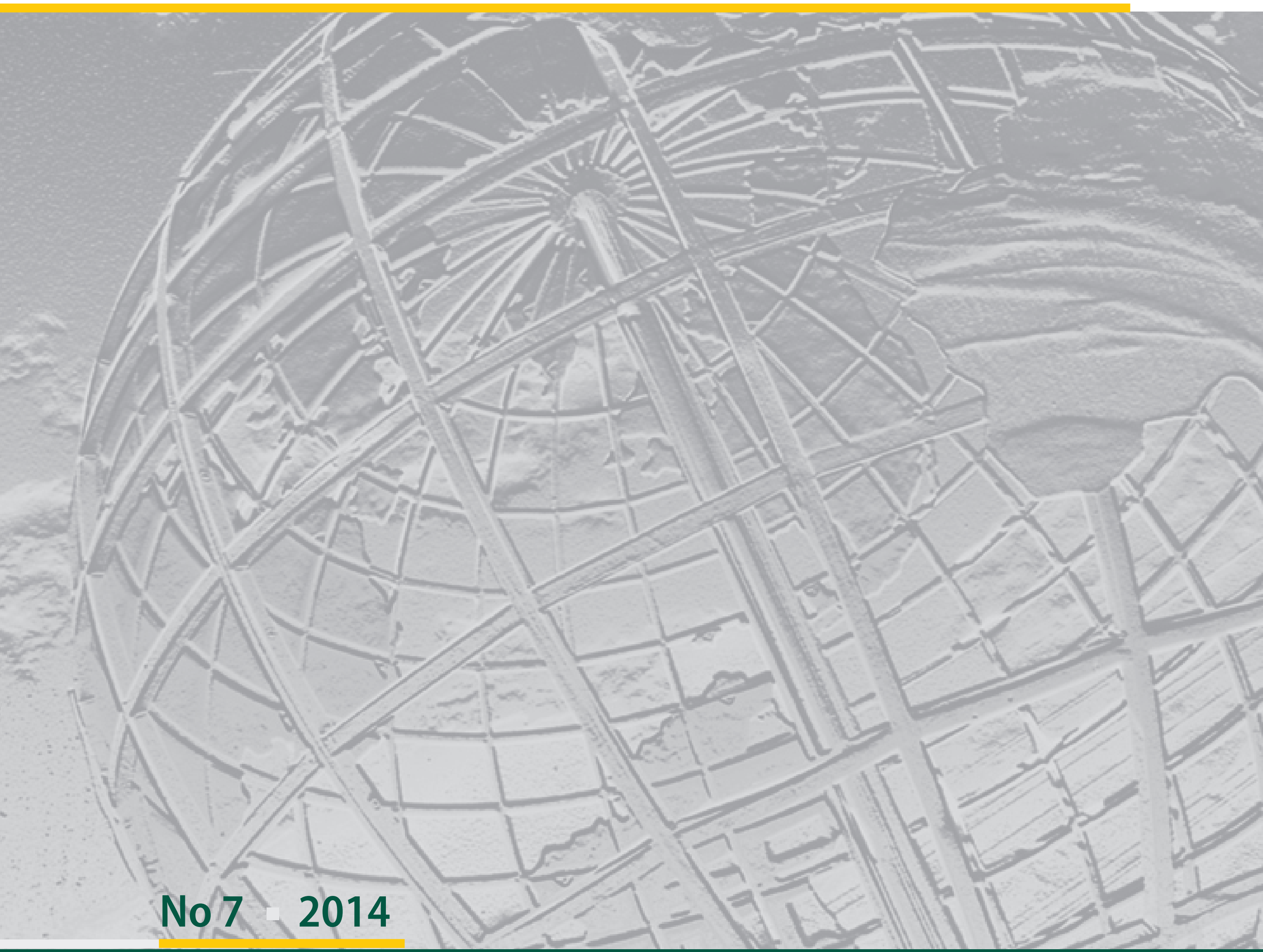
NATO ENERGY SECURITY CENTRE OF EXCELLENCE

Energy Security: Operational Highlights



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Energy Security in the NATO Framework

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Current events in Ukraine and Europe's slow response to the crisis show how much dependant on energy we are. Energy security becomes one of the main elements of global security considerations. This issue is being dealt with in various supranational, multilateral and bilateral fora. However, North Atlantic Treaty Organization (NATO) seems to be left outside these deliberations as it does not have explicit powers in the area of energy security. Does NATO have any possibilities to act in the area of energy security? Can those possibilities be compared with those of other fora (first of all – European Union) as well as with other newly established areas of NATO involvement.

Two aspects of energy security

According to the definition provided by the International Energy Agency, energy security refers to the uninterrupted availability of energy sources at an affordable price. This notion encompasses different elements depending on the period of evaluation: long-term energy security is mainly linked to timely investments to supply energy in line with economic developments and environmental needs. On the other hand, short-term energy security focuses on the ability of the energy system to react promptly to sudden changes in the supply-demand balance. The current concept of energy security emerged mainly as a reaction to the oil crisis of 1970s. The abovementioned understanding of the energy security is adopted by many NATO members, although most of them emphasize the aspect of security of energy supply.

European Union competence in the area of energy

Energy formally became an area of the EU competence only in 2009 when a Lisbon Treaty entered into force. According to Article 194 of the Treaty on the Functioning of the European Union[1], EU energy policy shall aim, in a spirit of solidarity between member states, to, *inter alia*, ensure security of energy supply in the Union.

At the supranational level, introduction of energy as one of the policy areas of the European Union can be presented as the successful example for NATO.

Despite such a late formal arrival of the energy issues to the legislators' agenda[2], EU institutions used other policy areas as a 'back door' for energy related issues to be regulated at the EU level. Since 1990, some 80 legally binding EU acts were adopted in the area currently understood as energy policy. About half of those acts had environmental policy as their legal basis, however, about 10 percent were aimed at ensuring security of energy supply and its external dimension. The EU Treaties allowed such circumvention at the time by providing EU legislators with the competence to adopt measures if these are necessary to attain objectives of the European Community, while no express powers were provided by the EU law. Council Regulation (EEC) No 2618/80 of 1980 (amended in 1984) can be given as one of the first examples of such legal documents. By this Regulation, a special European Community

1 Official Journal, series C, 326, 2012.
2 More on the EU energy policy: http://ec.europa.eu/energy/index_en.htm

regional development measure was established contributing to improvement security of energy security in certain Community regions (some of the mountain areas of Italy and islands of Greece) by way of improved use of new technologies for hydro-electrical power and of alternative energy sources.

Council Regulation (EC) No 2964/95 introducing registration for crude oil imports and deliveries in the Community is another example of the EU legislation aimed at security of energy supply. Finally, in 2010, Regulation (EU) No 994/2010 concerning measures to safeguard security of gas supply was adopted. In this Regulation, among other things, a clear definition and attribution of responsibilities among natural gas undertakings, the EU member states and the Union itself regarding both preventive action and the reaction to concrete disruptions of supply, are provided. In addition, lists of market and non-market based security of gas supply measures are provides in annexes to the Regulation. These measures are provided both from the supply and the demand side.

In addition, energy security issues were numerous times emphasized at the policy level. These non-legislative documents and political documents are important mainly because the content of the European energy security concept is elaborated therein.

Thus, in 2002, European Commission published a policy paper (so called 'Green Paper') 'Towards a European strategy for the security of energy supply'[3]. In this paper, energy security was defined not only from the supply side, but also from the demand side. The demand aspect of the energy security includes such elements as energy efficiency, energy savings, renewables, competition, prospection of new fields, prevention of leakages. In 2006, European Parliament adopted a Resolution on security of energy supply in the European Union[4], where solidarity of EU member states as well as a need for a common position were emphasized as important aspects of energy security.

EU Heads of States have numerous times addressed the issue of energy security as well. However, in most of cases only individual elements of the energy security were addressed: security of supply, energy efficiency, climate policy related aspects etc. It was not until March 2009, when Council of the European Union explicitly addressed the complexity of the issue, by stating that energy security is a key priority which needs to be enhanced by improving energy efficiency, diversifying energy suppliers, sources and supply routes, and promoting the Union's energy interests vis-à-vis third countries.

Moreover, the importance of the energy security considerations at the European level was confirmed by judicial authorities as well. European Court of Justice in several cases (C-72/83 Campus Oil, C-503/99 Commission v Belgium) stated that the safeguarding of energy supplies in the event of crisis (that could result in dangers for country's existence) falls within the ambit of a legitimate public interest and public security. In addition, court of the EEA (EU plus Iceland, Norway, Liechtenstein) stated that ensuring security of energy supply constitutes legitimate means for restrictions of free movement of capital (case E-2/06).

Currently, EU institutions take other political, legal, financial and administrative measures aimed at the creation and functioning of the single EU energy market: liberalization of the

3 COM(2000)769 Final, 2002.

4 Resolution from 23 March 2006, P6_TA(2006)0110.

electricity and gas markets, assistance for member States in implementation of trans-European energy networks, establishment of the EU Agency for the Cooperation of Energy Regulators, investigations of the dominant market position of the Gazprom. Finally, the idea of the new European energy community was recently put on the table by several EU member states.

European Union as an example for NATO

North Atlantic Treaty Organization was established in 1949 by means of the North Atlantic Treaty, whose initial signatories were 12 countries from North America and Europe.

NATO is an international organization founded in accordance with the international law and principles of the Charter of the United Nations, and aimed at the collective defence. Founding documents of international organizations set their main operational principles, aims, goals, objectives, organizational structure. These legal documents are deemed to be a 'Constitution' of the international organization, thus have to be stable; therefore complex procedures for their amendment are usually envisaged. For the same reason, goals, aims and objectives of the organization are usually stated in vague and non-specific language, so they remain relevant in various changing situations during the course of operation of the organization. This relevance in the changing reality is implemented by bodies of the international organization through the adoption of acts of the so-called internal (or 'secondary') law of the organization. These acts may have a form of strategies, concepts, decisions, conclusions, and other types of documents. From the legal point of view, this internal law of the international organization is a mere interpretation of its founding documents. Moreover, certain documents (e.g., declarations) reflect a political will of the members of the organization to fulfil their obligations under founding documents.

NATO and the European Union, although both being international organizations in form, from the legal point of view have substantial differences. NATO is a 'classical' international organization, assisting its members to achieve certain common goals, while not replacing its member states' sovereign rights in certain area. Meanwhile, in the case of the European Union, its member states have agreed to give up certain areas of their sovereignty to the supranational governance by the EU institutions. Therefore, the EU practice in certain policy areas and ability to legislate even when it does not have express competence cannot be applied in the case of NATO. For this reason, the energy security issue in the NATO framework has to be analysed independently and through the prism of the documents of highest NATO bodies.

NATO activities in the area of energy security

NATO Summits are highest political level meetings of Heads of States and Governments of NATO members aimed at evaluating and providing strategic direction for the Alliance. Although not regular meetings, Summits are important elements in the process of decision-making and policy shaping in NATO. For the first time, NATO's role in the area of energy security was outlined at the 19th NATO Summit held in Riga in 2006, following the first Russia-Ukraine gas dispute. In the declaration of this Summit, NATO members clearly indicated that they regard Article 5 of the North Atlantic Treaty as covering the area of energy security[:]

The Riga Summit declaration:

> 45. As underscored in NATO's Strategic Concept, Alliance security interests can also be affected by the disruption of the flow of vital resources. We support a coordinated, international effort to assess risks to energy infrastructures and to promote energy infrastructure security. With this in mind, we direct the Council in Permanent Session to consult on the most immediate risks in the field of energy security, in order to define those areas where NATO may add value to safeguard the security interests of the Allies and, upon request, assist national and international efforts.

In Lisbon Summit, five key areas where NATO can contribute to energy security were identified: information and intelligence fusion and sharing; projecting stability; advancing international and regional cooperation; supporting consequence management; and supporting the protection of critical infrastructure.

Many believe, the 2010 Lisbon Summit is the most important in the NATO history so far. Several paragraphs of the Lisbon Summit Declaration refer to the energy security issue. According to the Declaration, partnerships are also important in addressing emerging, continuing and trans-national challenges such as cyber and energy security. Further, it states that a stable and reliable energy supply, diversification of routes, suppliers and energy resources, and the interconnectivity of energy networks, remain of critical importance. Finally, the Alliance commits itself to consult on the most immediate risks in the field of energy security.
As stated above, NATO Strategic Concepts are the up-to-date interpretation of the North Atlantic Treaty. Most recent NATO Strategic Concept was adopted at the Lisbon Summit in 2010. As regards energy security issues, commitments of NATO itself and its members to deal with the energy security threats are expressed in this document by stating that NATO would 'develop the capacity to contribute to energy security, including protection of critical energy infrastructure and transit areas and lines, cooperation with partners and consultations among Allies on the basis of strategic assessments and contingency planning.'[5]
The new NATO Strategic Concept reflects the recent shift in the understanding of security and re-emphasises the importance of the Article 5 of the North Atlantic Treaty. Thus, new 'Emerging Security Challenges' – cyber attacks and energy security – were placed at the forefront of the NATO agenda.

During the Chicago Summit in 2012, NATO members repeatedly stated that 'a stable and reliable energy supply, diversification of routes, suppliers, and energy resources, and the interconnectivity of networks, remain of critical importance.'[6]

5 NATO 2010 Strategic Concept. Available at http://www.nato.int/cps/en/natolive/topics_82705.htm

6 NATO Chicago Summit Declaration. Available at: http://www.nato.int/cps/en/natolive/official_texts_87593.htm?mode=pressrelease

Document, goals for energy security	Means of implementation
Riga Summit Declaration 2006: Protection of energy infrastructure	Analysis of the most immediate risks in the field of energy security, in order to define those areas where NATO may add value to safeguard the security interests of the Allies and, upon request, assist national and international efforts.
Bucharest Summit Declaration 2008: **a)** Protection of critical energy infrastructure; **b)** promotion of stability in the energy sector.	**a)** Information fusion, and sharing; **b)** extension of international and regional cooperation; **c)** consultations with other international organizations.
Strategic Concept 2010: **a)** Protection of critical energy infrastructure; **b)** protection of energy supply routes; **c)** creation of possibilities for NATO to add – value to the energy security of its members;	**a)** Consultations with NATO member – states, and partners; **b)** Strategic analysis;
Chicago Summit Declaration 2012: **a)** Stable, and reliable energy supply; **b)** diversification of energy suppliers, resources, and supply routes; **c)** increase of energy effectiveness of NATO's armed forces.	**a)** Individual efforts by NATO's member states; **b)** increase of competence through consultations with NATO's partners; **c)** Efforts by NATO Energy Security Centre of Excellence;

Table1: Political statements and implementation measures.[7]

Thus, although North Atlantic Charter itself does not provide for explicit provisions regarding energy security, determination of its members to address the issue under auspices of NATO stems from the wording of the NATO Summit declarations as well as from the NATO Strategic Concept. During the Chicago Summit, leaders of the NATO members decided to further integrate, as appropriate, energy security considerations into NATO policies and activities, further develop partnership activities, significantly improve the energy efficiency of the military forces and to establish the NATO Energy Security Centre of Excellence.[8]

NATO Centres of Excellence are nationally or multi-nationally funded institutions that train and educate leaders and specialists from NATO member and partner countries, assist in doctrine development, identify lessons learned, improve interoperability, and capabilities and test and validate concepts through experimentation. They offer recognized expertise and experience that is of benefit to the Alliance and support the transformation of NATO, while avoiding the duplication of assets, resources and capabilities already present within the NATO command structure.

NATO Centres of Excellence are being established to cope with issues directly not falling under the North Atlantic Charter that, however, need more attention of NATO members. From the international law point of view, Centres of Excellence are individual international organizations, although having a tense relationship with NATO itself, as well as a particular place in the NATO legal system. This relationship and place in the legal system are determined by operational and functional Memoranda of understanding, signed by the founders of Centre of Excellence (who at the same time are members of NATO – e.g., NATO Energy Security Centre of Excellence was founded by Lithuania, Estonia, France, Italy, Latvia and Turkey) and NATO itself.

In order to have the legal effect on NATO and on its members, products of Centres of Excellence (strategic analysis, proposals for doctrine, standards and procedures etc.) have to be 'transferred' from Centres of Excellence to NATO itself. This transfer is implemented by NATO Council formally approving these documents and thus validating them as the official NATO point of view.

7 J. Juozaitis, 'Possibilities to use Lithuania's Membership in the International Organizations as an Instrument in Neutralizing the Threats to State's Energy Security', International Conference of Young Scientists on Energy Issues, May 2014.

8 NATO Chicago Summit Declaration, para.52, 53. Available at: http://www.nato.int/cps/en/natolive/official_texts_87593.htm?mode=pressrelease

Parallels with other NATO strategic area – Cyber Security Defence

Analysing, how the NATO Energy Security Centre of Excellence can contribute to the operation of the whole organization, parallels with the cyber-security can be drawn. Similarly to energy security, the impetus for NATO cyber defence policy was born out of a crisis. In 2008, NATO Cooperative Cyber Defence Centre of Excellence was established in Tallinn. The same year, the NATO Cyber Defence Policy was promulgated at the informal meeting of defence ministers in Vilnius. NATO Cyber Defence Policy responds to attacks that target its networks or its member country's network infrastructure. Capabilities and contents of this policy are defined in formal NATO documents or such high level documents like the Concept of Operations under NATO Computer Incident Response Capability (NCIRC) 2008.[9] Cyber defence is considered to be largely a national responsibility, and in case of a cyber attack, national criminal laws are applied.

Each country is encouraged to develop its own national cyber security strategy in accordance with NATO recommendations. Besides, all NATO member states were tasked to create Computer Emergency Readiness Team (CERTs) – one of the most effective tools for combating cyber attacks. CERTs bring a real time capability at the national level to monitor and deter attacks before they lead to national or international crisis. However, certain degree of legal harmonisation and coordination is achieved at the EU level: in 2012, the European Cybercrime Centre with Europol was established in the Hague.

From the legal point of view, NATO cyber defence actions lie within The North Atlantic Treaty Article 4, which calls upon Parties to consult each other whenever the security of any of the Parties is threatened.

As regards experience NATO Energy Security policy could gain from the cyber security policy, alongside the EU Cyber Security Strategy[10], the Manual on International Law Applicable to Cyber Warfare adopted by NATO CCD COE has to be mentioned[11]. This document is a significant tool particularly focusing on the international cyber security law as well as the law of cyber armed conflicts.

Place of STANAGs in the NATO legal system. Energy related STANAGs.

Standardization Agreement (STANAG) is the NATO standardization document that specifies the agreement of member Nations to implement a certain standard in order to meet an interoperability agreement. STANAGs are published by NATO to provide processes, terms and conditions that are common military or technical procedures for NATO members. Before a STANAG is published, the research is undertaken by subject-matter experts following the test in real life exercises to ensure proposed standards are practical. After this procedure, and once agreed by Allied nations, the document describing the NATO standard becomes a part of the officially approved STANAG, which is yet another example of the NATO secondary law. STANAGs become binding for those NATO Nations who choose to ratify and implement them, in whole or in part, within their own military system. Currently, energy is more or less addressed in more than 60 NATO Allied Publications. The majority of them standardize different aspects of fuel, from setting quality standards to technical solutions for fuel supply. Even though the number of Allied Publications

9 Dr. Rex B. Hughes, 'NATO and Global Cyber Defense', Cambridge University.

10 Cyber security Strategy of the European Union: An Open, Safe and Secure Cyberspace, Joint Communication, JOIN(2013)1 Final.

11 The Tallinn Manual, http://www.ccdcoe.org/249.html

related to energy is relatively significant, only few of them are relevant to energy and power generation: standards that are directly relevant to energy and power generation issue are very specific and technical. Indirectly, through their technical aspects (ensuring interoperability) a number of STANAGs can be attributed to the area of security of energy supply[12]. However, more thorough analysis of STANAGs is needed in order to draft new or tailor existing standards in order they contributed to the collective response to the need to implement technical solutions that indirectly raise level of energy security in the NATO member countries.

NATO – EU cooperation

Despite substantial differences in the legal framework, NATO and the European Union could contribute to each other's activities in the energy security area. However, relations between these two organisations currently are governed by the Joint Declaration on European Security and Defence Policy[13], as well as the so-called 'Berlin Plus agreement' (both signed in December 2002), dealing mainly with certain military and defence related issues[14]. Since, the European Union has experienced major expansions, both in a sense of quantity (geographic expansion) and quality (new areas of policy). Current relationship between the two organisations can be regarded as outdated. Therefore, new ground for cooperation and a new cooperation agreement has to be elaborated, including such areas as energy security and cyber defence.

Conclusions – towards energy security in the NATO agenda

Energy security is a new challenge that just recently emerged in the global geopolitical agenda. International bodies (in particular, NATO) where decisions are taken after lengthy discussions by member states, may not yet have sufficient legal instruments to this end. European Union has already created itself a credible reputation in the area of energy security. It circumvented its lack of competence and took energy to its agenda as well as to its primary law. This resulted in the EU being one of the front runners of the global energy security discourse. NATO legal system does not allow for such legal equilibristic.

Nevertheless, NATO should place energy security very clearly to its agenda. To this end, NATO Energy Security Centre of Excellence should be requested by the NATO (through the HQ SACT) to give a single definition of the energy security in the context of NATO activities, as well as to elaborate on its distinctive elements, by presenting particular proposals for NATO Member States. Outcome of this research, when adopted by the North Atlantic Council, would become an official position of the Alliance.

Further, NATO and the European Union should benefit from each other's activities in the area of the energy security. Therefore energy security should be put on the NATO-EU cooperation agenda as soon as possible, as well as to future bilateral inter-institutional agreements.
Finally, better account should be given to STANAGs, dedicated to energy security standards and standards of various elements. NATO Energy Security Centre of Excellence together with relevant stakeholders and NATO member states should identify and update existing as well as draft new STANAGs relevant to energy security and various its elements.

12 For the full list see: http://nsa.nato.int/nsa/nsdd/_CommonList.html
13 http://www.nato.int/cps/en/natolive/official_texts_19544.htm
14 More on NATO-EU partnership: http://www.nato.int/cps/en/natolive/topics_49217.htm

Unconventional Energy as a Game Changer in the Gulf

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On 27 October 2014 a floating storage and regasification (FSRU) unit, known as 'The Independence' arrived in Lithuania. Although the plans for its construction predate the Russian annexation of Crimea, the continued unrest in Ukraine has instilled a sense of urgency among NATO's eastern European members on the necessity to diversify their natural gas supplies. One of the alternative sources that Lithuania is looking to is the United States (US).

European Energy Security and the US Shale Revolution

In recent years, natural gas production in the US has swelled. This development has had several consequences. First, American natural gas prices have dropped considerably. Second, the US are at present practically independent in their supply for natural gas. The cause of this development lies in the extraction of previously considered 'unconventional' energy sources, more specifically, shale gas. This rise in extraction capacity, made possible by high energy prices and a technological development called hydraulic fracturing or 'fracking', is thus often referred to as the 'shale gas revolution'. A similar development currently takes place with unconventional oil production, like shale oil. This places the US on track of satisfying domestic oil demand by the mid-2020s. If the US becomes self-sufficient in energy, the question is what this will mean for traditional gas and oil exporters in other parts of the world, notably in the Gulf region.
Developments such as those in Lithuania also mean that, it is hard to imagine that the consequences of the developments in the US will remain largely domestic in the long term.[2]

FSRU vessel "Independence" sailed to the sea on its own course from South Korean shipyard Hyundai Heavy Industries Co., Ltd., in February, 2014. The ship's sea trial lasted nearly a week.[1]

1 "KN: FSRU Vessel Sailed Its Own Course to the Sea," February 6, 2014, http://www.sgd.lt/index.php?id=403&L=1&tx_ttnews%5BbackPid%5D=589&tx_ttnews%5Btt_news%5D=248&cHash=2ff60995c2e7e9c139dd7f5e71c773d7.

2 Sijbren de Jong, Willem Auping, and Joris Govers, The Geopolitics of Shale Gas - The Implications of the US' Shale Gas Revolution on Intra-State Stability within Traditional Oil and Natural Gas Exporting Countries in the EU Neighborhood, HCSS & TNO Strategy and Change (The Hague: The Hague Centre for Strategic Studies (HCSS), 2014).

However, it should be pointed out up front that this impact needs not necessarily translate into an increase in production of unconventionals in other countries or regions. For a variety of reasons, including institutional and geological differences, the increase in shale gas extraction capacity is unlikely to proceed as fast in other parts of the world as in the US. Energy sources are traded globally, and although regional differences in the energy mix (*i.e.*, the composition of energy supply divided over primary energy sources) exist, local changes in the energy mix have global consequences. A recent example, linked to shale gas, is the rerouting of coal supplies from the US to Europe, which caused coal prices to drop on the European market.[3]

Will Energy Prices Remain High?

At present, we live in a time whereby energy prices are relatively high. This fact can be seen in Figure 1, which also clearly shows how geopolitical and other events strongly relate to oil prices. Although the oil price has dropped from US$ 115 in June 2014 to around US$ 86 today, prices today can still be considered relatively high.

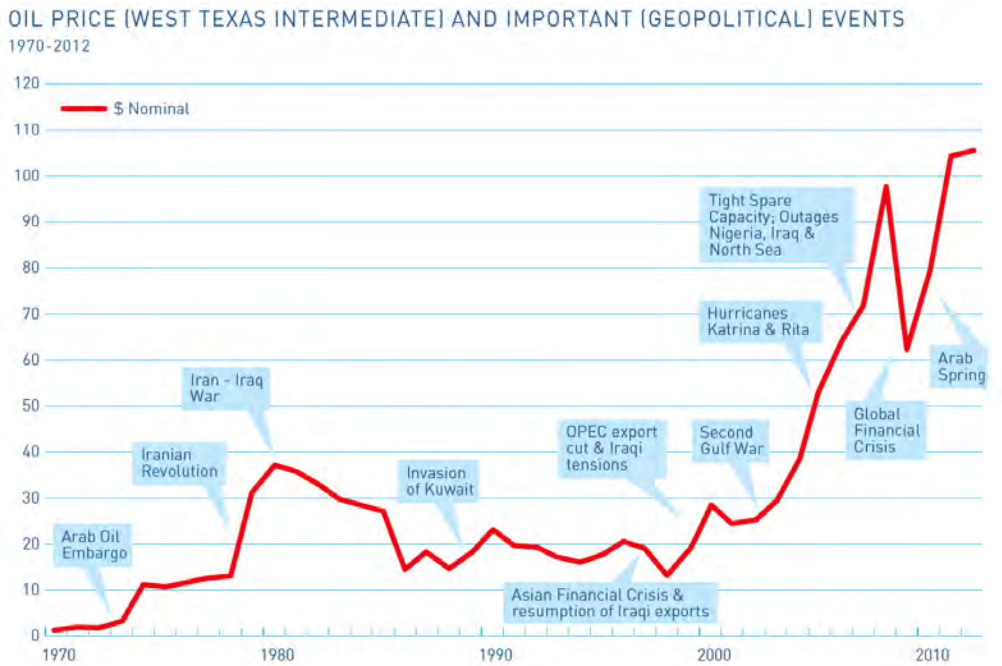

Figure 1. The oil price between 1970 and 2012, together with some major geopolitical events. Source: HCSS[4]

It should be pointed out that geopolitical events are not the only reasons for price swings. For example, discussions about depletion, and the growing demand from emerging economies, such as India and China, have led to a wide-spread belief that energy prices, notably oil prices, can only increase in the long term. However, this need not be the case, due to three important phenomena affecting the balance between supply and demand: technological progress, increased energy efficiency, and substitution.

Technological progress reduces extraction costs, resulting in a higher 'Energy Return On Energy Invested', or the ratio of the amount of energy obtained from a particular energy resource to the amount of energy used to extract that energy resource. The result is that pre-

3 Ed Crooks, "US Coal Exports to Europe Soar," Financial Times, October 3, 2012, http://www.ft.com/intl/cms/s/0/fbf0b9fa-0d63-11e2-97a1-00144feabdc0.html#axzz2x9WUN9pN.

4 Sijbren de Jong, Willem Auping, and Joris Govers, *The Geopolitics of Shale Gas - The Implications of the US' Shale Gas Revolution on Intra-State Stability within Traditional Oil and Natural Gas Exporting Countries in the EU Neighborhood*, HCSS & TNO Strategy and Change (The Hague: The Hague Centre for Strategic Studies (HCSS), 2014).

viously unattractive, or unconventional, resources, become competitive in the energy mix, and become the conventional resources of the future. The US' shale gas and oil revolution is a striking example of such a development.

Part of technological progress has its effect on the demand side. Combined with other efforts, it leads to a higher energy efficiency of the economy, also referred to as 'decoupling'. Notwithstanding that this is a development that takes place constantly; it has a profound impact on total demand. In all regions of the world, except for the Gulf, decoupling led to a constantly lower energy demand growth compared to economic growth. Whereas a situation with less decoupling would, *ceteris paribus*, lead to higher energy prices, a situation with decoupling would lead to lower energy prices. The latter is a cornerstone of energy policies in developed industrialized economies. Emerging economies are also starting to take benefit of these developments.[5]

Finally, as was indicated above, energy demand is composed of a specific mixture of primary energy sources, collectively called 'the energy mix'. Between these primary energy sources there is a constant competition, based on their characteristics and potential uses, and their price. Due to differences in price, developments may take place that substitute part of the demand of one source by another. In relation to shale gas, substitution may take place in the transport sector, where gas (including Liquefied Natural Gas, or 'LNG') is viewed more and more as an alternative for oil, or in chemical plants, where gas may replace oil as feedstock.

Bad News for Traditional Oil Exporters

These phenomena, together with developments such as the shale gas revolution, cause periods with relatively high oil prices to alternate with periods with relatively low prices, even when the developments in extraction capacity do not directly take place with respect to oil. Historically, especially oil shows large volatility between these periods of high and low prices, as if the imbalance between supply and demand is amplified in the price. Several explanations exist for this phenomenon, including the importance of market power (*e.g.*, higher prices lead to more producers, which reduce the ability or market power of single producers to keep the price high), but also the fact that overcapacity of oil production is accumulated, while for example excessive gas production is generally flared. However, especially a period of lower oil prices, poses bad news for traditional oil and gas exporting countries, many of which can be found in the Gulf region.

For many of the Gulf countries, practically all of their export revenue is generated by oil and gas exports. Within these economies, the resource rents, often calculated as part of GDP, also form a considerable part. 2011 for example, resource rents formed 31,7% of Iranian GDP 46,9% in Oman; 50,7% in Saudi Arabia and 29% in Qatar.[6] This income is used for financing large parts of the non-hydrocarbon economy, including education, health care, and subsidies for food and fuel. As such, the rents are used for an essential part of the 'social contract' in these societies.[7] If the revenues of oil and gas were to go down, this runs the risk of upsetting this social contract, potentially leading to social unrest in these countries. As government expenditure follows the

5 "China Imposes Strict Fuel Economy Standards on Auto Industry | Reuters," March 20, 2013, http://www.reuters.com/article/2013/03/20/china-auto-fuel-idUSL3N0CC2EK20130320.

6 "Total Natural Resources Rents (% of GDP)," World Bank, 2011, http://data.worldbank.org/indicator/NY.GDP.TOTL.RT.ZS.

7 Hakim Darbouche and Bassam Fattouh, "The Implications of the Arab Uprisings for Oil and Gas Markets" (The Oxford Institute for Energy Studies, September 2011), 34; Bill Law, "Gulf States Face Hard Economic Truth about Subsidies," BBC News Middle East, December 18, 2012, http://www.bbc.co.uk/news/world-middle-east-20644964; Amy Myers Jaffe and Ronald Soligo, "State-Backed Financing in Oil and Gas Projects," in Global Energy Governance: The New Rules of the Game, ed. Andreas Goldthau and Jan Martin Witte, 2010, 114–115.

income, most Gulf countries presently have a fiscal break-even price (*i.e.*, the price of oil needed for balancing the budget) of close or above $100 per barrel.[8] Sovereign wealth funds and large foreign exchange reserves (think Saudi Arabia, Qatar and the like) may mitigate these risks, but only temporarily. Countries such as Iran and Oman are considerably less lucky.

Another characteristic specific to the Gulf countries, is that population pressure is high. The population is generally very young, while a further considerable increase in the population is expected. This is caused by a still very high fertility, while mortality has declined due to improved health care. While the period after fertility declines generates the demographic dividend leading to a tremendous increase in population welfare, the demographic period the Gulf countries are in now, puts even greater pressure on government finances. The young population needs education, health care, cheap (*i.e.*, subsidized) food and fuel, and jobs. Especially youth unemployment is known to be a cause for heightened instability.[9] Therefore, the demographics put even more pressure on an already precarious social contract.

Finally, practically all hydrocarbon exporting countries in the Gulf are far more dependent on oil rents than gas rents. Only Qatar is an exception to this rule. As we explained above, the oil price is much more prone to price volatility. Further, in the shale gas revolution we already witness an early warning indicator of a potential drop in global energy prices.[10] A period with a further increase in instability in the Gulf region induced by shale and other unconventional sources of energy is thus a plausible future that the NATO Alliance should prepare for.

The Way Forward

With regard to these potential developments, NATO should in particular make use of the strategic functions of anticipation and prevention. Countries which are particularly vulnerable to changes in global energy markets (*e.g.*, due to a dangerously high fiscal break-even price), induced by unconventional energy, or other causes such as increased energy decoupling in developed economies, should be closely monitored.

On top of this, NATO could use the Science for Peace and Security Program, supported by its various Centres of Excellence (notably its Energy Security Centre of Excellence) to initiate cooperation with – and capacity building in – vulnerable countries. In effect, such cooperation could aim at a gradual restructuring of the economies and the manner in which countries in the region are governed. The effect of such an approach is that overall country resilience is strengthened, thus avoiding a sudden collapse of these regimes in the long run, and a repeat scenario of the 2011 Arab uprisings.

However, the degree to which countries in the Gulf region would be willing to strengthen cooperation with NATO along these lines hinges in particular on the perceived urgency of such cooperation in the Gulf region itself. Perhaps the most important task for NATO therefore is to engage in diplomatic efforts across the region conveying the message that the Gulf countries are not immune to the developments described in this article.

8 *Regional Economic Outlook Middle East and Central Asia* (International Monetary Fund (IMF), November 2013), 106.

9 In this respect, it should be borne in mind that the causes of the 2011 Arab revolutions related primarily to unemployment, notably youth unemployment; poverty; widening inequality; rising food prices; and increasingly visible evidence of corruption and the enrichment of elites. See "House of Commons - British Foreign Policy and the 'Arab Spring' - Foreign Affairs Committee," *UK Parliament*, July 19, 2012,

http://www.publications.parliament.uk/pa/cm201213/cmselect/cmfaff/80/8006.htm.

10 "The Triumph of Vladimir Putin," The Economist, February 1, 2014, http://www.economist.com/news/leaders/21595451-successes-abroad-and-winter-olympics-make-russia-look-strong-where-it-matters-it?spc=scode&spv=xm&ah=9d7f7ab945510a56fa6d37c30b6f1709.

Operational Energy: A Multi-Faceted Government Approach





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Recent analysis of the results achieved during consequent simulation exercises of 2013 and 2014 aimed at reducing diesel dependency at military deployable camps and stations in Canada demonstrates the potential of new technologies and the scope of possible savings: a 50% reduction can be achieved in total fuel consumption of cold weather operations. Will those achievements be translated into real-life technology demonstrations using actual military exercises? Will they be interoperable with Canada's NATO partners as they move towards new energy technologies?

Response to challenges through interagency cooperation

The Canadian Department of National Defence (DND) operates in remote locations in Canada for training and sovereignty operations, as well as globally under natural disaster conditions or in foreign territories with conflicts. To sustain operations from the Arctic to hot climatic regions, the DND depends heavily on long logistics lines of communications to supply fossil fuel (primarily diesel) as the main supply of power and energy for static (such as main operating bases, forward operating bases, etc.) and for mobility requirements. The transport of fuel represents a heavy logistics and financial burden to operations.

In non-permissive locations, fuel transport also requires route clearance, convoy escort and force protection. In eco-fragile remote areas such as the Arctic, the risk of fuel spills is also increased by the storage and transport of fuel, thereby adding to environmental issues such as greenhouse gas (GHG) emissions.

In support of DND's military operations and environmental objectives, Defence Research and Development Canada (DRDC)[1] has engaged in a power and energy Technology Demonstration (TD) project called Integrated Camp Energy – Technologies (ICE-T). The ICE-T TD project was initiated by reducing diesel dependency at military deployable camps and stations, both nationally and abroad. The project's main focus was Arctic operations.

The scarcity of existing Canadian Armed Forces (CAF) data for camp energy demand levels, consumption rates and purposes prevented the analysis and pre-selection of technologies for optimum operational impact. To mitigate this problem and to leverage their energy

1 http://www.drdc-rddc.gc.ca

R&D expertise, the Natural Resources Canada – CANMET Energy laboratory was mandated by DRDC to conduct energy audits and later determine suitable technologies that would maximize operational benefits.

Operation Nanook 2012

The data collected revealed a total camp consumption of 32,086 kWh for both diesel and propane for a typical week. The monitoring also showed that 85% of the total amount of diesel delivered to the camp was used by the generator farm to produce electricity and domestic hot water heating. A peak electrical demand of 247 kW and a total energy consumption of 22,279 kWh were recorded.

NRCan's CanmetENERGY monitored Canadian Armed Forces Operation NANOOK held in Inuvik (NWT), from July to September, 2012. The fuel, electrical energy consumption and climatic data of a 350-person camp were monitored.

The largest electric load during the exercise went to provide space heating for soldier accommodations. This load represents 33% of the total electricity generated on site. The kitchen, food preparation and ablution as well as the refrigeration units (i.e. reefers) took another 23%, while the Tactical Operations Centre and the offices required 19%. The vehicle fuelling station, transport and Electric Mechanical Engineers (EME), vehicle washing station and Central Material Traffic Terminal (CMTT) required 12%. The remaining loads were for the Reverse Osmosis Water Purification Unit (ROWPU) and sewage, which accounted for 9%, and a single ablution which required 4%.

Fuel Reduction Technology Demonstration

Using this energy profile for a typical Canadian Armed Forces cold climate deployed camp, CanmetENERGY-Varennes[2] was tasked with developing and demonstrating power and energy technologies capable of providing fuel consumption reductions for military operations deployed to cold climates. Preliminary analysis of the energy profile for Operation NANOOK 2012 clearly demonstrates that fuel reductions would be substantial if energy used for office and accommodation space heating and domestic hot water heating could be diverted from generator sets and provided as thermal energy recovery. Renewable energy sources were not evaluated because the significant expected fuel reductions achievable by thermal recovery did not justify solar panel and wind turbine introduction at this moment. Although thermal recovery has existed for quite a while, the camp demonstration task represented a special R&D challenge in that DRDC requested that the developed technology be "transportable" to meet expeditionary requirements in Canada's vast wilderness or abroad.

To achieve these goals, a mini-camp was erected by CanmetENERGY-Varennes at the site of Hydro-Québec's Institut de recherche électricque du Québec (IREQ). IREQ provided the site facilities near Montréal as well as their expertise with power management systems and cold weather *battery technology*[3]. Figure 2 presents an overview of the demonstration camp mechanical system. All of the mini-camp's electricity was produced by a variable speed generator (see GENSET in the schematic). The variable speed generator (CVT Corp.[4]) is designed to provide up to 125 kW of power while automatically adjusting its engine speed to minimize losses as electrical load demands vary. This generator was fitted with a heat recovery system to capture heat expelled by the engine-cooling jacket into the environment. The heat captured is transferred to propylene

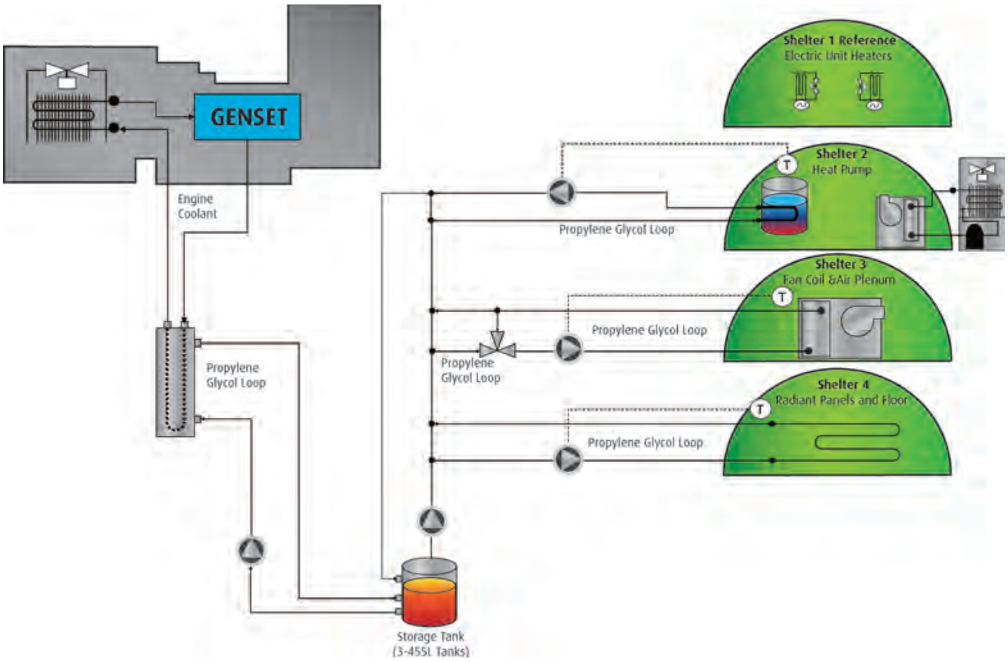
2 http://www.nrcan.gc.ca/energy/offices-labs/canmet/varennes/5761 , dated 27 May 2014. CanmetENERGY Varennes (QC) Research Centre.

3 http://www.hydroquebec.com/innovation/en/index.html, dated 27 May 2014 . Institut de recherche électricque du Québec (IREQ).

4 http://www.cvtcorp.com/powergeneration.html, dated 27 May 2014. CVT Corp. Designed for Power.

glycol, stored in a tank system (i.e. three 455-litre tanks), and distributed by pumps to the various shelters for space heating or to preheat domestic hot water (DHW). The camp demonstration was held in March 2013 with outdoor temperatures averaging between -8º and -15º Celsius.

Figure 1: ICE-T Demonstration Overview



Shelter 1 was the Reference Shelter and was heated using two standard DND 5 kW electric convective heaters. Shelter 2 featured the DHW water system as well as an energy efficient cold weather air-source heat pump. The remaining space heating configurations using heat recovered from the generator were as follows: a fan coil system (half of Shelter 3), a floor air plenum (the remaining half of Shelter 3), and a radiant floor and panel system (Shelter 4). In order to operate the heat recovery system, a maintenance shelter (not shown in the schematic) was required to house the propylene glycol storage tanks and the various pumps used to circulate the propylene glycol throughout the camp.

The shelters' energy consumption was individually monitored and the results are presented in Table 1. Also, this table includes the energy required for the additional pumps to operate the heat recovery system and the total energy reduction when comparing the proposed solution to the Reference Shelter. The energy reduction is considerable: compared to the reference shelter, a 47% reduction was achieved using a cold climate heat pump, while a 65% reduction was measured by using heat recovered from the generator and then used to provide heating by means of the fan coil or the under floor air distribution system. Finally, a 70% energy reduction could be achieved by installing a radiant floor heating system and using heat recovered from the generator.

Table 1: Energy Consumption for Space Heating Solutions

SHELTER ENERGY CONSUMPTION COMPARISON **(Based on 21 Days of Data)**					
Shelter Number	Description	Energy Consumption (kWh)	Energy Consumption including PUMP PENALTY (kWh)	Energy Consumption per Day including PUMP PENALTY (kWh/day)	**Energy Reduction (when compared to the Reference)**
1	***Reference***	2,791	2,791	132.9	-
2	Heat Pump	1,468	1,468	69.9	**47%**
3	Fan Coil & Under Floor Air Distributed	661	976	46.5	**65%**
4	Radiant Floor	427	820	39.0	**71%**

The camp demonstration proved that considerable energy reductions are achievable through the integration of a heat recovery system.

Modeling

In order to determine the impact of implementing a heat recovery strategy to provide space heating or DHW heating, a camp model was created using TRNSYS version 17. The equipment and physical characteristics for each type of shelter were used. Energy data was collected during Operation NANOOK and during the camp demonstration so that the model could be used to simulate the camp's energy requirements for different geographical locations and weather profiles. The mini-camp demonstration was operated for approximately 3 weeks in temperatures ranging from 0° to -22° Celsius.

The camp energy model was used to simulate the energy requirements for a camp with the same configuration as Operation NANOOK but operating in Edmonton (AB) for the month of January with an average temperature of -12ºC. The simulation showed that a camp built using standard DND equipment would require a peak electric demand of 1,359 kW and 145,000 litres of diesel fuel to operate.

The same energy model was used to simulate the impact of using recovered heat (from the generators) to satisfy some of the space heating and domestic hot water heating requirements of the camp configuration (see Figure 3). Once again, the energy model determined the impact of operating this camp in Edmonton (AB) for the month of January.

In this scenario, fan coils using heat recovered from the generator farm replaced the electric unit heaters used in the office shelters, the dining hall, the kitchen and the medical hospital. Also, the electric space heaters in the accommodation shelters were replaced with cold weather air-source heat pumps. Finally, the domestic hot water requirements for the ablutions were primarily provided by the recovered heat from the generator farm.

Figure 2: Camp Equipment Configuration

The camp configuration shown above using the heat recovery equipment is forecasted to require a peak electric demand of 922 kW and 70,000 litres of diesel fuel to operate. It must be noted that the heat recovery configuration requires a storage capacity of 10,000 litres to ensure proper supply of space heating and DHW heating.

Comparing the standard camp configuration to the heat recovery camp configuration shows that a ***50% reduction*** can be achieved in total fuel consumption of cold weather operations.

Going Forward

Fuel represents 50% of supplies transported into theatre to sustain deployed camps.[5] The reduction of fuel consumption will provide the military with environmental and operational benefits such as: reduced vulnerability to supplies; reduced vulnerabilities of deployed forces and increase in autonomy; reduced casualties related to supply convoys[6]; and ensuring future interoperability with NATO partners as they move towards new energy technologies. In addition, this scenario can provide a cost-effective energy supply. The Fully Burdened Cost of Energy ranges from $5/L to $105/L depending on convoy protection, distances, terrain, air coverage and hostility levels[7][8][9][10]. The fuel dependency reduction will also free assets and infrastructure and redirect them to other priorities, thereby increasing operational resiliency.

Finding affordable alternatives to how operations are sustained is critical to future operations. With the present set of data and using conservative assumptions, this study indicates that significant fuel consumption reductions can be achieved for a large deployed cold weather camp.

The long-term vision for the Canadian Armed Forces is to take the data collected during Operation NANOOK and the ICE-T camp demonstration and to translate them into real-life technology demonstrations using actual military exercises. It is only through the fielding and testing of new technologies that the actual benefits will be seen and the necessary resources allocated. The end state will see modern camps with alternative energy powering them as well as a reduced logistic and environmental footprint on operations.

5 http://www.army-technology.com/features/feature77200/, dated 26 Feb 2010. Casualty Costs of Fuel and Water Resupply Convoys in Afghanistan and Iraq.

6 Eady,D.S.; Siegel, S.R., Bell,R.S.,Dicke,S.H., Sustain the Mission Project: casualty Factors of Fuel and Water Resupply Convoys, Army Environmental Policy Institute, September 2009.

7 http://thehill.com/homenews/administration/63407-400gallon-gas-another-cost-of-war-in-afghanistan-, dated 31 January 2011, $400 dollar per gallon gas to drive debate over cost of war in Afghanistan, Roxana Tiron.

8 Dr. Melendez, G.J., Advancement in Power Management and Intelligent Distribution, IDGA Tactical Power Summit, January 2010, Slide no 5.

9 Geary, C., Approaches to more Efficient Power Generation, IDGA tactical Power Summit, January 2010, Slide no 10.

10 Deloitte, Defence: New realities, Innovative response.

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