security, and vice versa. In respect to this, the attention should be focused at social crises as a factor that threatens energy security. It is also very important to refer to the phases of social crises that emerged as consequences of energy insufficiency. Aside from the energy crises, it is necessary to consider political, economic, social, martial, and security crises that were the result of energy crises, or were an immediate cause of destabilization of certain regions. All of this is aimed at overtaking fuels and exploitation of energy resources in the regions where such forms of aggression are executed, mostly under the banner of democracy and creation of a civil society, as we were able to see in the recent history of militant foreign policy of USA, through two Gulf wars, Libyan crises, recent revolution on the "Black continent", but also through the rise of terrorist activities, from Al Qaeda to ISIS/ISIL. Recently, during a security gathering of Balkan states, I reminded that the entirety of terrorism in the 21st century comes down to monopolistic policy regarding fuels, and that for every terrorist plan, or a simple sabotage action, it is necessary to fulfill three components: 1) performer; 2) logistics; 3) contractor. Without a doubt, behind every such guerilla structure there is a contractor who aspires to achieve energy monopoly in resources, which is a direct attack on energy security, both of independent countries affected by the conflicts, and of overall energy security on the planet.

Defining the main subjects of energy security includes the government, its legislative, executive, and judicial authorities, its special services, military factor, police, and the means of mass media as the main subjects of security of every country. The theoretical analysis of the subjects mentioned provides a bigger picture of security frames, namely due to the specific roles they have in the system of energy safety. It is necessary to explore the strategic, tactical, and operative directions these subjects take, with a particular accent on their importance and roles, thus putting them in a certain causal connection with the key conditions to maintaining energy safety. After defining this, it is necessary to pay attention to the factors that endanger energy security, in which should be performed a theoretical analysis of the threat factors of multinational companies in the sphere of energy security, with an accent on their monopolies and the harmful actions they carry out, not only for material and financial reasons, but also for other social reasons. Special attention is given to fiscal policy, i.e. the means of forming prices on the energy market. Also, the importance and role of energy embargos as a form of threat to energy security should be pointed out.

The complete picture also refers to the negative influence that nuclear programs of certain countries have over energy security, and also to the destructive effects of some subjects through business and especially industrial espionage, hidden behind many seemingly independent engineering corporations, which, in their basic agenda, advocate environmental security, sustainable development, and energy efficiency as their primary goals. In fact, national services for espionage and counter-espionage activities are behind this in most cases, as are lobby groups that finance these types of organization, and therefore it is very important to pay special attention to the singularity and security of infrastructural networks on a nation-wide level, but also to the rise of cyber terrorism that is financed via financial embezzlements and other kinds of abuse of the global network, multinational companies, and alliances. The next step in the security plan includes "the energy security threats – tactical level". This step requires a theoretical analysts of energy security threat factors on tactical and operational levels. The last part of the security plan concerns the "corporative security of the energy sector", given that without corporative security, there is no successful business that the country can conduct in any sphere, especially when it comes to energetics. In developed countries which have a strong energy sector, the system of corporative security is a particularly serious branch of not only the system of the company, but also the system of national security. This is due to the fact that the question of fuels is a strategic matter of every country.

IV. CONCLUSION

Despite many controversies, society will eventually adopt renewable energy, since fossil fuels are limited in supply and bear burdens of huge environmental impact.[7] However, the question is not whether society will shift to renewable energy, but when. A complete transition to renewable energy is likely to take many years, and by the year 2050, the energy mix will remain fossil based. Nevertheless, the fossil fuels will remain a dominant energy source in the long term global energy mix. Energy strategists all around the globe must be aware of that fact and ready to define, secure, and realize appropriate strategic activities on different management levels. Also, aware of the fact that definition of energy strategy at the highest level reflects all other sublevels of strategic planning and predictions of all national, industrial and

[7] Energy Systems in a Controversial Transition, article, Miodrag M. Mesarovic, pg. 8

organizational energy strategies, we believe that all kinds of technical-technological innovations and changes in the energy sector happening during the past two decades bring a completely new point of view to the energy strategy of the 21st century.

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