



MINISTÈRE DES ARMÉES

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# French Operational Energy Strategy

*Defence Future Operational Energy Conference*

03/03/23

# Presentation

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- The Energy Defense Strategy : Energy as a transversal tool for the MOD FR
  
- French vision of energy for the military in 2040

# Presentation

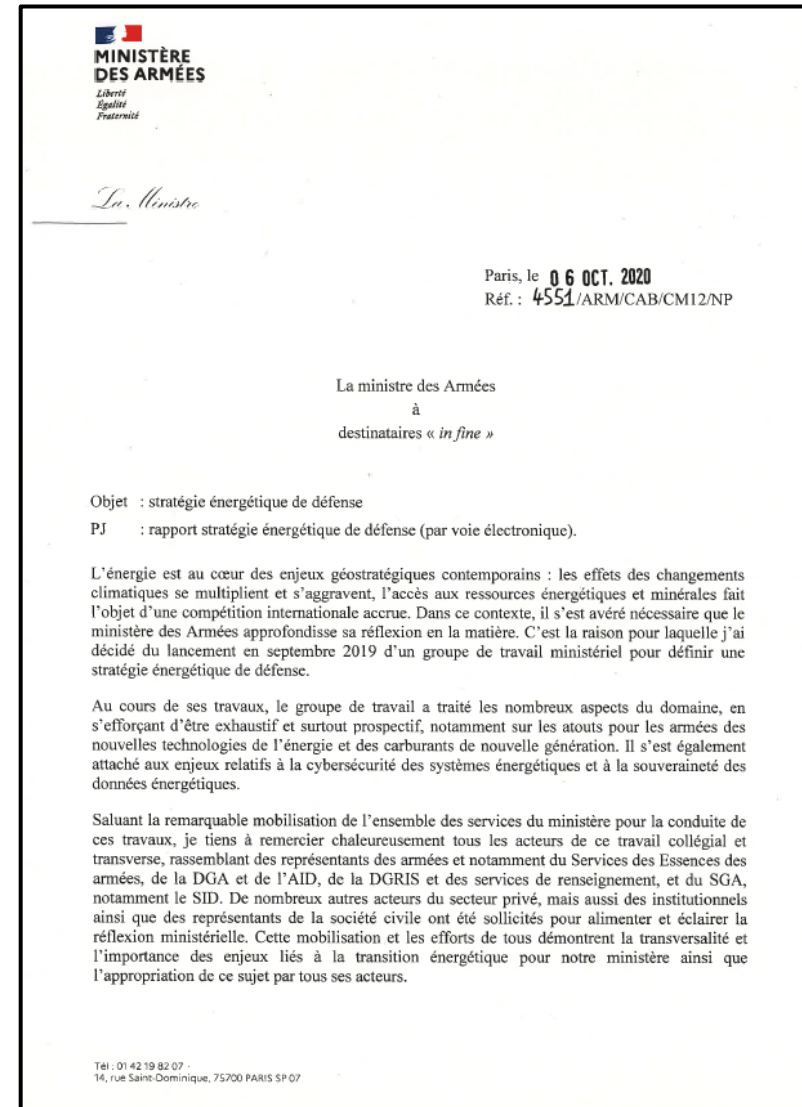
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- **The Energy Defense Strategy : Energy as a transversal tool for the MOD FR**
  
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# The Energy Defence Strategy

- Published in 2020
- 80 pages and 34 recommandations
- Implementation of a new energy governance
- Creation of the Operational Energy Division (DEO) of the French general Staff
- AND... it is available in english

**« Energy transition  
must be an operational  
asset »**



# Identification of new vulnerabilities



## Geopolitical



- Volatility of production zones and transit
- Volatility of the price of raw materials
- New dependence on critical metals

## Technological



- Technological dependence
- Equipment-energy incompatibility
- Becoming outdated and losing a technological

## Environmental



- Tension concerning energy and agricultural resources
- Climate change impacting operations
- Media influence on the environment

## Normative



- Financial costs of norms
- Environmental normative pressure
- Difficulty of asserting our needs for derogation

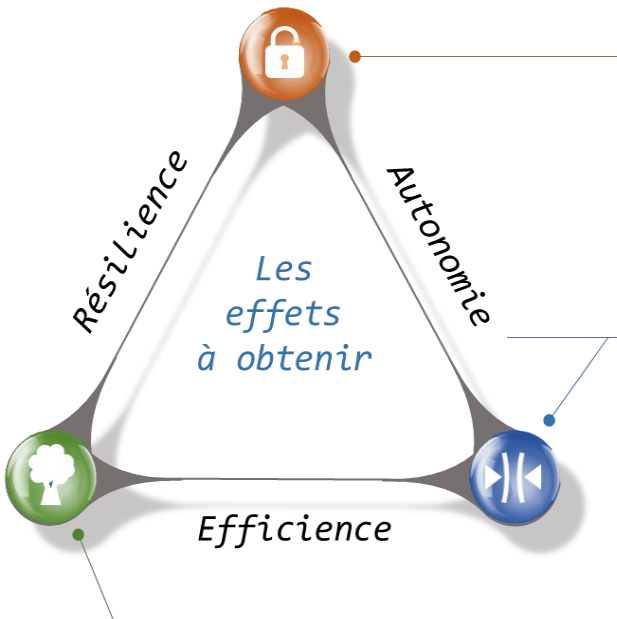
## Hybrid



- Cyber threats
- Terrorist threats
- Interdependence of strategic sectors

# The Energy Trilemma

## Le trilemme énergétique



Consommer sûr

- I take every necessary measures to secure my energy supplies

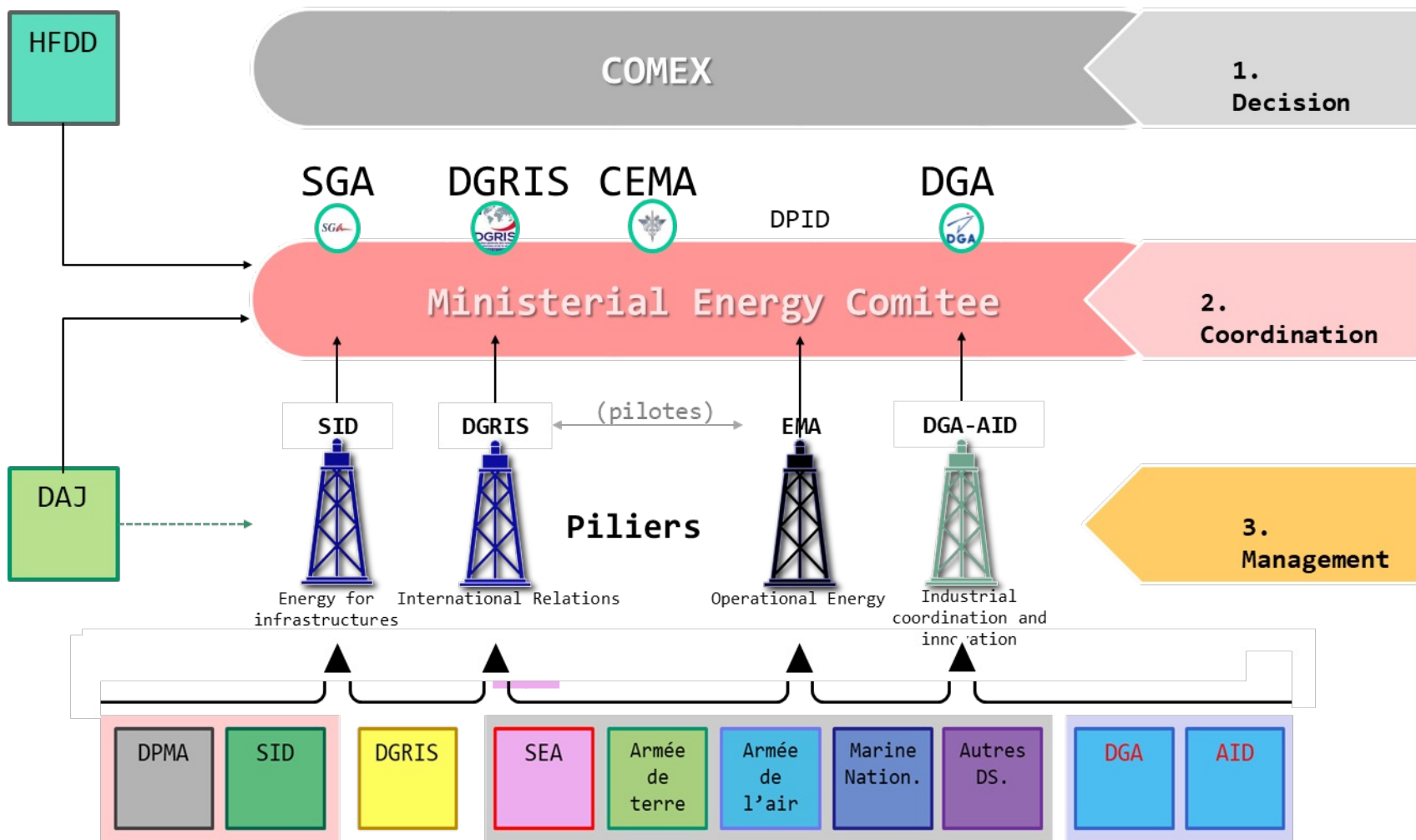
Consommer moins

- I decrease my logistic footprints as my vulnerabilities

Consommer mieux

- I increase my autonomy by a better control of my energy tools

# The energy governance



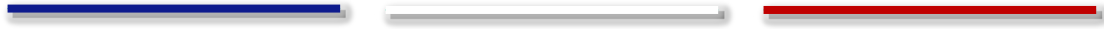
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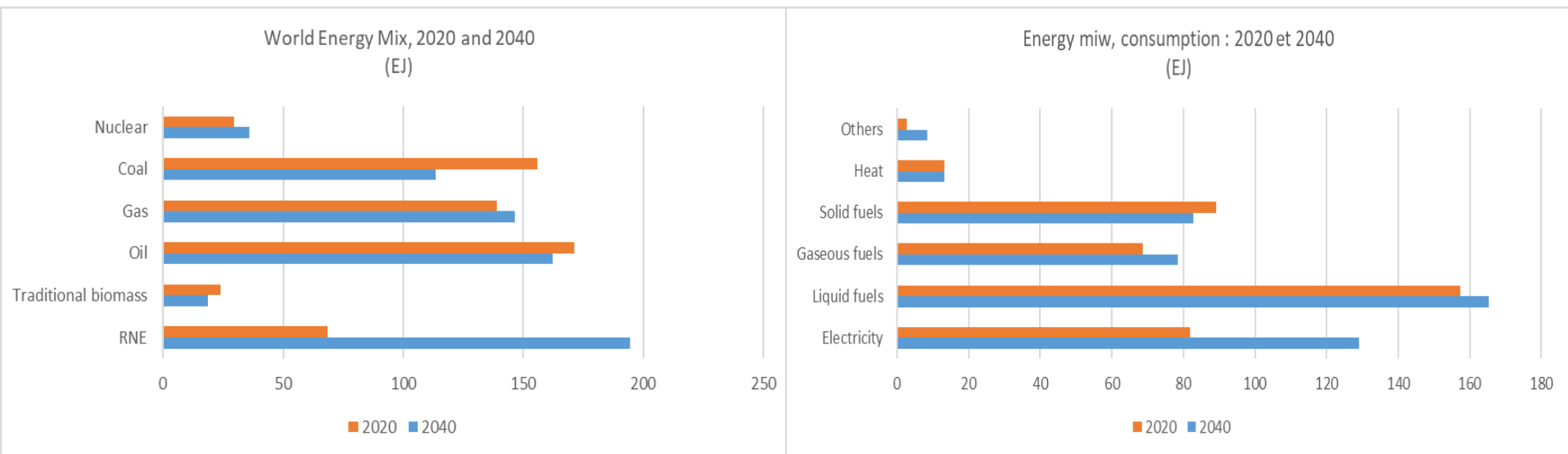


# Presentation of the energy situation in 2040

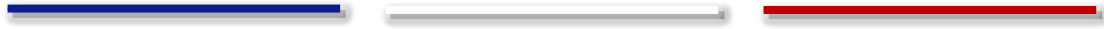


## Energy/Electric Mix in 2040 (APS Scenario)

- Growth of the primary energy production (589 EJ in 2020 -> 670 EJ in 2040)
- Decrease of the fossil energies in the mix (82% in 2020 -> 58% in 2040) BUT relative stability in terms of quantities (except for coal)
- The growth is mostly fueled by the Renewable Energy
- Low growth anticipated for hydrogen



# Geography of energy in 2040



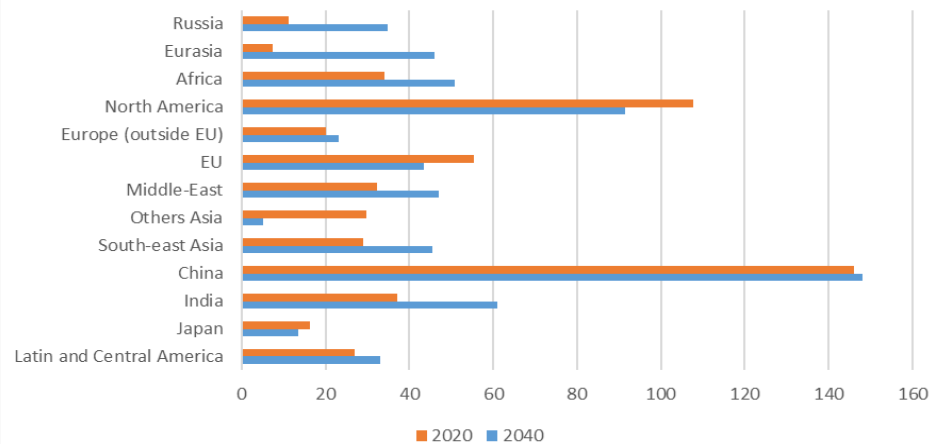
## Geography of energy production 2020-2040

- Decrease of US and EU share/Stability of latin America
- Small growth in Asia (important diversity), Africa and the Middle-East
- Strong Growth in Russia and Eurasia

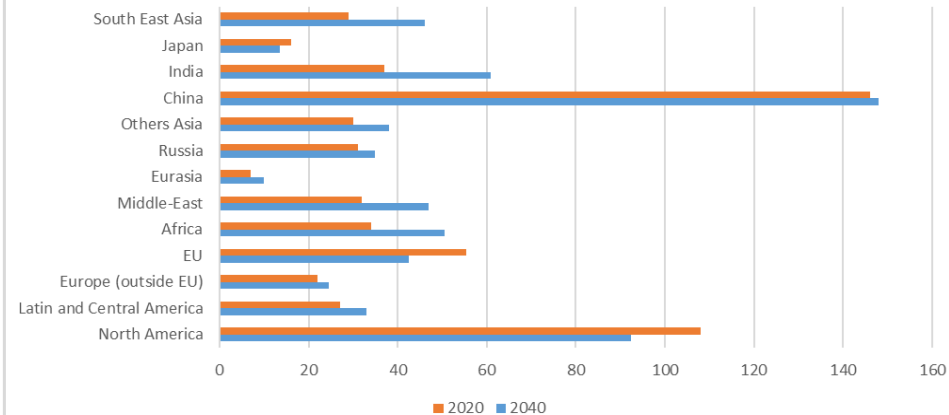
## Geography of energy consumption 2020-2040

- Decrease of US and EU share
- Strong Growth in Africa, India, South-East Asia and the Middle-East
- Relative stability elsewhere

Energy production in the different regions of the world, 2020 and 2040 (EJ)



World Energy consumption, 2020 and 2040 (EJ)



# Opportunities, limits and perspectives of new energy vectors for the civilian industry

## Land Mobility

- Electric engines with batteries
- Electric engines powered by hydrogen for and heavy vehicles transport
- Thermic engines powered by alternative fuels, biogas and possibly hydrogen

## Air mobility

- Sustainable Aviation Fuels (SAF)
- Hydrogen and electric aircraft
- Thermic/electric hybridation

## Marine Mobility

- Different types of motorization
- Different types of fuels
- Different temporalities

## Other uses

- Off-road
- Stationary storage

# Opportunities, limits and perspectives of new energy vectors for the military : land platform and other uses

- **Thermic propulsion** :
  - Availability of liquid fuel, spare parts and human resources
- **Hybrid propulsion**
  - Advantages for mobility and for acoustic furtivity
  - Potential for important fuel economies
- **Electric propulsion**
  - Difficulties: logistic, infrastructures (grid), autonomy...
  - Particular uses possible for off-road equipments and drones
- **Hydrogen, fuel cells and engines**
  - Low maturity in terms of production, use and logistic

## Power production in operation

- Liquid fuels for power generator (jet fuel)
- Use of new energy for operational camps : batteries and hydrogen for energy storage, grids, EMS...
- Soldier support

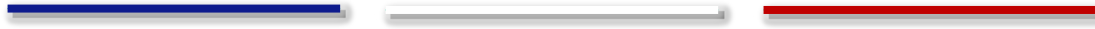
# Opportunities, limits and perspectives of new energy vectors for the military : Air and Marine platform

Liquid fuels will remain the « *alpha and omega* » for Air platforms

- Fossil fuels, biofuels or other alternative fuels refined into jet fuel
- Hydrogen might be a possibility for drones (Vtol) with a low sized logistic
- On the very long term (post 2050) liquid hydrogen might be possible for transport aircraft, following progress in the civilian area

Due to technical and operational necessities, military naval vessels will mostly use liquid fuels, however...

- Hybridation and/or engines electrification might be correlated with platforms electrification (new equipments, energy efficiency...):
- Hydrogen could become a source of energy for secondary vessels



# QUESTIONS?

