

Supply chain risks in the EU's energy technologies

Mohammad Ansarin, Frank Gerard, Perla Torres, Gergely Boldizsar, Liliana Guevara Opinska, Andrea Finesso

June 2024

www.trinomics.eu

Background



- (proposed) Net Zero Industry Act, focuses on manufacturing of components and devices of strategic energy technologies, up to 2030
- NZIA sets some technologies as strategic:
 - High maturity
 - Contribution to EU decarbonisation and competitiveness
 - Security of supply risks

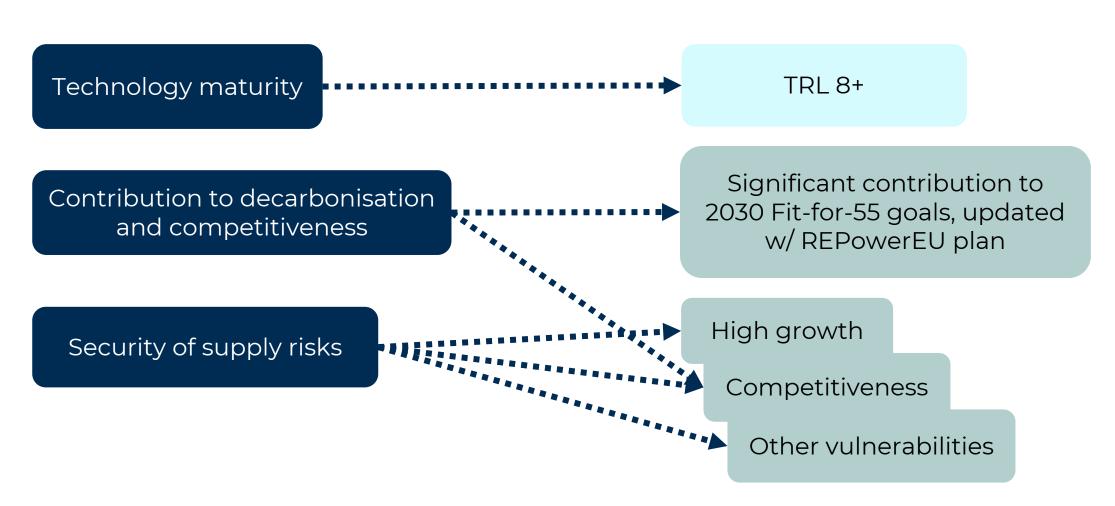
Strategic net-zero techs:

- 1. Solar photovoltaic and solar thermal
- 2. Onshore wind and offshore renewables
- 3. Batteries/storage
- 4. Heat pumps and geothermal
- 5. Electrolysers and fuel cells
- 6. Sustainable biogas/biomethane
- 7. Carbon capture and storage
- 8. Grid tech

Strategic technologies



NZIA:



Approach



Significant contribution to 2030 Fit-for-55 goals, updated w/ REPowerEU plan Comparative impact by 2030 for FF55 goals (e.g., energy input for energy sources, storage amount for storage, some qualitative)

High growth needs

High growth needed for EU manufacturing (otherwise: high import dependency)

Competitiveness

Competitiveness threats, market concentration, other vulnerabilities

Other vulnerabilities

Technology categories



- Solar photovoltaic and solar thermal
- 2. Onshore wind and offshore renewables
- 3. Batteries/storage
- 4. Heat pumps and geothermal
- 5. Electrolysers and fuel cells
- Sustainable biogas/biomethane
- 7. Carbon capture and storage
- 8. Grid tech

- 1. Solar photovoltaics
- 2. Solar thermal
- 3. Onshore and offshore wind
- 4. Ocean energy tech
- 5. Batteries
- 6. Other storage
- 7. Heat pumps
- 8. Geothermal energy
- 9. H2 Electrolysers and fuel cells
- 10. Sustainable biogas/biomethane
- 11. CCUS
- 12. Grid tech

+ secondary techs

Table 1



Tech	High Contribution to EU FF55 goals in 2030	High Growth Rate for manufacturing, import dependency	Competitiveness threats, market concentration, and other vulnerabilities	Aggregat e Score
Solar photovoltaic systems	5	5	5	15
Wind (onshore & offshore)	5	4	4	13
Batteries (storage and E-				
mobility)	5	5	3	13
Heat pumps	5	3	4	12
Carbon capture storage and utilisation	4	5	3	12
H2 Electrolysers and Fuel cells	3	4	4	11
Grid technologies	4	2	4	10
Offshore renewable techs (wave and tidal)	1	5	3	9
Other storage tech (incl. thermal storage)	3	3	2	8
Solar thermal systems	2	2	3	7
Sustainable				
biogas/biomethane techs	3	3	1	7
Geothermal energy systems	1	2	3	6

Table 2



Tech	High Contribution to EU FF55 goals in 2030	High Growth Rate for manufacturing, import dependency	Competitivenes s threats, market concentration	Aggregat e Score
Ener. System-related Ener. Eff. Measures	4	2	2	8
Nuclear fission	2	2	2	6
RFNBOs (excl. H2)	2	2	3	7
Bio-liquids (incl. Adv. Biofuels)	2	2	2	6
Solid Bioenergy	3	1	2	6
Hydropower (& pumped hydro storage)	2	1	2	5



Analysis of grid technologies



www.trinomics.eu

Grid technologies



- Traditional infrastructure (converters, transistors and ICs, transformers, cables, insulators, towers/pylons, etc.)
- Smart grid infrastructure
 - Smart meters (Advanced metering infrastructure): including both meters and comms/databasing infrastructure
 - Smart EV charging: power electronics and switches for charging, SCADA, etc.
 - Home energy management systems (HEMS): building automation and control systems

Traditional infrastructure



Raw Materials Aluminium Copper Magnesium Silicon metal Processed Materials Low-density polyethylene Ethylene propylene rubber Stainless steel

Grain-oriented

Concrete

Porcelain

electrical steel

Manufacturing of components & pre-assembly

Components & subcomponents

- Converters
- Transistors and integrated circuits
- XLPE cables
- MI cables
- Transformers
- Insulators
- Switchgear
- Towers / pylons
- Overhead cables

Distribution

Assemblies

· Control systems

substations

transmission.

Underground/

transmission

distribution

cabinets and

submarine.

AC AC/DC

Overhead

lines

lines

Electricity

boards

RoadsShipping

Transport &

• Rail

- Civil worksElectrical
- works SCADA svstems

Construction

Installation

Operations & Maintenance

- Maintenance facilities
- Control centres
- Remote monitoring
- 3rd party services
- Parts & consumables
- · Trained personnel
- Helicopters

tions & Decommissioning

· Recycling material

Composite polymers
 Dicum yl peroxide
 Mineral oil

Note: vulnerable elements found highlighted in bold.

HEMS



Raw Materials

- Boron
- Cobalt
- Gallium
- Germanium
- Silicon
- Lithium
- PGMs
- Graphite
- Indium
- Magnesium
- · Rare earth elements
- Tungsten
- Arsenic
- Nickel
- Chromium
- Copper
- Gold
- Silver
- Manganese

Manufacturing of components & pre-assembly

Assemblies

Software

o HEMS

o BEMS

and data

storage

Metering /

control

servers

Servers

Components & subcomponents

- Printed circuit boards
- Other electronics
- Routers/switches
- · GPRS modules
- Cables
- Human-machine interfaces
- · Controls for
 - o Energy storage
 - o HVAC equipment
 - Lighting
 - o Energy storage
 - o On-site energy generation
- Sensors
- Electronic radiator valves
- Piping

Transport & Distribution

Construction & Installation

Operations & Maintenance

- Roads
- Shipping
- Rail

- · Civil works
- Electrical works
- Systems commissioning
- Systems O&M
- Third-party services (VPN, cloud storage, etc)
- · Trained personnel
- Communications infrastructure

1: EU Demand



- High growth rate in Europe
 - Transmission grid expansions: €135b in ~43000km (ENTSO-E TYNDP 2022)
 - HVDC lines: 18% CAGR to 28000km in Europe by 2030 (IEA 2023, Energy technology perspectives)
 - Smart grid tech: rapidly expanding across EU: expecting to have 10-30% CAGRs in coming years! (COM (2022) 643)
- Overall, EU demand for this tech is rated to be **high** (4 points)

2: EU manufacturing growth



- Traditional infrastructure
 - Very good manufacturing base in EU (actually a net exporter in many key components)
 - However: ongoing delays by primary suppliers.
- Smart grid infrastructure
 - EU maintains **high manufacturing output** (about 1/5 of global production) for many components (PLCs, power electronics, embedded electronics, sensors, etc.)
 - Potential for scaling manufacturing is high, but some dependencies exist on other sources for some components
- Overall, low rating for EU manufacturing growth

3: Competitiveness (I/II)



- Traditional grid infrastructure
 - EU position is historically strong and remains so (Eurostat 2021 PRODCOM data)
 - EU remains dependent on external sources for a few key components.
 - Example: many multi-terminal HVDC systems (used in offshore grids) come from Chinese manufacturers
 - Example 2: large transformers (over 500 kVA) are being imported.
 - **High market concentration for some components**: 3 manufacturers make over 50% of EEA's (higher-voltage) power cables!
- Smart grid infrastructure
 - Strong competitive position for EU in many components, but import dependencies for some critical components (e.g., semiconductors, microprocessors, servers, electronic boards). US suppliers have good position globally for end-devices.
 - Market concentration was high but is decreasing. In a few cases, there is geographic concentration: semiconductors in East Asia (but some plans to tackle that as well by EC and US gov).

3: Competitiveness (II/II)



- Other vulnerabilities
 - Dependence on semi-conductor supply chain.
 - Software requirements and regulations.
 - Smart grid tech is often nascent tech with little standardisation.

• Overall, **high** rating (4 points) for this indicator

Conclusions



- Solar PV, Wind, Batteries remain the main critical techs
- Other strategic techs due to recent policies (e.g., heat pumps, hydrogen tech, CCS)
- Some tech of medium strategic importance for various reasons
- Secondary tech is less strategic (except building insulation material)
- Changes might appear when looking at a longer time window
- More info: full report on EU publications website



Supply chain risks in the EU's clean energy technologies

This study focuses on the clean energy technologies (CET) defined as strategic in the proposed Net Zero Industry Act (NZIA) and considers their strategic importance. The study looks at each technology chosen in the NZIA (and other less strategic but relevant technologies) and uses desk research and expert input to



Mohammad Ansarin

Mohammad.ansarin@trinomics.eu