EUROPEAN DEFENCE AGENCY

Military Green 2013

Climate, Environmental and Energy Security – From Strategy to Action

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Keeping the Momentum Going

The anticipated follow-up to Military Green 2012 has taken on a different form altogether. Last year's bash formed part of the Commission's Sustainable Energy Week gathering hundred and fifty attendants with the aim to raise awareness on the bigger picture of climate, environment and energy while exhibiting and demonstrating technological opportunities to reduce the footprint. The low key 2013 edition looks instead to develop roadmaps to deliver tangible results drawing on civil-military synergies.

Addressing energy and environment is essential to sustaining defence and crisis management capabilities. Recent operations have clearly shown that energy supply in theatre is an Achilles' heal. Time and again adversaries have targeted fuel convoys, compromising the operational effectiveness and causing unnecessary loss of life. Furthermore sustainable development as over the years worked its way into defence and crisis management such that minimising the environmental footprint is seen as a key

Following a strategic Government-only meeting earlier this year a number of areas were identified as quick wins, requiring little or moderate efforts. To launch the harvesting of these low hanging fruit it was decided to launch a set of expert workshops to identify challenges, opportunities and a viable collaborative way forward. The subsequent topics that have been covered are:

- Climate change and loss biodiversity as threat-multipliers to international security
- Increasing awareness on the impact of the EU directives
- Exploring new business models that make it attractive for all stakeholders (supplier, buyer, user and environment) to reduce the footprint
- Catalysing the introduction of alternative fuels
- Integrating novel alternative and renewable energy supply technologies for land installations

The target audience for Military Green 2013 has been experts in these different areas. In order to create a workable environment and facilitate discussions, the Workshop Series was intentionally aimed to keep the audience small. Invitations were therefore initially sent to a select crowd of Government and Institutional experts. The doors were then opened to industry and the general public depending on availability of seats. The small work workshop approach has proved to be successful in that has created an open and creative atmosphere drawing on the strengths of individuals with diverse yet complementary profiles.

This report represents a synthesis of the discussions that have taken place – not an accurate word-by-word account – that has been fused with open source information.

A Lifesaver

Reducing the footprint is a lifesaver. Minimising fossil fuel consumption reduces number of casualties on account of there being fewer fuel convoys for adversaries to target, freeing up resources that are used for protecting the convoys.

Overall capabilities are made more effective through enhanced endurance, mobility and autonomy. Also it cuts costs and decreases emissions both in theatre and at home while preparing for operations.

Bringing on board the environmental parameters and implementing through-life approach allows for comprehensively reducing the footprint over time.

Adding the big picture and looking at how changes to climate, biodiversity and energy affects international security, provides the means of developing capabilities to mitigate adversities.

The Story so Far

Collaborative work on energy dates back to the late 90's within the defence and crisis management community. The bottom-up approach revolved mainly around R&T and in Europe this took place in the former Western European Armament Group (WEAG) and its Common European Priority Areas (CEPA), primarily CEPA 16 on Electrical Engineering. Efforts looked at All Electric Ships, All Electric Vehicles and More Electric Aircrafts with the aim of introducing more energy distribution by electrical means so as to make the energy available to all consumers on board, thus increasing energy efficiency.

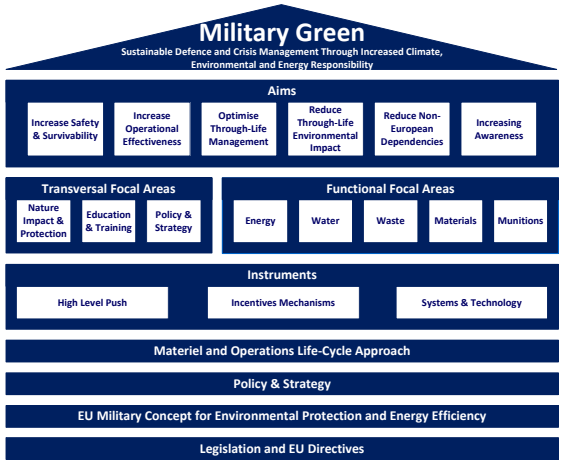
Within EDA early efforts focused on Fuel Cells as part of the Joint R&T Effort on Fuel Cells in an attempt to explore EU-wide cooperation together with European Commission and ESA. The result was a consolidation on military requirements for Fuel Cells as well as a first attempt at a joint roadmap.

Subsequent EDA efforts undertook a more holistic approach providing a framework for climate, energy and environment.

In parallel with early EDA efforts the Council of the European Union was tackling climate change in the context of international security, which resulted in a report by the former High Representative Javier Solana.

More than Just a Colour

Building on legislation and EU directives, Military Green further capitalises on EU Military Concept for Environmental Protection and Energy Efficiency. The Concept defines the principles and responsibilities to meet the requirements of Environmental Protection during EU-led military operations.

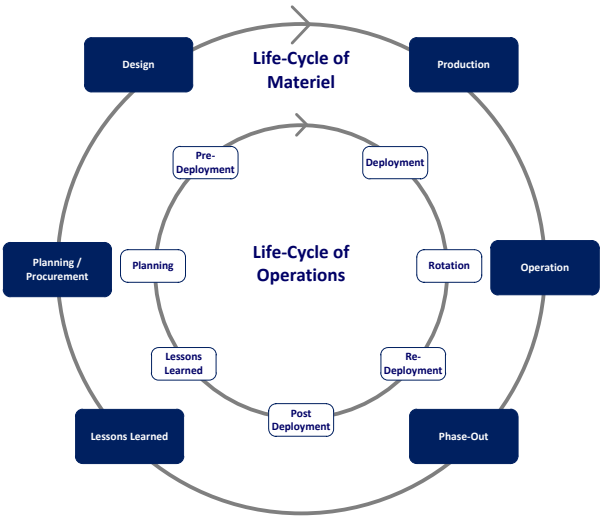


An illustration of the comprehensive approach

Military Green aims at reducing through-life costs and environmental impact while saving lives and increasing operational effectiveness. Three instruments are critical to achieving these aims.

- Getting buy-in from high level decision makers drives change
- Making it attractive to go for greener solutions for all stakeholders involved (end-user, buyer, supplier and environment) helps opting for change

- Changing behavioural patterns as well as introducing novel technologies alongside conventional ones enables implementing change



The long-term materiel life-cycle and the more urgent operations life-cycle

Adopting a lifecycle approach enables better understanding what measures need to be taken in the different phases in order to reduce the footprint both in the case of the urgent-natured operations lifecycle and long-term materiel lifecycle. Good planning can significantly reduce the footprint.

Optimisation of energy, water and waste management are current focal areas of Military Green together with catalysing developments of more eco-friendly materials and munitions. Enablers include transversal issues such as understanding the impact on climate and ecology, increasing general awareness among stakeholders and establishing tailored green policies and strategies.

Military Green offers further **the unique opportunity to go beyond just reducing the own footprint by contributing to long term stability and sustainable development in post-crisis zones**, putting mechanisms in place for transferring European values, policies and technologies.

Climate change in the context of international security

In addition, **Military Green supports capability development for climate driven crisis** by adopting a scenario-based approach.

Challenges and Opportunities

Energy and Environment is transverse and this is reflected in the national defence budgets. Funding is typically tied to armaments programmes dedicated to specific systems or to research programmes that look at a particular technology. With little or no funding ear-marked for climate, environment and energy in itself, it is difficult to address it holistically, especially at European level.

There are a number of efforts running within EDA addressing Energy and Environment. However, judging by the interest shown by Member States the volume of collaborative projects could be higher. A seemingly big hurdle to overcome is the mismatch between the scopes associated with Member State's potential funding contributions. With the funding contribution tied to a national armaments or research programmes it is sometimes difficult to alter the scope. In extreme cases it can be down to subtle differences in a type or size of technology that hinders collaboration. Overcoming this would result in an immense boost to Energy and Environment.

Establishing a climate, environment and energy strategy at European level tailored for the defence and crisis management community would help overcoming the above hurdles.

- It helps establish a European baseline for how to tackle energy and environment from a defence and crisis management perspective
- It further helps shape policy so that the community can contribute proactively to sustainable development
- It also helps shape policy that mitigates risks to international security on account of change to climate and biodiversity
- It helps **reap the fruit of the civilian momentum while steering defence investment**s specifically to areas not covered by civilian efforts
- It acts as a catalyst for increasing collaboration between Member States

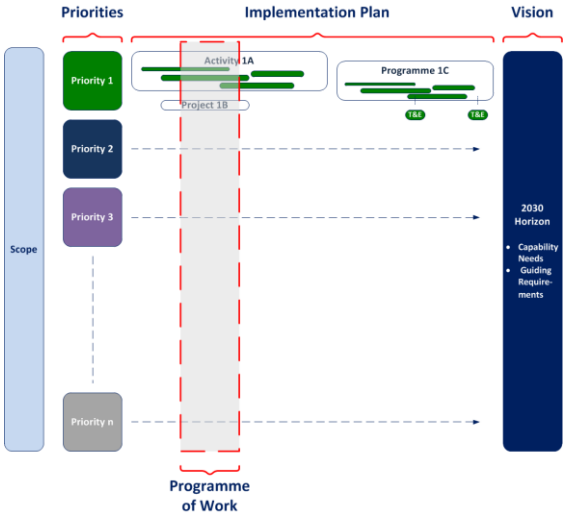
Strategy Development

In progress since autumn of 2012, the development of a comprehensive strategy has taken on an iterative process. Circulated informally to stakeholders during autumn last year, the draft was finally disseminated through the formal channels in early 2013 with the aim of fine-tuning it.

The first Military Green Coordinating Body Meeting was held on 14 February 2013. A predominantly Government-only forum, the meeting was dedicated to getting all stakeholders on the same page, revise the draft strategy and define a short term action plan. Subsequently the draft strategy was subject to one of the Military Green 2013 workshop sessions.

The draft strategy consists of three parts:

- The Vision & Strategy acts as the **compass**
- The Priorities & Implementation Plan provides the **map**
- The Programme of Work ensures the **pace**



The structure of the strategy

The Vision & Strategy document is the most static of the three inasmuch as it deals with the long term aspirations. It rests on a simple but solid vision statement.

> *"Military Green will act as a European driver for effective and sustainable defence and crisis management through proactively increasing energy and environmental responsibility."*
>
> *Military Green – Vision and Strategy*

The proposed Priorities are three.

- Enhance capabilities by reducing the footprint through-out the lifecycles
- Develop capabilities for countering adverse effects to international security pertaining to changes to climate and biodiversity
- Establishing a Knowledgebase

Within each there are a number of sub-priorities along with high level roadmaps for how to get there – the Implementation Plan.

The Programme of Work is divided into two categories, recurring activities and task specific ones.

The overall conclusion of the workshop session is that there is a need for establishing a strategy at European level endorsed by senior decision makers. The current incarnation of the strategy is robust and merely requires tweaking to get it right. It is envisaged that the Vision & Strategy will be the first of the three to be finalised, while seeking high level endorsement. The Priorities & Implementation Plan and Programme of Work will be developed further within the Coordinating Body itself. In this context the Coordinating Body will need to define its role more clearly.

Recommendations:

- To refine the Vision & Strategy with an eye at submitting to senior decision makers for endorsement by end of 2013, preferably as part of the European Council Conclusions
- To develop the Priorities & Implementation Plan further so that they clearly reflect stakeholder interests
- To turn the draft Programme of Work into a robust and usable tool while ensuring that each work stream has a sponsor and critical mass of interested stakeholders

Climate Driven Crisis

Centuries of human exploitation of the earth's resources have stretched its resilience to the limit. The global consensus that this is not sustainable has in recent decades resulted in the adoption of international policies and strategies. For Europe this has translated into a vision for achieving growth in a resource efficient Europe with a low carbon economy. Increasing energy efficiency, reducing consumption and reducing emissions of greenhouse gasses are vital. The same applies to mitigating the loss of biodiversity in order to ensure the quality of essentials such as water, air and soil.

What if we do nothing? Climate change is happening now. We are experiencing an increase in average temperatures. In some regions it is likely to raise sea levels causing floods. In others it may result in water scarcity and drought. Continuing to pollute air, soil and water can impair life-support including the capability of producing food. As highlighted in the European Security Strategy all of these aspects put international security at risk.

The **European defence and crisis management community therefore has a responsibility to reduce its contribution to climate change**, i.e. its footprint. It has also a responsibility for ensuring a **high level of preparedness to mitigate hazardous effects of climate change in progress**. For the latter it is important to thoroughly understand what the potential implications are and where they may occur, this in order to define capabilities and identify current and future gaps that will require attention.

Generic Trends and Consequences

Future trends in this realm, as taken from EDA's report on the Future Global Context, can be summarised as follows:

- Driven by growth in emissions over the last two-hundred years climate change, if it continues in the same rate will have significant effects over the next twenty-five years
- Freshwater will see increased scarcity and as such will become a strategic asset in geographical regions with limited surplus
- Energy demand will increase and access to it will become of geostrategic relevance not only in already dependent markets such as Europe but also in emerging economies such as China, Brazil, Indonesia and India. Fossil fuel use in these countries will remain important for years to come, but alternative, especially renewable, energy supplies will increasingly have to meet growing energy demand, not only for climate reasons, but also as fossil fuel reserves diminish over the course of the century. Improving energy efficiency will become an increasing priority in all parts of the world and for all sectors of the economy, including in the military and crisis management communities and this, combined with increasing reliance on renewables, will require new technologies, including, among other things, smart grids and devolved renewable power supplies in developing countries.
- Global food demand will increase, which is likely to drive prices up. Climate change will affect availability of natural resources, including food supply, which will also contribute to higher prices.

The generic consequences can be summarised as:

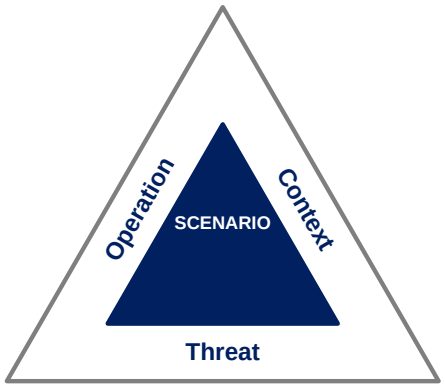
- Increasing conflict over resources (energy, food and water)
- Economic damage (e.g. hurricane Sandy affected not only domestic lives but also industry)
- Risk to coastal habitation and infrastructure (floods and sea level rise)
- Loss of territory and border disputes
- Increased environmentally-induced migration
- Further weakening of already vulnerable states leading increased to radicalisation (e.g. Somalia and Mali)
- Tension over energy supply and security (e.g. Algeria, Somalia and the pirates of West Africa)
- The loss or weakening of international governance structures

Developing scenarios is a powerful first step in this process of identifying capability needs hence a workshop session was dedicated to this.

It is said that a picture says more than a thousand words. While a scenario may not come close its essence is the same in this context. It helps convey the nature of a situation that may arise with all its intricacies. In doing so it further acts as the interface between the different stakeholders, thus acting as a common baseline to work from.

One way of describing a scenario is in three parameters. The threat, which in this case is implications of change to climate and loss of biodiversity, sets the scene. The context provides information on the whereabouts of where the threat may be faced. From these two parameters the Operation is defined, and in a European context these are associated with the Common Security and Defence Policy.

The Workshop established ten generic scenarios, which for the most part emphasising different geographical regions.



Scenario = Threat x Context x Operation

Scenario parameters

Africa

Overall there is a risk of a combination of drought, water scarcity, land overuse and floods. A vast continent, examples of what may happen include:

- A flooded Nile Delta due to rising sea levels
- Reduced rainfall in Horn of Africa
- Extremes and drought in southern Africa

This is likely to be combined with asymmetric insurgency (including drug trafficking). Furthermore

Specific consequences could be

- Poor harvests, food insecurity and shortages
- Intensified migration to through within Africa as well as to Europe including environmentally-induced migration
- Health decline due to spreading of vector-borne diseases
- Compromised European energy security (especially if dependent on Saharan solar energy)

Middle East

Water scarcity is the major threat in an already conflict prone region, which today is a highly dependent on external supply. It is expected that the flows of the Yarmuk and Jordan rivers will reduce.

Specific consequences are

- Water shortage
- Drop in crop yields
- Induced instability (e.g. Egypt and Sudan, Turkey, Syria and Iraq)
- Implications on Europe's energy security (fossil fuel supply chain, e.g. passing through the Suez Canal)

South Asia

Water stress is the main challenge and is expected to cause rising sea levels, changes to monsoon rain patterns as well as decreased melt water from the Himalayas.

Specific consequences are:

- Loss of agricultural productivity and subsequent food shortages (e.g. the floods in Pakistan)

- Spread of diseases
- Loss of coastal habitations (notably Bangladesh and the Gulf of Bengal)
- European economic partnerships may suffer and the EU could eventually be drawn in to regional conflicts

Central Asia

As with South Asia water stress is the main challenge associated with shortages in certain regions and flooding due the melting of glaciers.

Specific consequences are

- Impaired agricultural activity
- Impaired electricity supply
- Instability
- Context

Central America and Caribbean

Central America and the Caribbean are expected to face:

- Salinization and desertification
- Sea level rise and flooding of low-lying areas
- El Nino
- Changes in rainfall patterns
- Increased surface temperature and acidification of the sea
- Melting glaciers in the Andes
- Intensification of hurricane activity

Specific consequences are

- Social and political tensions
- Food and water shortage
- Natural disasters
- Context

Arctic

The major threat to the Arctic is the melting of polar ice caps. The Greenland glacier plays a particularly important role, one that may well be compromised already.

Specific consequences are:

- Jet Stream is already being affected, which has a direct impact on Europe
- Freshwater balance disturbed
- Opening of new water ways
- Access to hydrocarbons
- Geo-strategic dynamics will change affecting European Security interests

Geo-Engineering Backfired A – Carbon Dioxide Removal

The threat here revolves around carbon dioxide removal systems that malfunction. Failure in carbon capture systems can impair soil. Ocean fertilization gone wrong can lead to acidification. Enhance disintegration techniques can also impair soil.

Specific consequences are food shortages.

Geo-Engineering Backfired B – Global Cooling

The overall threats associated with attempting to cool the world can be summarized as follows:

- Systems end up in the hands of adversaries

- Reflector systems – system failure will lead to abrupt temperature increases
- Enhanced Albedo – unexpected genetic effects to plants and impaired marine ecosystems due to cloud whitening
- Aerosol Injection – unevenly distributed

Specific consequences are:

- Long term implications of attempting to cool the globe are still unknown
- These systems can be used as weapons in the hands of a capable adversary

Generic Capabilities

A general analsysis of the scenarios described above reveals the need for a combination of civil and military capabilities.

Unlike most political and religious conflicts, climate driven crises can be predicted years, even decades in advance and thus the scenarios can serve to estimate the specific capabilities and capacities that will be needed well in advance of the lead-times necessary for their development.

Preventive Capabilities

The most effective way of countering any type of threat is to prevent it from happening or preventing the subsequent hazardous affects.

- **Network Enabled Early Warning** implies getting actionable intelligence from a number of different complementary sources inter-connected while embedding a suitable discrimination processing that allows for decision makers to better understand the potential severity of a threat's consequences. In practice it is less academic than it sounds. In fact what it boils down to is the following:
    - Sharing and acting on information exchanged across borders, between institutions and with third parties at a global scale
    - Creating within the EU appropriate institutionalised structures to support the decision making process
    - Enhancing existing monitoring sensor networks and analysis centres across the globe
    - Developing systems associated with sensors and information processing in preparation for the future with enhanced predicting abilities
- **Mediation and Negotiation** implies the capability of dialogue to avoid conflicts emanating from climate driven tension between stakeholders:
    - Establishing a formal and mandated function within the EU institution structures to be the focal point for Climate, Environment and Energy to work both inside and outside the EU
    - Developing international dialogue mechanisms for stakeholders with a vested interest in a particular geographical region, like for instance the Arctic

- **Infrastructure Development Support** looks at providing geographical regions at risk with engineering type services for :
    - Establishing adequate management infrastructure to tackle for instance rising sea levels, e.g. building protective barriers, establishing evacuation management systems and ensuring robust information and communication systems
    - Strengthening energy, water and food supply infrastructures in regions where shortages are otherwise likely
- **Education and Training** implies equipping local governance with a strong Knowledge, Skills and Competence base

Reactive Capabilities

Reactive capabilities are the most visible. In many cases they are the most well-established and straight forward. They tend to become operational once a crisis occurs hence the inherent reactive nature.

- **Support to local governance** to ensure peace, security and enforcement of law
- **Security and military support** in conflict zones (e.g. as the EU has already provided in the Congo) – in extreme cases, military intervention, as in Mali and off the coast of Somalia
- **Reconstruction** of critical infrastructures
- **Evacuation** from immediate danger
- **Refugee Management** in theatre and at home

Enabling Capabilities

Enabling capabilities are those that facilitate the use of both preventive and reactive capabilities.

- **EU Climate, Environment and Energy Security Policy** needs to be developed to allow for both the preventive and reactive capabilities to operate more effectively
- **Education and Training** to embed an institutionalised culture of taking climate, environment and energy security seriously with a clear awareness of the implications of doing nothing
- **EU Values and Policies** export as an inherent part of post conflict reconstruction
- **Stakeholder Forums** to ensure that all stakeholders, civil and military, are on board at an early stage
- **Global Geo-Engineering Governance** to ensure that Geo-Engineering if implemented will not backfire.

Recommendations:

- To perform a thorough risk assessment for the different parts of the world
- To better understand geopolitics and socio-religious conflict drivers
- To perform analysis of the cost of not acting
- To develop proposals how EU institutional infrastructures can be explored
- To develop proposals for how the

Treaty's article 41.3 – Start-Up Fund – can be exploited for "preparatory activities"

- To strengthen international cooperation within and outside of the EU
- To develop proposals on how the EU institutional infrastructures can be improved, notably in terms of long-term (beyond five years) planning

EU Directives

The EU Directives are binding and the days defence exemptions are running out. Thus the defence and crisis management community need to understand the implications of the Directives. Furthermore the community needs to understand the associated obligations as well as any opportunities for being proactive.

During the February meeting, increasing awareness on this topic was identified as a priority and a quick-win, the rationale being that the Directives are fairly new and therefore the awareness of them are still limited but growing. As it turned out, although one session was dedicated to the Directives, several of the sessions ended up touching on them.

The Commission's DG Energy kindly came and briefed on the Energy Efficiency Directive (EED). Adopted in October 2012, the Directive 2012/27/EU on Energy Efficiency sets the framework for promoting measures for increasing energy efficiency within the EU 2020 20 % headline target while paving the way for the future.

A comprehensive approach, the Directive tackles:

- **Legal obligation to establish energy saving schemes in all Member States:** The energy retail and distribution industry is obliged to save 1,5 % per year of their sales by volume. This has to be achieved through implementing energy efficiency enhancing measures, passive or active. Energy saving mechanisms can as an alternative be introduced by Member States in the form of funding or voluntary agreements to achieve the same results.
- **Public sector to lead by example:** Practice what you preach – the public sector has a legal obligation to purchase efficient buildings, products and service. Thereby increasing the market uptake of these sorts of products while at the same time reducing consumption through renovation works covering at least 3 % of the total floor area.
- **Major energy savings for consumers:** Recording of energy consumption data through individual metering will allow consumers to manage their consumption patterns better. Access free of charge to past and present (real-time) data is a key enabler as is the billing mechanism, which should reflect the data from the metering.
- **Industry:** Incentivise energy audits among big and small companies with the aim of identifying measures to reduce consumption.

- **Efficiency in energy generation:** Monitoring energy efficiency in the generation process while establishing national plans for heating and cooling that incorporate waste heat recovery

- **Energy transmission and distribution:** Ensuring that national energy regulators take energy efficiency into account in their decision-making process contributes to increasing energy efficiency

So what does this actually mean for defence? Looking at the Energy Efficiency Directive's article 6.2, the following paragraphs provide more details.

1. Member States shall ensure that central governments purchase only products, services and buildings with high energy-efficiency performance, insofar as that is consistent with cost-effectiveness, economical feasibility, wider sustainability, technical suitability, as well as sufficient competition, as referred to in Annex III.

The obligation set out in the first subparagraph shall apply to contracts for the purchase of products, services and buildings by public bodies in so far as such contracts have a value equal to or greater than the thresholds laid down in Article 7 of Directive 2004/18/EC.

2. The obligation referred to in paragraph 1 shall apply to the contracts of the armed forces ***only to the extent that its application does not cause any conflict with the nature and primary aim of the activities of the armed forces****. The obligation shall not apply to contracts for the supply of military equipment as defined by Directive 2009/81/EC of the European Parliament and of the Council of 13 July 2009 on the coordination of procedures for the award of certain works contracts, supply contracts and service contracts by contracting authorities or entities in the fields of defence and security.*

Directive 2012/27/EU on Energy Efficiency

In practice it means that for mission critical systems the directive does not apply. However, for many applications it does apply, especially at home.

Another Directive of high relevance in this context is the Green Public Procurement Directive

Green Public Procurement (GPP) is a process whereby public authorities seek to procure goods, services and works with a reduced environmental impact throughout their life cycle when compared to goods, services and works with the same primary function that would otherwise be procured.

COM (2008) 400 Public Procurement for a Better Environment

The GPP aims at using the trillion-Euro public sector leverage to make a contribution to sustainable development. It also acts as an instrument to influence the market in a green way.

Benefits

- *Political*
    - *GPP is an effective way to demonstrate a public authority's commitment to environmental protection and sustainable consumption and production.*

- *Environmental*
    - *GPP allows public authorities to achieve environmental targets*
    - *GPP sets an example to private consumers*
    - *GPP raises awareness of environmental issues*
- *Social / Health*
    - *GPP can improve quality of life both directly and indirectly*
    - *GPP helps establish high environmental performance standards for products and services*
    - *GPP provides incentives for*
    - *industry to innovate*
    - *GPP promotes green products and environmental technologies*
    - *GPP saves money when the lifecycle cost of products is considered*

Green Public Procurement, ISBN-13 978-92-79-19456-6 Catalogue number KH-32-11-670-EN-C

The GPP adopts a life-cycle approach to ensuring clear cut criteria for products, services and works.

The GPP is implemented through National Action Plans.

Other Directives that are relevant include:

- Energy Performance of Buildings Directive
- Eco-Design and Energy Labeling Directive
- Energy Saving Directive

Making Ministries of Defence and their associated agencies aware of the Directives and their implications in a European setting could:

- Enable Ministries to act proactively towards the goals at an early stage
- Open opportunities for pooling and sharing at European level where the defence and crisis management community can take technology leadership that will have spill-overs to the civilian domain

Recommendations:

- To strengthen the ties with the European Commission in particular with regard to the implications and implementation of the Directives and continue to convey this to Member States
- To support strengthening of national coordination between Government bodies
- To monitor implementation progress in within Ministries of Defence

This Means Business

Go Green

Creating a win-win situation for all stakeholders to opt for responsible solutions is essential, especially in a domain like defence and crisis management where climate, energy and environment are not necessarily core business. Money talks as is evident from the Go Green project that is in

the process of being launched within the EDA framework.

The project is a pilot for a new type of business model where Member States pool their rooftops and surplus land through the EDA and offer it to the market in the context of solar energy supply. Bidders compete to put together the best through-life management offers while relieving Member States of the investment burden. Seven Member States under the sun have thus joined this project, which not only enhances self-sufficiency but also increases the presence of green energy on the grid.

EU Incentives Mechanisms

From a European perspective the beauty of it all is that incentives creation is foreseen in several EU Directives including the Energy Efficiency Directive (EED).

While defence' eligibility to access to structural funds is complex in most cases, the EED is an open door to many new opportunities to contribute to sustainable development.

Cohesion Policy Funds (2007-2013):

- *5,4 billion € for energy efficiency (up to 8 billion € if all MS re-allocate 4% for housing under ERDF)*

Intelligent Energy Europe Programme (2007-2013):

- *735 million € for 'soft' energy efficiency/renewables projects*
- *Capacity building, awareness raising, best practices sharing*

European Local Energy Assistance Facility (ELENA):

- *97 million € for technical assistance to mobilise investments*
- *To scale up projects and reduce transaction costs and support Project development phases*

European Energy Efficiency Fund (EEE-F):

- *265 million € for investments into mature, bankable efficiency/renewables projects*
- *20 million € for technical assistance*
- *Role model projects, leverage effect, EPC support…*

European Commission, DG Energy

Of particular interest to the defence is the European Local Energy Assistance (ELENA). The implementation of large energy efficiency enhancing projects struggle many times due to lack of know-how. ELENA therefore provides technical assistance in structuring programmes, developing business plans, energy audits and supporting the tendering process. EU Member States, Norway, Lichtenstein, Iceland, Croatia and Norway can use ELENA. Defence being part of the Public Sector is therefore eligible.

Also of interest for more mature projects is the European Energy Efficiency Fund (EEE-F). A public-private partnership, it is dedicated to energy efficiency, renewables and urban transport. It targets authorities at all levels, from municipal to regional, as well as any public and private entities acting on their behalf.

In addition there is the Energy Performance Contracting methodology to increase energy performance at a lower risk.

Energy Performance Contracting (EPC) is a form of 'creative financing' for capital improvement which allows funding energy upgrades from cost reductions. Under an

EPC arrangement an external organisation (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.

European Commission, Joint Research Centre, Institute for Energy and Transport

The Energy Performance Contracting scheme is directly applicable to defence and something that should be used increasingly.

With most suppliers of responsible products targeting the civilian market there is a need to develop incentives to make the defence and crisis management market more attractive.

Recommendations:

- To increase awareness in Ministries of Defence on the EED mechanisms for financial support to energy efficiency enhancing projects
- To encourage Ministries of Defence to identify potential pilots that can draw on the ELENA and EEE-F and explore if these pilots can be exploited in a collaborative setting
- To encourage Ministries of Defence to take part in the Energy Performance Contracting Campaign
- To exploit Energy Performance Contracting both at home and in theatre
- To develop incentives for civilian suppliers of responsible technologies to tailor their products for defence and crisis management

Shaking that Fossil Fuel Addiction

Fuel Dependencies

As part of the Military Green effort EDA launched a study in 2012 to address the dependency on fossil fuels in operations. The study, now concluded, sheds light over the actual consumption and proposes concrete measures to increase energy efficiency and in doing so reduce the overall fuel consumption.

Using fossil fuels comes with an addiction that is hard to shake and we rely on them heavily to get through the day. Diesel and petrol power our cars and busses while coal and oil help us keep warm in the winter and cool in the summer. The latter types of fuels also help power the metro systems and the overhead railway lines to take us longer distances. To take us really long distances kerosene is what propels us all the way up into the Jetstream.

The defence domain is no less susceptible. On the contrary, over the years the dependency has grown and although it mainly concerns logistic fuels, they are nonetheless fossil. But as shown by this Workshop there is room for change and improvements can be made today, some aided by technology others through spreading awareness.

Contracted to Spanish company ISDEFE, the study with the acronym Fuel-D provides a statistical picture of overall energy consumption in operations as well as specific data associated with selected camps in theatre. The statistics have been analysed in order to identify trends and opportunities for reducing consumption. Fuel-D has further developed a software tool to allow mission planners to better understand how capabilities can be enhanced by reducing energy consumption

and how this affects the cost burden positively. In addition Fuel-D has shown how camp designs can be optimised through the introduction of novel and renewable energy technologies.

The optimized designs as well as the mission planning tool show the potential of these alternative technologies and what the break-even points are. The alternative technologies addressed are among others solar, wind and geothermal – the latter showing huge potential in both urban and remote settings in deployed operations and Spanish company Geoter is a pioneer.

The successful conclusion of the Fuel-D study feeds straight into EDA and Member States expert work in developing Best Practices for Energy Supply Systems for Land Installations.

European Advanced Biofuels Flight Path Initiative

Novel fuel types, are they the future? Well in light of decreasing availability of fossil fuels over time as well as their general adverse effects to the environment perhaps there is no choice.

There are a number of efforts on-going across the globe and one of the bigger ones is the European Commission's European Advanced Biofuels Flight Path Initiative. It is coordinated effort between the European Commission, aircraft manufacturers, airlines and biofuel producers with the aim of speeding up the commercialization of biofuels in Europe.

The "European Advanced Biofuels Flight path" initiative is a roadmap with clear milestones to achieve an annual production of two million tonnes of sustainably produced biofuel for aviation by 2020.

The "Biofuels Flight path" is a shared and voluntary commitment by its members to support and promote the production, storage and distribution of sustainably produced drop-in biofuels for use in aviation. It also targets establishing appropriate financial mechanisms to support the construction of industrial "first of a kind" advanced biofuel production plants.

European Commission, DG Energy

In terms of expenditure the European Commission is making a huge effort. Under the framework programme FP 7 under the period 2007 to 2013 ten large scale demonstration projects are running with a total funding of approximately 75 MEUR. Fuels covered are:

- Fischer-Tropsch
- Dimethyl-Ether
- Ethanol
- Bio-oil
- Biodiesel
- Biomethane

EC Funded Large-Scale Demonstration Projects Funded under FP 7

Cluster	Acronym	Coordinator	Provider	Biofuel	EC Support (MEUR)	Biomass	Production Capacity (t/y)
Synthetic	OPTFUEL	VW	Choren Industries	Fischer Tropsch	7,8	Wood	15 000
	BIO DME	Volvo	Chemrec	Dimethyl-ehter	8,2	Black Liquor	600 t/y – 150 days operation
LG EtOH	BIOLYFE	Chetex Italia	Chetex Italia	Ethanol	8,6	Various	40 000
	FIBREEtOH	UPM	UPM	Ethanol	8,6	Fibre	20 000
	KACELLE	Dong Energy	Inbicon	Ethanol	9,1	Straw	20 000
	LED	Abengoa	Abengoa	Ethanol	8,6	Corn resd.	50 000
Pyrolysis	EMPYRO	BTG	BTG	Bio-oil	5,0	Wood	17 4000
Algae	ALL-GAS	Aqualia	Feyecon	Biodiesel & biomethane	7,1	Algae	90t/ha y algae
	BIOFAT	Abengoa	Alga Fuel	Biodiesel & ethanol	7,1	Algae	90t/ha y algae
	INTESUAL	Centre of Process and Innovation	Centre of Process and Innovation	Biodiesel	5,0	Algae	90t/ha y algae
					Total: 75,1	Algae	90t/ha y algae

European Commission, DG Energy, A Performing Biofuels Supply Chain for EU Aviation

An interesting initiative, the defence and crisis management community need to address how it can benefit from this. In doing so the following questions need to be addressed:

- What measures are needed for biofuels to be implemented in the context of not only aerial systems but also marine and land systems?
- What are the procedural differences between the civilian and military domains when implementing new fuel types?

Defence has an opportunity to act proactively be at the forefront of reducing fossil fuel dependencies, thus contributing to sustainable development.

Defence Technology Efforts

Over the years a number of collaborative projects have been launched addressing both environmental responsible technologies and systems across services (air, sea and land).

Collaborative environmentally responsible activities, programmes, projects and proposals within EDA and its predecessor the Western European Armament Group included:

- *Energy*
  - *All Electric Combat Vehicle*
  - *Diesel Fuel Processor for Fuel Cells*
  - *Electric Actuators – BE, FR*
  - *Molted Carbonate Fuel Cell System*
  - *Naval Electric Distribution System Based Upon Innovative Solid State Switches*
  - *High Speed Generator*

- *DC Hybrid Switch*
- *Pulsed and Burst Power Supplies for Electric Weapons, Sensors and Armour*
- *Survey of the Maturity of Diesel Compatible Fuel Cells*
- *Electric Armour*
- *Overall Platform Energy*
- *Energy Supply for Unmanned Underwater Vehicles*
- *Fuel Dependencies*
- *UMS – Study of Hybrid fuel cells Energy Interoperable System*
- *Go Green – ARM*
- *High Energy Efficiency Container*

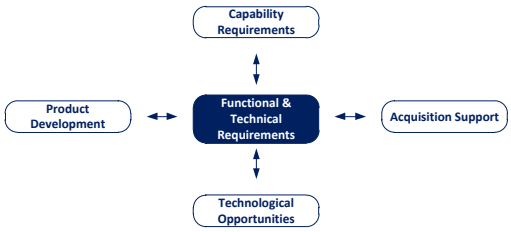
- *Munitions*
  - *Insensitive Munitions and Ageing (IMA)*
  - *Environmentally Responsible Munitions (ERM)*
  - *Munition-Life Management*
  - *Sensor on Structural Health Monitoring*

- *Materials*
  - *Corrosion Control on Navy Ships*
  - *Antifouling Coatings for Warships*
  - *Environmentally Compliant Coatings*
  - *Drag Reducing Antifouling Coatings for Navy Ships*
  - *New Paint Systems for the Protection of Critical Areas of a Ship*
  - *Fouling Control for Sea Water Piping Systems*
  - *REACH – Harmonisation of Defence Exemptions*

- *Climate & Ecology*
  - *Protection of Marine Mammals Against Sonar Emissions*
  - *Biological Effects of Radio Frequency Electromagnetic Fields*

Best Practices and Requirements

The glue that holds all these projects together in a capability development context is the requirements. Defining the requirements helps steer science and technology. The process of doing so is not necessarily easy and requires patience and applying a methodical systems engineering process that sets capability targets, breaks them down into requirements that get translated in to functional and technical requirements.



Functional and Technical Requirements as the glue and the guide

Introducing more performance orientated energy and environmentally responsible requirements can be a very effective way achieving results.

An illustration of the capability process highlighting the role of requirements as the glue between capability needs and technology

EDA has embarked on developing Best Practices targeting land installations. These are accompanied by generic requirements that can be used at a later stage during an acquisition process. The approach is not to impose anything but rather to establish a common baseline among experts for sensible practices and requirements that can be implemented voluntarily.

This approach can serve as the basis for Energy Performance Contracting. It further supports potential future eco/energy labelling of equipment.

Addressing behaviour is also an aspect that needs more attention and there are already examples of Member States developing training modules for this.

Recommendations:

- To build on the statistics gathered as part of the Fuel Dependencies study in order to establish a bank of data that can be used for monitoring of progress in efficiency and consumption in theatre
- To adopt a similar approach to statistics at home
- To explore how defence can tap into the Flight-Path initiative, perhaps through EDA acting as an observer on behalf o Ministries of Defence
- To continue to develop Best Practices and Requirements for other systems and applications
- To identify a simple system or technology as a pilot for eco / energy labelling
- To develop programmes that address the different aspects of energy and environment in a comprehensive and applications orientated way
- To develop further training modules for all stakeholders to increase awareness and more responsible decision making at all levels

Everything is Connected

The Footprint of Environment

Everything comes with an environmental footprint. But the environment also comes with a footprint, in particular on equipment. Several standards exist to ensure compatibility of different types of natural and induced environmental conditions. In light of recent operations it is of great interest to see how well these standards have been met and if they are sufficient. There are national efforts on-going and there is an opportunity to coordinate these at European level in order to learn from each other's experiences and feedback into the requirements generation and standardisation processes. It can further help steer science and technology efforts. This of course requires appropriate administrative arrangements between Governments and Industries.

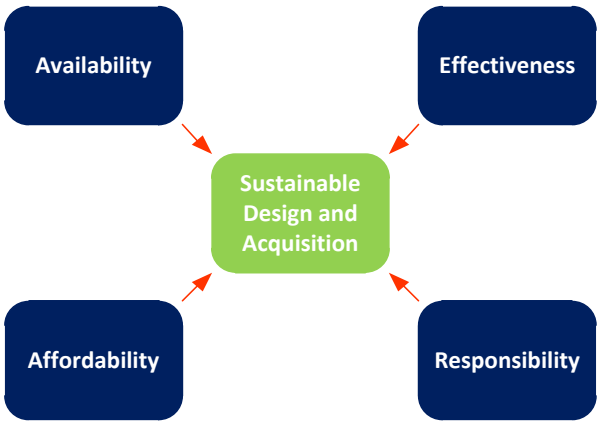
Sustainable Design

Sustainable Design is an approach and philosophy that advocates designs that do not affect the environment negatively while taking into account social and economic aspects. It has emerged in later years as a contributor to Sustainable Development and predominantly addresses recyclability, water, waste and energy efficiency.

So is this applicable to defence and crisis management and if so how? The approach needs to be comprehensive and needs to take into account:

- Environmental considerations
- Livelihood of the domain
- The domain's purpose and credibility

Below is an attempt to develop these aspects into parameters that affect the requirements and choices in the design and acquisition process.



A model for describing sustainable design and acquisition in a defence and crisis management context

- **Availability:** The availability in terms of its maturity, likelihood of implementation, supply chain, knowledge-base etc
- **Effectiveness:** The contribution to a capabilities effect, endurance, autonomy, deployability etc
- **Affordability:** The cost associated covering all aspects in not only acquisition but also development, through-life management, disposal etc
- **Responsibility:** Safety aspects as well as the footprint in terms of environment, ethics etc

Modelling

Modelling has an increasingly important role to play. While modelling tools exist today and are very advanced, the scope is sometimes quite limited to one specific science. There is a need, especially in a sustainable design context, to model in a comprehensive way. The tools exist but need to be fused together appropriately. Also models need to be developed and validated so that they can contribute to qualitative modelling.

An opportunity that dawned during the workshop was that Swedish FOI's framework tool would be an interesting way of taking the mission planning tool from the Fuel Dependencies study to the next level.

A comprehensive tool could enable designing in a sustainable way taking into account the parameters listed in the previous section.

It could therefore complement a recently launched technology assessment exercise that is based on the same parameters. The methodology aims in a comparative manner understand pros and cons among different types of technologies. Furthermore it exposes where civilian efforts are sufficient and where specific defence efforts are needed.

Recommendations:

- To assess interest among Member States to share information on how equipment in recent operations has coped with the footprint of environment and tailor appropriate enabling means for sharing the information
- To develop a comprehensive modelling tool for defence and crisis management applications in support of more responsible designs
- Generate interest to get more input to the technology assessment exercise

Conclusions

The Workshop has seen a wide range of topics being covered under a very short time. This has proved a very effective way of kick-starting new work streams. It is, however, up to EDA Member States to decide how to take on board the recommendations proposed in this report. For that reason there will be a series of activities this autumn of 2013 to coordinate their respective wills and find opportunities for collaboration.

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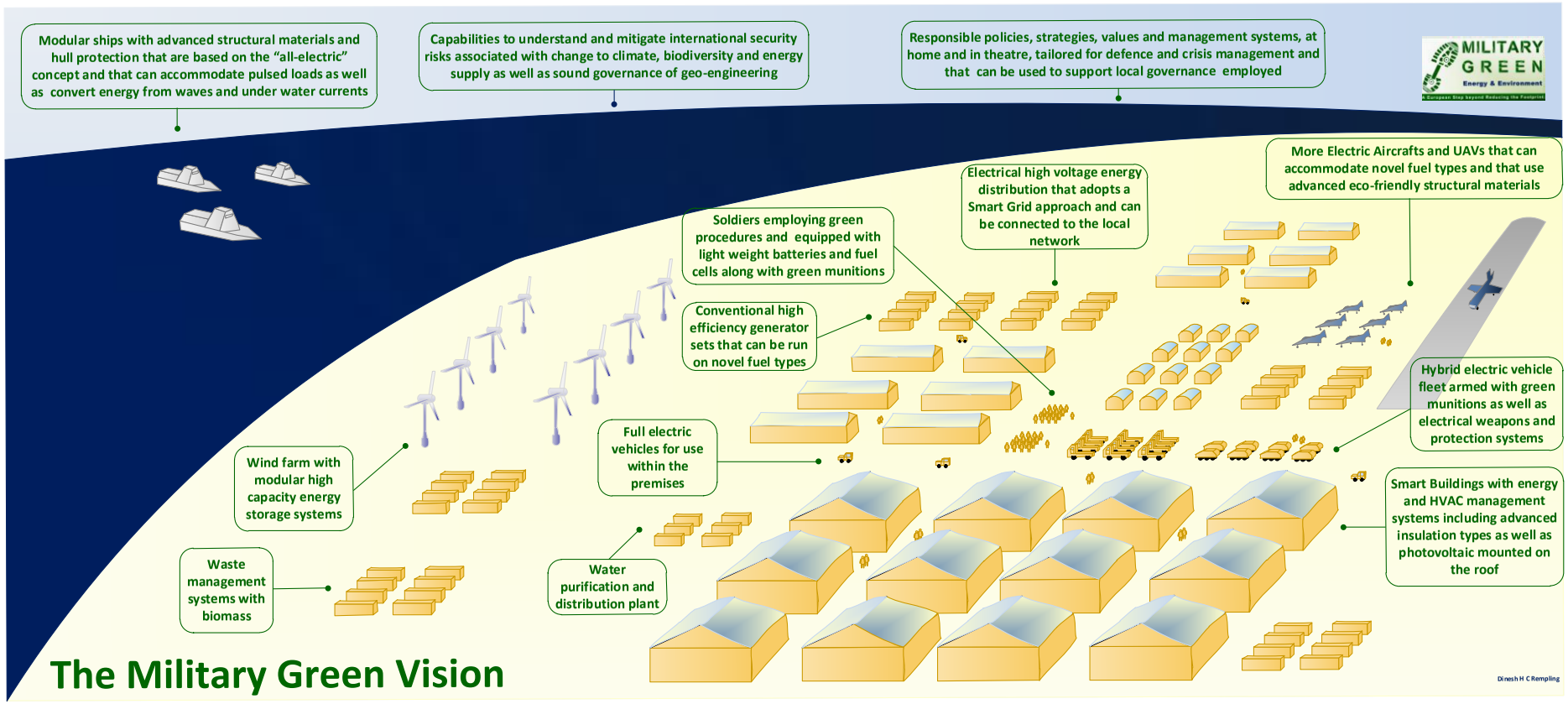
Modular ships with advanced structural materials and hull protection that are based on the "all-electric" concept and that can accommodate pulsed loads as well as convert energy from waves and under water currents
Capabilities to understand and mitigate international security risks associated with change to climate, biodiversity and energy supply as well as sound governance of geo-engineering
Responsible policies, strategies, values and management systems, at home and in theatre, tailored for defence and crisis management and that can be used to support local governance employed
MILITARY GREEN
Energy & Environment
More Electric Aircrafts and UAVs that can accommodate novel fuel types and that use advanced eco-friendly structural materials
Electrical high voltage energy distribution that adopts a Smart Grid approach and can be connected to the local network
Soldiers employing green procedures and equipped with light weight batteries and fuel cells along with green munitions
Conventional high efficiency generator sets that can be run on novel fuel types
Hybrid electric vehicle fleet armed with green munitions as well as electrical weapons and protection systems
Full electric vehicles for use within the premises
Wind farm with modular high capacity energy storage systems
Smart Buildings with energy and HVAC management systems including advanced insulation types as well as photovoltaic mounted on the roof
Waste management systems with biomass
Water purification and distribution plant
The Military Green Vision
Dinesh H C Rempling