EUROPEAN DEFENCE AGENCY

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Impacts of pandemics on defence-related critical energy infrastructure: lessons from the COVID-19 pandemic

The defence sector heavily depends on civilian critical energy infrastructure (CEI). Disrupting its stable operation could challenge the armed forces' security, safety, and operational effectiveness. In this light, Europe needs to re-examine its strategic energy autonomy, using the COVID-19 pandemic as a 'wake-up' call. This CF SEDSS research study maps the direct and indirect effects of the pandemic on CEI, also highlighting relevant insights, and states key recommendations towards increased resilience for the civilian and defence energy sectors.

Scope and Objectives

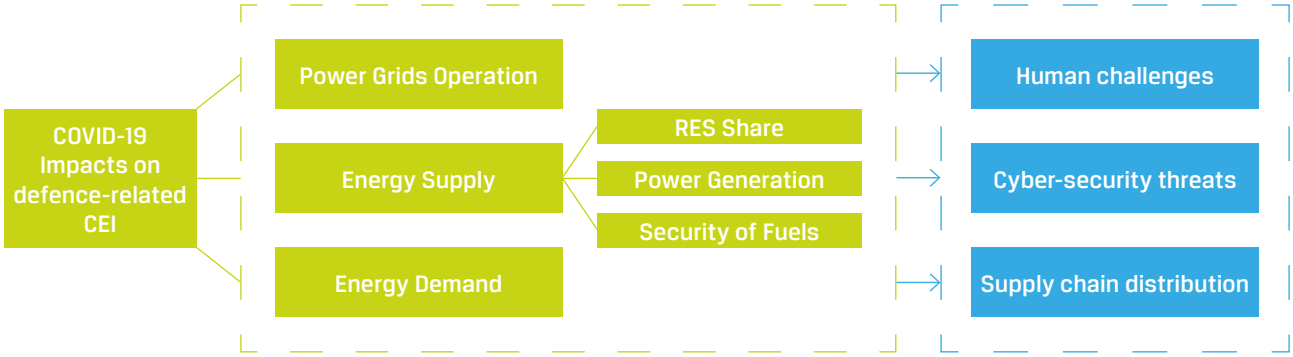
The scope of this study is to explore and assess the effects of pandemic-related threats on CEI that are of direct relevance to defence.

The **study's main premise is that the COVID-19 pandemic crisis, seen as a large-scale 'stress-testing' experiment for defence-related CEI, could provide lessons for improving the sector's resilience and readiness** in anticipation of similar future risks.

The key objectives of the study are to:

- **Identify key impacts** of the COVID-19 pandemic on CEI and services;
- **Identify and present lessons learnt** from the pandemic and summarise transferable **insights;**
- **Recommend** how the civilian and defence energy sectors can increase their resilience.

The **conceptual approach** adopted in this study **for tracing** COVID-related direct and indirect impacts can be seen in the following infographic. Work is grouped into **three main topics** (energy demand, energy supply and power grids operation) and **three cross-cutting topics** (human challenges, cyber-security threats and supply chain disruptions) that constitute additional vectors of the COVID-19 influence on CEI.



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Methodology

An extensive **evidence base** was created through an "information mining" process. An **expert-driven desk study,** augmented using an **artificial intelligence (AI)** driven tool, leveraging advanced natural language processing (NLP) algorithms, identified **multi-dimensional effects** of COVID-19 on CEI through an extended literature review. Over **250.000 peer-reviewed academic papers** were processed by the AI tool and **over 350** were finally retrieved and added to the study's database.

Impacts on Defence-Related CEI

EU armed forces rely heavily for their energy needs on civilian infrastructure. COVID-19 caused a wide range of disruptions with direct and indirect impacts on CEI. The pandemic also pushed the world to a new era of economic activity whose mid-to-long term effects **are still unfolding.**

Main effects identified:

- **Electricity demands** deviated from their expected volumes and shapes, causing increasing load forecasting errors that stressed power grids. Increased **distributed energy resources** (mainly renewables) caused stability issues in some distribution systems.
- Fossil fuel **electricity generation** dropped by up to 25 GW in EU countries by April 2020 with direct effects on European **energy companies' financial sustainability**. The drop in fuel consumption caused turmoil with cascading effects for refineries.
- Initially, **natural gas** growth projections dropped by 5-10%. However, in 2021, a **natural gas crisis** erupted, influenced by the COVID crisis through a combination of cascading effects. The gas crisis highlighted **an over-reliance of the EU on imported natural gas** and should be considered as a major lesson to be learned.
- **Renewable energy sources** (RES) were a success story **increasing their share** of the (reduced) energy load **surpassing fossil fuels for the first time.** This increase should, however, be **contextualised** in view of their priority access to the grid guaranteed through contracts and due to difficulties in adjusting RES production due to hydroclimatic uncertainties.
- **Delays** in **infrastructure maintenance and new projects deployment** due to personnel constraints caused by the lockdowns were often reported.
- **Severe supply chain bottlenecks** emerged that will continue to cause knock-on effects in the energy market for the foreseeable future.
- The pandemic also **catalysed a rapid digitalisation** for most sectors – a fact that can be seen as an **anti-fragility effect.** However, a dramatic increase in **cyber-threats,** tripling above average pre-COVID numbers, **was also reported,** affecting CEI as these also **became more digitalised** and adopted **working from home** practices.

Insights and Recommendations

It is recommended that **a wider protective "net" is cast around CEI,** beyond 'just' infrastructure. Indicatively:

- New AI tools are needed to increase **load forecasting accuracy** and **system flexibility** under extreme events.
- The EU energy sector should prioritise its **strategic autonomy** and **decrease its reliance on imported natural gas.** To this effect, short-term activities should include, *inter alia,* ensuring the sustainability of European **refineries,** re-examining the role of locally available fuels, and increasing the diversity of imported fuels. Longer-term activities, in support of a more robust move towards renewables, should include more ambitious and faster investment in the development and deployment of technologies for large-scale energy storage (e.g., hydropower with pump-storage capabilities and hydrogen).

- For the **defence sector, in particular,** a strategy towards increased resilience should include:
  - casting a **wider net in risk assessment and management** of energy dependencies (and other linked civilian services, such as water) of military installations and home bases, adopting an **end-to-end** approach that also addresses financial and supply chain issues on the civilian side;
  - reducing energy/fuel consumption by **increasing energy efficiency** (especially in heating and transportation) **needs to be accelerated** to reduce dependency from civilian CEI;

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- investment in novel technologies of **energy generation and longer-term storage,** to be owned and operated by the military. In this context, RES, biofuels, and hydrogen (e.g., fuel cells, hydrogen power plants, but also hydrogen for synthetic fuel production) should be prioritised;
- **Cyber-awareness and related cyber-security technology** development and deployment should be accelerated in the civilian and defence sectors.

- MoDs should become **more engaged** in the planning and operational resilience of civilian CEI by communicating armed forces requirements to ensure uninterrupted operational readiness under the most challenging conditions (such as future, even more disruptive pandemics).
- This study suggests alternatives towards such a collaboration, introducing the concept of **'military energy resilience'** as an equivalent to 'military mobility' in the energy domain.

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