Consultation Forum for Sustainable Energy in the Defence and Security Sector

(CF SEDSS)

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GUIDANCE DOCUMENT

A ROADMAP FOR SUSTAINABLE ENERGY MANAGEMENT IN DEFENCE AND SECURITY SECTOR

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SECTION 1: INTRODUCTION

1.1 Overview

The purpose of this guidance document is to propose a roadmap for achieving a sustainable energy future for the defence and security sector. It complements the final report of the Consultation Forum for Sustainable Energy in the Defence and Security Sector (CF SEDSS).

The content is the result of the combined efforts, knowledge, and experience of participants in the CF SEDSS; expert speakers from governments, academia and industry; the working group volunteer moderators; and European Defence Agency (EDA) staff.

During the 24-month period of the CF SEDSS, a lot of topics were covered, generating a wealth of reference material ranging from:

- the global strategic context for energy as well as the defence context for energy;
- the purpose and scope of EU energy legislation; and
- some of the available delivery tools and techniques.

During the Forum's duration, it has been possible to set out the first elements of a roadmap considering energy interventions in areas such as zero-emissions buildings and renewables for the defence sector.

There are still a number of developments which need to occur to ensure that all of the sections in the roadmap are pieced together and, for that reason, this will be a living document: one which is up-to-date and focused on developing further the necessary answers to the key questions. To facilitate this development, defence organisations will need to follow a structured path which is often served by implementing internationally agreed frameworks which can be adapted according to the requirements of a particular MOD or armed force, taking into account regional needs and even site-specific considerations.

One such mechanism for achieving this is through the application of ISO 50001 on Energy Management Systems (EMS), which has been increasingly adopted by civilian sectors and with a growing number of MODs recognising the added value which the standard can bring to an organisation's energy performance, and, therefore, cost and operational control performance.

While the standard provides a systematic pathway to follow, there is also an overarching need to put in place a cultural shift so that energy is considered in all relevant aspects of military capability planning and operations, including on defence infrastructure, to become a way of working rather than something which is added-on as an after-thought and is only driven by a limited number of energy-conscious individuals.

Energy management needs to become integrated within corporate decision making and behaviour. Although energy training, policy and leadership are all part of ISO 50001, such a shift in corporate culture will take time to be embedded in the defence sector, mainly due to the fact that the defence sector is just entering into this policy area.

While it is important at a tactical (e.g. building or site) level to implement a structured approach through energy management system implementation, it is vital not to lose sight of the equally important strategic and underpinning work, including strategy and policy development; awareness and education; and stakeholder engagement which needs to take place. It is this which will lay the foundations and organisational structures for delivering a more sustainable energy future in the medium- to- longer term.

1.2 Scope

The scope of this document is to review the topics covered during the CF SEDSS from October 2015 to October 2017, over the five plenary meetings held and the work which took place in between. This covers:

- the strategic context for energy in the defence sector;
- energy management;
- energy efficiency;
- renewable energy;
- financial considerations.

Additionally, and on top of the topics above, the protection of defence-related critical energy infrastructures was addressed by a separate experts' group, and this work is covered by a conceptual paper.

SECTION 2: CONTEXT AND STRATEGIC DRIVERS

This section sets out the megatrends related to energy security and energy efficiency including EU legislation and strategy, as well as the defence context for energy in terms of security of supply, cost and environmental impact, associated defence vulnerabilities and resilience opportunities.

2.1 Global megatrends in relation to energy security

By the middle of this century, some projections – including those set out by the United Nations – indicate that the global population will increase to around 10 billion people. In addition to a growing population, demographic changes are showing an increasing trend towards urbanization with 2007 as the first year with more people living in cities than in rural areas. Such changes in megatrends are already having significant implications for economic and societal development, not least increasing the demand for equal access to housing and sanitation, but also to natural resources including raw materials, food, water, and energy. To manage human needs more sustainably, governments need to be able to understand and interpret the trends and to implement effective action. The defence sector is no different to any other sector of society in this respect. Therefore, it is becoming increasingly important for defence to take into consideration existing and emerging megatrends in defence planning.

Until the middle of this century, while hydrocarbons are likely to remain the most significant sources of energy, renewable and nuclear energy will need to make an increasing contribution to the energy mix both to help to control costs but also to improve the security of supply and enhance energy independence, to maintain economic prosperity and well-being. At the same time, economies will need to enhance energy efficiency to ensure that expensive and limited hydrocarbon resources are used in the most efficient manner.

Energy security is a key element for Europe.[1] Member States support energy infrastructure projects in order to increase energy security and respond to the growing energy demand in the EU. As set out in the Protection of Critical Energy Infrastructure (PCEI) Conceptual Paper, which formed a part

[1]EUROPEAN COMMISSION (2014) "European Energy Security Strategy", (COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL, Brussels, 28.5.2014), http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330&from=EN

of the CF SEDSS, the geopolitics of energy plays a key role in cementing better relationships with other countries and vice versa: smooth relations among states contribute positively to excellent cooperation in the energy sector. It is also obvious that geographical location in itself is crucial in meeting the above-mentioned needs of security in the energy sector, and prosperity and stability in a wider geographical area. An important feature of the energy sector is the interdependence of energy, as well as the dependence of other sectors on energy. This means that the energy sector as such is uniquely critical for a country and, consequently, an extremely attractive target for threats (terrorist attacks or cyberwarfare). This is not a new threat. Energy-transit countries also need to be well protected from threats from the countries supplying them with energy.

Countries' energy security may also be disrupted by terrorist attacks against critical energy infrastructures (internally and abroad), transit disruptions in key "chokepoints", cyber threats, as well as CBRNe[2] threats, both intentional and accidental. Such transnational risks to energy infrastructure, including cyber security threats, require not just national-level coordination and intelligence-sharing among governmental agencies, industrial players and local communities, but also harmonisation of procedures, in the form of a regional framework, among various countries.

Geopolitical considerations in the energy sector may also take the form of a country's *ability to contribute to the diversification of routes and sources*. Gas-transit countries fall into this category. The more pipelines that are installed in a country, or are interconnected with each other, the more diversified the route. However, an abundance of routes is not the only ingredient of energy security; the availability of a multitude of sources must also be taken into account. Multiple energy sources in combination are vital to energy security - and especially within volatile geopolitical contexts. This implies that the EU energy market is not dependent on one primary source, or a single energy supplier. This diversification contributes to market stability.

Diversification of energy supply, however, requires sophisticated and complex infrastructure, with emphasis on cross-border infrastructure projects which meet international standards of energy security. For example, design specifications for natural disasters tolerance, technical and operational specifications which mitigate the threat of disastrous accidents, and security measures of the highest standards to deal with the threats of terrorist attacks or cyberwarfare. As a consequence, it is important that a country's relations with its neighbours enhance the stability of a wider region, thus becoming a bridge of nations with common interests in the energy sector. This could make specific countries' energy infrastructure more vulnerable (in the sense of it being critical), but robust bilateral relations and participation of those countries in multilateral mechanisms can reassure the energy community regarding the safety and security of energy supply across and within those countries' borders.

2.2 Defence context for energy

The concept of international and national security now is very different to what it was ten or twenty years ago, let alone fifty or one hundred years ago. There is a growing recognition that there are new and emerging threats to global stability and security at both international and national levels. New threats can emanate from states, but also from non-state actors such as terrorists (home-grown or overseas), insurgents and criminals, and from the limited access to natural resources, as the security of our energy supplies increasingly depends on fossil fuels located in some of the most unstable parts of the planet.

The EU Global Strategy, published in June 2016, sets out that amongst other threats climate change and energy insecurity endanger our people and territory, while wider environmental

[2] Chemical, Biological, Radiological, Nuclear and Explosive.

stresses could exacerbate potential conflict, in light of their impact on desertification, land degradation, and water and food scarcity.

> *The EU Global Strategy starts at home. Over the decades, our Union has enabled citizens to enjoy unprecedented security, democracy and prosperity. We will build on these achievements in the years ahead. Yet today terrorism, hybrid threats, climate change, economic volatility and energy insecurity endanger our people and territory.*
>
> *The Energy Union represents an integrated effort to work on the internal and external dimensions of European energy security. In line with the goals of the Energy Union, the EU will seek to diversify its energy sources, routes and suppliers.*
>
> *EU Global Strategy June 2016*

Whilst environmental pressures are unlikely to result in the need for new military capabilities, they are likely to impact on where armed forces are deployed and the way in which they operate now and in the future. Operating in increasingly hostile environments with potential energy and water shortages could increase energy demand and trigger the need for new advanced materials to cope with tougher conditions, shaping our capability requirements and budgets. It will be necessary for the defence sector to ensure that there are sufficient units at the appropriate availability, and the impact of climate change and resource security will need to be managed throughout the supply chain to ensure that risks to the secure supply of materials, energy, and labour are managed and our military capabilities maintained.

Europe's armed forces need to ensure that they have the appropriate capabilities to deliver their missions and that they are able to operate in a sustainable fashion. This means approaching defence decisions in different and innovative ways. It means adapting to the world in which the military lives and operates, including by integrating sustainability principles into defence acquisition and military planning to realise defence sector supply base socio-economic opportunities and benefits from a move towards a low carbon and circular economy.

Finding innovative and sustainable solutions to improve the energy performance of military equipment can contribute to enhancing military capability while helping to manage through-life cost and other risks. For instance, by increasing the energy/ fuel efficiency of military equipment, by integrating renewable and alternative energy/ fuel systems into power source mixes, and by monitoring and managing energy requirements, the defence sector can reduce through-life cost risks. Increased energy efficiency and the integration of renewable energy sources will also result in enhanced mission endurance and freedom of action as increased capability can be achieved through using less energy to deliver the same military effect for extended periods of time. At the same time vulnerability to attrition and associated risk to life and equipment can also be reduced as a result of fewer fuel re-supply convoys moving across hostile environments. Therefore, there is a need for the defence sector to become more efficient with the energy resources of which it consumes and reduce its dependence on fossil fuels, through the implementation of energy efficiency and renewable energy production technologies, and policy and behavioural interventions. This applies to operating in static conditions as well as deployments.

2.3 Managing Energy as a Military Capability

Often future energy demand is not properly factored into capability planning stages, and opportunities for efficient consumption are rarely investigated; energy is treated as a commodity rather than as a capability in its own right. For infrastructure capability this means setting

requirements which are focused on delivering resilient defence infrastructure which is capable of continuing to provide the backbone of Europe's military forces now and in years to come. This will have implications for how infrastructure is designed and managed as well as how that infrastructure is supplied with energy sustainably to meet the required demand. This requires understanding energy demand by applying effective management systems both through procurement activities for new buildings, for refurbishment projects, and throughout the life of the building and other infrastructure assets.

To achieve these strategic objectives requires having access to, and exploiting, appropriate knowledge, tools and techniques in order that the high-level requirements are translated into action at an operational and tactical level. As with all change management, such a transition to a sustainable energy future in the defence sector should be facilitated by adopting a systematic approach. Through the application of recognized standards such as ISO 50001 Energy Management Systems, MODs can put in place a series of required mechanisms in a structured format. This includes having policies in place, ensuring commitment from senior management, and having appropriate monitoring, recording, and data analysis tools in place to understand where efforts should be focused and where the greatest return on investment can be achieved. This needs to be underpinned by a proper management system audit regime.

Results cannot be achieved purely through paper trails; having suitable qualified and experienced personnel employed is another key factor. This requires staff to be trained in all elements of energy management and it also requires a certain level of awareness to be achieved amongst key staff across all of the functions of MODs and armed forces to ensure that energy is managed alongside other key priorities for defence. As such, energy should be regarded as fundamental to the delivery of military needs as much as any other capability: it should be treated as a capability in its own right and even as a capability multiplier across the defence enterprise.

2.4 Energy Strategy and Policy

EU Climate and Energy Framework: Energy Strategy and the Energy Union

Overview

The European Union's energy policies are driven by three main objectives:

- We want secure energy supplies to ensure the reliable provision of energy whenever and wherever it is needed;
- We want to ensure that energy providers operate in a competitive environment that ensures affordable prices for homes, businesses, and industries;
- We want our energy consumption to be sustainable, through the lowering of greenhouse gas emissions, pollution, and fossil fuel dependence.

These goals will help the EU to tackle its most significant energy challenges. Among these, our dependence on energy imports is a particularly pressing issue, with the EU currently importing over half its energy at the cost of €350 billion per year. Other important challenges include rising global demand and the scarcity of fuels like crude oil, which contribute to higher prices. In addition, the continued use of fossil fuels in Europe is a cause of global warming and pollution.

Key policy areas that will help us achieve our goals include:

- A **European** Energy Union that will ensure secure, affordable and clean energy for EU citizens and businesses by allowing a free flow of energy across national borders within the

EU, and bringing new technologies and renewed infrastructure to cut household bills, create jobs and boost growth;

- A **European** Energy Security Strategy which presents short and long-term measures to shore up the EU's security of supply;
- A resilient and integrated energy market across the EU - the internal energy market. To this end, new pipelines and power lines are being built to develop EU-wide networks for gas and electricity, and common rules are being designed to increase competition between suppliers and to promote consumer choice;
- Boosting the EU's domestic production of energy, including the development of renewable energy sources;
- Promoting energy efficiency;
- Safety across the EU's energy sectors with strict rules on issues such as the disposal of nuclear waste and the operation of offshore oil and gas platforms.

To pursue these goals within a coherent long-term strategy, the EU has formulated targets for 2020, 2030, and 2050.

2020 Energy Strategy

The 2020 Energy Strategy defines the EU's energy priorities between 2010 and 2020. It aims to:

- reduce greenhouse gases by at least 20%;
- increase the share of renewable energy in the EU's energy mix to at least 20% of consumption;

EU countries have agreed that the following objectives should be met by 2030:

- a binding EU target of at least a 40% reduction in greenhouse gas emissions by 2030, compared to 1990;
- a binding target of at least 27% of renewable energy in the EU;
- an energy efficiency increase of at least 27%, to be reviewed by 2020 with the potential to raise the target to 30% by 2030;
- the completion of the internal energy market by reaching an electricity interconnection target of 15% between EU countries by 2030, and pushing forward important infrastructure projects.

Together, these goals provide the EU with a stable policy framework on greenhouse gas emissions, renewables and energy efficiency, which gives investors more certainty and confirms the EU's lead in these fields on a global scale.

On 30 November 2016, the Commission released a package of draft legislative proposals designed to help achieve these targets. The measures include draft proposals on electricity market design, renewables, and energy efficiency.

The EU aims to achieve an 80% to 95% reduction in greenhouse gases compared to 1990 levels by 2050. Its Energy Roadmap 2050 analyses a series of scenarios on how to meet this target.

Progress

The EU has already made important progress towards meeting its targets:

- The first 'state of the Energy Union' report from November 2015 showed that much progress had been made since the adoption of the Energy Union in February 2015, and 2016 was a key year of delivery;
- Between 1990 and 2012, the EU cut greenhouse gas emissions by 18% and was well on track to meet the 2020 target;
- In 2014, the projected share of renewable energy in the gross final energy consumption was 15.3%, up from 8.5% in 2005;
- The latest renewable energy progress report from 2015 states that 25 EU countries were expected to meet their 2013/2014 interim renewable energy targets;
- Energy efficiency is predicted to improve by 18% to 19% by 2020 – barely missing the 20% target. However, if countries implement all the necessary EU legislation, the target should be reached.

2050 Energy Strategy

The EU has set itself a long-term goal of reducing greenhouse gas emissions by 80-95%, when compared to 1990 levels, by 2050. The Energy Roadmap 2050 explores the transition of the energy system in ways that would be compatible with this greenhouse gas reductions target while also increasing competitiveness and security of supply.

To achieve these goals, significant investments need to be made in new low-carbon technologies, renewable energy, energy efficiency, and grid infrastructure. Since investments are made for a period of 20 to 60 years, policies that promote a stable business climate which encourages low-carbon investments must start being made today.

Energy Roadmap

The European Commission's 2011 Energy Roadmap set out four main routes to a more sustainable, competitive and secure energy system in 2050: energy efficiency, renewable energy, nuclear energy, and carbon capture and storage. It combined these routes in different ways to create and analyse seven possible scenarios for 2050.

Conclusions of the analysis:

- Decarbonising the energy system is technically and economically feasible. In the long run, all scenarios that achieve the emissions reduction target are cheaper than the continuation of current policies;
- Increasing the share of renewable energy and using energy more efficiently are crucial, irrespective of the particular energy mix chosen;
- Early infrastructure investments cost less, and much of the infrastructure in the EU built 30 to 40 years ago needs to be replaced anyway. Immediately replacing it with low-carbon

alternatives can avoid more costly changes in the future. According to the International Energy Agency, investments in the power sector made after 2020 would cost 4.3 times as much as those made before 2020;

- A European approach is expected to result in lower costs and more secure energy supplies when compared to individual national schemes. With a common energy market, energy can be produced where it is cheapest and delivered to where it is needed.

Energy projections

The EU produces market projection reports for 2030 and 2050 based on current trends and policies. They include information on possible energy demand, energy prices, greenhouse gas emissions and other potential developments.

Energy trends up to 2050

2.5 EU Energy Legislation

This section provides an overview of the legislation covered in the Consultation Forum: Energy Efficiency Directive (EED), Energy Performance of Buildings Directive (EPBD), and the Renewable Energy Directive (RED).

Energy Efficiency Directive (EED)

Overview

The 2012 Energy Efficiency Directive establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. Under the Directive, all EU countries are required to use energy more efficiently at all stages of the energy chain, from production to final consumption.

As part of the legislative package released on 30 November 2016, the Commission proposed an update to the Energy Efficiency Directive, including a new 30% energy efficiency target for 2030, and measures to update the Directive to make sure the new target is met.

The detail of the Directive, including European Commission guidance notes, is available at:

https://ec.europa.eu/energy/en/topics/energy-efficiency/energy-efficiency-directive

Specific measures and policies

New national measures must ensure major energy savings for consumers and industry alike. For example:

- energy distributors or retail energy sales companies have to achieve 1.5% energy savings per year through the implementation of energy efficiency measures;
- EU countries can opt to achieve the same level of savings through other means, such as improving the efficiency of heating systems, installing double glazed windows or insulating roofs;

- the public sector in EU countries should purchase energy efficient buildings, products and services;
- every year, governments in EU countries must carry out energy efficient renovations on at least 3% (by floor area) of the buildings they own and occupy;
- energy consumers should be empowered to better manage consumption. This includes easy and free access to data on consumption through individual metering;
- national incentives for SMEs to undergo energy audits;
- large companies will make audits of their energy consumption to help them identify ways to reduce it;
- monitoring efficiency levels in new energy generation capacities;
- EU countries must draw-up long-term national building renovation strategies which can be included in their National Energy Efficiency Action Plans.

Buildings under the Energy Efficiency Directive

Snapshot of discussion during the CF SEDSS

A number of key articles of EED were reviewed during the CF SEDSS. In particular, discussion among MODs was on:

EED Article 4 – Building Renovation: requiring MS to define long-term strategies for stimulating renovations (in particular, cost-effective deep renovations) in their building sector, in order to increase with immediate effect the historically low renovation rates, and ultimately reduce significantly the energy consumption of the building stock by 2050.

EED Article 5 – Exemplary role of Public Bodies' buildings complementing the Energy Performance of Buildings Directive (EPBD) by setting a specific renovation target of an annual 3% (calculated on the total floor area of heated/cooled buildings with a total useful floor area over 250 m2) for public buildings owned and occupied by its central government, which are required to be renovated to meet at least the national minimum energy performance requirements set in application of Article 4 of the EPBD, with exemptions applying to many of the MOD's typical building types or categories:

(a) buildings officially protected as part of a designated environment, or because of their special architectural or historical merit, in so far as compliance with certain minimum energy performance requirements would unacceptably alter their character or appearance;

(b) buildings owned by the armed forces or central government and serving national defence purposes, apart from single living quarters or office buildings for the armed forces and other staff employed by national defence authorities;

(c) buildings used as places of worship and for religious activities.

EED Article 20 – National Energy Efficiency Fund (NEEF), financing and technical support: which invites (non-binding) MS to establish dedicated financing facilities, such as National Energy Efficiency Funds (NEEFs), or use of existing ones, to support energy efficiency investment.

Energy Performance of Buildings Directive (EPBD)

In addition to the 2012 Energy Efficiency Directive, the EU's other main legislation covering the reduction of the energy consumption of buildings is the 2010 Energy Performance of Buildings Directive .

As part of the legislative package released on 30 November 2016, the Commission proposed an update to the Energy Performance of Buildings Directive to help promote the use of smart technology in buildings and to streamline the existing rules. The Commission also published a new buildings database – the EU Building Stock Observatory – to track the energy performance of buildings across Europe.

Under the existing Energy Performance of Buildings Directive:

- energy performance certificates are to be included in all advertisements for the sale or rental of buildings;
- EU countries must establish inspection schemes for heating and air conditioning systems or put in place measures with equivalent effect;
- all new buildings must be nearly zero energy buildings by 31 December 2020 (public buildings by 31 December 2018);
- EU countries must set minimum energy performance requirements for new buildings, for the major renovation of buildings, and for the replacement or retrofit of building elements (heating and cooling systems, roofs, walls, and so on);
- EU countries have to draw up lists of national financial measures to improve the energy efficiency of buildings.

Renewable Energy Directive (RED)

Overview

The Renewable Energy Directive establishes an overall policy for the production and promotion of energy from renewable sources in the EU. It requires the EU to fulfil at least 20% of its total energy needs with renewables by 2020 – to be achieved through the attainment of individual national targets. All EU countries must also ensure that at least 10% of their transport fuels come from renewable sources by 2020.

As part of the legislative package released on 30 November 2016, the Commission published a proposal for a revised Renewable Energy Directive to make the EU a global leader in renewable energy and ensure that the target of at least 27% renewables in the final energy consumption in the EU by 2030 is met.

National action plans and progress reports

The Directive specifies national renewable energy targets for each country, taking into account its starting point and overall potential for renewables. These targets range from a low of 10% in Malta to a high of 49% in Sweden.

EU countries set out how they plan to meet these targets and the general course of their renewable energy policy in national renewable energy action plans.

Progress towards national targets is measured every two years when EU countries publish national renewable energy progress reports.

Cooperation mechanisms

The Directive promotes cooperation amongst EU countries (and with countries outside the EU) to help them meet their renewable energy targets. This cooperation can take the form of:

- statistical transfers of renewable energy;
- joint renewable energy projects;
- joint renewable energy support schemes

Sustainable biofuels

Biofuels and bio liquids are instrumental in helping EU countries meet their 10% renewables target in transport. The Renewable Energy Directive sets out biofuels sustainability criteria for all biofuels produced or consumed in the EU to ensure that they are produced in a sustainable and environmentally friendly manner.

Companies can show they comply with the sustainability criteria through national systems or so-called voluntary schemes recognised by the European Commission.

2.6 European Strategic Energy Technology Plan

The European Strategic Energy Technology Plan (SET-Plan) aims to accelerate the development and deployment of low-carbon technologies. It seeks to improve new technologies and bring down costs by coordinating national research efforts and helping to finance projects.

The SET-Plan promotes research and innovation efforts across Europe by supporting the most impactful technologies in the EU's transformation to a low-carbon energy system. It promotes cooperation amongst EU countries, companies, research institutions, and the EU itself.

The SET-Plan comprises the SET-Plan Steering Group, the European Technology and Innovation Platforms, the European Energy Research Alliance, and the SET-Plan Information System (SETIS).

Accelerating the transformation of Europe's energy system

Research, innovation and competitiveness are one of the five dimensions of the Commission's Energy Union strategy. The integrated SET-Plan is part of a new European energy Research & Innovation (R&I) approach designed to accelerate the transformation of the EU's energy system and to bring promising new zero-emissions energy technologies to market.

In September 2015, the Commission published a Communication defining the new European research and innovation strategy for the coming years. The Integrated SET Plan builds on the Energy Union strategy and highlights the areas where the EU needs to strengthen cooperation with SET Plan countries and stakeholders to bring new, efficient and cost-competitive low-carbon technologies to the market faster and in a cost-competitive way.

The Integrated SET-Plan:

- Identifies 10 actions for research and innovation, based on an assessment of the energy system's needs and on their importance for the energy system transformation and their potential to create growth and jobs in the EU;
- Addresses the whole innovation chain, from research to market uptake, and tackles both financing and the regulatory framework;
- Adapts the governance structures under the umbrella of the SET-Plan to ensure a more effective interaction with EU countries and stakeholders;
- Proposes to measure progress via overall Key Performance Indicators (KPIs), such as the level of investment in research and innovation, or cost reductions.

The EU Steering Group on Strategic Energy Technologies (SET- Plan Steering Group) consists of high-level representatives from EU countries, as well as Iceland, Norway, Switzerland, and Turkey. It ensures better alignment between the different research and innovation programmes at EU and national level, as well as the SET Plan priorities. It also increases cooperation between national programmes to avoid duplication and heightens the impact of public investment.

European Technology and Innovation Platforms

The European Technology and Innovation Platforms (ETIPs) were created to support the implementation of the SET Plan by bringing together EU countries, industry, and researchers in key areas. They promote the market uptake of key energy technologies by pooling funding, skills, and research facilities.

The platforms:

- ETIP Wind
- ETIP PV
- Ocean Energy Europe
- European Geothermal Energy Council
- The European Innovation Partnership on Smart Cities and Communities marketplace
- Smart Networks for Energy Transition
- ETIP on Renewable Heating and Cooling
- European Biofuels Technology Platform
- CCS Platform
- Sustainable Nuclear Energy Technology Platform

European Energy Research Alliance

The European Energy Research Alliance (EERA) aims to accelerate new energy technology development by cooperation on pan-European programmes. It brings together more than 175 research organisations from 27 countries, involved in 17 joint programmes. It plays an important

role in promoting coordination among energy researchers along the SET Plan objectives and in the technology transfer to the industry.

European Energy Research Alliance website

SET-Plan Information System

The EU's SET-Plan Information System (SETIS) provides information on the state of low-carbon technologies. It also assesses the impact of energy technology policies, reviews the costs and benefits of various technological options, and estimates implementation costs. This information is useful for the European Industrial Initiatives, private companies, trade associations, the European Energy Research Alliance, international organizations, and financial institutions.

SETIS website

SECTION 3: ANALYSIS OF CF SEDSS WORK AND OUTPUTS

This section covers the topics covered during the CF SEDSS events including the status of energy efficiency, energy management and renewable energy in the defence sector, and includes current defence sector trends.

The section has been divided in to three main sub-sections covering the three working group of the CF SEDDS: Energy Management (sub-section 3 (I)), Energy Efficiency (sub-section 3 (II)), and Renewable Energy Sources (sub-section 3 (III)).

Sub-section 3(I): energy management

This sub-section focus on the topics covered by CF SEDSS Working Group 1 – Energy Management.

Energy Management Status Analysis

The main finding is that although there is a common understanding that the reduction of energy usage, along with the enhancement of energy efficiency, are important for reinforcing the military operational capabilities (and simultaneously reducing energy budgets as well as reducing resource-spending and greenhouse gas emissions (assisting EU to meet relevant targets)), the above mentioned perception has not led the defence sector so far to a significant transformation of approach towards energy management.

In the sub-chapters to follow, a thorough analysis of the current status is carried out on:

a) Energy Strategies;

b) Energy Management Systems, and in particular:

   i. the development and implementation of Energy Management Systems;

   ii. energy data & billing;

   iii. the human factors that affect energy in defence context;

   iv. procurement with respect to energy efficiency;

   v. Energy Performance Contracting.

To map the MS MODs approach on the aforementioned issues that fall under the scope of WG1, 4 questionnaires have been developed and circulated around participating MS:

a) Questionnaire on Energy Data Collection, Analysis and Sharing (*"Q-1"*, Jan. 2016): the 23 MS that have replied to this questionnaire constitute a significant sample, since they represent 94.7% of EU defence expenditure as well as 90.9% of EU defence personnel [3].
b) Questionnaire on Energy Efficiency Awareness & Training (*"Q-2"*, Nov. 2016): the 22 MS that have replied to the questionnaire constitute a significant sample, since they represent 96.9% of the EU Defence expenditure and 91.0% of EU Defence personnel[4].
c) Questionnaire on Energy Management Systems – Public Procurement – Energy Services Companies & Energy Performance Contracting (*"Q-3"*, May 2017): the 21 MS that have replied to the questionnaire constitute a significant sample, since they represent 93.2% of the EU Defence expenditure and 86.0% of EU Defence personnel[5].
d) Questionnaire on Energy Strategies in the Defence Sector (*"Q-4"*, May 2017): the 21 MS that have replied to the questionnaire constitute a significant sample, since they represent 93.4% of the EU Defence expenditure and 86.7% of EU Defence personnel[6].

3.1 Energy Strategies

EU Framework

By 2020, the EU aims to reduce its greenhouse gas emissions by at least 20%, increase the share of renewable energy to at least 20% of consumption and achieve energy savings of 20% or more. All EU countries must also achieve a 10% share of renewable energy in their transport sector.

Moreover, all EU Member States have agreed on a new 2030 framework for climate and energy, including EU-wide targets and policy objectives for the period between 2020 and 2030, which, in a nutshell, include a 40% cut in greenhouse gas emissions compared to 1990 levels, at least a 27% share of renewable energy consumption, and at least 27% energy savings compared with the business-as-usual scenario.

Through the attainment of these targets, the EU can help combat climate change and air pollution, decrease its dependence on foreign fossil fuels, and keep energy affordable for consumers and businesses.

EU MoDs Current Status on Energy Strategies

[3] Data for the year 2015, retrieved through EDA Defence Data portal (http://www.eda.europa.eu/info-hub/defence-data-portal). The EU MS MoDs that provided replies to Q-1 are: AT, BE, BG, CY, CZ, DE, EE, EL, ES, FI, FR, HR, HU, IE, IT, LT, LV, NL, PT, RO, SE, UK. Additionally, CH contributed to Q-1.
[4] Data for the year 2015, retrieved through EDA Defence Data portal (http://www.eda.europa.eu/info-hub/defence-data-portal). The EU MS MoDs that provided replies to Q-2 are: AT, BE, BG, CY, DE, EE, EL, ES, FI, FR, HR, IE, IT, LT, LV, NL, PL, PT, SE, SI, UK. Among the participating MS is DK, which holds an opt-out from EU policies in relation to security and defence and does not provide defence data to EDA.
[5] Data for the year 2015, retrieved through EDA Defence Data portal (http://www.eda.europa.eu/info-hub/defence-data-portal). The EU MS MoDs that provided replies to Q-2 are: AT, BE, CY, DE, EE, EL, ES, FI, FR, HR, IE, IT, LT, LV, NL, PT, RO, SE, SI, UK. Among the participating MS is DK, which holds an opt-out from EU policies in relation to security and defence and does not provide defence data to EDA.
[6] Data for the year 2015, retrieved through EDA Defence Data portal (http://www.eda.europa.eu/info-hub/defence-data-portal). The EU MS MODs that provided replies to Q-2 are: AT, BE, CY, DE, EE, EL, ES, FI, FR, HU, IE, IT, LT, LV, NL, PT, RO, SE, SI, UK. Among the participating MS is DK, which holds an opt-out from EU policies in relation to security and defence and does not provide defence data to EDA.

Energy Strategies in the defence sector set the plans of action designed to achieve long-term energy efficiency and reduced energy consumption without any compromise to the operational objectives, assisting, at the same time, in the implementation of the EU Energy Strategy.

According to the replies to the *Q-4* Questionnaire (May 2017):

a. 10 MODs (48%, 10 out of the 21 that replied) indicated that they do have an Energy Strategy.

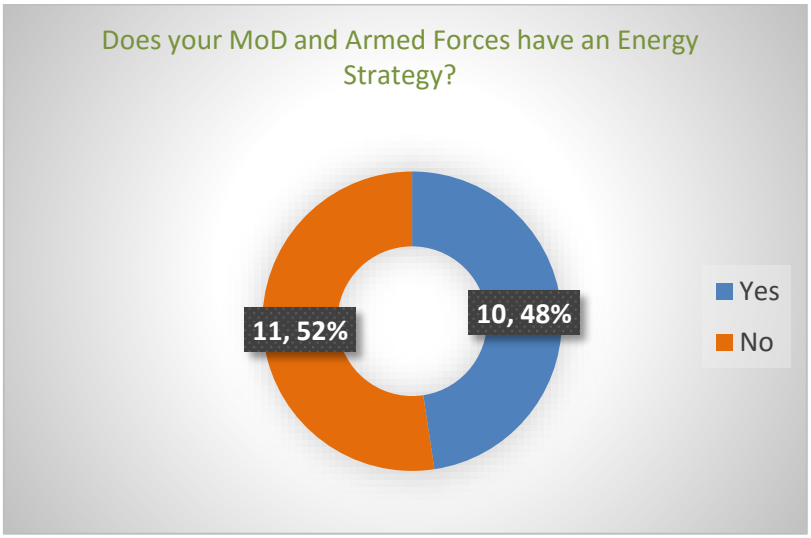


Figure 1: Incorporation of Energy Strategies in the Defence Sector

In such cases:

i. In the majority of these MODs (70%, 7 out of the 10 MODs that do have an Energy Strategy), their Energy Strategy consolidates with their Environmental Protection or Sustainable Development Strategy into one document. In this Survey, only in 2 cases a stand-alone Energy Strategy has been promulgated. There is also the case of one MS that has issued both a Sustainable Defence Strategy (including energy) and a dedicated Energy Performance Strategy.

ii. In the overwhelming majority of the MODs (90%, in 9 out of the 10 MODs that do have an Energy Strategy), the Energy Strategy is linked with the military operational capabilities. In the rest of the cases, the Energy Strategy deals only with infrastructure and support activities.

b. In the near future, 9 MODs (82%, 9 out of the 11 MODs that currently have not issued an Energy Strategy) are planning to develop one. This will result to 19 MS in total that will have an Energy Strategy (90%, 19 out of the 21 that replied) in the years to come.

Challenges and Barriers

The following challenges/ barriers have been identified:

a) The visibility of energy as one of the most critical operational capabilities' enabler is not clear in many cases, leading to the low commitment of all levels of command and personnel. This phenomenon is attributed to the following reasons:

i. The link between energy and operational capabilities is not adequately highlighted;

ii. In cases that an Energy Strategy is combined with an Environmental Protection or Sustainable Development Strategy, the aforementioned link between Energy and operational capabilities is downgraded in favour of the undeniable environmental protection benefits (i.e. CO_2 emissions, sustainability of resources, etc.);

b) A shortage of suitably qualified and experienced MOD professionals in the energy-related domain has been identified in some MODs, leading to insufficient capacity within the respective defence organisations to implement action plans in support of an Energy Strategy. In such cases, the development of an Energy Strategy provides little or no added value other than to satisfy a policy requirement.

c. A plethora of "strategies", "concepts" and "policies" abound within and overwhelm the military sector, diluting the actual commitment of all levels of command. This has a knock-on effect in terms of the engagement of personnel and the realisation of effective Energy Action Plans deriving from the Energy Strategy.

d. The limited availability of funding and investments in many MODs hinders the realisation of an Energy Strategy through the implementation of comprehensive action plans. EU and National Competent Authorities on Energy have not necessarily been supportive in terms of providing the essential funding. This further weakens the support for and effectiveness of a MoD Energy Strategy.

e. Further to the above, the defence exemptions in EED (par. 2b of Article 5) are in some cases misinterpreted by National Competent Authorities on Energy, resulting in unequal treatment in terms of national funding for the energy efficiency upgrade of the significant share of building stock of the MODs/ armed forces that are not exempted (i.e. living quarters and offices).

f. There are cases of MODs/ Armed Forces that have yet to establish a dependable energy data collection mechanism, which will enable them to partition energy consumption into significant energy uses. This issue may lead to the selection of inappropriate Energy Performance Indicators (EnPIs) as well as to poor energy consumption forecasts (if any). Consequently, the developed Energy Strategies are coarse and very generic and are not supported by relevant action plans targeting specifically the significant energy uses. The aforementioned issues are justified by the following facts, captured by *"Q-1"* Questionnaire (January 2016):

i. Less than half of the MODs do project their future energy needs (in 10 out of the 22 MODs that replied, 45%).

ii. Just around one out of three MODs do partition their electricity/ gas consumption into relevant uses, such as offices, accommodation, production/ maintenance, operations, etc. (in 7 out of the 20 MODs that replied, 35%).

3.2 Energy Management Systems

Development and Implementation of Energy Management System Structures

EU Framework

Article 5 of the *EED* requires public bodies to play an exemplary role as far as their energy efficiency and energy consumption of their buildings are concerned. To that end, public bodies are

encouraged to adopt specific energy efficiency action plans and, moreover, develop and implement Energy Management Systems (EnMSs).

Energy auditing, which is a key element of every EnMS, is specifically addressed in *Article 8* and *Annex VI* of the *EED*, in order to emphasize the requirements for high quality as well as for safeguarding the impartiality of the auditors.

Apart from EnMSs, the European Parliament and Council have developed the Eco-Management & Audit Scheme (EMAS), a comprehensive tool for promoting continuous improvements in the environmental performance of organisations by the establishment and implementation of Environmental Management Systems (EMSs), based on the international Standard ISO 14001:2004. Currently, EMAS has been promulgated as *Regulation (EC) 1211/2009*. In the context of EMAS, energy is considered a significant environmental aspect and energy efficiency as one of the core environmental indicators.

EU MODs Current Status on Energy Management Systems

According to the discussions during the 2nd CF SEDSS WG1 plenary meeting (June 2016) and the relevant replies on *Q-3* Questionnaire (April 2017), the majority of MODs/ AF do apply EnMSs and / or EMSs to some extent.

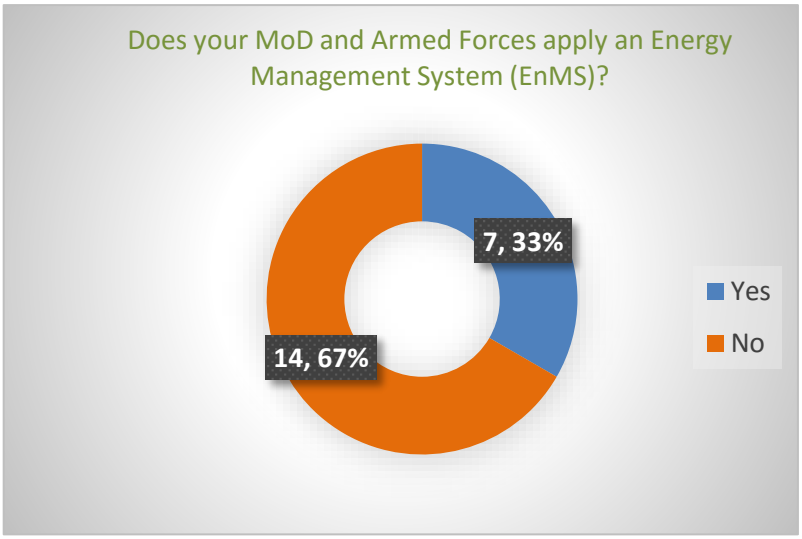


Figure 2: Implementation of Energy Management Systems in the Defence Sector

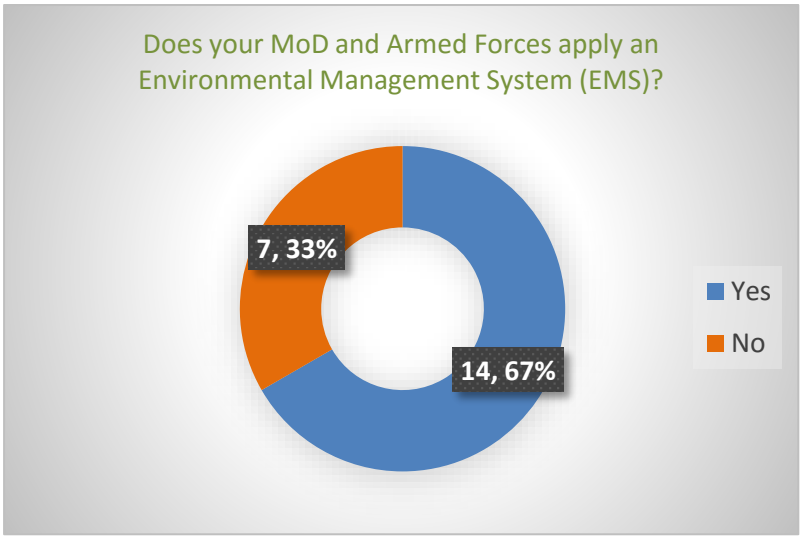


Figure 3: Implementation of Environmental Management Systems in the Defence Sector

However, there are different levels of maturity on the application of energy management among MODs/ Armed Forces. In more detail:

a) There are examples of the comprehensive application of EnMSs: 2 MODs/ Armed Forces (10%, 2 out of the 21 MODs that replied) apply certified EnMS. Among them:

   i. 1 MoD applies ISO 50001 with a wide-scale scope (i.e. covering almost or all military facilities) (since 2013);

   ii. 1 MoD applies ISO 50001 in narrower scopes, in pilot scale (few installations, since 2015).

b) Additionally, there are some MODs that have developed and implement both EnMSs and EMSs (24%, 5 out of the 21 MODs that replied). In more detail:

   i. 1 MoD applies an ISO 50001-certified EnMS in pilot scale (since 2015) as well as an ISO 14001-certified EMS in a few number of sites;

   ii. 1 MoD applies an ISO 50001-certified EnMS in a number of sites managed by contractors as well as ISO 14001 EMSs to almost all their facilities, many of which have been certified;

   iii. 1 MoD applies both ISO 50001-based and EMAS-based systems covering almost or all military facilities;

   iv. 1 MoD applies both ISO 50001 and ISO 14001 in all facilities except military camps, a few of which are certified;

   v. 1 MoD applies both an EnMS and an EMS based on internal directives (since 1995).

c) Moreover, there are numerous cases of MODs that implement EMSs (based on either ISO 14001 or EMAS) which incorporate energy consumption as one of the significant environmental aspects and, thus, manage energy. In more detail, more than half of the participating MODs / Armed Forces (43%, 9 out of the 21 MODs that replied) apply an

Environmental Management System (EMS) which identifies energy as one of the main environmental aspects. Among them:

i. 7 MODs apply EMSs with a wide-scale scope (i.e. covering almost or all military facilities):

   a. 1 MOD applies an ISO 14001-certified EMS to all its facilities;

   b. 1 MOD applies ISO 14001 EMSs to almost all its facilities, many of which have been certified;

   c. 3 MODs apply an ISO 14001-based EMS to all their facilities;

   d. 1 MOD applies an EMAS-based EMS to all its facilities;

   e. 1 MOD applies an ISO 14001 EMS to many of its facilities, but only very few have been certified. Moreover, there is also a pilot case of an EMAS – certified facility (since 2016);

ii. 1 MOD applies an EMAS-certified EMS in pilot scale (since 2011) and the initiative will be broadened during the next years with the inclusion of many more camps;

iii. Furthermore, there is the case of one MOD that had applied an ISO 14001-based EMS in all installations, which, however the project was suspended in 2016.

d) The rest of the MODs (24%, 5 out of the 21 that replied) do have action plans for improving their energy performance but these initiatives are not conducted in the structured approach of an EnMS/ EMS. In such cases, there is a reflective energy management strategy or it is included in a wider public sector mandate.

c) In half of the cases, the MODs that have developed and implemented EnMSs/ EMSs, were granted relevant financial/ technical assistance by national or EU funding mechanisms/ competent authorities (52%, 11 out of the 21 that replied). In more detail:

   i. 6 MODs (32%, 6 out of the 19 MODs that replied) have received some sort of technical assistance from National Competent Authorities;

   ii. 4 MODs (21%, 4 out of the 19 MODs that replied) have been granted financial assistance from National Competent Authorities in the past;

   iii. There was only just one MOD that was granted EU funding for the development and implementation of an EnMS in pilot scale;

e) There is an increasing number of MODs that are planning to develop and implement EnMSs in the near future. In more detail, 11 MODs are planning to move towards that direction.

Challenges and Barriers

The challenges and barriers identified by MODs that actually implement or are planning to implement an EnMS/ EMS can be summarised to the following:

a) Human Factors (i.e. commitment, awareness, motivation, communication and training); a topic which was extensively covered during the 3rd meeting of WG1 (Rome, November 2016);

b) Availability of human resources to assume duties as energy managers/ energy team members;

c) Financial resources:

   i. Taking into account the continuously reduced MOD budgets, funding the implementation of an EnMS and its accompanying action plans is not considered a priority, even though in many cases the Return on Investment (ROI) of such projects is very attractive and will have a long terms positive impact on budgets;

   ii. Within the financial procedures of most MODs, various/ different budget lines have to be used for the implementation of action plans (e.g. for training, infrastructure renovation, fuel monitoring, procurement of equipment, etc.). The owners of these budgets are different and there are challenges into coordinating such actions.

d) Organisational issues:

   i. Energy efficiency in general has been mentioned only as a broad responsibility of "all commanders". In most cases, energy was identified as a responsibility of the overall system but no specific leader/commander has been assigned as owner/ manager. This is coupled with the fact that various internal stakeholders do exist (e.g. logistics support, infrastructure, human resources/ training, operations, maintenance, etc.), without anyone taking the lead;

   ii. In most of the cases that energy efficiency improvement plans with broad objectives have been established at the top level, there are no corresponding, specific actions and targets assigned to every single military unit;

   iii. Multi-tier hierarchy chains [i.e. strategic level: MOD and Chiefs of General Staffs, operational level: commands/groups, tactical level: corps, divisions/stations, brigades/wings, battalions/squadrons (and equivalent civilian chains of command)]: to reach common agreements on EnMS/ EMS issues around 7 tiers of command have to be involved;

   iv. Wide communication on energy-related issues among same level units and formations that would lead to dissemination of good practice has not been established yet.

   v. In general, energy management review meetings are not a common practice among defence organisations. Only annual progress reports supported with general EnPIs are submitted to the top level and, in most cases, these processes are isolated from other key functions of the defence sector. Only in the sites that an EnMS/ EMS is applied, periodic energy efficiency meetings are held to review progress and capture actions towards stated objectives, since this is a requirement of the relevant standards.

   vi. Energy managers in the operational/ camp level are in most cases appointed with other time-consuming tasks, a fact that actually slackens their engagement and effectiveness.

   vii. Frequent turnover of military personnel.

e) Technical issues:

   i. Data collection/ metering: sufficient data granularity is key to ensure that action plans are effectively targeting on Significant Energy Uses (SEUs) and the

commitment of personnel and all levels of command is maintained. In some cases evidence in the form of energy data and mainly on how energy consumption is partitioned is difficult to acquire.

ii. Definition of the EnMS/ EMS scope: there is always the debate on whether to include operational activities within the scope and which will be the impact of such an action towards the operational capabilities.

iii. In some MODs/ Armed Forces there are still grey zones in terms of whether certain legislative clauses actually exempt defence-related infrastructure and activities. This affects the progress of the works and slows down the investments, since additional efforts are required to investigate/ interpret the statutory requirements, in cooperation with the competent authorities.

Energy Data & Billing

EU Framework

In *Article 3*, the EED stresses the necessity of setting national Energy Efficiency targets. In order to monitor the progress of achieving these targets, among others, there are requirements concerning metering of energy products (*Article 9*), billing information (*Article 10* and *Annex VI*) and the relevant costs of access to both metering and billing (*Article 11*).

EU MODs Current Status on Energy Data & Billing

According to the discussions during the 1st CF SEDSS WG1 plenary meeting and the relevant replies on *Q-1 Q*uestionnaire (January 2016):

a) All MODs collect energy data and maintain relevant records. The types and details of data, as well the competent bodies that are responsible for these tasks vary between MODs.

b) Smart metering is acknowledged as a very useful tool. In more detail:

i. Two-thirds of the MODs (65%, 15 out of the 23 MODs that replied) have embraced this approach and are currently utilizing smart meters in order to monitor actual electricity/ gas consumption and maintain records.

ii. However, in most cases the smart meters are used to monitor the energy consumption of the entire camp “at the gate”. To that end, less than one-fifth of the MODs (18%, 4 out of the 22 MODs that replied) partition the electricity/ gas consumption into relevant uses (e.g. offices, accommodation, production, etc.) with the use of smart meters to some extent. Another 4 MODs do actually partition the aforementioned consumptions by other methods. Summing up, 38% of the MODs have a process of partitioning electricity gas consumptions into relevant uses.

iii. Less than one-fifth of the MODs (17%, 4 out of the 23 MODs that replied) use smart meters for transport fuel monitoring.

b) With respect to the energy consumption bills (electricity/ gas /heating oil):

i. The quality of information provided by energy retailers to the MODs is in general according to the provisions of the EED in 19 out of 23 MODs (83%). 4 MODs (17%, 4 out of the 23 MODs that replied) do not acquire the billing information in accordance with Annex VII of EED;

ii. As far as complimentary information on historical consumptions is concerned, it is available to most MODs (87%, in 20 out of the 23 MODs that replied);

iii. Electronic billing is provided by energy retailers to more than three-quarters of the MODs (77%, in 17 out of the 22 MODs that replied);

iv. In more than two-thirds of the EU countries (70%, in 16 out of the 23 MODs that replied) the energy consumption bills are paid centrally, either by the MOD or by the relevant General Staff. In most of these cases, the energy-reduction action plans are launched and managed centrally. In the rest of the cases, the commanders of the camps are responsible for covering the relevant expenses.

c) Almost half of the MODs (48%, in 11 out of the 23 MODs that replied) project their future energy needs for planning reasons.

d) Modelling for future energy needs is a very useful tool; however it is of limited use until now.

e) Additionally, in more than half of the cases (52%, in 12 out of the 23 MODs that replied), the MODs submit annual energy reports to the competent energy authorities.

f) All reporting (on annual consumptions and/ or on future energy needs) has been proven until now time-consuming and of no added value to the MODs, since this action does not serve as a basis for further cooperation between the MODs and the competent authorities (e.g. for inclusion of the Armed Forces into financial schemes or energy efficiency upgrade projects, as it is highlighted in *Chapter 5*).

Challenges and Barriers

With respect to the installation of smart meters, the following financial and technical burdens were identified:

a) The slow pace of the installation of such devices by the energy providers – there are cases where the MODs had to purchase the equipment.

b) In most cases, the military installations have been founded many decades ago and expanded, in the years to follow, not in an orthodox way. This fact has led to complex internal distribution grids that require significant numbers of smart meters in order to partition energy consumptions per use.

c) Lack of commitment from senior/ middle level management to engage in such action plans (see more on this on the *Human Factors Affecting Energy Efficiency* sections).

d) Lack of financial resources, since the budgets of all MODs are cut down. There was just one case (4% of MODs that replied) where an MOD was benefited by national/ EU funding in order to install smart meters (and this was just for a few installations).

e) The significant size of the building stock, which, in most cases, is scattered around the whole country.

f) In some cases the state of ownership discourages such acts, since there are EU countries in which the Armed Forces are just occupants and the competent national authority – owner is not interested in investing in such schemes.

g) The age of buildings requires, in some cases, costly preparatory works to install smart meters.

h) There is a potential risk of cyber security compromise with respect to smart metering and remote monitoring.

Human Factors Affecting Energy Efficiency

EU Framework

With respect to the human factors affecting Energy Efficiency, the EED states that the EU Member States should:

a) encourage training programmes for the qualification of energy auditors in order to facilitate sufficient availability of experts (*Article 8*).

b) promote suitable information, awareness-raising, education/ training initiatives and technical assistance in order to inform on the benefits and practicalities of taking energy efficiency improvement measures and, further onto building relevant capacities among the general public and specific sectors (*Articles 17* and *18*).

EU MODs Current Status on Human Factors Affecting Energy Efficiency

MODs acknowledge the importance of human factors on energy efficiency and the definition of relevant qualifications when personnel is involved in tasks related to energy usage.

In terms of the human factors in defence context, we have to accept the following:

a) MOD's/ Armed Forces' personnel are well-disciplined and have been accustomed to following procedures, more than personnel of any other sectors (public or private).

b) There is a direct link between operational capabilities and energy efficiency, which is to the interest of the defence institutions but it also affects, in certain cases (e.g. deployment, crisis), the welfare of personnel.

c) The core of military personnel has entered the Armed Forces at an early age, through military academies or recruiting that involves subsequent training. At these early stages, personnel is more adaptable to new mind-settings and to new approaches of work. To that end, the effort to secure the commitment of the future leaders and followers has to start at these very early stages.

The human factors on energy savings and energy efficiency improvements which are illustrated in the diagram below[7] were explored within the defence context.

[7] Adopted from *"Building Energy manager's Resource Guide"*, written by NIFES Consulting Group on behalf of Sustainable Energy Ireland (SEI).

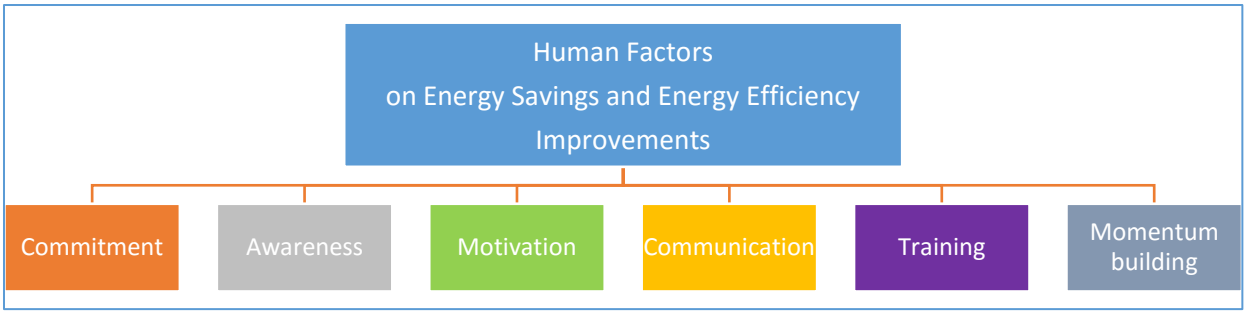


Figure 4: Human Factors on Energy Savings and Energy Efficiency Improvements

The concepts entailed within each of the aforementioned aspects, according to the discussions during the 3rd CF SEDSS WG1 plenary meeting and the relevant replies on the *Q-2* questionnaire (November 2016) are the following:

a) Commitment (i.e. willingness to engage in energy efficiency improvement schemes, save energy and accomplish relevant targets):

i. The general, main objective of the MODs/ Armed Forces is to secure the sovereignty and serve the national interests of their country. Therefore, the objective of continuous improvement in energy management (as it is dictated by the Plan – Do –Check – Act cycle) may be pursued systematically by defence decision-makers only in the cases where there are evident links between energy and operational requirements. In all cases, operational imperatives always prevail and determine the way of work in all the lines of command.

ii. A commitment for energy efficiency and energy savings from the strategic level of command is of paramount importance. However, in most cases this is not clearly defined and/or the mandate is not accompanied with the provision of the necessary resources.

iii. The lowest level (tactical) plays a key role, since at this level of command the implementation of all relevant projects and the mind-setting of personnel is actually taking place.

iv. There have been cases reported in which the operational / tactical levels of command have downgraded relevant mandates on energy efficiency due to the fact that these mandates were neither supported by adequate funding nor the actual resources available in that level were sufficient enough to support both the operational capabilities (as dictated by relevant procedures and plans) and any new schemes on energy efficiency.

v. In general, personnel as well as commanders are more committed during deployment and/ or crisis, since in such operational environments energy resources are scarcer and any lack of them may well have adverse impacts on the operational capabilities or even human lives.

b) Awareness (i.e. understanding of energy issues and their impact on the defence sector):

i. Energy efficiency awareness schemes should aim to provide the necessary information to formulate cultural change in the direction of energy savings and energy efficiency improvements.

ii. According to *"Q-2"* Questionnaire (November 2016), the vast majority of MODs have launched some forms of energy awareness campaigns (90.9%, in 20 out of the 22 MODs that replied).

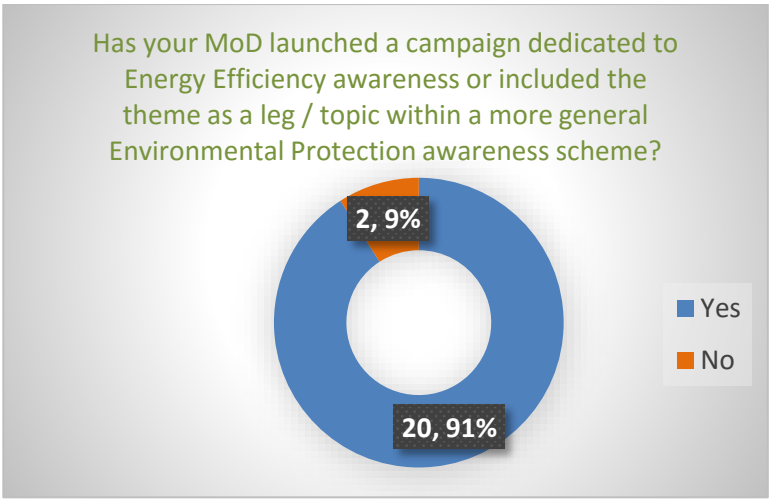


Figure 5: Implementation of Energy Efficiency Awareness Campaigns in the Defence Sector

In more detail:

a. 3 MODs have had both dedicated energy efficiency awareness campaigns as well as environmental protection awareness schemes that included energy efficiency (13.6%).

b. 10 MODs have launched dedicated energy efficiency awareness campaigns (45.5%).

c. 6 MODs have not launched dedicated awareness campaigns to energy efficiency, however, they have integrated the topic into larger, environmental protection awareness schemes (27.3%).

d. 1 MOD was included in the scope of a broader governmental campaign on energy efficiency (4.6%).

e. Just 2 MODs have not carried out any similar awareness campaigns (9.1%).

iii. Around one-third of the MODs (36%, 8 out of the 22 MODs that replied) were assisted by National Competent Authorities into their awareness schemes. In more detail:

a. 6 MODs have received media material (i.e. leaflets, brochures etc.) (27%, 6 out of the 22 MODs that replied).

b. 4 MODs have received technical support (18%, 4 out of 22 MODs that replied).

c. Not a single MoD has received national funding for awareness campaigns.

iv. Moreover, only just 1 MOD (5%, 1 out of the 21 MODs that replied) has received some EU funding for awareness campaigns.

v. The shortage and/ or low quality of energy data hinders energy-awareness campaigns.

c) Motivation (i.e. the factor or combination of factors and enthusiasm that drive hierarchy and personnel to save energy and increase efficiency). There are numerous factors that may influence the motivation of individuals and/ or groups within MOD's/ Armed Forces' personnel, such as:

i. Awareness; although there is a clear distinction between awareness and motivation, i.e. what people know vs why they take action, these two elements are interrelated, as it is depicted in the following grid [8]:

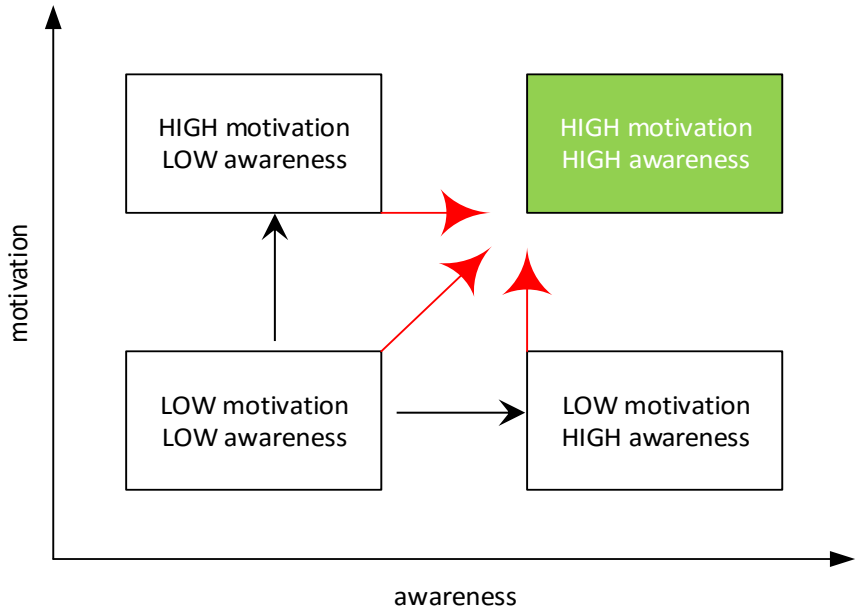


Figure 6: Awareness / Motivation Grid [5]

Within the MODs/ Armed Forces there is personnel that falls into all 4 categories of motivation/ awareness presented in the aforementioned diagram.

ii. Operational imperatives; military personnel have a very high sense of duty. In operations, especially during deployment, the availability of energy resources is decisive on the success of the operations. This parameter affects all levels of hierarchy and personnel.

iii. Personnel safety; As many recent studies emphasize, energy savings and energy efficiency improvements during operations reduce the exposure of personnel to threats related to logistic support of energy resources.

iv. Exemplar behaviour/ commitment from commanders; the paradigm of leadership of all levels paves the way for personnel to follow accordingly.

v. Legislation and internal orders; this is a typical top-down approach that military personnel, being well-disciplined, is accustomed to follow.

[8] Adopted from *"Building Energy manager's Resource Guide"*, written by NIFES Consulting Group on behalf of Sustainable Energy Ireland (SEI).

vi. Financial incentives; this is the main driver for higher levels of command to reduce energy consumption mainly in everyday activities but also during operations.

vii. Running competitions; internal competitions on energy savings among military units or individual personnel have been proven to boost motivation, especially when prizes and/or publicity are involved.

viii. Keeping modern; adopting new trends based on civil counterpart activities refreshes motivation.

ix. Social pressure; up until now the cases in which public opinion has focused on defence energy consumption and/ or Green House Gas (GHG) emissions are detrimental and sporadic. However, this parameter should not be undermined in the future.

d) Communication (i.e. various methods of delivering as well as receiving messages related to energy savings and increase of energy efficiency):

i. There is a need for communication streams that address energy issues internally as well as externally. As a first step, the relevant stakeholders in all levels should be identified, as seen in the diagram below.

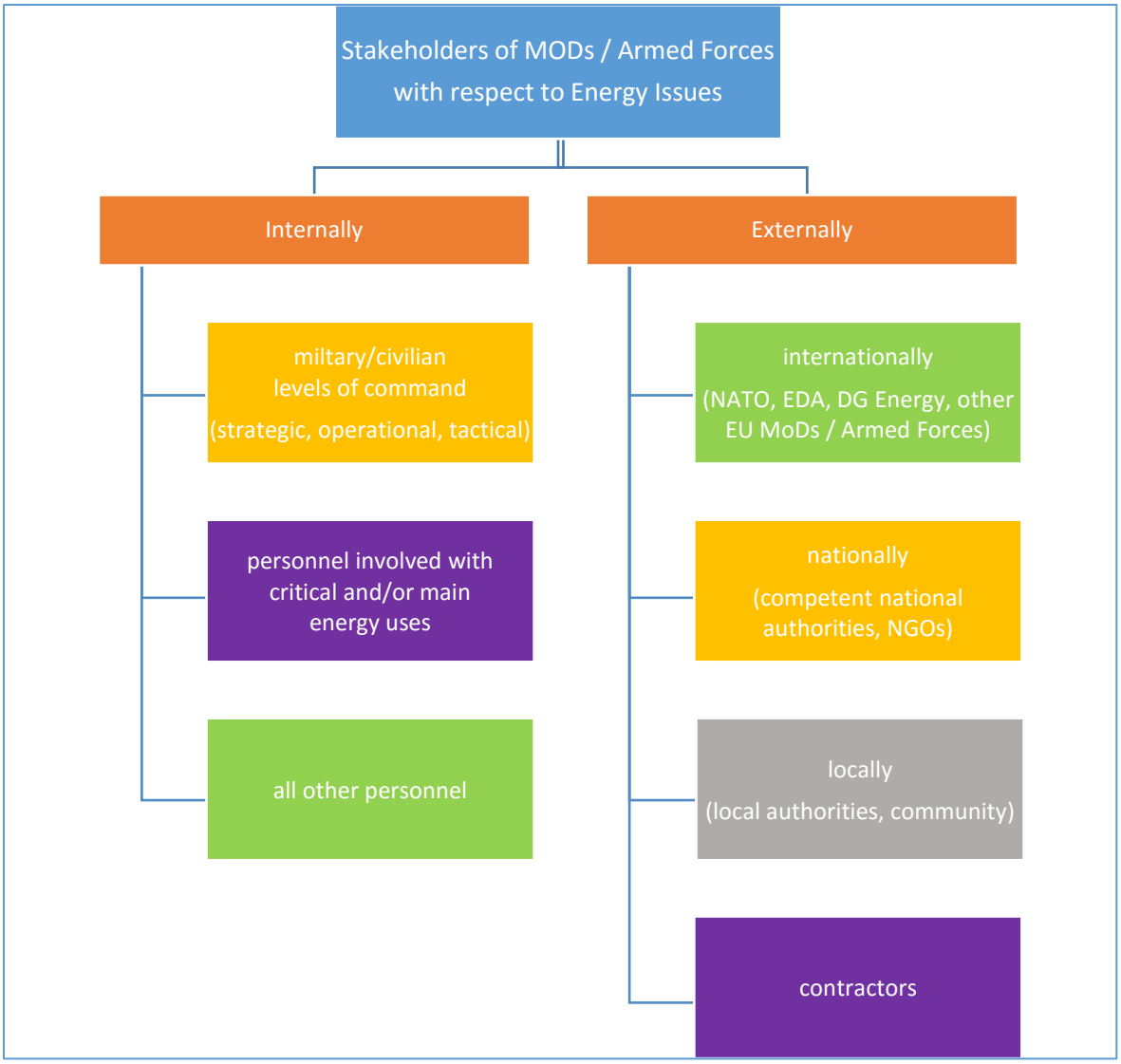


Figure 7: Stakeholders of MODs / Armed Forces with respect to Energy Issues

ii. So far, in most cases, the communication with respect to energy issues between all the aforementioned internal and external stakeholders is not consistent and is mainly focused on just reporting energy consumption and not on topics with more added value for the future, such as lessons-learnt, new initiatives, funding tools, etc.

e) Training (i.e., the process of imparting knowledge and skills which enable personnel to undertake their role and duties taking energy efficiency and energy saving into consideration):

i. Different levels and syllabus of training are applied, depending on the duties/ job descriptions as well as the skills of personnel.

ii. MODs/ Armed Forces have initiated professional training schemes in the regimes of energy efficiency. To that end, according to the discussions during the 3nd CF SEDSS WG1 plenary meeting and the relevant replies on "*Q-2*" Questionnaire (November 2016):

a. Professional training to engineers and technical personnel has been provided on the following topics:

   - Design and construction of energy efficient infrastructure: in around two-thirds of the MODs (64%, 14 out of the 22 MODs that replied).
   - Renovation of existing infrastructure in order to comply with the new legal framework on energy efficiency: in more than three-quarters of the MODs (77%, 17 out of the 22 MODs that replied).
   - Design and application of Renewable Energy Sources (RES): in more than two-fifths of the MODs (41%, 9 out of the 22 MODs that replied).
   - Design and application of smart grids: in almost a quarter of the MODs (23%, 4 out of the 22 MODs that replied).

b. However, there is an almost unanimous perception that the aforementioned training schemes have to be improved and deliver more concrete results (95%, 18 out of the 19 MODs that replied).

c. Energy efficiency has been incorporated into the syllabus of professional training of many specialties, which, according to their duties and expertise use or have an impact on energy. A non-exhaustive list includes:

   - aircraft pilots (on efficient throttling of aircraft engines during taxiing and take-off):
   - heating/ air-conditioning technicians (on execution of relevant inspections and maintenance):
   - vehicle drivers (on eco-driving);
   - equipment operators (on operation under energy saving modes);
   - fuel logistics personnel (on preserving the quality of POL and handling of waste / drainage fuels);
   - procurement officers (on applying energy efficiency requirements and/ or special terms on energy savings during tendering).

d. Training on energy auditing is of paramount importance both for implementation of the relevant legal framework and, more critically, for mapping the building stock and equipment and, consequently, assessing any opportunities and methods for improvement:

   - Half of the MODs (50%, 11 out of the 22 MODs that replied) have, to some extent, competent personnel within their infrastructure domain that have attended training programmes for the qualification as energy auditors. However, in the majority of MODs the numbers of qualified energy auditors are not sufficient.
   - In around one-fifth of the cases (22.7%, 5 out of the 22 MODs that replied) the national legislative frameworks do not foresee the registration of civil servants and/or defence personnel as energy auditors. To that end, any potential energy auditing schemes within

defence may suffer from various implications, that in many cases stall such schemes (e.g. sets an extra financial burden to the MODs).

- In one case, the MOD decided not to purse systematic training on energy audits and to outsource this task to the relevant facility management contractors not because of lack of expertise, but because of other reasons (fluctuating workload on energy audits, registration processing fees, general government direction to outsource services, etc.)
- Only one MOD benefited, to some extent, by national funding in order to conduct trainings on energy audits.

e. Momentum (i.e. the force that maintains the continuous improvement on energy efficiency):

- Once some energy-related awareness and training schemes are reaching their end, it is always a challenge to maintain the continuous improvement of energy management.
- Moreover, the high turnover of commanders and military personnel adds greatly to the challenge of keeping the momentum.
- In the cases where an EnMS/ EMS is not established, keeping this momentum relies only in the personal commitment of the involved staff and it is not an established "procedure".
- Currently, within the defence sector there are no monitoring mechanisms of identifying behavioural trends and reacting accordingly by launching initiatives that affect the human factors on energy efficiency.

Challenges and Barriers

The challenges and barriers that are identified concerning the human factors that affect energy efficiency fall under 5 main categories:

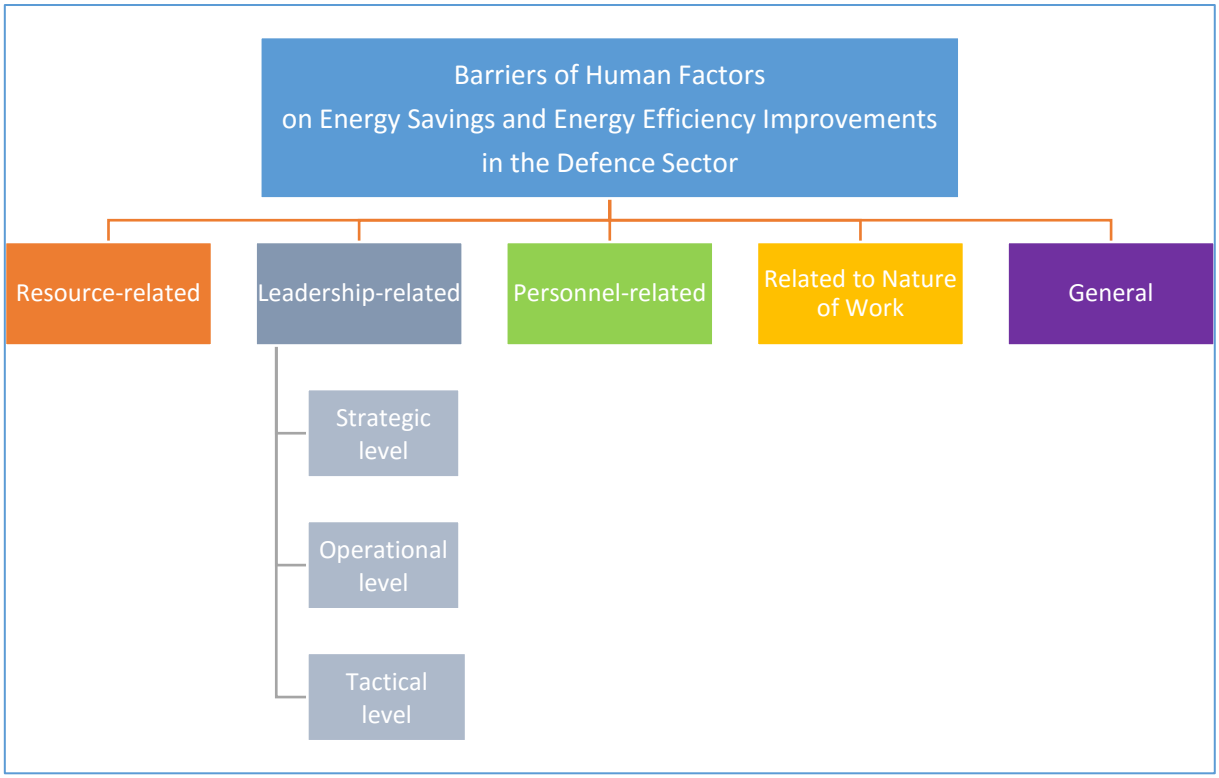


Figure 8: Barriers of Human factors on Energy Savings and Energy Efficiency Improvements in the Defence Sector

a) Resource-related barriers:

i. The lack of commitment of National Competent Authorities and central governments to assist the defence sector to undertake energy efficiency improvements.

ii. The general discomfort to commit to rules and requirements which have been enacted by the general government or EU and require changes that:

a. are perceived to require different approach to everyday work, already dictated by operational, imperative requirements;

b. are not being supported by relevant funding;

iii. The general scarcity of financial resources to implement large-scale energy efficiency projects that demonstrate vigorously the commitment of top management (strategic level);

iv. The general tendency (not limited to the defence sector) to neglect funding on training and awareness schemes and direct all available financial resources to more technical solutions, such as renovations and procurement of equipment.

b) Leadership-related barriers:

i. The levels of command within the defence sector are multi-tier:

a. strategic level: MOD and Chiefs of General Staffs;

b. operational level: Commands/Groups;

c. tactical level: corps, divisions/stations, brigades/wings, battalions/squadrons (and equivalent civilian chains of command).

To that end, in order for energy efficiency to excel, around 7 tiers of command have to commit to the cause.

ii. The turnover of top management (i.e. Ministers, Chiefs of Staff) and every 2 – 3 years stalls the launch of many long-term projects in non-operational domains.

iii. The turnover of operational and tactical commanders (as well as of most military personnel) every few years in duty stations, inland and abroad, that requires acclimatization periods in new main duties and operational objectives, results in slow / poor involvement with other aspects, such as energy efficiency, at least at the beginning. This has also a negative impact on the momentum that may have previously been built by previous commanders.

iv. The shortage of commitment of the middle and / or lower level of command that occurs time to time, even in cases where the strategic level command has actually supported energy efficiency improvements (in the means of promulgation of energy policies and mandate for launching relevant projects).

v. The shortage of active involvement of middle and lower level commanders to undertake the task of customizing the messages to be marketed to various target groups of personnel in order to address practical and everyday situations.

vi. The different levels of awareness on energy issues among the levels of command, especially on the links between energy efficiency and the operational capabilities.

vii. The fact that in more than two-thirds of the MODs (70%, in 16 out of the 23 MODs that replied) the energy consumption bills (electricity / gas / heating oil) are paid centrally either by the MODs or by the relevant General Staff (in the rest of the cases, the commanders of the camps are responsible to cover the relevant expenses). In such cases there is a lack of motivation at camp / installation level and the energy-reduction initiatives and action plans, as well as the management, are launched centrally.

c) Personnel-related barriers:

i. The rotation of personnel every few years in various duty stations hinders their involvement with energy efficiency activities, since other, more imminent activities related to their new operational tasks have to be addressed. This has also a negative impact on the momentum that may have previously been built by or within former personnel.

ii. The different levels of awareness on energy issues among personnel.

iii. During competitions on energy savings among different military units, fair play has to be safeguarded, since there have been reported cases of rivalry and misbehaviour.

d) Barriers related to nature of work:

i. The imperative to operate in various environments, under a wide range of climatic characteristics and available energy resources, especially when it comes to deployed missions. This requires, in some cases, further awareness-raising and training.

ii. The general motto “train as you fight” that cross-cuts all defence activities, in order to ensure operational readiness and full exploitation of the military capabilities, cannot always be applied in the case of energy efficiency. In other words, during training the energy-related issues can be taken into account, but there are cases in operations that the parameter of energy-saving has to be down-graded due to operational and / or personnel safety imperatives.

e) General barriers:

i. The tendency to emphasise potential financial benefits from energy savings and / or energy efficiency upgrades rather than focusing on indisputable benefits towards personnel (e.g. comfort).

ii. The portions of information that is disseminated through awareness schemes has to be balanced and targeted. Overdose of information may lead to fatigue and loss of enthusiasm.

Public Procurement and Energy Efficiency

EU Framework

According to Article 6 of the EED, EU Member States shall ensure that central governments, in which the MODs and Armed Forces (AF) are included, purchase only products, services and buildings with high energy efficiency performance, insofar as that is consistent with cost-effectiveness, economical feasibility, wider sustainability, as well as sufficient competition.

A specific clause for the AF, under paragraph 2 of Article 6 of the EED, allows MODs to apply the aforementioned requirements only to the extent that no conflict with the nature and the primary aim of the activities of defence is caused.

Annex III of EED provides guidance on the energy efficiency requirements for purchasing products, services and buildings by the central government, taking into account:

a) The Energy Labelling Directive *(Directive 2010/30/EU)* as well as its delegated acts on specific products.

b) The Eco-design implementing regulations (under *Directive 2009/125/EC*) adopted after the entry into force of the EED.

c) The EU-US Energy Star Agreement 14.

d) The minimum energy efficiency requirements for buildings and building elements that the EPBD obliges EU Member States to set.

e) The Public Procurement Directive (PPD – *Directive 2014/18/EC*).

EU MODs Current Status on Public Procurement and Energy Efficiency

According to the replies to *Q-3* Questionnaire (May 2017):

a) The majority of the MODs/ AF have incorporated the relevant specifications concerning energy efficiency into their procedures/ requirements for the procurement of various products. In more detail:

	Type of Product	Compliance
	Air conditioners [Regulations 626/2011/EU and 206/2012/EU]	**82%** of the MODs / AF that replied (14 out of the 17)
	Circulators [Regulations 641/2009/EU and 617/2013/EU]	**53%** of the MODs / AF that replied (9 out of the 17)
	Dishwashers [Regulation 1059/2010/EU]	**65%** of the MODs / AF that replied (11 out of the 17)
	Domestic ovens, hobs and range hoods [Regulations 66/2014/EU and 65/2014/EU]	**65%** of the MODs / AF that replied (11 out of the 17)
	Electric Motors [Regulation 4/2014/EU]	**67%** of the MODs / AF that replied (12 out of the 18)
	Water heaters and hot water storage tanks [Regulations 812/2013/EU and 814/2013/EU]	**83%** of the MODs / AF that replied (15 out of the 18)
	Heaters [Regulations 811/2013/EU and 813/2013/EU]	**67%** of the MODs / AF that replied (12 out of the 18)
	Local space heaters, solid fuel local space heaters [Directives 2015/1185/EU, 2015/1186/EU and 2015/1188/EU]	**65%** of the MODs / AF that replied (11 out of the 17)
	Solid fuel boilers [Directives 2015/1187/EU and 2015/1189/EU]	**53%** of the MODs / AF that replied (8 out of the 15)
	Lamps, directional and LED [Regulations 874/2012/EU and 1194/2012/EU and Directive 2015/1428/EU]	**78%** of the MODs / AF that replied (14 out of the 18)
	Lamps, non-directional, fluorescent and professional [Regulation 874/2012/EU and Directive 2015/1428/EU]	**78%** of the MODs / AF that replied (14 out of the 18)
	Refrigerated storage cabinets [Directives 2015/1094/EU and 2015/1095/EU]	**65%** of the MODs / AF that replied (11 out of the 17)
	Household refrigerating appliances [Regulation 1060/2010/EC]	**75%** of the MODs / AF that replied (12 out of the 18)
	Electric power consumption standby and off mode of electrical and electronic household and office equipment [Regulation 801/2013/EC]	**76%** of the MODs / AF that replied (13 out of the 17)
	Television [Regulations 1062/2010/EU and 801/2013/EC]	**65%** of the MODs / AF that replied (11 out of the 17)
	Transformers [Regulation 548/2014/EU]	**65%** of the MODs / AF that replied (11 out of the 17)
	Household tumble driers [Regulations 392/2012/EU and 932/2012/EU]	**56%** of the MODs / AF that replied (9 out of the 16)
	Vacuum cleaners [Regulations 665/2013/EU and 666/2013/EU]	**69%** of the MODs / AF that replied (11 out of the 16)
	Ventilation units [Regulations 1253/2014/EU and 1254/2014/EU]	**78%** of the MoDs / AF that replied (14 out of the 18)
	Household combined washer-driers [Directive 96/60/EC]	**65%** of the MODs / AF that replied (11 out of the 17)
	Household washing machines [Regulation 1061/2010/EU]	**71%** of the MODs / AF that replied (12 out of the 17)

	Tyres [Regulation 1222/2009/EC]	**62%** of the MODs / AF that replied (10 out of the 16)
	Computers [Regulations 617/2013 and 174/2013/EU, Commission Decision 2015/1402/EU along with EU-US Energy Star Agreement]	**84%** of the MODs / AF that replied (16 out of the 19)
	Electronic displays and imaging equipment [Commission Decision 2014/202/EU along with EU-US Energy Star Agreement]	**79%** of the MODs / AF that replied (15 out of the 19)
	Uninterruptible Power Supplies (UPS) [Commission Decision 2014/202/EU along with EU-US Energy Star Agreement]	**67%** of the MODs / AF that replied (12 out of the 18)
	Enterprise Servers [Commission Decision 2014/202/EU along with EU-US Energy Star Agreement]	**71%** of the MODs / AF that replied (12 out of the 17)

Some of the categories of products are procured by MODs/ Armed Forces in very small quantities, hence their energy footprint is relatively small.

b) As far as the tendering specifications for service contracts, as listed in Annex II of the PPD (maintenance-repair, transport, telecommunications, computer – IT, architectural, engineering, technical, building-cleaning, sewage/ disposal, education, etc.), they have been incorporated into the relevant MOD/ Armed Forces contracting requirements in different levels. In more detail, according to the replies to a relevant question of *Q-3* Questionnaire (May 2017):

   i. 10 MODs (50%, 10 out of the 20 MODs that replied) stated that in few tendering cases they have actually included a clause for the service providers to use products that comply with the relevant energy efficiency requirements;

   ii. 4 MODs (20%, 4 out of the 20 MODs that replied) stated that in many tendering cases they have included such a clause;

   iii. 4 MODs (20%, 4 out of the 20 MODs that replied) stated that in all tendering cases they have included such a clause;

   iv. 2 MODs (10%, 2 out of the 20 MODs that replied) stated that they have never included such a clause into their tendering requirements.

c) In terms of purchase and/ or rental agreements for buildings, there are also different levels of incorporation of requirements concerning compliance with the national minimum energy requirements set under the EPBD among the MODs/ Armed Forces. In more detail, according to the replies to a relevant question of *Q-3* Questionnaire (May 2017):

   i. 8 MODs (40%, 8 out of the 20 MODs that replied) stated that they have actually included a clause on compliance with EPBD national minimum energy efficiency requirements in all contracts for purchase/ rental of buildings;

   ii. 5 MODs (25%, 5 out of the 20 MODs that replied) stated that they have included such a clause in many contracting cases for buildings;

   iii. 4 MODs (20%, 4 out of the 20 MODs that replied) stated that they have included such a clause in few contracting cases for buildings;

iv. 3 MODs (15%, 3 out of the 20 MODs that replied) stated that they have never included such a clause into contracting cases for buildings.

Challenges and Barriers

The challenges and barriers identified by MODs that have incorporated, to some extent, relevant energy efficiency requirements in the tender specifications for products and services include the following:

a) Availability of energy efficient equipment in the market, especially in the cases that products are purchased in the local markets;

b) Availability of certified service providers in sufficient numbers throughout the country;

c) Excessive cost of procurement of energy efficient equipment/ certified service providers, combined with the fact that the operational performance and / or the lowest price of purchase/ life-cycle are the key or dominant criteria and (i) energy efficiency is valued less, or (ii) no justification through Return on Investment (ROI) is mandatory;

d) Absence of central mandate/ guidelines within the internal procurement processes for incorporation of energy efficiency specifications in the tendering/ contracting requirements;

e) Gaps in the training/ motivation of procurement officers;

f) Some products are purchased in very small quantities locally by the camps' authorities and go unnoticed.

Energy Performance Contracting

EU Framework

According to Article 18 of the EED, EU Member States shall promote the energy services market by supporting the public sector in taking up energy services offers, in particular for building refurbishment.

Energy Performance Contracting (EPC) is a form of financing for capital improvement which allows funding energy upgrades from cost reductions. Under an EPC arrangement, an external organisation (Energy Service Company - ESCO) implements a project to deliver energy efficiency, or a renewable energy project, and uses the stream of income from the cost savings, or the renewable energy produced, to repay the costs of the project, including the costs of the investment. Essentially the ESCO will not receive its payment unless the project delivers energy savings as expected.

ESCOs, differently from the traditional energy consultants or equipment suppliers, can also finance or arrange financing for the operation and their remuneration is directly tied to the energy savings achieved. Therefore ESCOs accept some degree of risk for the achievement of improved energy efficiency in a user's facility and have their payment for the services delivered based (either in whole or at least in part) on the achievement of those energy efficiency improvements.

EU MODs Current Status on Energy Performance Contracting

Participants acknowledged the following potential benefits of pursuing EPC with ESCOs, although their experience on this topic so far is limited (see next paragraph):

a) Reduction of energy consumption and other agreed criteria, such as Green House Gas (GHG) emissions and production of energy by Renewable Energy Sources (RES);

b) Execution of energy efficiency upgrades, even without the necessity of initial capital investment from the side of the MODs/ Armed Forces (resulting to no increases to national budgets/ debts);

c) Transfer of risk from the MoD to the contractor in terms of real performance obtained (i.e. guaranteed savings, provided all requirements of the contracts are met / followed), adaptation of innovative technologies and volatile prices of energy products (mainly oil);

d) Ownership of the equipment is passed to the MoD/ Armed Forces after the end of the contract (in case it was originally procured by the ESCO);

e) Utilisation of the contractors' human resources and expertise to engineer and further maintain the technical interventions, coupled with the scarcity of relevant resources / expertise from the MODs' / Armed Forces' side in many cases;

f) Parts of the savings can be agreed in the contract to be returned to the landowner (MOD / Armed Forces) during the contract;

g) Justification of the investments by a Return on Investment considered on global cost (including future energy bills).

However, according to the replies to Q-3 Questionnaire (May 2017):

a) The majority of the MODs/ AF have not signed any EPCs with ESCOs yet. In more detail, only 4 MS MODs (19%, 4 out of the 21 that replied) have actually proceeded in utilising this mechanism. Among these MS MODs, only one has significant experience with numerous projects on various stages (on-going, in procurement phase, in feasibility study phase).

b) Numerous MODs (39%, 7 out of the 18 that replied) are considering either to launch pilot scale EPC projects for the first time or to strengthen their past attempts and seek for EPCs under a new framework.

Challenges and Barriers

The challenges and barriers identified by pMS in the development and implementation of EPCs include the following:

a) Gaps in the national legal frameworks for the implementation/ contracting of Power Purchase Agreements (PPAs), including EPCs.

b) Internal procedures on budgeting that do not allow pay-back from existing budget lines for billing and/ or to pay more than the actual consumption from the operational budget lines;

c) Uncertainties on the future uses/ occupation of buildings and land usage in the long term, due to large scale re-organisations within the MODs/ Armed Forces.

d) Lack of baseline data (energy and its drivers), in combination with challenges to acquire the blueprints of buildings and their equipment that have been built several decades ago and in various phases;

e) MoD's/ Armed Forces' liabilities towards the institutions that fund EPCs in the cases of ESCOs' bankruptcy and especially in terms of maintenance/ownership of equipment and, perhaps, loan instalments;

f) Reluctance of senior management to commit to long-term contracting with the private sector (ESCOs);

g) Several cases where most of the opportunities for reduction of energy consumption/ increase of energy efficiency have already been harvested internally through other MOD/ AF initiatives and the remaining potential for improvement constitutes less attractive business cases for ESCOs;

h) Potential challenges in the cooperation between the MoD technical personnel that is responsible for the maintenance of infrastructure and the ESCO's personnel, in terms of allocation of maintenance tasks and duties.

i) Cases of limited expertise from the side of the involved MOD's/ Armed Forces' personnel to:

   i. Perform preliminary energy audits, feasibility studies and setting the energy usage baseline;

   ii. Evaluate the technical proposals of the interested ESCOs during the tendering phase;

   iii. Verify the actual savings during the implementation of the EPCs;

   iv. Sustain the maintenance and support of the equipment after the end of the contract.

Sub-section 3(II): ENERGY EFFICIENCY

This section focuses on the work conducted in the energy efficiency working group of the Consultation Forum. If focuses on some Defence specific issues; the challenges and opportunities for the Defence sector; energy legislation regarding the Energy Efficiency Directive (EED) and Energy Performance of Buildings Directive (EPBD); deep renovation of buildings; inspection of heating, ventilation and cooling systems; human factors regarding operational control; and energy performance contracting.

3.3 Particulars of the Defence sector regarding Energy Efficiency

Common elements and particulars of defence sector building stock have been identified among MODs as obstacles or hindrance to (a) the implementation of the EED and EPBD, (b) the creation of buildings stock inventory (only buildings that need energy for indoor heating/cooling count towards this inventory), and (c) implementation of energy efficiency measures in general, among them: a large portfolio of buildings (hundreds/thousands of buildings), a "campus" grouping of buildings, these hundreds/thousands of buildings are not individually metered and thus require a great amount of resources to collect information, a mixture of technical/storage/office/ leisure/living accommodation uses that may change with time, fixed operational energy consuming equipment, large variations in operational tempo, a significant amount of cultural heritage buildings, security issues, difficulty to see or realise the ROI, some buildings not used or needed, use of some buildings may not be known, some of the buildings are not property of the MoD and belong to another Public Body (thus, MoD doesn't have decision power), and separate budgets for procuring energy and maintenance leading to no incentives to implementing energy efficiency measures.

These obstacles or difficulties are common to almost all MODs in almost all cases. MODs' building stock inventories do, generally, contain only basic information on buildings and floor area which is insufficient for MoDs to plan and prioritise implementation of energy efficiency measures.

Even if MODs were to renovate their building stock at a 3% a year refurbishment/replacement rate, as required by the EED Article 5, it would take over 33 years to bring the building stock up to current standard, let alone keep pace with technical developments over that time.

A quick and inexpensive way to prioritize buildings for attention would be required. Relative benchmarks for defence buildings would be useful to identify where the greatest benefits can be realised from investment. Comparing actual energy consumption with a benchmark would allow for prioritization.

3.3.1 Differences between the defence sector and the civil sector.

The following differences have been identified between the defence sector and the civil sector:

a) **Priorities:** The defence sector is operationally driven, with different purpose and priorities to the commercially driven civil sector, and thus, the defence sector is less ambitious as far as energy savings are concerned.
b) **Building types:** Non-operational buildings in the defence sector (offices, hospitals, schools, restaurants, etc.) show great amount of commonality with the civil sector; the standards of non-operational buildings in the defence sector are simpler than in the civil sector. It is operational buildings in the defence sector that are different, reflecting defence specific particulars and a greater energy demand.

c) **Approach to energy efficiency in buildings:** Defence sector requires a "cluster" or "campus" approach (groups of dependant buildings), as opposed to the single building approach in the civil sector, and also has different energy management requirements, depending on the type of "cluster" (runways, hangars, workshops, offices, laboratories, hospitals, canteens, etc.). Commonalities within clusters can be exploited by different buildings to obtain energy savings.
d) **Occupation pattern:** the defence sector shows wide variations in building occupation over time; buildings are designed for a specific capacity for specific requirements or needs under certain circumstances, and then the occupation changes widely over time when circumstances change, resulting in spare capacity during certain times in between operational periods.
e) **Power network and metering Infrastructure.** The majority of the infrastructure is, in general, old, and the energy bills refer to a single meter at the gate. Bills come for an entire campus.
f) **Economies of scale:** the defence sector suffers from limitations to exploit economies of scale due to three reasons, mainly: a) unavailability of budget, or changes in planning and shifts of budget allocation, b) changes in priorities, normally in detriment of energy efficiency, and c) geographical spread of building stock.
g) **Security of supply:** at a local level, for defence sector, security of supply relies mainly on the use of generator sets; it is only at a National Level that the diversity of energy sources is normally higher (for instance, nuclear + hydro + biomass + wind power + PV power). Defence remote operations tend to demand a higher amount of energy and a tighter security of supply than base operations. There is a diversity of backup solutions in comparison with a single type solution in the civil sector.
h) **Cyber security:** cyber security becomes a more critical issue in the defence sector, due to the sensitivity of the information; smart systems and remote metering, for instance, become critical issues for defence. In general, defence is a higher level target than the civil sector and thus, security becomes a very high priority. The defence sector tends to adopt bespoke, rather than commercial standard systems.
i) **Non-energy related consequential costs associated (creating space to move into other buildings, etc.):** same as for civil sector.

These differences represent not only challenges to, but also some opportunities, for the defence sector:

a) **Challenges:**
   i) Procurement procedures are rather more complex in the public sector than in the private sector;
   ii) Defence sector, as part of the public sector, has to perform an "exemplary role", which the private sector can spare;
   iii) Public Administration budgeting cycles are shorter than payback periods;
   iv) Re-investing money saved in energy consumption reductions is not permitted for most MS;
   v) Rotation of military staff (they often have to change positions once they get to understand the fundamentals of energy savings);
   vi) Creation of adequate building stock inventories;
   vii) Development of a multidisciplinary cross-government network for energy.

b) **Opportunities for the defence sector:**
   i) To develop a dedicated Defence Energy funding programme;
   ii) To clarify access to EU Funding for defence energy-related projects;

iii) To develop a Defence Energy Strategy within the context of the National Energy Strategy.

3.4 Implementation of EU Directives' relevant articles.

Thorough discussions have been held around EED and EPBD relevant articles, in particular:

a) Reviewing EED key articles:
   i) EED Article 4: Building Renovation Strategies and Plans
   ii) EED Article 5: Exemplar role of public bodies buildings
   iii) EED Article 20: Energy efficiency national fund, financing and technical support

b) Revision of EPBD key articles:
   i) EPBD Article 3: Methodology for calculating the energy performance of buildings
   ii) EPBD Article 4: Setting of minimum energy performance requirements
   iii) EPBD Article 5: Cost-optimal methodology
   iv) EPBD Article 6 and 7: New and Existing buildings
   v) EPBD Article 8: Technical building systems
   vi) EPBD Article 9: Nearly zero energy buildings
   vii) EPBD Articles 11,12 and 13: Energy performance certificates
   viii) EPBD Articles 14, 15 and 16: Inspection of heating and a/c systems

The following common features and positions were found during the discussions concerning energy efficiency and renovation strategies and plans:

a) Most MODs have an energy efficiency plan and building renovation strategy plan.
b) Generally, there is uncertainty about how much MODs are contributing to their National targets. The 3% renovation rate National target (EED Art. 5) is allocated to each MS Public Administration building stock as a whole; each MOD can negotiate a lower/higher rate of renovation with its Central Government. Also, MS may choose to implement alternative measures providing equivalent energy savings and not follow the 3% renovation rate.
c) MSs have a clear definition of what a NZEB is, although it differs among MSs and standards have not been set up.
d) MSs have minimum energy performance requirements for new and renovated buildings, and for technical building systems that MODs follow.

Obstacles or difficulties that MODs find in the implementation of EU Energy Efficiency legislation, National or MoD specific energy efficiency plans and, in general, implementation of energy efficiency measures, are common to almost all MODs in almost all cases, and can be summarised as follows:

a) Disconnect between energy procurement, energy efficiency, energy consumption awareness and maintenance plans, leading to no drivers for energy efficiency measures.
b) Disconnection between duty holder and budget holder, leading to a lack of incentive to save energy.
c) Lack of a single senior MOD energy management point of accountability.
d) Need to prioritise buildings on the basis of adequate building stock inventory and benchmarks.
e) Building stock inventories are inadequate.
f) Difficulties to create and update an adequate building stock inventory register: too many buildings, mixed or unknown use, property issues, lack of individualized metering, lack of

resources, difficulties to collect data (externalisation of maintenance), lack of human resources to collect data and monitor energy consumption.

g) Payback periods are too long for cost benefits to be realised.
h) Lack of funds for implementation of energy efficiency improvement measures.
i) Complete lack of knowledge/awareness about financing mechanisms and available funds.

Some interesting information collected through a questionnaire to WG2 included:

a) 100% of respondent MODs **(*[9])** declared that their MS have transposed EED & EPBD into National legislation;
b) 100% of respondent MODs **(*)** are classified as Public Bodies;
c) 70% of respondent MODs **(*)** are carrying out a program of refurbishments but Article 5 of EED is not the primary reason; no MoD has declared it is publishing a list of MOD buildings with energy performance data to meet requirement of Article 5 of EED;
d) 58% of respondent MODs **(*)** are carrying out some form of audit programme on selected buildings and producing Energy Performance Certificates; there is a mixture of internal and external personnel carrying out certification;
e) 54% of respondent MODs **(*)** are implementing Energy Efficiency (EE) measures recommended in the Energy Audit Reports;
f) 46% of respondent MODs **(*)** have engaged in some form of Contract with an Energy Service Company (ESCO), with a number of pilots being assessed currently, (one good experience and one bad experience of an ESCO reported);
g) 100% of respondent MODs **(*)** declared that their MS has a National Energy Efficiency Action Plan (NEEAP) in place, although not all of them have an approved definition of a NZEB;
h) 100% of respondent MODs **(*)** declared that they are aware of various funding mechanisms (MOD, EUSF, ECO, National funding) to finance Energy Efficiency measures; half of them reported that National Funds are not open to MoD;
i) 92% of respondent MODs **(*)** have or are developing an asset data base of buildings (although it may not be adequate); most have site-level energy consumption figures; a few have building-level energy consumption figures; the majority do not have energy benchmarks for defence buildings;
j) 100% of respondent MODs **(*)** are applying national building standards, with cost-optimal methodology for the calculation of minimum EP requirements embedded in their national building standards;
k) 71% of respondent MODs **(*)** have identified barriers to the implementation of EE measures, such as:
    i) Internal funding;
    ii) Expertise;
    iii) Awareness of decision makers and defence personnel;
    iv) Management Information (buildings and energy consumption);
    v) Criteria for external funding
l) No MOD has committed to a renovation rate, or equivalent % in energy saving, with their Central Government to contribute to the 3% renovation rate National Objective Renovation is part of a wider set of initiatives to improve energy efficiency.

(*) Sample: % referred to a sample of 13 EU MoDs (the remaining 15 EU MoDs did not answer)

3.5 Renovation of existing buildings and deep renovations to NZEB standards

With respect to the renovation of existing buildings and deep renovations to NZEB standards, MODs have no concerted programs for implementation of energy efficiency measures, both applicable to technical systems and building envelope, and renovations take place on an opportunity basis.

The adoption of a solid comprehensive methodology and an holistic approach to implementation of energy efficiency projects (preparation -> design -> pre-construction -> construction -> in use) has been identified as necessary for the success of such projects, with insufficient time and effort allocated to commissioning being one of the most common and critical mistakes that compromise the realisation of the energy savings potential.

The adoption and pursuit of different energy targets by different MS lead to different drivers (energy saving, cost saving, green energy production, CO2 reduction, societal benefits, etc.) that affect the approach to and design of the energy efficiency projects, and ultimately define and outline the type and scale of the refurbishment interventions.

Moreover, the existing variability in the interpretations and requirements for NZEB standards established by different MS seems, at first sight, to act as a hindrance to the adoption of an EU common approach and framework for an EU NZEB definition. Belgium, with three different interpretations in its three different regions varying from no requirements in one region, to very strict requirements in another region and adoption of "*passivhauss"* standards in the other region, was provided as a good example of this variability. However, considering the very different climatic conditions across the EU, it has also been questioned if a common definition of the NZEB concept would be practicable, or even possible, and whether it may be better to keep the definition of NZEB open for MS to decide on it on the basis of their national specific conditions.

Overall, MoD delegates declared that, even though the defence sector has some exemptions from complying with the EPBD, there may be opportunities to act on accommodation units, offices, schools, etc.

Since defence sites are normally composed of multiple buildings with different uses and different characteristics and energy saving opportunities, a "cluster approach" to a NZEB concept that takes into account the aggregate effect of a combination of different interventions and solutions is considered more appropriate and applicable to the defence sector than a single building approach.

For example, within one military site, there may be one building that is apt for renovation and saving energy, another for installation of PV and producing energy, and another for any intervention. There may also be space on the site for installation of low carbon energy generation (e.g., CHP, mini wind turbines, or geothermal exploitation). It is the net zero, or nearly zero energy sum of the cluster that should be accounted for.

MODs delegates identified the following obstacles, limitations and challenges to the implementation of a NZEB renovation programme:

a) Finance: funding is not accessible to the defence sector;
b) Cost savings attained in utilities are not translated into capital that can be reinvested in additional energy efficiency measures;
c) Lack of expertise/training.

In the main, deep NZEB renovations have not yet taken place in the defence sector.

3.6 Inspection of air conditioning and heating systems and retrofitting of technical building systems.

The delegates supported the outcomes of the Concerted Action that EPBD provisions on building technical systems are not effective; the inspection reports are too complex to prepare and then to understand, requiring a level of knowledge that users may not have and, in addition to that, there is no obligation to act on the recommendations for replacement or upgrading technical building systems.

Most MODs declared that they do not act on the inspection report recommendations, and that replacements or upgrading take place on an opportunity basis. Those MODs that act on the recommendations declared that they normally do it when calculations and payback periods are clearly given in the report.

Inspections of technical building systems in the Defences sector normally take place within two wider inspection programs at MODs:

a) Inspections within maintenance plans;
b) Inspections through external service contractors.

Electronic monitoring and control systems in heating and a/c systems are normally implemented in buildings, although their implementation is not done to satisfy the provision for reduction of inspection frequencies in Articles 14 and 15 of the EPBD. Moreover, even if an electronic monitoring and control system is installed, it becomes very difficult to keep the systems optimised when inspections and maintenance services are externalized to contractors.

Concerning the establishment of requirements for the procurement of new, replacement and upgrading of technical building systems (for new and renovated buildings), MODs declared that some national guidelines exist. However, these guidelines are too general and need to be more precise and specific.

With regard to the requirement to purchase only products, services and buildings with high energy-efficiency performance, MODs declared that the existing procurement plans provide only general guidelines that are open to different options.

It was also noted that in some MS, particularly in Nordic MS, the public sector has to act and lead by example for the private sector.

3.7 Behavioural aspects of energy efficiency (human factors) and operational control.

Behavioural aspects comprising users' habits and cultural norms, as well as users' operational control over technical building systems, had been identified as key aspects impacting energy consumption and energy performance of buildings.

MODs are aware of the potential savings between 5% and 20% of energy consumption that behaviour, or rather, change of behaviour, may produce, in accordance with literature and reference publications, as well as of the potential to use behavioural change programmes as an alternative measure to obtain equivalent energy savings to those required by through the 3% building renovation rate, in accordance with Article 5 of the EED.

Moreover, it has also been discussed and recognized how the implementation of the ISO 50001 can bring about changes in behavioural aspects and improvement in the operational control of technology that result in energy savings within an organization.

The need has also been identified to simplify the existing wide variety of behavioural models and behavioural change process methodologies and come up with a suitable and effective methodology for defence. The UK MOD shared the principles and progress of its initiative "Maximisation of Energy Efficiency Behaviours Project" on behavioural change, which is based on the **COM-B model** (**B**ehaviour underpinned by **C**apability, **O**pportunity, and **M**otivation), and the application of a systematic and guided methodology for identifying what needs to change in the person and/or the environment in order to achieve the desired behaviour change and the types of interventions that would be expected to be effective (**FISH approach**). This methodology could be of application to other EU MODs.

MODs highlighted and stressed the need to broaden the scope of energy efficiency plans and interventions to address both technology and cultural change together, in order to exploit synergies and realise their full untapped potential. In spite of the fact that technology may result in energy savings (if money is available) in the short run and that cultural change may take longer to achieve and bring positive results, it was also recognised the latter is still essential for the former and that either of them leverage on the other. Technology was also identified as a driver that could bring cultural change as part of a comprehensive and holistic plan.

Despite the general agreement on the need to address behavioural aspects, it was found that the vast majority of MODs/Armed Forces have not a comprehensive behavioural change program being implemented or running across their whole organization; only IE has applied ISO 50001 to a great extent and the UK has national initiatives, while Belgium and Lithuania have some localised projects, and Greece as well as France have implemented ISO50001 in some military sites, whereas other MODs/Armed Forces are now at the preparation stage.

Some of the reasons why MODs have not a behavioural change program in place are:

a) energy consumption considered as a lower priority issue within their organisations;
b) difficulty to control variables: cultural change is not a laboratory experiment where all variables can be controlled;
c) difficulty to measure results: there are no, or at least few, tangible indicators of where the impact of the behavioural change programme has been;
d) difficulty to quantify results, articulate benefits and translate them into monetary value;
e) difficulty to justify and request funding for implementation of a programme where benefits cannot be articulated and translated into monetary value;

Finally, no MOD has quantitative data on the impact of a comprehensive behavioural change program implemented in their organization; only some MODs have qualitative data, including surveys and historical records of behaviour within organisations, and the UK has a portfolio of evidence (83+).

3.8 Building Management Systems technologies

MODs recognize that the installation of, or replacement of existing inefficient building systems, for new state-of-the-art highly efficient building systems is at the core of the energy efficiency measures. The setting of requirements in respect of the appropriate control of the technical building systems, and the installation of active control systems such as automation, control and monitoring systems, aiming to save energy, are required by Article 8 of the EPBD.

MODs have revised Building Automation and Control Systems' (**BACS**) functionalities and building operation principles from a conceptual and holistic perspective, and discussed what makes a building more efficient, and also about the contribution of **BACS**'s functionality to the improvement in the Energy Performance of Buildings. This also touches on other aspects, such as the

implementation of metering and building automation within an energy management system, impact on operations, interoperability, economic efficiency, the criticality of having an appropriate and updated building stock inventory data base, or the implementation of distributed intelligence that allows for sensitive, adaptive, responsive and interactive actions in response to different conditions.

MODs agreed on the importance of installing BACS and metering in their real estate at site and building level as a means to monitor and control appropriate operation of technical building systems and maximise energy savings. However, they do not make use of the full range of BACS that are now available, and they have metering and site-level only; only some of them have sub-meters at building level and then only in part of their real estate (ca. 10%-40%). An increasing number of the meters are 'smart' meters which allow remote monitoring of energy consumption.

Only a few MODs have integrated systems installed at site level covering a number of buildings and facilities which facilitates active energy management.

Some of the reasons why MODs/Armed Forces have not installed BACS are:

- high cost of installation;
- lack of technical leadership

Some MODs have some quantitative data on the impact of BACS installation, although they would have to dig in very carefully on a case by case basis to obtain this data, and there is no continuous automated reporting. Qualitative data is more common among MODs, although this data is more a "gut feeling" than something that has been objectively monitored in detail and accounted for. Once again, the lack of a proper baseline that is suitable for comparison purposes was highlighted by most of the MODs.

Renovations, demolitions and selling buildings were also mentioned as alternatives to big BACS implementations when looking at the big picture, especially in budgetary terms.

3.9 Energy Performance Contracting (EPC) through Energy Service Companies (ESCOs)

Subparagraph 7.c) of Article 5. Exemplary role of public bodies' buildings of the EED, asks MS to encourage public bodies to use, where appropriate, energy service companies, and energy performance contracting to finance renovations and implement plans to maintain or improve energy efficiency in the long term.

The reality of EPC through ESCO in the defence sector is that, in general terms and with the exception of only one MS (UK), legal and accounting rules and regulations seem to constitute an insurmountable obstacle to put this contracting into place.

MODs reached the following conclusions:

a) **Need for comprehensive energy consumption data and adequate building stock information:**

   It is very important for the success of Energy Performance Contracting with an ESCO to have energy consumption data for 3 to 3,5 years, ideally, and an agreed energy consumption baseline for the building, as well as properly monitoring and controlling the performance of the energy efficiency/production measures that have been implemented in the building;

It is also very important to define the profile of the building properly, taking into account multiple aspects, such as state of the building and technical systems, installations, building fabric, occupation and utilisation, among others;

In the absence of solid data, or as a complement to existing insufficient data, information obtained through Energy Audits can be a replacement for such missing data.

This is again one important problem for the defence sector, as most MODs do not have adequate building stock inventories and sufficient energy consumption information.

b) **Need for tender specifications preparation, legal framework and accounting rules extensive expertise:**

Energy saving objectives of the Contract should be defined as to allow for adaption to new circumstances, such as a reduced or increased occupation of the building, or a change in the utilisation of the building, or a reduction/increase in the intensity of the activity that is carried out in the building.

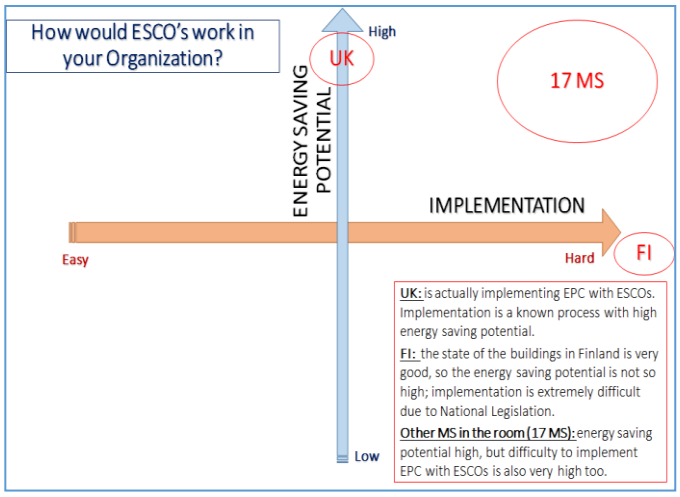
All costs (own personnel costs, external consulting fees, etc.) incurred in the Project must be reflected in the business case to reflect the real total costs and real savings.

The accounting rules and legal framework should be agreed upon from the outset of the project, to avoid problems with the organisation's budgeting planning, accounting standards and legislation:

i. problems with the separation of procurement/ maintenance/ services budgets and the impossibility to account for and transfer future savings obtained from services contracts to procurement investments/ maintenance contracts;
ii. problems with payback periods being longer than the maximum allowed duration of service contracts for Public Admin (4 years) are also common across the MS;
iii. problems with legal consideration of ESCO as "hidden loans" counting towards the debt of the Country are also common across the MS;
iv. problems with ESCO's not taking the risk to guarantee savings over 10 or 15 years, or with buildings and systems so old and requiring so much investments that make savings not viable economically seem also to be common across the MS;
v. ESCO's payments are considered as deficit (EC's DG Energy informed that the problem of the consideration of ESCO's payments as deficit is common across the EU and is being looked at by EUROSTAT to see if they can approach this issue in a different way).

Generally, MOD's/Armed Forces do not have the necessary familiarity and experience in house to prepare the specifications, to develop the legal framework and a comprehensive contract, and/or follow up on the performance of the Contract.

Figure 9: shows how MOD's see ESCOs in their organisations in respect of difficulty of implementation and energy saving potential. It is important to note that, out of 19 MS present in the room, there are only two exceptions to the general perception that ESCOs have a very high energy saving potential but are very difficult to implement. The first one is the UK, where success has been achieved with Energy Performance Contracting in delivering energy saving in the wider public sector.



The other MS, but for a different reason, is Finland, who sees implementation of ESCO's as almost impossible but does not see so much energy potential, due to very good performance of their existing building stock.

These difficulties represent a series of challenges to the defence sector that hinder the implementation of EPC and ESCO's, such as:

- Proper definition of scope and objectives in the Contract is rather complex;
- Development of a valid legal framework for EPC and the appropriate expression of the correct contractual requirements is very difficult;
- National legislation is an obstacle in that it does not allow for service contracts beyond 4 years, which fall short of the normal pay back periods;
- Accounting standards are an obstacle in that they consider ESCOs as "hidden loans" counting towards the debt of the Country;
- Monitoring and controlling the performance of the Contract is also difficult;
- Difficulty to plan ahead due to variation in occupation and operations in the building.

EPC and ESCO's also represent opportunities of great energy and cost savings potential:

- ESCOs can be faster and, sometimes, cheaper, in delivering results and savings;
- Externalisation of services frees internal resources and de-risk investments by your organization;
- Access to commercial and technical knowledge

3.10 MS Experiences/ Discussion Points/ Main Findings and Achievements

Impact of the EPBD on the defence sector

The results from the questionnaire on the EPBD showed that the impact of this directive has not been uniform across the EU defence sector. Moreover, a majority of EU MOD delegates (60%)

observed that the overall impact of the EPBD was small. The reasons attributed to it were common across the EU defence sector, with the main reasons (among others) being:

- Energy efficiency interventions and infrastructure maintenance are of lower priority to defence, with the bulk of the budgets being dedicated to armament and other operational purposes;
- Lack of commitment, sensitivity and adequate mentality towards energy sustainability (especially at senior levels)

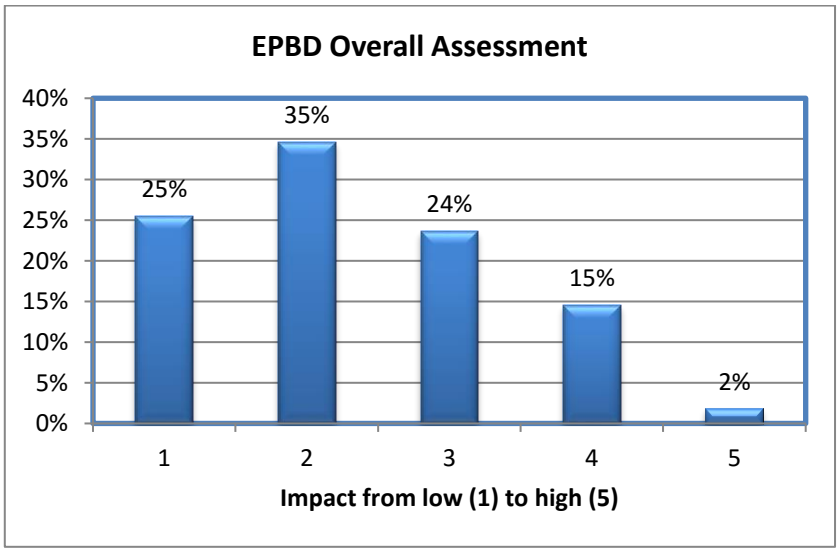
The progress achieved on monitoring of building information and data collection is small. Military bases and camps typically have limited (usually one) consumption meter, and the infrastructure is normally old, with very limited information about building fabric, installations or layouts of energy distribution networks. The implementation of the UK MOD's project proposal to establish benchmarks and databases for defence building stock was considered of importance to help EU MODs gain this information through the appropriate tools, procedures and equipment.

The majority of the MODs' delegates also observed the limited impact of the technical building systems operational management and maintenance provisions, due to the lack of resources; ICT solutions, such as smart meters, or smart automation and control systems, are few and isolated.

As concluded from previous meetings, there seemed to be a trend to deal with energy efficiency interventions on an ad-hoc basis through small scale low cost works with relatively limited impact, rather than as part of a plan, and a lack of base/compound level interventions. The EPBD on its own does not seem enough to highlight the importance of renovations, which is acknowledged by everyone. Ultimately, the renovation rate depends on the availability of funding.

This lack of resources, commitment and tactical direction and the consideration of energy efficiency as a lower priority are still there despite the high degree of EU MODs' accountability towards the achievement of their national energy efficiency objectives. The CF SEDSS was identified as the pivot point and key driver to overcome these obstacles and bridge the gap through the exchange of views, know-how and best practices among EU MODs, the promotion of EU defence sector interests and direct involvement with the EC, and the identification of opportunities for materialisation of collaborative initiatives.

The following graphs show the impact of different aspects of the EPBD on the defence sector:



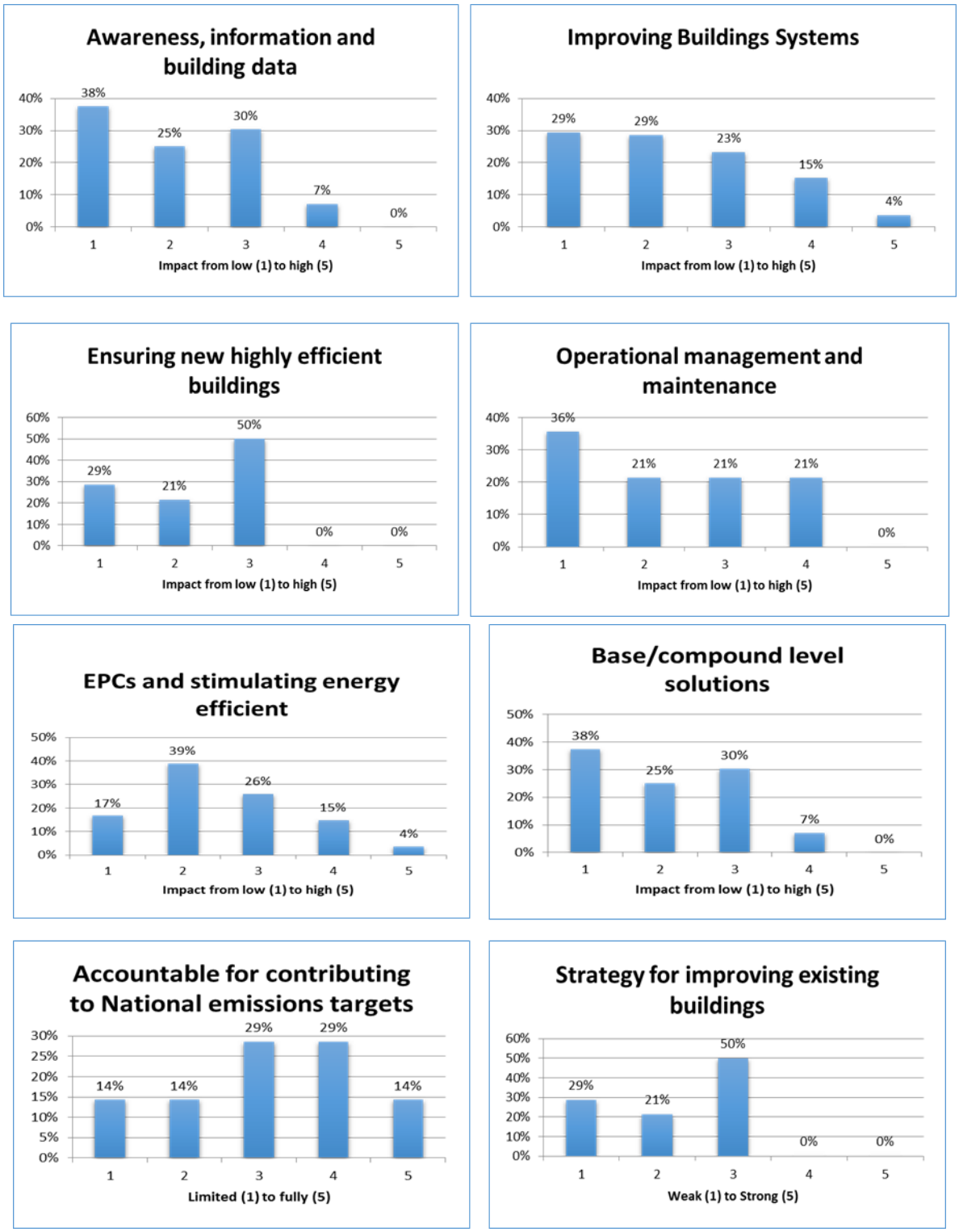


Figure 10: different aspects of the EPBD on the defence sector.

Smart Readiness Indicator for Buildings:

Further to the Clean Energy Package presented by DG Energy during the Consultation Forum, the principles behind the concept of "Smartness Indicator" (SI) (as a metric on the readiness of a building to interact with and adapt to the needs of the users, operating efficiently, identifying problems, and interacting with the grid accordingly), were further explored. Progress towards

'smarter' building systems can support a more efficient implementation of the EPBD and result in additional benefits for building users, energy consumers and future grids.

The inclusion of the SI in the revised EPBD (Article 8(6)) has been proposed by the EC with the objective to promote the take-up of smart technologies for buildings via:

- Ensuring information and awareness;
- Facilitating investments in smart building technologies;
- Putting building occupants at the centre;

The SI will be a cost-effective measure that can lead to significant impacts on the energy efficiency of the EU building stock. The first Stakeholder meeting of the EC Technical Study into amending EPBD took place in Brussels on 7 June, 2017.

<u>Example of deep renovation in the defence sector: From obsolete to smart buildings.</u>

An example of a cost-effective deep renovation of the ES MOD's Agency headquarters was presented and explained to the audience. Through this renovation, an obsolete building was transformed in to a highly efficient smart building which can be easily and quickly adapted to varying numbers of occupants and uses, through interventions in the building envelope, building interior fabric and structures, and installation of highly efficient technical building systems, including solar PV, solar thermal, and cogeneration technologies.

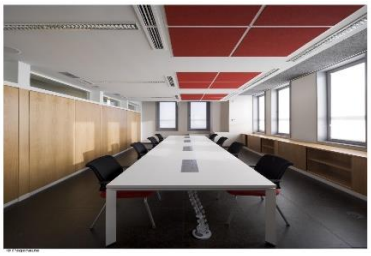
The renovation project was done in accordance with the current Spanish construction and environmental legislation and energy performance requirements. This was in order to achieve the highest achievable energy performance rating (A or B) and energy production for self-consumption, and to comply with the most stringent security measures required in the defence sector, among others:

- Security in access points, division of zones according to security levels (ZAR);
- Security in the classified projects development:
  - Classified documentation: NATIONAL/ NATO/ EU/ ESA ;
  - TEMPEST Room;
  - OTAN/ UE/ ESA/ SLP Control Point;
- Security systems.

The requirements for the distribution of spaces were also common to those identified generally in the defence sector, such as:

- Facilitate collaboration between multidisciplinary work teams;
- Provide flexibility in the reconfiguration of teams and spaces (within 2 days);
- Cooperation between different departments;
- Facilitate communication and exchange of information;
- Facilitate staff mobility;

- Productive and comfortable work environment.



All technical building systems are monitored and controlled in real time with a centralised SCADA system which keeps the whole building at the required levels of comfort with the most efficient consumption of energy.

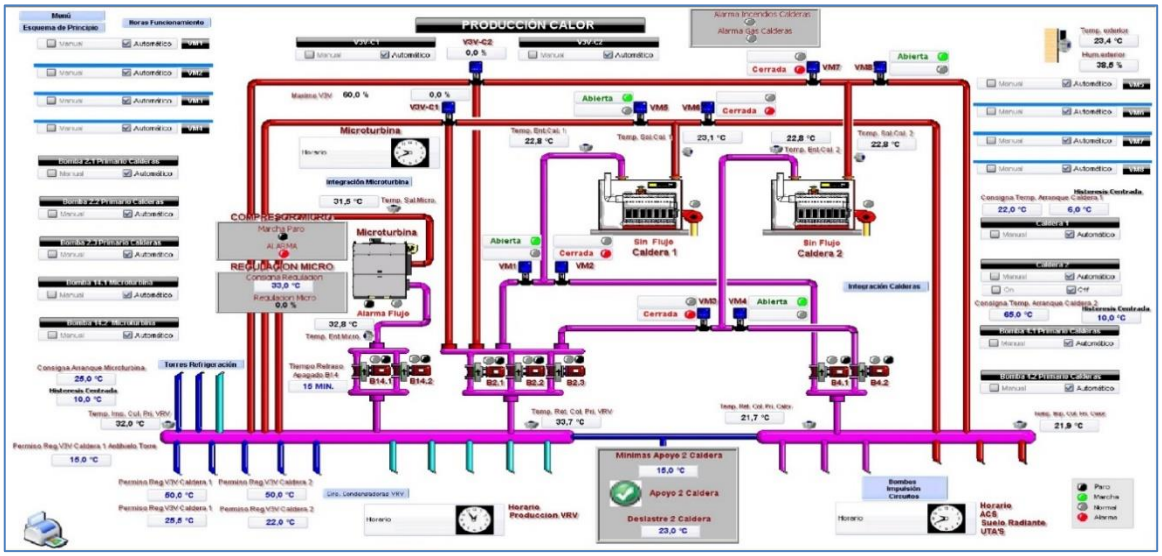


Figure 11: Building system

Evidence was provided on significant energy and cost savings realised up to now, with updated payback periods of 3,92 years for the light system (LUXMATE lighting control system and DALI electronic ballasts), or 11 years for the VRV system condensed by water (expected to be shortened upon realisation of further savings before reaching 11 years).

Applicability of the EPBD's provisions on Energy Performance Certificates to the defence sector

Different EU MODs have different interpretations of the concept of a "public building", resulting in different understandings, policies and approaches to EPBD Articles 11, 12 and 13 regarding the obligation to obtain and display an Energy Performance Certificate (EPC) on MODs' buildings. Interpretation ranged from no obligation to full coverage. Some MODs considered that a building is "public" when it serves a public service, leaving out defence buildings completely. In addition, the definition of being visited frequently by the public is not clear either, leaving room to define what "frequent" means, or if citizens visiting the building for business purposes (industry mainly) are considered as public, for example.

The implementation of ECP or audit programmes was not found to be uniform across EU MODs; some of them have programmes and some of them do not, and the personnel carrying them out were internal for some MODs and external for others. The lack of resources and budget were the main obstacles to implementation.

The lack of proper benchmarks for defence buildings was again highlighted, and the willingness to have universal minimum energy performance requirements for all weather conditions throughout the year was put on the table as food for thought. The methodology may be appropriate for standard buildings, but may not apply for defence specific buildings.

Finally, there was unanimous agreement on the fact that sometimes it is not cost effective to raise the performance of specific buildings. Also, raising the commercial value of a building is of limited impact to the defence sector. Overall, the objective of displaying the EPCs was not obvious.

The overall impression was that the defence sector is not obligated to comply with these provisions, although benchmarking defence building energy performance was seen as a good idea.

SUB-SECTION 3(III): RENEWABLE ENERGY SOURCES

During the Consultation Forum events, a number of technologies were reviewed and discussed in terms of the potential for exploitation by the defence sector within the remit of CF SEDSS. This section deals with the feasibility of different technology options including defence specific challenges and benefits of biofuels, wind, solar and geothermal energy. Examples of these are set out below.

3.10 Renewable Energy Technologies

Wind energy

The terms 'wind energy' or 'wind power' describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy produced by wind into mechanical power.

Wind turbines operate on a simple principle: the energy in the wind turns two or three propeller-like blades around a rotor. The rotor is connected to the main shaft, which spins a generator to create electricity.

Wind turbines are mounted on a tower to capture the most energy possible. At around 30 meters or more above ground level, the turbine blades can capture the kinetic energy found in faster and less turbulent wind found at that altitude. Wind turbines can be used to produce electricity for a single building, or can be connected to an electricity grid from where the electricity can be distributed to greater effect.

Since wind is the result of a combination of the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and the rotation of the earth, the distribution of wind patterns and speeds vary across the world and are further effected by vegetation density and height, bodies of water, differences in topography as well as buildings. Therefore, a range of physical factors need to be considered when planning for the installation of wind turbines and ultimately selecting the most appropriate sites, as not all locations will provide the best return on investment in terms of electricity generated.

Other factors which need to be taken into account are national planning legislation and potential interference with military operations or civilian considerations, especially radar function with certain types of wind turbines.

<u>Wind turbine design and location</u>

Modern wind turbines fall into two basic categories:

The horizontal-axis wind turbines typically either have two or three blades. These three-bladed wind turbines are operated with the blades facing into the wind. While these turbines are well-proven to produce adequate amounts of electricity, the main draw-back is that they produce a Doppler effect which interferes with radar function, and as such has location-limiting effect on military sites where this capability is required.

The vertical-axis design may operate in lower wind speeds than the horizontal-axis design and it has been shown that there is much reduced impact on radar function as the Doppler Effect produced by vertical-axis design turbines is significantly reduced.

Wind turbines can range in size from 100 kilowatts to as large as several megawatts. The larger wind turbines can be more cost effective. These are usually the types which are used in greater number in wind farms, providing larger quantities to an electrical grid. A further logistical challenge which needs to be taken in to consideration is the actual transportation of the large components to the required location. Offshore wind turbines can be the largest, and can often generate even more power. They have the added advantage that the large components can be transported by ships rather than by road. However, in terms of direct utility for military installations, this could be more limited as evidently the location of off-shore wind farms cannot be such that it would interfere with the operation of a naval dockyard or so far offshore that supplying power back to the shore at the required point of delivery becomes cost-prohibitive.

Single small turbines, below 100 kilowatts, are used for single buildings, telecommunication dishes, or water pumping. Smaller turbines can be combined with smart demand management technologies, diesel generators, batteries, and photovoltaic systems. These smart hybrid systems are more usually used in remote, off-grid locations, where connection to a main grid is unavailable. This type of technology is perhaps better suited to a more deployed scenario, although at more remote locations, at home or training installations the benefits can be equally applied.

Solar

Solar generation is part of a suite of technologies which can offer increased mission endurance through enhanced energy autonomy as well as reduced cost and mission risk.

Solar energy can be converted into electrical power by using Photovoltaic (PV) technologies, the principle of which is based on the absorption of solar irradiation by a semiconductor material. The versatility of PV systems enables a high degree of compatibility with current military operations.

Technology solutions are already available for all of these applications but further research is required to enable the integration and militarisation of appropriate renewable energy technologies.

Smart grids

A smart grid is an electric system which can include a variety of power sources such as conventional electrical supply, supply from liquid fuel via diesel generators, and renewable energy sources, running in combination with energy storage technologies, and demand monitoring (smart-metering) and management technologies.

Smart grids also make use of electronic power conditioning and control of the production and distribution of electricity to ensure maximum efficiency from the energy supplied and consumed.

Smart grids enable digital two-way communication between the supply and demand. Smart grids have the potential to improve the efficiency of energy distribution and usage, both through grid design and through consumer participation.

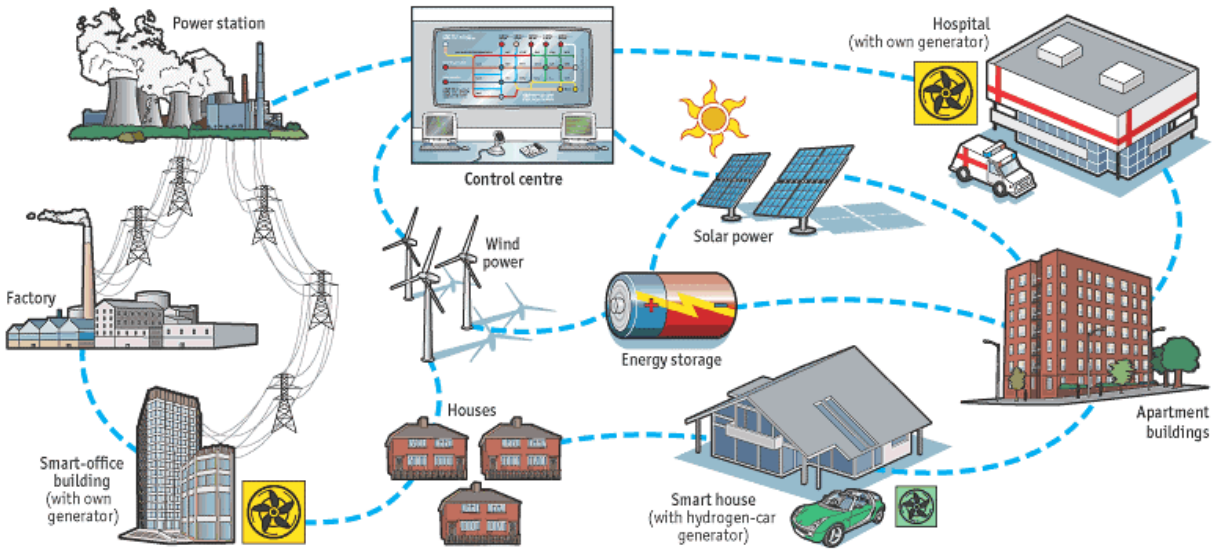


Figure 12: Smart grid

Energy Storage

With the combination of ever increasing electric grid energy demands and the global recognition of the need to reduce our reliance on fossil fuels driving a renaissance in the use of renewable power, there are a number of different systems currently in use or under evaluation, with different solutions serving different needs.

These efforts, however, must face economic realities – the need to provide energy solutions at existing or reduced costs to the consumer. Cheap, reliable energy storage is the key to transitioning to renewable power.

There are a number of different types of technology used in energy storage:

Mechanical (Kinetic and Potential)	Electrochemical (Chemical)	Electrical (Electromagnetic and Static fields)	Thermal
Pumped Hydro (PHS)	Secondary batteries • Alkaline • Lithium • Sodium-sulphur • Sodium- iron chloride • Redox flow •	Super capacitors	Molten salt thermal storage
Compressed Air (CAES)	Hydrogen	Superconducting magnetics	Ice thermal storage
Flywheel (FES)			Heat thermal storage
			Chilled water thermal storage

Biofuels

This includes biofuels, synthetic fuels, synthetic gas, hydrogen, oxygen, and gas (natural, methane, etc.) which can be used in various applications such as: automotive vehicles, vessels, aircrafts and many types of mobile machinery (e.g., generators and power tools).

The military, legal and policy frameworks under which such fuels can be used come under STANAG's/AFLP's in all three domains (land, maritime, aviation). It should also be noted that there are different clearance and certification processes involved.

Case study: IT NAVY – FLOTTE VERDE

At the third CF SEDSS event, IT presented Flotta Verde, a project aimed at finding an alternative ship fuel to petroleum, increasing national energy security and reducing polluting emissions. Flotta Verde adopts three different strategies in order to achieve these goals: obtaining synthetic fuel from renewable sources, in line with the targets set by Directive 2009/29/EC (Horizon 2020); developing and using innovative "Eco Design" technologies on-board ships (such as LED lighting and silicone painting); and finally, reducing the fuel consumption of ships via the use of "Energy Saving" procedures (such as electric propulsion, propeller cleaning, appendages optimisation, Low Speed OPS Optimisation and the use of single shafts). IT also emphasised that its Navy is a pioneer and leader in Europe with regards to "Green Diesel", demonstrated by the desire to have their ships operating with a fuel that has a renewable origin component of 50%, going even further than the European Commission's '10% by 2020' requirement. The presentation then finalised by detailing the benefits of the HVO biofuel compared to FAME. These include: a higher power density, no hygroscopy, oxidation stability and no risk of fouling or clogged filters. Moreover, it was stated that as an advocate of "Green Diesel", IT managed to have synthetic fuel derived from biomass included in NATO specifications, which followed from a Statement of Cooperation in April 2014 between the US and IT Navies.

Case study: UK DEFENCE STRATEGIC FUELS AUTHORITY (DSFA)

The UK MOD's DSFA has a mandate to: provide the coordinated fuel requirement from defence users to buyers; bring strategic coherence to the fuel supply chain; act as a single point of contact for international engagement on fuel related matters; and to provide a single fuel technical authority for Defence Standards and UK-led STANAGs.

With regards to aviation, the DSFA presentation recognised the need for and value of alternative fuels, and welcomed the developments at NATO level. The DFSA also maintained that they are pushing to gain clearances for the use of synthetic fuels on all UK Ministry of Defence platforms, in order to improve European interoperability and in the interest of industrial and market flexibility. Most platforms have given the carte blanche in this regard, although there are discussions still ongoing with the remaining platforms.

Aside from the slow approval process, the challenges in the aviation field include costs and availability. However, the DSFA stresses that there are concerted efforts being made for further procession. With regards to land and maritime fields, the presentation reiterated the concerns with FAME fuels, such as log-term storage issues and the risk of microbial growth, and thus the potential for alternative fuels in these areas, although similar challenges are present as in the aviation field, alongside the limited experience of those in the land and maritime fields with regards to maintenance and the general operability of alternative fuels.

Future prospects for biofuels

The conclusions with regards to aviation were that military certification of alternative fuels was a slow process with interchangeability and interoperability issues, whereas the navy did not encounter such issues meaning that certifications were ongoing. Insofar as land forces are concerned, alternative fuels can be used as long as blend requirements are met (EN50; ASTM D975) and as long as the process complements NATO's Single Fuel Policy.

It was generally accepted that there would be no obvious benefit for the European defence community to form a parallel structure to look at biofuels penetration and that as long as non-NATO MS could understand and react to NATO fuel policy then the NATO approach should maintain its long-held primacy.

Therefore from the third CF SEDSS event, two of the main conclusions were that:

a. NATO Fuel strategy and structural approach was sufficient to meet the EU armed forces' needs, including MS who were not part of NATO as the policy was widely distributed and unclassified;
b. Full Biofuel adoption was technically feasible but economic and departmental policy within the MODs would not allow further penetration without an overarching political policy framework.

Biomass

Biomass can be used for producing electricity, and at the same time heat can be recovered and could potentially be used within a district heating system. There are different types of biomass sources including bark, coconut shells, corn cobs, energy crops, food waste, saw dust, and wood chips, and there are also different types of technologies that can be used for producing electricity from biomass:

- combustion
- torrefaction
- pyrolysis
- gasification

It is important selecting the technologies, to consider a variety of factors including the associated costs, the relative efficiencies and the purpose for which it will be used. For instance, biomass gasification vs biomass combustion can result in:

a) Higher efficiency;
b) Lower temperatures than combustion, therefore longer lifetimes of gasifier;
c) Same construction costs but lower maintenance costs than combustion plants;
d) Lower air emissions.

Waste to energy

This technology group refers to any waste treatment process which creates energy in the form of electricity, heat or transport fuels (e.g. diesel, biogas) from a waste source.

It could include thermal (direct combustion and incineration), thermo-chemical (torrefaction, plasma treatment, gasification, pyrolysis, thermal polymerization, catalytic depolymerisation) and biochemical (composting, ethanol fermentation, and anaerobic digestion). Future work could be conducted on the integration and militarisation of appropriate technologies.

SECTION 4: FUTURE PROSPECTS

This section focuses on the potential future direction for all of the elements covered during the 24 months CF SEDSS. It sets out some proposals of what is realistic given the current status of the pathway for a sustainable energy future.

It provides information on the potential for improving energy performance in the military through the selection of the most viable options for delivering sustainable energy in defence, the development of energy roadmaps and base-lining tools, risk management and mitigation measures, strategic planning for energy, and some technology options.

SUB-SECTION 4(I): ENERGY MANAGEMENT– FUTURE PROSPECTS

4.1 Energy Strategies

Desirable and Feasible Choices

MoDs acknowledge the necessity of an Energy Strategy as a significant enabler towards increasing energy efficiency and reducing energy consumption within the defence sector, provided that it is sustained by concrete action plans.

The Energy Strategy should be endorsed by the highest level within MOD. An Energy Strategy will:

a) Prove the commitment of the hierarchy;

b) Set specific objectives and SMART (Specific – Measurable – Achievable – Relevant – Time-bound) targets for critical Energy Performance Indictors (EnPIs);

c) Allocate required resources;

d) Engage the appropriate internal and external stakeholders;

e) Prove the significant role of energy in both supporting and sustaining military operations;

f) Have to be linked to the national Energy Strategy;

g) Provide a solid basis for discussions/ negotiations on funding opportunities with important national/ EU stakeholders.

h) Include a monitoring mechanism to safeguard its implementation and the continuous improvement axiom.

In a holistic context, the Energy Strategy should not only focus on military components and facilities, but it should also include operational matters, even though the latter do not fall under the scope of the EED. A military Energy Strategy is suggested to link energy and sustainability with the mission and the military operational objectives. Therefore, it should cater not only for infrastructure and supporting activities, but also for military operational activities, since:

a) military operations and exercises represent a significant proportion of energy consumption;

b) energy efficiency in military activities deliver tangible benefits to the operational objectives in terms of sustainability and effectiveness.

All levels of command have to be involved in delivering an Energy Strategy.

To overcome the challenges/ barriers described in Section 3, MODs have to seek after:

a) An internal champion (individual and operational unit) on Energy within the MOD and AF organisational structures, in order, as a first step, to establish a dependable energy data collection system that will further enable the development of an Energy Strategy.

b) Close cooperation with:

   i. the national competent authorities and be actively involved during consultations for the development of the National Energy Efficiency Action Plans;

   ii. industry, in order to incorporate either off-the-shelf energy efficient products into the military domain or develop new, tailor-made solutions for energy efficient military activities (operations and support).

c) Guidance from EU (DG ENERGY) and the national central governments, to involve officially the defence sector in the achievement of national targets on energy efficiency and to make access to national funding available;

d) Re-investing a significant portion of the financial savings that will arise by the implementation of the Energy Strategy and the supporting action plans into new energy efficiency projects, and not to be returned to the central government budget or to be used for other purposes. Moreover, these newly generated action plans should aim to combine increased energy efficiency with increased comfort for the involved personnel;

e) Further exploration of the Energy Performance Contracting (EPC) tool towards defence infrastructure (see further at the relevant paragraphs on EPC of this report).

Objective

Based on the actual discussions during the CF SEDSS WG1 meetings and the submitted questionnaires, the MODs'/ Armed Forces' experts have concluded that an Energy Strategy should be issued by each MOD, in order to initiate and maintain actions for a more energy efficient, and less energy consuming, defence sector.

Roadmap

The development of a generic roadmap for the implementation of an Energy Strategy in a defence context may include the following stages:

a) Develop the Energy Strategy:

   i. Appoint a champion on energy within the defence organisational structure;

   ii. Gather indicative data on energy consumption and relative costs;

   iii. Perform a Strategic Analysis on Energy against legislation/ national targets, cost, support activities, operational capabilities (e.g. SWOT (Strengths – Weaknesses – Opportunities – Threats), Scorecards, Gap Analysis, etc.)

b) Translate the Energy Strategy:

   i. Develop Strategic Objectives, derived from the aforementioned Analysis and linked with the operational capabilities and the core role of defence;

   ii. Set appropriate Energy Performance Indicators (EnPIs);

   iii. Determine SMART targets;

   iv. Construct and prioritize action plans, while foreseeing and allocating the required resources (human, financial, material);

   v. Assign accountability (i.e. define roles);

c) Align the MoD/ Armed Forces:

   i. Pursue the commitment of all levels of hierarchy;

   ii. Communicate the Energy Strategy internally;

   iii. Cooperate closely with all the departments and especially with the ones that deal with strategic foresight, operations, support, finance, human resources, education/ training and public relations;

   iv. Increase the motivation of personnel (through awareness/ training and provision of tangible results reflecting benefits on their well-being and on the common – 'broader than MOD' – interest);

d) Look for allies:

   i. Identify regional and national stakeholders and pursue capacity building, technical support and funding;

   ii. Communicate the Energy Strategy towards the external stakeholders;

   iii. Participate regional/ national consultations and pursue cooperation, without compromising the operational capabilities and imperatives.

e) Set up internal mechanisms to make use of the influx of relevant technical support and external funding;

f) Realise the action plans;

g) Monitor the performance against the specified objectives and targets;

h) Conduct reviews and engage hierarchy in the de-briefing procedures;

i) Adapt with a vision to continuous improvement.

4.2 Energy Management Systems

Development and Implementation of Energy Management System Structures

Desirable and Feasible Choices

EnMS is a strong tool to assist MODs in increasing their energy performance.

The implementation of the energy efficiency action plans required by the EnMSs will accelerate the MODs' internal processes for improvement and will raise the voice towards the national energy authorities for funding.

Energy management is multi-tasking, affects most specialties within the defence sector and should not be restricted to the programme of work of engineers only.

Commitment of all levels of management is required:

a) Top–level managers initially agree on the necessity of improving energy efficiency. However, embracement of the concept and support with required resources is not always sustained afterwards;

b) Middle–level managers (i.e. commanders) play the most crucial role in the tactical – operational level. The development of action plans requires the active engagement of middle-level management in terms of prioritisation and allocation of human and other resources. The implementation of the action plans necessitates the involvement of the low-level management and a critical mass of personnel.

Human factors (commitment, awareness, motivation, communication, training and momentum-building) play a significant role in the actual involvement of all tiers of management and personnel (refer to the *Human Factors Affecting Energy Efficiency* sections for more).

ISO 50001 is a generally acceptable Energy Management System (EnMS) and has an integrated approach based on life-cycle analysis. Environmental Management Systems (EMSs), such as ISO 14001 and EMAS III, to the extent they include the energy aspect, may be suitable for energy management.

Although certification of EnMSs/ EMSs is required by EED when stand-alone energy audits are not carried out and certification by itself can also enhance the public image of the defence sector, it should not be the ultimate goal when applying an EnMS/ EMS. However, the certification process has been proven to be beneficial to various types of organisations, including defence, since, among others, it:

a) Acts as a credible peer-review of the applied EnMS/ EMS;

b) Provides an impartial proof of conformity with the implemented EnMS/ EMS standard, which is more widely accepted to external stakeholders and public opinion;

c) Maintains the momentum to continue the implementation of the applied EnMS/ EMS, through the initial certification – surveillance audits – re-certification cycle for ISO 50001/ ISO 14001, or the verification – registration cycle for EMAS.

Easy wins based on no/ low cost actions can boost an EnMS EMS at the beginning. However, in order not to lose the momentum, allocation of adequate resources has to be secured.

The selection of appropriate Energy Performance Indicators (EnPIs) is critical. Wrong EnPIs can be misleading. The establishment of EnPIs requires the involvement and commitment of senior level management, in terms of mandate and allocation of funding.

The execution of an energy review to analyse energy uses/ consumptions and to identify, prioritise and record opportunities for improvement is very important. Furthermore, the establishment of an energy baseline, using the information in the initial energy review and taking into account variables that affect energy consumption (e.g. weather conditions, occupancies, activity cycles, etc.), coupled with the appropriate EnPIs, can provide a clear view of the progress of the applied EnMS/ EMS.

In 2017 the European Defence Agency, following relevant support from EDA's Energy & Environment Working Group (EnE WG), participating Member States as well as the pertinent requirements of EU legal framework on Energy Efficiency regarding EnMSs, launched a course entitled *"Defence Energy Managers' Course (DEMC)"*, which aims to enhance the MoDs capabilities through the establishment and implementation of EnMSs within their organisations.

The DEMC participants reinforce their understanding of the complexities of managing energy within a defence organisation or sub-organisation and acquire the capacity to structure, implement and improve an effective EnMS. In more detail, through the attendance of the course, MoD/ Armed Forces personnel is trained to the required technical standard to deliver practical, cost-effective solutions and, uniquely, benefit from case-specific mentoring support to their first project delivered within the context of their normal work activities. The first-ever international course based on ISO 50001 and tailored to the specificities of the defence sector, was launched in two phases:

a) Pilot DEMC, joined by 9 MS, which provides the initial EnMS approach in the defence sector and synchronises the various relevant national requirements. The Pilot Course will last 14 months (started on April 2017), comprising of 3 classroom sessions (9 days of academic training in total) alternating with relevant mentoring and in-situ on-the-job training for developing and implementing an EnMS at home in MOD organisations (11 months in total);
b) Pending a successful outcome of the pilot course, up to 6 steady state DEMC could be envisaged for the 3 years to follow. The steady state courses would build on the pilot course while taking into account experience gained through the pilot course, as well as any recommendations and feedback from participating MS.

Objective

Based on the actual discussions during the CF SEDSS WG1 meetings and the submitted questionnaires, the MODs'/ Armed Forces' experts have concluded that the MODs should move forward to the development and implementation of Energy Management Systems or Environmental Management Systems (that include energy as one of the significant environmental aspects) in order to pursue the continual improvement of energy performance to the benefit of the military capabilities and resilience.

Roadmap

A generic roadmap for developing and implementing an EnMS across MODs and Armed Forces may include the following activities:

a) Appoint a champion on energy within the defence organisational structure;
b) Gather concrete energy data in order to:
    i. identify the significant energy uses and set a baseline;
    ii. support the necessity of developing an EnMS towards senior management;
c) Prepare a feasibility study to launch an EnMS pilot project (generic objectives, scope, internal actors, resources, milestones/ timelines, etc.);
d) Prepare an Energy Policy and an Energy Strategy for approval by the senior management (strategic level);

e) Raise the awareness of senior management (strategic level) towards energy (submit a SWAT analysis and some showcases) and secure their commitment by approval of the energy strategy and launch of the pilot project;

f) Secure, via the signed energy policy, the required initial resources for launching the project (i.e. select an energy manager/ team, small budget for training/ small interventions/ awareness campaign, etc.);

g) Seek for allies internally and externally (EDA, Ministry of Energy, national authorities, energy providers, etc.) for technology transfer and potential financial support;

h) Train the core team (energy manager and team, advisable to include staff from organisational level);

i) Raise the awareness among personnel and the operational and tactical levels of management and encourage their engagement;

j) Develop the EnMS procedures and start implementing all the parts of the system (legislative & other requirements, energy review, energy baseline, EnPIs, objectives/ targets/ action plans, documentation/ records, operational control, procurement/ design, monitoring, auditing, review);

k) Disseminate loudly your first (quick) wins towards all stakeholders:

   i. all levels of management: to prove the validity of the concept and apply for more resources;

   ii. all personnel of the installation included in the scope: to reward their involvement and motivate further;

   iii. external stakeholders: to seek for assistance (technical/ financial) and demonstrate your work;

l) Plan the next steps for continuous improvement within the pilot project having in mind to select the most appropriate timing to expand the scope of the EnMS to other installations as well.

4.3 Energy Data & Billing

Desirable and Feasible Choices

The axiom of all types of management systems that "only what is measured leads to a defined improvement" leads to the necessity of appropriate energy data collection and consequent analysis as the first step for a successful EnMS. This is also applicable to the defence sector as well.

The Significant Energy Uses (SEUs) have to be identified and, to the best possible and economically feasible extent, to be monitored.

Geographical Information Systems (GIS) applications are considered as helpful tools to set up and maintain information on production/ distribution of energy in link with the SEUs.

Smart metering technologies are evolving and relevant costs are continuously reducing.

Close cooperation with the national competent authorities as well as with the energy providers has to be pursued.

Funding through relevant calls of the National Energy Efficiency Action Plans has to be explored.

Energy modelling tools have to be explored further, in cooperation with the national competent authorities and expert institutions.

Absolute numbers on consumptions of energy products (electricity and fuels) and drivers can serve only as a first approach on data collection and cannot provide a clear picture on the trends (improvement or deterioration) of energy efficiency. To that end, the development of appropriate Energy Performance Indicators (EnPIs) is imperative.

An Energy Performance Indicator (EnPI) is a measure of energy intensity used to calculate the effectiveness of energy management efforts. An appropriate choice of an EnPI is one that, at the minimum cost and effort necessary, provides direction and feedback on how much progress is being made and if the energy plan is on track to meeting its goals. Inappropriate EnPIs could provide misleading or confusing information. EnPIs may vary from simple ones (that result from the division of total energy consumption to an activity metric), to more comprehensive ones (that include regression analysis that estimates the dependence of a variable - (typically energy consumption for energy use)) on one or more independent variables (such as weather conditions, production volumes, activity cycles, occupancy, covered area, etc.) And this is while controlling for the influence of other variables at the same time.

The European Defence Agency, following relevant support from EDA's Energy and Environment Working Group (EnE WG) participating Member States, has been developing a mechanism and a relevant template to gather data on energy consumption of the EU MODs annually.

Objective

Based on the actual discussions during the CF SEDSS WG1 meetings and the submitted questionnaires, the MODs'/ Armed Forces' experts have concluded that the defence sector should move forward to gather and analyse energy data in a more systematic approach to:

a) Forecast energy consumption for budgetary reasons (billing and planning);

b) Plan more accurately new interventions in terms of energy resilience to support future requirements and activities;

c) Launch action plans for increasing energy efficiency and reducing consumption/ costs while supporting or even enhancing the military operational capabilities and requirements.

Roadmap

A generic roadmap for collecting and analysing energy data may include the following activities:

a) Appoint a champion on energy within the defence organisational structure;

b) Establish a mechanism of collecting coarse data (on electricity/ fuels consumptions and drivers) at the beginning;

c) Include the installation of smart metering in the construction specifications of all future buildings and in the contracting requirements for procurement/ leasing/ rental of buildings;

d) Strengthen the quality of your energy database with the use of smart metering;

e) Pursue continuous cooperation with:

i. energy providers and national competent authorities in order to obtain more metering devices;

ii. expert institutions in order to acquire the appropriate level of capacity on energy data processing;

f) Train your energy team in the use of more sophisticated EnPIs that are based on regression analysis;

g) Utilise appropriate EnPIs;

h) Process your energy data in various ways for the purposes of presenting results to:

i. the top management, in a simplified way, in order to demonstrate the general trends of energy consumption and to justify the implementation costs of action plans;

ii. the personnel managing the SEUs, in a more detailed manner, in order to identify improvement opportunities and abnormal situations and motivate them to work diligently on increasing energy efficiency and reducing energy consumption;

i) Keep being updated on the innovative solutions on data collection and processing.

4.4 Human Factors Affecting Energy Efficiency

Desirable and Feasible Choices

All participating MODs' delegates acknowledged the paramount importance of human factors as enablers to improve energy efficiency.

As far as the differences between military and civil concepts of human resources related to energy savings and efficiency are concerned, they focus on the following:

a) the scope of energy efficiency and savings within the military has two pillars: facilities and military activities (exercises and operations). Within those two pillars, different messages have to be emphasised and communicated internally and externally. In more detail:

i. Energy savings and improvement on energy efficiency in facilities have positive impacts on financial costs (key message to leadership and central government) and, consequently, may lead to investments that will improve the standards of the workplace (a key message to personnel and lower level management);

ii. Energy savings and improvement of energy efficiency in military activities have positive impacts on military operational capabilities and, moreover, reduce risks related to logistic support (personnel exposure to the enemy, availability of energy sources and financial costs), which is a key message to all stakeholders.

b) the turnover of personnel from one duty station to another is significant within the Armed Forces. In more detail, every 2-3 years military commanders and personnel are transferred to different locations, and, in many cases, with different tasks appointed. To that end, all the elements of human factors that are analysed later on in this report have to be pursued consistently.

Commitment

All levels of command (strategic, operational and tactical) have to be involved and express their commitment. In more detail:

a) senior management commitment has to be portrayed by both the provision of resources (funds, appointment of energy manager and campaign team, availability of personnel to attend training sessions, etc.) and by personal involvement (personal briefs to middle level management, exemplary behaviour, site walk-overs, etc.);

b) middle and lower level management have to embrace the energy saving concept in terms of tailoring the awareness messages to the needs and specificities of their groups, overseeing the execution of best practices and, also setting the role model.

Subcontractors have to at least acknowledge and follow the energy policies of the MOD/ Armed Forces, in order to enhance the energy-efficient life-cycle of products and services, with a special focus on the armaments industry.

Awareness

Since energy is a cross-cutting domain that affects all defence work strands (operational and support), all levels of command and specialties of personnel should be aware of the impact of energy on their course of business.

Energy data as well as data related to the implications of energy shortage to defence operations/ support provides concrete evidence on the role of energy as capability multiplier and has to be the backbone of energy awareness schemes. To that end, energy data collection and analysis from the MODs/ Armed Forces is required. The format of energy data presented to the various stakeholders, in order to raise their awareness, needs to:

a) address issues that they encounter during the execution of their duties and present relevant examples;

b) emphasis on drivers for energy efficiency other than the cost-saving effect (e.g. reduced energy footprint, better working conditions, sustainability of operations, etc.);

c) focus on more practical data, avoid plain reproduction of energy amounts in kWh and send clear messages that any energy savings will (also) have a positive impact on their duties and everyday work.

The higher levels of command (strategic) have to embrace the idea of launching energy efficiency awareness campaigns on a large scale and provide means accordingly. Consequently, the middle and lower levels of command (operational and tactical, respectively) have to be actively recruited to tailor the quality and quantity of information that should be provided to relevant personnel, depending on the addressees' specialties and duties.

The energy awareness campaigns have to be well designed and to address the following aspects:

a) Raising a campaign team: involving people that hold key positions to boost the campaign. The team has to have a clear mandate from the hierarchy, well-defined roles/ authorities and meet regularly in order to respond to the challenges that will arise;

b) Funding: although funding is in all cases inadequate for awareness campaigns, any available financial resources have to be secured from the beginning, to enable the campaign team to plan and develop the campaign;

c) Communication strategy: Following a clear path for internal and external communication [incl. appropriate timing to launch the campaign, target groups, selective and tailored information to every single group, use of suitable communication methods (e.g. presentations, workshops, leaflets, newsletters, posters, banners, stickers, promotional merchandise, competitions, recognition to significant contributors among personnel, rewards, exhibitions, participation to conferences/ fora, response to inputs from personnel and/ or other stakeholders, etc.)];

d) Monitoring; in every step of the campaign, measure the savings achieved that are attributed to changes in mind-set and avoid confusion with the changes that were achieved because of other factors (e.g. technical measures, climatic conditions, number of personnel, etc.).

MODs'/ Armed Forces' contractors have to be aware of energy issues related to the defence organisation they are working with in order to align their programme and code of work accordingly, especially in cases where Energy/ Environmental Management Systems are implemented.

Motivation

The key objective is to raise the motivation of all personnel, especially groups of significant importance in decision-making and energy usage, i.e. to the top-right state (green) of the figure on the Implementation of Energy Efficiency Awareness Campaigns in the Defence Sector*: Awareness – Motivation Grid* (high motivation and high awareness). A survey in order to determine the mass of each one of the above quadrants, in terms of a simple questionnaire, can provide valuable inputs for developing an awareness/ motivation campaign and identifying potential assistants among personnel (among those who are already highly aware and motivated).

Straightforward orders and guidelines on application of legislation have to be provided, in order to set the internal framework and provide the means for energy savings and energy efficiency improvements.

As soon as the internal framework is paved, clear messages have to be circulated internally to:

a) all levels of management on the benefits of improving energy efficiency and reducing energy consumption (operational effectiveness, cost reductions and public image, etc.);

b) all personnel on how energy savings can have a positive impact on other areas, apart from cost savings. These may include:

   i. Reinvestment of cost savings from energy savings on projects that can improve even more working place conditions;

   ii. Improvements on their working place standards (through better regulation of working environment conditions);

   iii. Avoidance of unnecessary exposure to risks. In more detail, by enhancing energy efficiency, fuel supply activities during deployments may be reduced in volumes and frequency, leading to less exposure of personnel that is involved into such logistic operations taking place in hostile environments;

iv. Improved productivity and/or simplification of procedures to the benefit of personnel;

v. Environmental consciousness and social responsibility.

Contractors have to be motivated to pursue energy savings and comply with defence energy policy and regulations during their course of cooperation with MODs/ Armed Forces. To that end, relevant specifications on tenders and contracts have to be foreseen.

Communication

Communication should be tailor-made, according to the addressees. In more detail:

a) An appropriate code of contact/ language should be adopted, depending on the addresses (e.g. comic strips/ simplified charts for personnel, formal letters enriched with relevant but unclassified data to external stakeholders, etc.);

b) Information that is relevant and has an impact on the specific addresses should be provided, avoiding general and undocumented statements.

The outreach has to be reciprocal, i.e., MODs/ Armed Forces should have mechanisms not only to send messages related to energy issues, but also to receive, interpret and respond accordingly to the messages of relevant stakeholders and interested parties internally (i.e. adopt top-down and bottom-up approaches of communication) and externally (e.g. international, national and local competent authorities, community, NGOs, contractors etc.).

Monitoring of the responses to the messages sent internally and externally enables optimum evaluation and a timely response, and, to that end, it should be pursued.

Training

Different levels and a syllabus of training has to be applied, depending on the duties/ job descriptions, as well as the skills of personnel. To that end:

a) Engineers and technical personnel have to be trained on energy auditing, application of EPBD requirements on new and existing installations, design and application of RES, development and implementation of EnMSs/ EMSs, smart grids, HVAC maintenance, etc.;

b) Personnel of various specialties has to be also trained [(military) platforms/ equipment operators, logisticians, procurement officers, etc.], according to their duties and expertise, on:

1) the energy efficient operation of military platforms (aircrafts, naval ships, land vehicles) and supporting equipment;

2) appropriate storage of fuels, energy efficient logistics and public procurement of energy efficient products, services and buildings.

Momentum

To maintain momentum, a proper monitoring mechanism has to be set, with the main objective to evaluate the behavioural trends related to energy among personnel and respond accordingly,

injecting portions of awareness, communication and training to enhance commitment and motivation.

Objective

Based on the actual discussions during the CF SEDSS WG1 meetings and the submitted questionnaires, the MODs'/ Armed Forces' experts have concluded that the application of EnMSs and the implementation energy efficiency improvement schemes can be achieved and sustained only through a systematic and constant approach on the aspects of human factors that involve building commitment, raising awareness, nurturing motivation, maintaining internal and external communication and providing appropriate training.

Roadmap

A generic roadmap on triggering the human factors related to energy efficiency improvement may include the following stages:

a) Appoint a champion on energy within the defence organisational structure;

b) Pursue close cooperation:

   i. internally with the champions that deal with human resources, education/ training and public relations;

   ii. externally with the national competent authorities on energy, by inviting them to bilateral meetings in order to include the MODs into their tank of stakeholders, when it comes to consultations and to provide economical funds as well as technical support/ capacity building to the MODs/ AF in the regime of energy efficiency;

c) Raise the MODs'/ Armed Forces' external visibility on the topic of energy efficiency by actively participating to relevant initiatives, consultations, events and fora;

d) Set the internal framework on how to improve energy efficiency, i.e. start realising the first steps of an EnMS and provide explicit guidance, suitable to all internal addressees;

e) Identify gaps in professional training of engineers and technical personnel as well as personnel of various specialties, which, according to their duties and expertise, use/ regulate significant amounts of energy and, further on, work closely with other internal and external stakeholders to bridge these training gaps;

f) Launch awareness campaigns on energy related issues (increase of energy efficiency, rational use of energy resources);

g) Inject energy efficiency awareness and motivation right from the start of personnel's career paths: from the military academies and the basic training of recruits/ conscripts;

h) Establish a mechanism of rewarding the units and individuals on exemplary performance for using efficiently the energy resources;

i) Monitor the energy performance of target activities [e.g. accommodation, building management, levels of maintenance (organisational, intermediate and depot), transportation, etc.], in order to react promptly to behavioural changes.

4.5 Public Procurement with respect to Energy Efficiency

Desirable and Feasible Choices

There are parameters of higher value that define the specifications on procurement of equipment and services rather than energy efficiency, such as military operational requirements (including technical suitability and availability) and personnel safety (as top priority), as well as cost-effectiveness. Provided all the latter are followed, energy efficiency specifications should be integrated into the procurement process of the MODs.

Objective

Based on the actual discussions during the CF SEDSS WG1 meetings and the submitted questionnaires, the MODs'/ Armed Forces' experts have concluded that the procurement of energy efficient products/ equipment, services and buildings, in accordance with the relevant EU and national legal frameworks, has to be further pursued, but not to the detriment of military operational requirements and/ or personnel safety.

Roadmap

A generic roadmap for incorporating energy efficiency specifications in the tendering/ contracting requirements of the MODs/ Armed Forces for common products, services and buildings may include the following stages:

a) Liaise internally with the procurement departments;

b) Liaise with the national competent authorities to clarify the national legislative requirements on green/ energy efficient public procurement;

c) Prepare a feasibility study on procurement of indicative, common types equipment of high energy efficiency class, in order to showcase the added value of purchasing energy efficient products (less operational costs, higher life-cycles in most cases – which also may impact positively military operational objectives);

d) Prepare an Energy Strategy/ Policy (strategic level) and a handbook (operational level) on procurement (or amend the existing one) for approval by the MODs'/ Armed Forces' administration;

e) Raise the awareness of administration/ senior management (strategic level) towards energy and secure their commitment by approval of the Energy Strategy/ Policy on procurement;

f) Pursue central procurement (in order to monitor the adaptation of energy efficiency requirements more easily and benefit from economies of scale) instead of fragmented, smaller contracts executed locally;

g) Raise the awareness of all personnel on the benefits of procuring energy efficient equipment, services and buildings, since some personnel will be responsible for drafting technical specifications;

h) Train the procurement officers;

i) Monitor the actual progress of procuring energy efficient products, services and buildings, and compare the actual relative energy consumptions and running costs in order to validate the concept and further motivate the involved personnel.

4.6 Energy Performance Contracting

Desirable and Feasible Choices

So far, MODs/ Armed Forces have limited experience on EPC and cooperation with ESCOs due to the challenges identified.

Besides the alignment of internal procedures that is required in most of the MODs in order to subscribe to EPCs, close cooperation with the National Competent Authorities will bridge potential legislative gaps and facilitate the implementation of EPCs.

Training of personnel is critical, hence participation to relevant national schemes is advised, in addition to experience – sharing / lessons learnt with other public bodies that have implemented or are in the phase of launching EPCs.

Objective

Based on the actual discussions during the CF SEDSS WG1 meetings and the submitted questionnaires, the MoDs'/ Armed Forces experts have concluded the utilisation of the EPC funding mechanism has to be further explored, taking into account the specificities of the defence sector.

Roadmap

A generic roadmap for implementing EPCs with ESCOs may include the following stages:

a) Liaise with the National Competent Authorities for capacity building/ technical assistance;

b) Identify any potential national legislative gaps in EPCs involving the public sector and consult with National Competent Authorities;

c) Identify any potential internal (MODs/ Armed Forces') framework gaps (budgeting; long-term contracting; pay-back from billing budget lines);

d) Determine a suitable site for pilot-scale EPC project and prepare a feasibility study (types of interventions, Return on Investment, framework requirements, payment mechanisms to the contractors, involved actors, gaps in training of involved personnel, etc.);

e) Raise the awareness of senior management (strategic level) towards EPC and secure their commitment by approval of a pilot case;

f) Raise the awareness of all personnel on the benefits of EPCs (all will be using the facilities and some will be responsible for operating HVAC equipment);

g) Launch the pilot-scale EPC project and monitor its progress in the light of expanding the utilisation of this mechanism to larger scopes.

SUB-SECTION 4(II): ENERGY EFFICIENCY – FUTURE PROSPECTS

4.7 Continuation of the CF SEDSS

For the continuation of the CF over the next 24 months, WG2 participants expressed their interest in addressing the following new broad topics:

a) Financing of Defence Energy Projects through the new Defence Research Programme;
b) Further exploration of financing dual use defence energy projects through EU Structural Funds;
c) Interpretation of and compliance with Public Sector Procurement rules;
d) Energy in deployed camps: it would important to define common operational procedures and energy/water/waste standards in common EU-led military overseas operational deployments. EDA should check with NATO to avoid duplication of work;
e) Life cycle costs approach regarding technical building systems;
f) Budgeting cycle planning in Public Administration: it was suggested to bring NATO to provide experience on planning in advance;
g) Definition of separate targets for energy consumption (owing to lower use) and for energy efficiency (owing to more efficiency);
h) Consideration of imposing targets on the defence sector in exchange for availably of funds to help finance energy efficiency measures;
i) Development of energy policies and strategies at a high level in the MoD/Armed Forces Organizations;
j) Identification, development and implementation of collaborative projects, focusing on the exploration and provision of knowledge and training on tools and mechanisms that will allow MoD's to prepare and follow the path for implementation of projects, rather than on financial support to specific projects.

With respect to the format and organization of the continuation of the CF, the following observations and proposals were made by WG2 participants:

a) The number, duration and format of meetings from this CF are found correct;
b) There is a desire for further engagement of participants (through questionnaires, for example) in between meetings;
c) There is a request for engagement of Ministries of Energy, Industry or Economy and Tax Revenue representatives;
d) There is a proposal to structure the CF Working Groups differently: rather than existing focus on Energy Management, Energy Efficiency WG and RES, the CF could be structured in WGs dedicated to:
e) High level policies/methodology,
f) Project identification, development and implementation, and
g) Financing;
h) There is a request to circulate the meeting agenda in advance, to allow for research and preparation of the meeting;
i) There is a request for earlier circulation of meetings summary reports.

4.8 Collaborative Initiatives on Energy Efficiency

The identification and discussion of collaborative initiatives aimed at the fulfilment of the EU Directives is considered of interest and of great importance by MODs/Armed Forces, which face obstacles and difficulties in finding financing for their projects individually and, sometimes, lack appropriate guidance.

Several proposals or initiatives for collaborative projects arising during the meetings and proving of great interest to MS, are in particular:

a) Financing mechanisms: to explain what financing mechanisms exist and how to apply for funds (presentation on Horizon 2020 funding planned for 2nd Plenary meeting);

b) Military Nearly Zero Energy Buildings (Mil-NZEB) refurbishment project: potential collaboration among MODs to build or renovate existing buildings to NZEB standards. The aim of the MIL-NZEB refurbishment project would be to demonstrate the feasibility of, and benefits from, the transformation of existing non-efficient military buildings/sites into nearly zero energy buildings/sites through the design, evaluation and implementation of effective refurbishment interventions, satisfying realistic return on investment (ROI) period requirements, and contributing at the same time to the energy efficiency, renewable energy and reduction of CO_2 emissions, and EU and National objectives.

From which there are five main objectives:

i. assessment of buildings/site energy consumption and CO_2 emissions in several MS (preferably under different climatic conditions);
ii. analysis, assessment and proposal of suitable NZEB standards to the project (National specific NZEB standards vs military specific NZEB standards across the EU), and development of a common framework and a harmonised methodology for the definition of an NZEB concept for military buildings;
iii. design and justification of applicable energy efficiency and energy production cost-effective measures towards achieving NZEB standards;
iv. identification of, and application for available EU funds suitable for the public defence sector;
v. implementation of designed and justified applicable energy efficiency and energy production cost-effective measures and demonstration of better performance.

For the selection of buildings suitable for this project, it would be particularly important to consider:

i. The specific portfolio of defence buildings, consisting of:
    - Dual use buildings
    - High building stock in need of refurbishment
    - High energy intensity use of the building stock
    - High number of old buildings with historic protection nature (excluded from EPBD), which come with constraints to what technical solutions for refurbishment can be applied
    - 24hr use of buildings
    - High replicability potential

ii. The applicability of NZEB national standards to the defence sector and the definition of a common framework and harmonised methodology for military

specific buildings need to be further studied and discussed (military specific NZEB standards (across MS) vs national specific NZEB standards);

iii. The inclusion of training, awareness raising and education plans;
iv. The development of demonstrators before full implementation;
v. Technology approach vs building approach: assess what available technologies could be applied to selected buildings that would assure a quick and inexpensive implementation (modular/prefab panels refurbishments, for example);
vi. Building approach vs "cluster approach": since defence sites are normally composed of multiple buildings with different uses and different characteristics and energy saving opportunities, a "cluster approach" to a NZEB concept that takes into account the aggregate effect of a combination of different interventions and solutions that may be applicable to different buildings is considered more appropriate and applicable to the defence sector, than a single building approach. The cluster approach takes full advantage of working at "site level", rather than at "building level";
vii. Replicability and scalability criteria.

MODs agreed to move the discussions about this Project Proposal out of the CF and into EDA's energy and environment programme for consideration as an EDA CAT B Project. Although other funding sources should also be reviewed since the project in its entirety would be significant in scope.

c) Benchmarking project proposal: potential collaboration on Defence building stock benchmarking.

MODs agreed that more work is required to identify existing reference benchmarks that could be adapted to the defence sector; however, they did agree too that it would be recommendable and preferable to create a EU defence specific building stock inventory and EU defence specific reference benchmarks based on climatic regions (rather than nationally), that allow the objective assessment and comparison of buildings across the EU, and the prioritisation of investment cases, due to the following reasons:

- the defence building stock has very specific particularities ;
- even when compared with equivalent commercial buildings (military housing vs civil housing, military canteen vs commercial restaurant, etc.), military buildings have different requirements and perform differently ;
- different energy targets, requirements and calculation methodologies in different MS give different performance ratings for the same levels of energy consumption.

The approach to this project should have to be flexible enough to accommodate very different portfolios of buildings in different MS (from hundreds of buildings to thousands of buildings, of different types and with different uses).

4.9 European Commission's proposals on new rules for clean energy transition and proposed changes to EED and EPBD.

The main goals of the new Clean Energy Package prepared by the European Commission are focused on the creation of jobs and growth, on bringing down greenhouse gas emissions, and securing energy supply.

The revised version of the EED and EPBD, which are expected to be approved at the beginning of next year, aim to ensure a better alignment with the 2030 strategy and that the 2030 objectives are reached, and simplify the text, mainly. The revision of the directives consists on the revision of some relevant articles and the introduction of new provisions for Electro-mobility and a smartness indicator.

A first assessment of the impact of the proposed changes to the EED and EPBD on the defence sector before has been done by the UK and concluded that there is no major impact on the defence sector.

4.10 Recommendations for further work on RES in Defence

A number of these technologies were presented and discussed at CF SEDSS during the parallel working group sessions on renewable energy sources.

For instance, the second meeting was characterised by a very lively debate on each of the topics presented and covered a range of technical, operational and conceptual issues in great detail as delegates sought to improve their understanding and challenge differing approaches to optimise agreement over best practice.

Overall, it was found that the MS had differing perspectives of the utility of RES to defence and, although a significant body of work had been completed on deployed hybrid systems, there was generally less activity at home where limited budgets, understanding of opportunity and a lack of objective data (both benchmarking and within business cases) blocked progress on RES penetration.

With a few exceptions, MODs did not approach RES as core business, but were increasingly keen to develop understanding and to explore cost effective options both autonomously or in collaboration.

The idea of a holistic approach to sustainability was compelling and the more global ideas were worthy of consideration by DG Energy for inclusion within the Energy Union work, especially as cost would reduce significantly at larger scale.

Energy Service Companies offered a viable opportunity to decrease cost and transfer risk, but some cultural barriers still existed with the military's predisposition to the use of diesel as the first energy option. The additional costs of force protection and logistic overheads should also be included in any proposed business case. Little work had been done to explore the use of the deployed energy concepts at home and a service-based approach to both was seen as both viable and cost effective.

The technology based sessions in the events can be summarized as follows:

- The solar session demonstrated the dominance of the self-consumption model, the extensive use of the technology by ESCo and noted many MS had local experience and ground truth data, which could benefit others especially for areas of low intensity insolation.
- For wind, the newer technologies, at small scale, could be integrated into military sites in a pleasingly aesthetic and functional way to augment main supply, but would always require either a grid- based or local storage solution as back-up. Additional empirical data was needed on performance versus cost.
- The use of hybrid systems with integral RES at remote military sites in the European mainland was a realistic alternative and could offer high degrees of resilience to critical systems. Many MS have an understanding of the problems of wind turbine and radar interference and this might be a good area for collaboration accepting that national vulnerabilities would exist in the classified domain.
- The Biomass study was worthy of real consideration to move ahead to the next stage and the district heating benefits would need to be further refined to improve on an already compelling approach.
- Geothermal applications enabled through ground loops should be an attractive proposition for defence and sharing of data/business cases in this area would be beneficial to all to improve benchmarking and confidence.

- Small hydro was definitely an underexplored area in a readily exploitable field and was therefore attractive as a possible collaborative opportunity for MS to consider.
- The work on fuel cells and energy storage was largely complete and it would be captured in fact sheets.
- Smart grids would require some additional, albeit limited, discussion to resolve the macro and micro view so an agreed position could be established in future.
- Waste to energy was an important area worthy of further consideration and further investigation for the future.

From the discussions and the evidence received, it had become evident that the 24 month period was quite ambitious to move MODs into the RES space. However, the capacity building approach could realise significant benefits downstream as the 2020 and 2030 EU emission targets were fully implemented. The cultural makeup of the MODs did not naturally align itself with RES technology deployment based purely on sustainability arguments and hard-edged business cases would remain an essential criterion for successful RE implementation.

The review of the current situation was based on Member States' responses to questionnaires issued by the WG moderators and by the responses of participating delegates during WG sessions in event 4 (Lisbon) and event 5 (Thessaloniki). Only a minority of Member States had a separate energy strategy or policy for defence and only a minority had implemented an Energy Management Structure. Very few states were implementing the RES directive in the defence sector. Not surprisingly very few states had a RES strategy. Nevertheless, many states had pilot studies and research projects in place particularly on Solar PV with smaller numbers on Bio-mass and Bio-fuels. A significant number of states expressed frustration with national procurement rules and also with certification and compliance issues which they felt were impeding RES implementation.

Overall there is a lot of work required before EDA MS will reach the necessary level of organisation to successfully implement energy efficiency programmes including in the area of RES.

4.11 Objective setting for RES in the Defence sector

There was a considerable divergence of views on what the RES objectives or end state should be for the defence sector. The following are the aspects on which consensus was achieved:

- **Contribute to national/EU RES effort.** Many states wished to say 'make a significant contribution' but others felt that this was not the defence sector's concern and/ or that the defence sector was too small to make a 'significant' contribution at national level.
- **Increase resilience of the defence sector.** Most delegations agreed on the value of RES in increasing resilience within the defence sector. However, one delegation strongly argued that there were other measures such as generators which would ensure resilience more effectively that RES. Most delegations would support expanding the scope to include the role of RES on operational deployments while realising that this is not within the current scope of the CF.
- **Make financial savings in defence budgets.** There was general agreement on this objective. However, there was some scepticism expressed on whether such savings would benefit the defence sector or would be absorbed back by central government.

- **Make the defence sector an 'exemplar' for national and EU RES effort.** Delegates agreed that armed forces had a special role in society and therefore were in a unique position to display leadership in reducing carbon footprint and improving energy efficiency within MS.
- **Increase RES awareness and skills within armed forces to enhance operational effectiveness.** All delegations agreed that RES awareness and skills can help improve operational effectiveness especially on deployed operations.
- **Contribute to European and national energy security by reducing dependence on fossil fuels**. It was accepted that RES within the defence sector would reduce dependence on fossil fuel imports.

4.12 Roadmap for RES

There was a general agreement that buy-in at strategic level within states was essential if substantive progress is to be made in the defence and security sector.

A TOP-DOWN/ BOTTOM–UP approach was agreed. CF SEDSS can have a significant impact in fostering the BOTTOM-UP element. However, it should be supported by a TOP-DOWN component which sets agendas both at EU and national levels.

States can help achieve progress through developing an energy policy and management framework including the following;

- Increase awareness of energy matters especially RES in the defence sector at national level.
- Develop and maintain a National Defence Energy Strategy/Policy with a RES component.
- Develop and maintain an Energy Management Structure for the defence sector at national level.

Having established a strong energy policy and management framework states either individually or collectively could consider the following initiatives.

- Develop and/or review frameworks for delivery of RES projects in both national and EU contexts including appropriate procurement procedures, collaborative processes, funding mechanisms and consideration of Energy Performance Contracts.
- Examine feasibility of applying existing and emerging RES technologies across national defence sectors, including by implementing pilot projects where relevant.
- Develop an Implementation Plan for RES in the Defence Sector, consistent with NATO approaches to RES where applicable.
- Pool findings and share experiences at EDA level.

4.13 Potential RES project development

The WG also considered the scope for future work on RES in Phase 2 of the CF including the following possible projects:

- **Develop a RES feasibility tool-kit.** This could encompass all viable RES technologies and assist states in selecting the most appropriate technologies in particular applicable circumstances.
- **Further examine energy storage systems.** Energy storage was identified as a significant obstacle to wider deployment of RES. More efficient and cost effective storage options would significant enhance the viability of RES technologies.
- **Monitor new and emerging technologies.** The RES technology sector is undergoing rapid development and innovation and the CF should ensure that it remains appraised of technological developments.
- **Examine viability of mixed RES technologies in one installation.** This proposal was made by one state and supported by others. The intention in general is to assess the advantages and disadvantages of such mixes e.g. wind and solar.
- **Investigate role of Energy Performance Contracts in delivering RES projects in defence sector.** The WG agreed that Energy Performance Contracts could play a significant role in developing and implementing RES capacity in the defence sector particularly where significant capital investment was required.

4.14 Recommendations on method of work of WG within Phase 2 of CF.

- **Enhance intersessional work component.** It was agreed that much more work could be achieved through intersessional working. This would require greater consistency by MS representatives in providing the necessary inputs to the Moderators. The response during Phase 1, e.g. to questionnaires, was disappointing and will have to improve.
- **Develop and agree clear objectives for each task within WG.** The development and agreement of clear targets is an essential prerequisite for an efficient system of work. It was felt that initial work could be done through intersessional work to facilitate decisions being finalised at the first meeting of Phase 2.
- **Develop and agree intermediate milestones for each task within WG to maintain momentum and to manage workload**. Once the targets and goals are finalised there is a need for milestones to measure and confirm progress towards achievement of the identified goals.

SECTION 5: FINANCIAL CONSIDERATIONS

5.1 Overview

Finance and access to funds was a recurring theme throughout the Consultation Forum. This section deals with both presentations made as well as potential sources of funding and helps with the identification of financing mechanisms for energy efficiency and renewable energy in defence. However, given that complexities for funding are even greater for the defence sector, this is an area which would need closer examination and assessment especially with changing funding dynamics. Therefore, this section sets out the differences between funds, although it is important to note that not all of the funds are available to the defence sector. As such, it is important to establish which are and which are not.

Therefore, despite there being a number of financial mechanisms at an EU level, there are a number of challenges which MODs face; these were highlighted on a number of occasions during the CF SEDSS events. At an EU level, there are a number of instruments which are linked to the European Investment Bank which, amongst its exclusions from financing activities, includes ammunition and weapons, military/ police equipment or infrastructure: see http://www.eib.org/attachments/documents/excluded_activities_2013_en.pdf

MODs should therefore be conscious of these restrictions when exploring options for finance. However, there are ways in which MODs can operate successfully within the complexity of the financial rules.

A selection of funding mechanisms are set out below including ways in which the defence sector can potentially benefit.

MODs also face internal challenges. For instance, alternative policy measures of the National Energy Efficiency Action Plans (NEEAPs) do not include any specifically allocated funds for the MODs. Although in many cases the MODs are required to achieve energy targets set for the whole public sector. The CF SEDSS events discovered that there is scarcely any extra financial support provided by MS central governments and the investment has to be covered by continuously constrained defence budgets. There were only two cases where MODs benefited from national/ EU funding to upgrade energy efficiency in selected camps. In contrast, other areas of the public sector are favoured for securing funding for the promotion of energy efficiency.

Through-life costing for projects should embrace all elements of energy related procurement, storage, distribution and management which should, through an evidence-based approach, help address the institutional challenges faced including lack of understanding and commitment throughout the management chain and different professional functions. This should drive changes including tapping in to cost savings made through investment in energy being translated into capital for reinvestment in broader military requirements.

EDA has produced a summary of the various types of funds that are available and the sorts of topics for which they are used, see: www.eda.europa.eu/eufunding This has a particular focus on European Structural and Investment Funds (ESIF), the new EU COSME (Competitiveness of Enterprises and SMEs) Programme and Horizon 2020 in relation to what is achievable for the defence sector including through dual-use technology applications.

5.2 Horizon 2020

Horizon 2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more breakthroughs, discoveries and world-firsts by taking great ideas from the lab to the market.

Horizon 2020 is the EU funding programme implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness.

Seen as a means to drive economic growth and create jobs, Horizon 2020 has the political backing of Europe's leaders and the Members of the European Parliament. They agreed that research is an investment in our future and as a result was put at the heart of the EU's blueprint for smart, sustainable and inclusive growth and jobs.

By coupling research and innovation, Horizon 2020 is helping to achieve this with its emphasis on excellent science, industrial leadership and tackling societal challenges. The goal is to ensure Europe produces world-class science, removes barriers to innovation and makes it easier for the public and private sectors to work together in delivering innovation.

Horizon 2020 is open to everyone, although not to defence applications, with a simple structure that reduces red tape and time so participants can focus on what is really important. This approach makes sure new projects get off the ground quickly – and achieve results faster.

The EU Framework Programme for Research and Innovation will be complemented by further measures to complete and further develop the European Research Area. These measures will aim at breaking down barriers to create a genuine single market for knowledge, research and innovation.

See https://ec.europa.eu/programmes/horizon2020/

5.3 ELENA and Energy Performance Contracting

ELENA is a joint initiative by the EIB and the European Commission under the Horizon 2020 programme. ELENA provides grants for technical assistance focused on the implementation of energy efficiency, distributed renewable energy and urban transport projects and programmes.

The grant can be used to finance costs related to feasibility and market studies, programme structuring, business plans, energy audits and financial structuring, as well as to the preparation of tendering procedures, contractual arrangements and project implementation units. There is also the potential to look at innovative project structures, such as those which can be delivered via Energy Performance Contracts and to which the defence sector could have potential access despite the constraints of operating within EIB rules. However, this needs to be explored further.

The ELENA facility is led by a team of experts consisting of engineers and economists with extensive experience in the **transport and energy sector**. Established in 2009, the ELENA facility has awarded around EUR 100 million of EU support triggering an estimated investment of around EUR 4 billion on the ground. More information about completed and ongoing projects is available on the EIB projects page.

What type of assistance can be co-financed by ELENA?

ELENA can be used to co-finance any type of assistance necessary to prepare, implement and finance an investment programme. For instance, it can support the development of market studies, business plans, energy audits, financial engineering, structuring of programmes, preparation of tendering procedures and contractual arrangements and project implementation units with existing or newly recruited staff. However, ELENA does not pay for the actual hardware investments, basic research, or technology development. The eligible costs for technical assistance include staff time, overheads, travel and subsistence, sub-contracting, and minor other specific costs – "it pays for brains, not for bricks".

What are the co-financing conditions for ELENA?

ELENA can cover up to 90% of the project development cost. In addition, each EUR of EU funding must lead to at least 20 EUR of investments in sustainable energy (mandatory leverage factor of 20) by the end of the action. If this minimum leverage is not achieved, the final beneficiary has to reimburse, in part or in full, the amounts received, except in specific circumstances beyond the control of the beneficiary. The duration of ELENA support is currently limited up to three years.

What is the state-of-play?

Over the past 5 years, our funding of around 100 M EUR, managed by public banks (ELENA facilities) and by the Commission (EASME PDA and MLEI), has constituted a pipeline of around 100 PDA projects leading to 4.8 billion Euros of investments. This pipeline will contribute to create a track record of large-scale investment programmes, funded mostly through private finance, which should in turn demonstrate the profitability and reliability of sustainable energy investments.

What kind of investment programmes can be supported by ELENA?

ELENA can be used for the development of sustainable energy investment programmes in the field of public and private buildings, urban transport, street lighting, distributed renewable energy sources, district heating/cooling networks or local infrastructures. Energy efficiency in transport is the second most important field of action for ELENA after energy efficiency measures in buildings. In the current EIB-ELENA Facility, 27% of the investments have been triggered from the transport sector. These investments represent an amount of around EUR 1 billion. Examples of previous PDA projects in the area of urban transport are available in the annex.

In terms of size of investments, the objective of EIB-ELENA is to focus on the development of investment programmes above EUR 30 million. Small projects can be supported when they are integrated into larger investment programmes.

What kind of projects does ELENA support?

Typically, ELENA supports programmes above EUR 30 million over a period of around 2-4 years, and can cover up to 90% of technical assistance/project development costs. Smaller projects can be supported when they are integrated into larger investment programmes.

The annual grant budget is currently around EUR 20 million. Projects are evaluated and grants allocated on a first-come-first-served basis. ELENA may co-finance investment programmes in the following fields:

- Energy efficiency and distributed renewable energy
    - public and private buildings (including social housing), commercial and logistic properties and sites, and street and traffic lighting to support increased energy efficiency;

- integration of renewable energy sources (RES) into the built environment – e.g. solar photovoltaic (PV) on roof tops, solar thermal collectors and biomass;
- investments into renovating, extending or building new district heating/cooling networks, including networks based on combined heat and power (CHP), decentralised CHP systems;
- local infrastructure including smart grids, information and communication technology;
- infrastructure for energy efficiency, energy-efficient urban equipment and links with transport

- **Urban transport and mobility**
  - investments to support the use and integration of innovative solutions for alternative fuels in urban mobility;
  - investments to introduce on a large-scale new, more energy-efficient transport and mobility measures in urban areas including passenger transport, freight transport, etc.

ELENA – How it works

1. You are a public or private entity pursuing an energy efficiency, renewable energy or sustainable transport project and are **looking for financing to support project development**.
2. Contact ELENA providing a **brief description of your entity and the planned investment programme**. This should include information about the type of investment programme(s), the approach to implementation as well as the expected investment cost and time schedule of the programme. We will also need an overview of the main needs and scope of the technical assistance requested, justification of costs and an indication of the requested amount.
3. The ELENA team will review the information and assess if the project or programme meets the eligibility criteria. ELENA provides proactive support during the application process. For more information see FAQ.
4. **If the assessment is positive**, you will need to **complete the** application form. The European Commission will provide the final approval based on our assessment.

5.4 Energy Performance Contracting

The funding mechanism for the following case study was operated through a third party – the Energy Service Company –which means that the defence sector could also potentially operate through the same structure but without the constraints of the EIB regarding military spending.

See http://www.eib.org/products/advising/elena/index.htm

Case study – London RE:FIT Energy Performance Contract

The Greater London Authority has received an ELENA contribution to set up a project implementation unit for preparing the retrofitting of hundreds of public buildings owned by several London boroughs, colleges, universities and hospitals. This ELENA project has directly contributed to the development of an ambitious and forerunning systemic retrofitting programme called RE:FIT which is based on the Energy Performance Contracting (EPC) approach with ESCOs. As a result, the Technical Assistance has leveraged investments of more than EUR 60 million in 400 buildings and energy savings representing around EUR 6 million a year with an EC contribution of EUR 2.8 million. On the longer term, the RE:FIT programme aims at retrofitting more than 2000 buildings covering 10-12 million m2 of property with an investment of around EUR 500 million.

Due the gaps in knowledge and expertise in establishing an EPC, support is available to take interested parties through the process such as:

- **Advice** – How the Framework works, Energy Performance Contracting, RE:FIT process, project delivery, guides and documents, funding options, contracts, client resources, Measurement & Verification, training, ESCO approach/ issues/ resources
- **Active Client support** - start-up meetings, template help, project brief, building selection, bid approach, business case, presenting to Board level, market test, attending project and steering group meetings, reviewing client & ESCO documents
- **Business Development** – engaging with sectors, central government, trade associations, interest groups by 1) meetings 2) speaking events 3) telephone/email 4) newsletters articles, in line with the Business Development strategy
- **Energy Data Benchmarking (estate-wide)** - validation of energy data, clarifying discrepancies, benchmarking providing portfolio/building targets (kWh, £, tCO2, savings, payback) for business cases and tender targets
- **12 ESCOs 'Supervision' –** 2-way feedback, issue resolution, Framework Governance, monthly future opportunities list, quarterly meetings.

5.5 European Energy Efficiency Fund

The European Energy Efficiency Fund (EEEF) aims to support the goals of the European Union to promote a sustainable energy market and climate protection. The main objectives are:

1) Contribute to the mitigation of climate change

EEEF contributes with a layered risk/return structure to enhance energy efficiency and foster renewable energy in the form of a targeted private public partnership, primarily through the provision of dedicated financing via direct finance and partnering with financial institutions. Investments should contribute significantly towards energy savings and the reduction of greenhouse gas emissions to promote the environmentally friendly use of energy. Maximizing its impact, EEEF facilitates investments in the public sector, which offers an enormous potential, but

in which projects are often hindered or decelerated due to budget restrictions and lack of experience with this kind of investment.

2) Achieve economic sustainability of the Fund

EEEF pursues its environmental goals by offering funding for energy efficiency and small scale renewable energy projects. The Fund observes the principles of sustainability and viability, combining environmental considerations and market orientation. It does so by financing economically sound projects, allowing for a sustainable and revolving use of its means.

3) Attract private and public capital into climate financing

By achieving the first two objectives, EEEF aims to attract additional capital into climate financing. The environmentally and socially responsible way of conducting its business, the innovative public-private partnership structure and the experience of its stakeholders will be used to bring more capital into an area whose financial means are currently insufficient to strongly contribute to the mitigation of climate change.

See http://www.eeef.eu/home.html

5.6 European Structural and Investment Funds

European Structural and Investment Funds (ESIF) may be used in the defence sector to co-fund productive investment projects and support the modernisation of the defence supply chains.

There are five types of European Structural and Investment Funds (ESIF): European Social Fund (ESF), Cohesion Fund (CF), European Agricultural Fund for Rural Development (EAFRD), European Maritime and Fisheries Fund (EMFF), and of greatest relevance to defence is the **European Regional Development Fund** (**ERDF)** which can support defence and dual-use projects (both preparation and management), for example:

- product, process or technology R&D+I;
- machineries/intangible assets purchase, consultancy services;
- protection of intellectual property rights (IPR) and related activities;
- matchmaking events, (foreign) fairs and exhibition participation;
- dual-use incubators, demonstration centres, dissemination.

The selection of projects for funding is not handled at European level, but by Managing Authorities (MAs) in Member States. Funding national local projects, though a share of ERDF (so-called "Interreg") is also earmarked for cooperation.

Projects can be submitted by a range of different types of organization including: SMEs and larger companies; universities, public/private RTOs; NGOs, associations, foundations; chambers of commerce, development agencies; local authorities and other public bodies; a consortium; and training centres.

EDA has produced some guidance on the applying for ESIF which is available at:
www.eda.europa.eu/**esifguide**

Examples of defence and dual-use projects funding

EDA has been providing some pilot projects successfully with technical assistance to access the ERDF. Awarded projects are listed here: www.eda.europa.eu/ESIFsuccess.

A first pilot project, supported by the EDA, was awarded in February 2014 called 'TURTLE', with €774,000 co-funding (60% of the total project cost). The project was a consortium led by an SME, but also involves a technology laboratory, a school of engineering, and a naval research centre.

The project supported the development of a robotic vehicle for underwater operations with the potential to be used for both civil and defence applications. The aim of this Portuguese civil-military research project, supported by EDA, is to develop sub-systems with the capability of deep-sea long-term presence and specifically to produce new robotic ascend and descend energy efficient technologies to be incorporated in robotic vehicles used by civil and military stakeholders for underwater operations. In the defence sector, the technology will allow underwater unmanned marine systems and robotics to operate at a lower cost and with enhanced capabilities. Looking for underwater mines is one possible use, while other dual-uses include exploration, scientific data gathering and fisheries.

A recent project established using ESIF was in relation to the use of energy and environmental technologies to develop a transferable Autonomous Composting Unit (ACU) for organic wastes to be used in military missions; see http://www.eda.europa.eu/info-hub/press-centre/latest-news/2017/10/05/eda-ensures-eu-funding-for-circular-economy-in-defence

5.7 Summary of EU Funding Opportunities[10]

	European Structural and Investment Funds (ESIF) Access to EDA's support platform See EDA's ESIF success stories			COSME Access to EDA's support platform		Horizon 2020		
	European Regional Development Fund (ERDF[1])	European Territorial Cooperation goal (ETC[2]: CBC / Interreg)	European Social Fund (ESF[3])	Financial instruments[4]	Access to markets	Thematic areas	SME instrument[5]	Financial instruments
Overall Goal	JOB CREATION and COMPETI-TIVENESS	Cross-border / Transnational COOPERATION	HUMAN CAPITAL training and skilling	FINANCING SMEs	SME/Clusters ACCESS to MARKETS	Cross-border RESEARCH and INNOVATION (R&I)	RESEARCH and INNOVATION in SMEs	Access to RISK FINANCE for R&I
WHO (can apply)	SMEs[6], large companies, academia, (other) research institutes, public bodies, consortia	SMEs / large companies, academia, (other) research institutes, training centres, NGOs, other private/public bodies, consortia	Projects from enterprises / companies, academia, (other) research institutes, training centres, NGOs, other private/public bodies, consortia	SMEs (but **EIF restricted sectors**[7])	Clusters / Cluster partnerships	Consortia with minimum 3 participants from 3 different Member States	SMEs	Innovative[8] SMEs, Mid-Caps[9], Large Caps (but **EIB excluded sectors**[10] / **EIF restricted sectors**)
(for) **WHAT**[11]	Productive investment projects in the defence sector. Projects supporting the modernisation of the defence supply chains. Defence and dual-use[12] activities in research and innovation		Projects supporting key skills and competencies in both the defence and dual-use domains	Enterprise expansion and growth[13]	Projects on partnership building / cluster internationalisation	Research and innovation activities with an exclusive focus on civil applications	Research and innovation activities with an exclusive focus on civil applications	Enterprise viability and growth[14]
WHICH (funding tool)	Grants, loans, loan guarantees, equity	Grants, loans	Grants, loans	Loans, loan guarantees, equity	Grants	Grants, prizes, procurement, pre-commercial procurement, public procurement of innovative solutions	Grants	Loans, loan guarantees, equity
WHEN (deployment period)	2014-2020: calls for proposals and/or (continuously) «open window»	2014-2020: calls for proposals[15] and/or (continuously) «open window»	2014-2020: calls for proposals and/or (continuously) «open window»	2014-2020: always open (demand-driven[16])	2014-2020: calls for proposals	2014-2020: (normally) open call for project proposal	2014-2020 (3-4 cut-off dates per year)	2014-2020: always open (demand-driven)
WHERE (to apply)	**Managing Authorities**[17]	**Managing Authorities**	**Managing Authorities**	**Financial Intermediaries**[18]	EASME[19]	**European Commission** and **JUs**[20] (Brussels)	**EASME**	**Financial Intermediaries**
HOW MUCH (per capita)	Up to €50 mn (but also above if EC approves)	Up to €50 mn (but also above if EC approves)	Not defined (call related)	Loans: ≤ €150.000 for all SMEs; above only for "non-innovative" SMEs	Not defined (call related)	Funding range: €1-50 mn	Phase I: €50.000 (lump sum) per project. Phase II: €500.000-2,5 mn[21]	Loans: between €25.000 and €7,5 mn
HOW	Project folder application	Project folder application	Project folder application	No need for projects or business plans[22]	Project folder application	Online application (**Horizon 2020 participant portal**[23])	Online application (**Horizon 2020 participant portal**)	No need for projects or business plans[24]

Figure 13 – Panorama of EU funding opportunities

[10] It should be noted that COSME is not for MODs but for Small and Medium Sized Enterprises, and H2020 is not for defence use.

FINANCIAL CONSIDERATIONS FROM CF SEDSS

5.8 EU Framework

In order to achieve the cumulative end-use energy savings within the EU and from a national perspective, the EED requires MS to set energy efficiency obligation schemes, which involve energy distributors and/ or retail energy sales companies. As an alternative to, or combination with, the energy efficiency obligation schemes, MS may opt to take other policy measures to achieve energy savings among final customers (such as the MODs). The latter measures may include, among others, financing schemes or instruments, or fiscal incentives that will lead to the application of energy–efficient technologies/ techniques, and that will have a positive effect on the end-use energy consumption.

Moreover, every 3 years, starting from April 2014, all MS have to submit to the EC indicative National Energy Efficiency Action Plans (NEEAPs) to enable the Union to meet its energy consumption targets. The NEEAPs shall cover significant energy efficiency improvement measures (including the means to financially support them) and expected/ achieved energy savings and the public bodies that have developed energy efficiency plans shall be included. To that end, MS should consult key stakeholders prior to the development of the NEEAPs.

5.9 EU MODs Current Status

The cooperation between the MODs and the national competent authorities on energy efficiency may vary from close and fruitful (in few cases) to typical or none (in most cases).

In more than half of the cases (12 M-S, 52%), the MODs did not contribute to the consultation on the respective National Energy Efficiency Targets. Moreover, in 11 M-S (48%) the MODs were not invited to the process of establishing alternative policy measures for achieving the respective National Energy Efficiency Target.

The alternative policy measures of the National Energy Efficiency Action Plans do not include any specifically allocated funds for the MODs. Although in most cases the MODs have to achieve the energy targets set for the whole public sector, there is scarcely any extra financial support by the central government and the investment has to be covered by the continuously reduced budgets of the MODs. In more detail, there were only two cases (9% of MS MODs) where MODs benefited by national/ EU funding in order to upgrade energy efficiency in selected camps. However, other areas of the public sector are favoured by individual funding for the promotion of energy efficiency. Under that light, in the near future it is foreseen that there will be no room for substantial improvement with respect to energy upgrades of existing MODs infrastructure.

All MS are very interested on identifying alternative funding sources (national and EU) to support energy efficiency upgrades. Moreover, in many cases technical assistance in managing such processes within the MODs will be required, since there is no previous experience on the subject.

PROCUREMENT

5.10 Procurement process

The role which the procurement process could play should be more clearly defined: for instance, service contracts, including Energy Service Companies (ESCOs), can be used as a mechanism to

access EU funds in a way which could not otherwise be realized through direct application from an MOD. In parallel, the development of procurement standards for energy saving products (e.g., construction materials) and energy efficient consuming products (e.g., electrical and electronic equipment) could usefully be pursued further. Market tested products should be routinely used in defence contracts and a mechanism for adopting standard specifications should be explored as part of this.

SECTION 6: CONCLUSIONS AND RECOMMENDATIONS

Observations for Future Work

The Consultation Forum for Sustainable Energy in the Defence and Security Sector has provided a unique and significant opportunity to increase the momentum on developing a sustainable energy pathway for the defence sector. While other sectors of society may be at a more advanced stage of this journey, through the CF SEDSS, the defence sector has demonstrated its willingness to engage in tackling tough challenges and produce solutions to its advantage, which will also contribute to the overall and greater objective of the decarbonisation of the EU economy by 2050. Although progress on improving energy performance is evident, it can be concluded that the CF SEDSS initiative has highlighted that more can be done across the sector and that there are specific bottlenecks for the defence sector that need to be tackled.

As such, there is a strong business case for the Consultation Forum to continue its work. EDA welcomes the opportunity to continue to work with the European Commission on a further phase of the Consultation Forum and facilitate the expanding needs of the comprehensive network of stakeholders which has been a product of this initiative.

To further support a continuation of the CF SEDSS, it would be useful to take account of some lessons learned, stakeholder observations, and proposals regarding format and organization which included:

A. Format and organisational aspects

- The balance between the number, duration, and format of meetings of CF SEDSS was correct;
- An enhanced level of stakeholder engagement with participants (for instance, through questionnaires or sharing of other documentation) in between meetings which could facilitate stakeholder-led research and preparation of the meeting;
- A request for a broadening of stakeholder engagement to include:
  - other government departments, specifically Ministries of Energy, Industry, or Economy and Tax Revenue representatives;
  - other National and EU relevant Authorities;
  - Institutions key to Defence; and,
  - Industry and other suppliers.
- Collaboration between WG1 (Energy Management) and WG2 (Energy Efficiency) may help tap and leverage on each WG's outcomes and results;
- Consideration of alternative structures to the CF SEDSS Working Groups: rather than the present model of Energy Management, Energy Efficiency and Renewable Energy Sources, there could be structures around high-level policies and methodologies; project identification, development and implementation, and financing.

B. Proposed topics

- Empowering MODs to identify, develop and implement collaborative projects through the exploration and provision of knowledge and training on financial tools and mechanisms. Rather than being on financial support to specific projects, this would assist with the identification of suitable financial instruments and a greater understanding of how such mechanisms work in practice;
- Striving towards the identification of tools and instruments that would help Member States / Ministries of Defence to develop tangible projects which are linked to objectives of the relevant energy directives.

- Financing of Defence Energy Projects through the new European Defence Research Programme, or through the next EU Multiannual Financial Framework (MFF) 2021-2027;
- Further exploration of financing dual use defence energy projects through EU Structural Funds;
- Interpretation of and compliance with Public Sector Procurement rules where this is justified and applicable;
- Capacity building towards the development and implementation of: Energy Performance Contracting; Energy Management Systems, including appropriate Energy Performance Indicators; setting energy targets, energy monitoring and modelling which could incorporate exploring the scope for defining separate targets for energy consumption (owing to lower use) and for energy efficiency (owing to more efficiency);
- Through-life cost approaches regarding specific issues such as technical building systems;
- Using evidence to build energy considerations in to budget cycle planning in public administrations;
- Development of energy policies and strategies at a high level in MOD/Armed Forces organizations.

C. Reflections

- The wide disparity in Renewable Energy Sources (RES) RES approaches across EU MS demonstrates a need for greater sharing of information in this field. There is a need to examine how RES can contribute to a lowering of the carbon footprint of the defence and security sector as well as for a closer focus on the obstacles to major RES projects and how these might be overcome (e.g., planning constraints, excess production, storage and coordination with other public bodies and the private sector). Building the business case for RES and technologies, together with their integration within defence infrastructure management activities should also be a main factor to be addressed.

- A second phase of the Consultation Forum should be developed in a way which, both, identifies specific bottlenecks of the defence sector and offers possible solutions to address them and anticipates future needs by balancing defined stakeholder requirements with the joint leadership of the EDA and DG Energy. Specific concepts could be factored in any agreements upfront while recognizing the need to be flexible with the content as the second phase matures. In this way concepts could be discounted should these be determined to have limited scope for improving a sustainable energy future for the defence sector, and those which show the greatest potential could be developed further including any which were neither articulated nor known during the initiation of the second phase.

Recommendations

As the future direction is developed, it is important to keep in sight that the aim of the MODs/ Armed Forces is to preserve the sovereignty of their countries. Therefore, what is done on energy should contribute to maintaining military capability in a safety driven way. While energy efficiency and the use of renewable energy is not a primary defence objective, it can serve as a capability multiplier. In relation to this, there was also an explicit view from MODs that the existing defence exemptions within the EU legal framework on energy efficiency may have to be maintained.

MODs can play a leading role within the public sector on the energy improvements, provided that relevant funds are secured and that this is accompanied by a strong political will. MS MOD experts agreed that energy improvements will lead to reduced cost risks and to improvement of capability development and delivery. Also, the military expectations included that sustainable energy

transition will lead to cost-control though technologies and behavioural change, to reduced vulnerability, and reduced environmental impact.

Within the above context the following recommendations are being put forward:

a) **MS MODs/ Armed Forces** should proceed with implementing the following actions, without any compromise to military operational objectives and capabilities:

   i. Develop, promulgate and support through relevant resources (human and economic) an Energy Policy and an Energy Strategy, to initiate and sustain action plans for a more energy efficient, and less fossil fuel-dependent and consuming, defence sector with a greater diversity of energy sources;

   ii. Engage more with industry in terms of Research and Technology for the provision of sustainable and energy efficient solutions, either by the incorporation of off-the-shelf products to the military environment or by the development of tailor-made, new products;

   iii. Develop and implement Energy Management Systems or Environmental Management Systems, which should include energy as one of the significant environmental aspects, to pursue the continual improvement of energy performance in a way which benefits military capabilities;

   iv. Establish a mechanism to gather and analyse energy data systematically to:

      - Forecast energy consumption for budgetary purposes (billing and planning);
      - Plan more accurately new interventions to address future energy trends;
      - Launch action plans for increasing energy efficiency and reducing fossil fuel consumption/ costs while supporting or even enhancing the military operational capabilities and requirements.

   v. Trigger human factors which are related to energy efficiency improvement and renewable energy sources, and technologies penetration focused on building commitment, raising awareness, nurturing motivation, maintaining internal and external communication, and providing appropriate training. This is important to help gain commitment at a high level to invest in energy efficiency and renewable energy;

   vi. Create new and/ or amend existing procurement procedures and practice to enable the selection of energy efficient and renewable energy products/ equipment, services and buildings in accordance with relevant EU and national legal frameworks, but not to the detriment of military operational capabilities;

   vii. Explore further the feasibility of the EPC funding mechanism, taking into account the specificities of the defence sector.

b) **MS national Competent Authorities on Energy should:**

   i. Remove the barriers that exist in some MS with respect to the involvement of civil servants (MOD personnel included) in energy auditing schemes and at the same time strengthen the procedures that safeguard impartiality;

   ii. Include competent MOD personnel in the national training schemes on energy auditing;

   iii. Not discriminate against MODs when funding for energy efficiency, and ensure renewable energy upgrades are available for the public sector (through the National Energy Efficiency Action Plans, the European Structural and Investment Funds (ESIF) as

well as other funding mechanisms), to enable MODs to contribute to national energy efficiency and renewable energy source targets.

c) The European Commission and the MS national central governments should:

i. provide guidance to the national Competent Authorities on Energy to acknowledge the defence sector as a significant stakeholder in terms of energy usage and to enable MODs to gain access to national funding and technical assistance;

ii. Assist EDA and MODs in capacity building and realization of projects related with energy efficiency;

iii. Look for synergies with other energy efficiency-related EC activities and bring relevant communities together to exchange good practices.

d) EDA should:

i. Promote further cooperation in the regime of energy efficiency;

ii. Act as an interface towards EC on energy efficiency (framework, funding instruments, etc.);

iii. Provide capacity building on energy efficiency.

CLOSING STATEMENT

The first phase of the Consultation Forum succeeded to establish the European Defence Energy Network, something which did not previously exist. This has enabled the defence sector to analyse collectively the challenges and opportunities of moving towards a sustainable energy future, including the benefit of applying energy legislation to defence infrastructure capabilities and the challenge of integrating energy into business cases for investment decisions.

The second phase of the work will evidently build on what has been accomplished during the first phase and will foster action and results focused on a greater emphasis on implementation. This should include the identification of tangible defence energy projects and how to identify and deploy the appropriate available funding instruments which are available. In this challenging endeavour it is critical to ensure that all involved actors realise that they are key stakeholders and catalytic to the effort of taking this successful outcome to the next level.

The Continuation of the Consultation Forum for Sustainable energy in the Defence and Security Sector presents the defence sector with an economic and strategic opportunity in an area of work which continues to grow in importance, while mobilising an important sector which can significantly contribute to the objectives towards the establishment of an Energy Union.

List of Abbreviations

CBRN	Chemical, Biological, Radiological and Nuclear
CF	Consultation Forum
CHP	Combined Heat and Power
DG	Director General
EC	European Commission
ECI	European Critical Infrastructure
EDA	European Defence Agency
EDEN	European Defence Energy Network
EED	Energy Efficiency Directive
EEEF	European Energy Efficiency Fund
EIB	European Investment Bank
ELENA	European Local Energy Assistance
EMS	Environmental Management Systems
EPBD	Energy Efficiency Directive
EPC	Energy Performance Contracting
ESA	European Space Agency
ESCOs	Energy Service Companies
ESIF	European Structural and Investment Funds
EU	European Union
ICT	Information and Communication Technology
MOD	Ministries of Defence
MS	Member States
NATO	North Atlantic Treaty Organization
NZEB	Nearly Zero Energy Buildings
PCEI	Protection of Critical Energy Infrastructure
pMS	Participating Member States
RED	Renewable Energy Directive
RES	Renewable Energy Sources
SEDSS	Sustainable Energy in the Defence and Security Sector