sciendo International Conference KNOWLEDGE-BASED ORGANIZATION
Vol. XXV No 1 2019

SMART, SECURE AND SAFE ENERGY MANAGEMENT APPROACH – AN EDUCATION FRAMEWORK IMPROVING THE COMPETENCE GRID OF THE PROFESSIONALS IN THE ENERGY SECTOR

Miroslav Vergilov DIMITROV*, Nataliya VENELINOVA**

***"G. S. Rakovski" National Defence College, Sofia, Bulgaria**
****"Anghel Kanchev" University of Ruse, Bulgaria**
dimitromster@gmail.com, nvenelinova@uni-ruse.bg

Abstract: *The paper presents evidence based brand new approach of the permanent rise of the competences and know-how transfer between researchers, teachers and professionals aiming to ensure the specific expertise of the human resources engaged in energy security management. The approach has a collaborative and integrative nature and relies on the hybridization between energy management, urban development planning, environmental management, civil protection, protection of critical infrastructure and the national security applied fields. The authors redefine the conventional understanding of the energy security by describing a practically oriented integrated approach of teaching energy security, based on 3 separately existing concepts: the concept for smart energy security grid, those for the smart cities and the standard operative procedures applied to energy security management. Smart, Secure and Safe Energy Management (3SEMA) is both behaviorally and technically oriented and presented in a circular chart, involving all actors on certain territory with the purpose to apply smart, secure and safe approach in governing the energy sector, taking into consideration the dynamic technological changes and the concept of intelligent urban use.*

Keywords: energy, security, smart city, intelligent use, education, governance

1. Introduction

The sustainable economy with a lesser impact on environment has been a priority on global scale, recognized by the EU on policy-making and regulatory levels for decades. The development of efficient renewable power sources on industry level is a special priority in South-eastern Europe due to the growing need to modernize the existing industrial plants in terms of technologically safe, environmentally friendly and economically efficient competitive dynamic societal expectations and needs. But the "new geography of energy" [1] shows that in 2000 the global demand of energy was 40% in Europe and North America and 20% in developing countries and the estimations for 2040 is completely reversed.

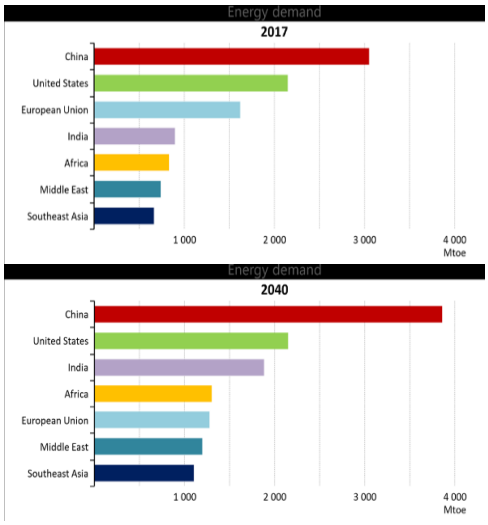

Figure 1 Energy demand in 2017 and 2040 [1]

DOI: 10.2478/kbo-2019-0034

This trend definitely changes both the short and the long-term understandings of energy security as well, which we consider in the present paper as horizontal issue not only for the energy sector at national and global perspective but for each government policy implemented at all decision-making levels.

It might be surprising, but the statistics in WEO 2018 reported that 70% of the annual investment in energy supply (about $2 trillion required each year) comes from state-directed entities or from such with partial governmental share [1, p. 3] (for instance those receiving state aid or state loans or any other type of financial instruments blend). The increasing share of variable renewables raises the flexibility needs of the whole sectors bound to the energy and calls for rapid reforms to deliver investment in power plants, grids and energy storage, and to unlock demand-side response of the economies.

Such a context, together with the adoption of large scale renewable power production, creates emerging labor market that requires both specific evidence-based training of academic professionals, combined with increasing interdisciplinary R&D activities, but also a brand new approach to the whole education policy relevant to the energy sector.

2. 3SEMA – an education framework for professionals in the energy sectors.

Due to the above described trends and factors the conventional approach in the traditional education, especially the higher one, which is based on the idea of strictly specialized capacity building in each separate intra-sectoral energy field, still doesn't meet the needs, neither of the operators, nor of the policy makers. Thus the actors (both public and private including even the non-governmental organizations e.g. specific analytical, pressure, lobbying or monitoring groups) face the paradox of enough highly specialized human resources, which don't cover the competence map relevant to the hyper dynamically changing energy environment.

In addition, after September 2001 another important driving force for system changes appears together with the fast development of IT – the security issues related to the complicated geopolitical situations e.g. extremely raising terroristic threats which dramatically increase the vulnerability of the energy critical infrastructure; the conflicts in Ukraine and Syria with their relation to the oil and gas markets add challenges, never before imagined, to some of the more powerful industries: such as power production and transportation.

The core elements of each critical energy infrastructure (CEI) is the power transmission and distribution grid network infrastructure.

Without any doubt, a lot of existing advanced monitoring and control technologies are able to effectively deal with either physical, technical or cyber-security threats at individual or corporate level. However, the reciprocal interaction and related impacts of different threat types at different micro and macro levels are not adequately captured and accordingly managed. Thus, a joint cyber-physical-urban approach to manage CEI security becomes necessary [2].

"*The strongest capability of the attackers was not in their choice of tools or in their expertise, but in their capability to perform long-term reconnaissance operations, required to learn the environment and execute a highly synchronized, multistage, multisite attack"* [3].

The proliferation of emerging technologies including mass use of drones' sets creates both surveillance opportunities but also needs of new competences and skills acquisition for engineers, decision-makers, and researchers, working in the energy field.

Energy systems are undergoing substantial changes but the essence for achieving sustainable, secure, affordable and intelligent energy and a global progress

towards long-term goals, can be found not only in developing and deploying key clean-energy technologies but first ensuring the energy sector with new type of hybrid specialties. They are featured by high adaptiveness based on a collaborative platform which would ensure fast environment emergency response to every predictable threat came with the rapid changes in the global competitive. As the President of Edison Electric Institute (EEI), Tom Kuhn, highlighted at NARUC's 2019 Winter Policy Summit in Washington, the reliability, and resiliency of the energy sector lays in the importance of partnerships between industries and governments in securing the energy grid. Key objectives in such partnership are to strengthen cyber and physical defenses and to elevate preparedness. Kuhn also said, "Our strong industry-government partnership, coordinated through the ESCC (Electricity Subsector Coordinating Council), will continue to be key to accomplishing our shared goal of protecting the energy grid against all threats." [4]

At the same Summit, Scott Aaronson, vice president of security and preparedness at EEI states: "*One of the things that comes with CEO leadership is 'good is never good enough,' and so while we are extraordinarily proud of the work we have done to build out this council the way that we have, we have a drive to be better, to do more, and one of the things that we are doing as an ESCC is to build out a program management approac*h" [4]; he also notes the need for focusing on an initiative to help energy companies to create a culture of integral security as part of their operations. [4] All this can be achieved through the sharing of existing knowledge and good practices and through opportunities for joint work in pursue of new products and innovations. Indeed this is dealing not only with the DEFENDER model shown on Figure 2 but the two other concepts – the public private partnerships (PPP) as contemporary form of social-economic maturity and smart city concept.

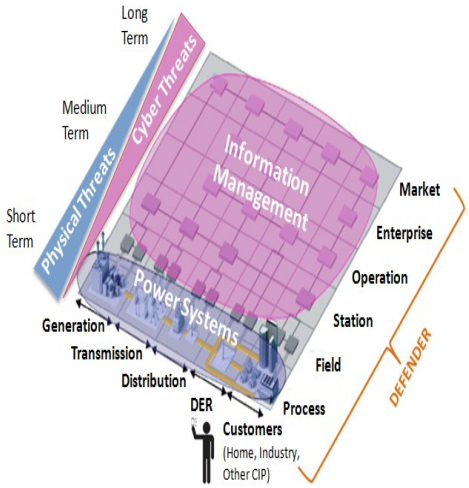

Figure 2 Joint cyber-physical approach to manage CEI security [2]

They should be seen as key instrument to mitigate the threats in the energy sector. [5] This practice is however not a new one as it can be traced back to the ancient times. For instance, in the 4th century BC in the city-state (polis) of Athens prominent citizens financially contributed to public festivals. Some centuries later, in the Roman Empire, civilians worked hand-in-hand with the Roman army to build the necessary infrastructure. As T. Melchiorre [6, p. 26] summarizes the "PPPs practice is the progressive specialization in modern societies, which means that performing tasks requires highly specific expert knowledge. As a consequence, the division of labor, which is seen as essential in modern societies, blurs the lines between the public and the private sector. Therefore, many tasks that were previously performed by the state are today handled by specialized companies " [6, p. 3].

But such partnerships might be seen in a very contradictive perspective when we are dealing with the security field. The very first suggestion is predominantly optimistic and refers to the collaborative models of PPPs where an ideal status of consensus is in their roots. This type of non-hierarchical

outsourcing means that the governmental structures empower the privates delegating decision-making functions. This raises the question: is the private sector enough prepared for the complicated interdisciplinary horizontal and vertical issues to govern together with the public bodies the contemporary energy sector in shared manner without overlapping functions and responsibilities and in a highly vulnerable information environment, which is subject of permanent cyber-attacks?

From the point of view of the flexibility of the private sector and the large variety of investments, such type of partnership would be considered as great opportunity to decrease the governmental control and the burden to ensure public financing for innovations, which would liberate the energy market. On the other hand such liberal policy, sharing the responsibilities for the energy systems management, might create large range of threats even in the strong democracies, both for the energy sectors and the related industries and services as well.

In our perspective, this co-oriented PPPs models regardless of the type of the governance and the legislation base, is definitely an ideal case which is theoretically existing in the energy management but not fully applicable to the energy sector partnerships. Even in the subsectors related with energy R&D activities and innovations it cannot be introduced completely and this can be proven even by an overall look at the figures for total public energy RD&D budgets by countries in comparative plan per year in the last decade and by regions [7].

Practically such non-subordinate model of collaboration between the public and the private actors in the energy sectors might be extremely dangerous for both for the national security and the security of the sector, because it should never be forgotten that the CEI is part of the national security system of each country. In terms of globalization the PPPs model of non-subordinated type with equal shares of all partners reveals much more complicated issues referring to the sensitivity of the information management of the energy sector at national level, the comparative advantages of the countries exporters in the energy sector, the development and introduction of safe and clean technologies without regional faveolization aiming to ensure the global wellbeing and sustainability. As can be supposed, such perspective can be predominantly philosophic but it is not practically applicable for the energy sector in the near future and this might be proven with a simulation aiming to assess the affordability of the energy supplies and energy products prices.

It doesn't mean that we are definitely "against" the non-hierarchical models of PPPs in the energy sector, we are just highlighting that the energy sector, especially the energy security sub-sector, both at macro and micro level is still not enough prepared for sharing responsibilities for the public security and safety and for co-governance in real partnership of the energy policy. First, the knowledge base and the collaborative culture should be subject of capacity building efforts, then the collaborative practice might be changed redefining the existing asymmetrical models of multilevel governance of the energy sectors and transforming the asymmetry in collaborative partnership equally oriented to the horizontal security issue within the energy sector and outside.

Based on the above developed analytical considerations we developed the 3SEMA (Smart, Secure and Safe Energy Management Approach) as a framework for improvements in the competence grid of the professionals in the energy sector.

3SEMA is a theoretically developed proposal for redefinition of the education relevant to the collaborative future of the energy security sector. The approach is based on the idea of flexible competence grid of the professionals, researchers,

decision-makers, entrepreneurs and all other public and private actors where the flexibility is aiming to respond to the needs of the energy sector of large scale adaptive professional competences and skills that are changing together with the innovative technologies and the sustainable resource-friendly use of energy. On the other hand, the approach centralizes the security issues; that's why the core concept in the framework is CEI integrating all the security aspects relevant at micro level where the simplest unit is the city. We took the smart city concept as a base, where both the anthropogenic and technological improvements are synergic ally interconnected. That's why the social-economic and policy making competences as well as their IT aspects – all these viewed from the perspective of the energy sector and the security policy have been centralized as mandatory. They are aiming to ensure the permanent rise of the competences, skills and special focus of the professionals in the energy sector. Due to the large varieties of sub-sectors which are highly specialized the 3SEMA proposes extended scope of curricula, which is a result of the personal choice, the current HR needs of the sector and the changes in the territory where certain experts will act. This extended scope also introduces the collaborative sharing of experience, information and know-how by being fully practically oriented, serving to fulfill the gaps in the knowledge and skills of the human capital on a micro-level and to booster the transfers between all key actors in energy security. Such integrative approach creates a self-regulating alliance and establishes the behavior and the culture of collaborative remote equal access, rights but also responsibilities, which is the pre-phase for the development of the energy communities of the future based on the non-subordinated PPPs. The added value of the 3SEMA will be generated by the researchers and the NGOs involved in the exchange of information for the purpose of raising the competence grid. Then the researchers will work on solving real public or private problems of the actors in energy management. This is the way, which we propose to achieve all actors' equal involvement and co-orientation to the goal to develop smart, secure and safe energy management which is territorially responsive and globally acting (see below Figure 3)

Figure 3 3SEMA, 2019 M.Dimitrov &.N,Venelinova

3. Conclusion

The approach has a collaborative ground and integrative nature and relies on the hybridization between energy management, urban development planning, environmental management, civil protection, protection of critical infrastructure and the national security applied fields. The results we are expecting from further applying and improvements of 3SEMA is to facilitate sharing of knowledge, to develop innovative teaching and learning methods and solutions, and to create opportunities for personal and organizational collaborative-based professional development in energy security management.

References

[1] International Energy Agency, "World Energy Outlook," IEA, Paris, 2018.

[2] DEFENDER consortium, 2019. [Online]. Available: http://defender-project.eu/.

[3] D. Willacy, "https://www.smartgrid-forums.com," 06 Jully 2016. [Online]. Available: https://www.smartgrid-forums.com/wp-content/uploads/2018/06/07.-SmartSec-Europe-2016-National-Grid-David-Willacy.pdf. [Accessed 2018].

[4] K. Randolph, "Dailyenergyinsider.com," 12 February 2019. [Online]. Available: https://dailyenergyinsider.com/featured/17597-energy-infrastructure-security-requires-continuous-industry-government-collaboration/. [Accessed 03 June 2019].

[5] M. Carr, Public-private partnerships in national cyber-security strategies., Oxford: John Wiley and Sons Ltd, 2016.

[6] T. Melchiorre, "Recommendations on the importance on CEI stackeholder engagement, coordination and understanding of responsibilities in order to improve security," NATO Energy Security Centre of Excellence, Vilnius, 2018.

[7] IEA, "https://www.iea.org," 2019. [Online]. Available: https://www.iea.org/statistics/kwes/rdd/.

[8] IEA, "https://www.iea.org/topics/energysecurity/," [Online].

[9] R. S. Irungbam, "The Model of Smart Cities in Theory and Practice," *Journal for Studies in Management and Planning,* vol. 02, no. 4, p. 162, April 2016.