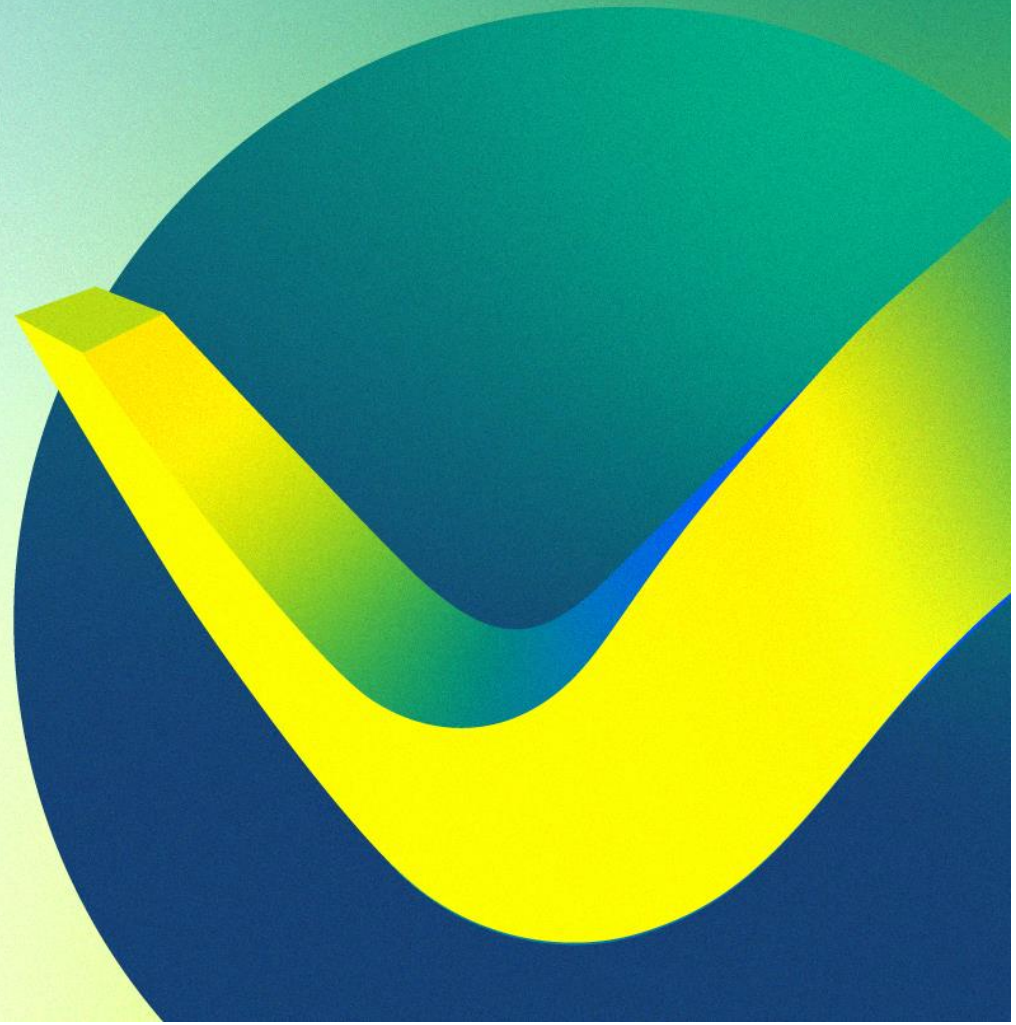
Powering the future: The role of steel in energy storage systems

ERIK NYMANN

BUSINESS INNOVATION & MARKET INTELLIGENCE

SSAB EUROPE



Scope

- Why store energy?
- How can energy be stored?
- How can steel support this segment growth?

SWEDISH
STEEL PRIZE

KEY DRIVERS

By storing energy; the renewable energy mix can increase – import dependency decrease – cost can be reduced

SWEDISH STEEL PRIZE

Key energy drivers for Europe 2030 and beyond

CLIMAT TARGETS

Renewable Energy mix + Solar + Wind – Fossil fuel

ENERGY SECURITY

More Independent + Capacity – Import

ENERGY COST

Reduce price Volatility + Energy security – Season dep.

Source: European Association for Storage of Energy (EASE)

Renewable energy sources (RES) aim to constitute 45% of the energy mix by 2030 in order to reduce emissions

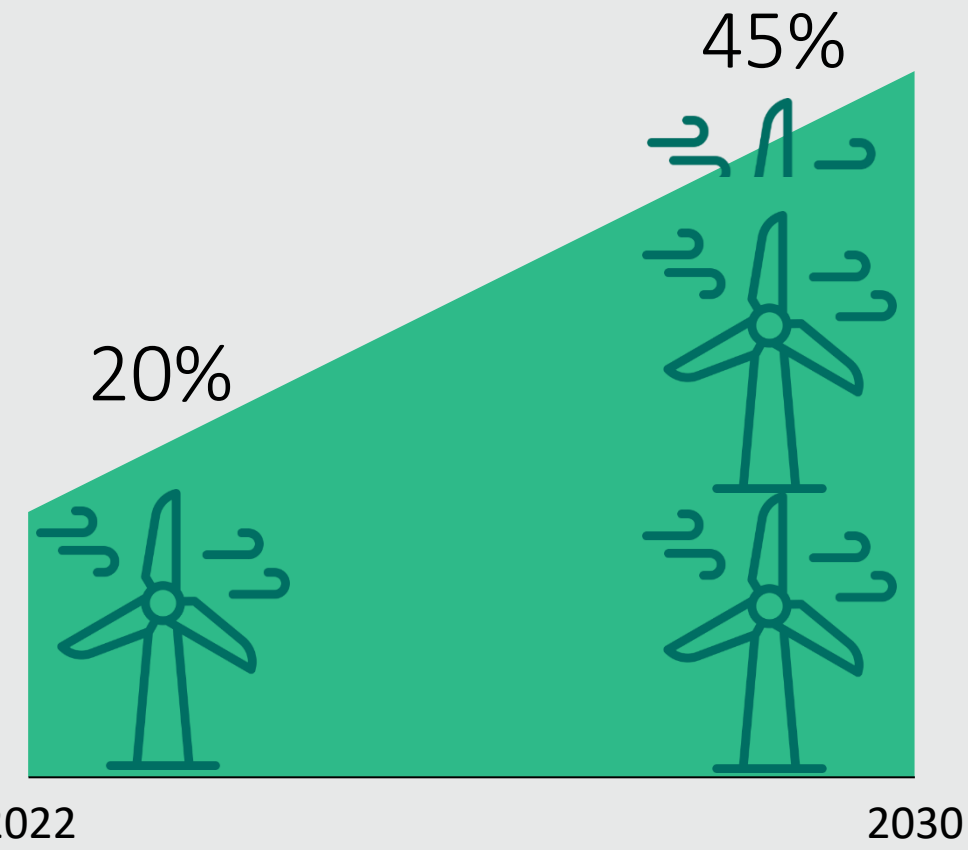
SWEDISH STEEL PRIZE

The increased renewable energy mix in Europe needed to reach 55% Green House Gas (GHG) reductions

2030

55 %

45 %



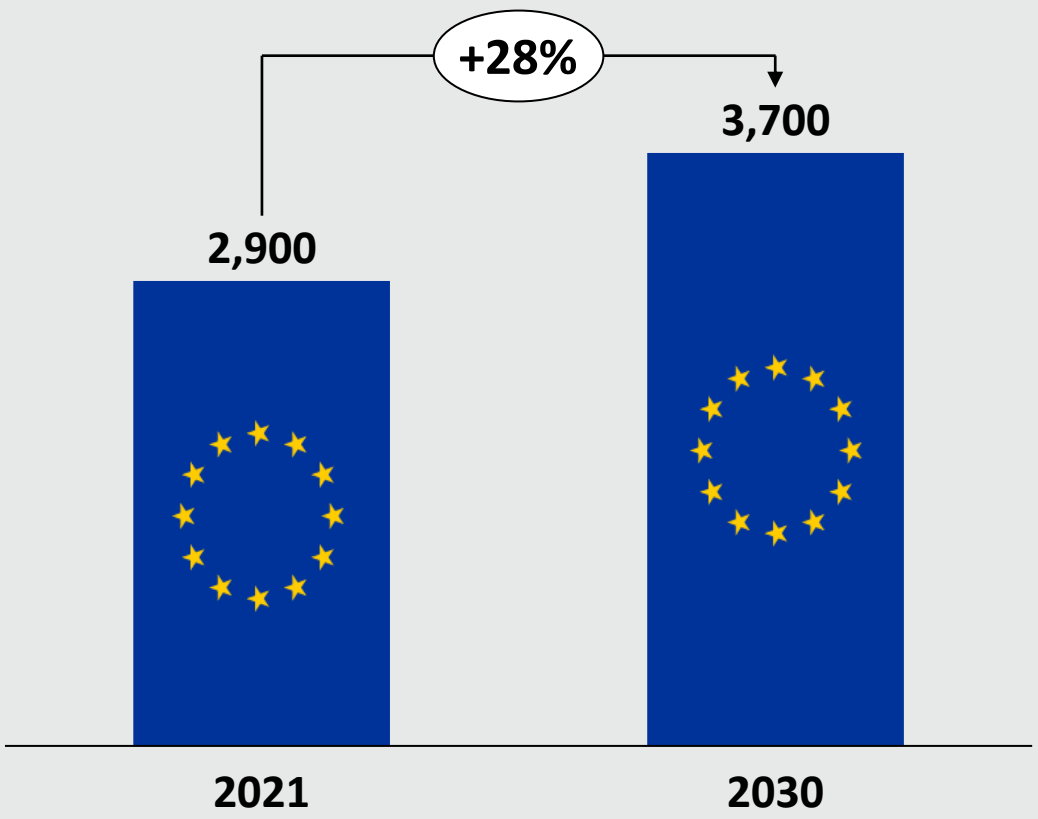
Source: European Commission, REPowerEU

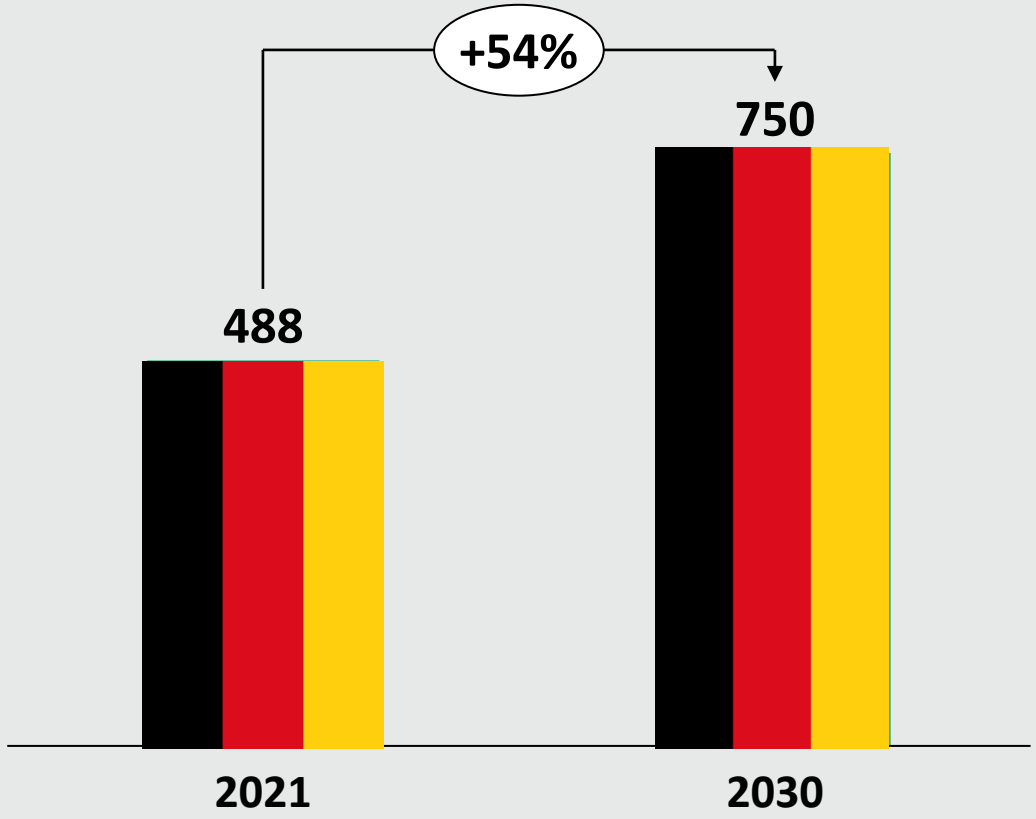
Europe´s energy need 2030 will rise 1 800 TWh and Germanys need will rise 262 TWh (28-54% increase)

SWEDISH STEEL PRIZE

The expected increase in energy need in Europe and Germany until 2030

Energy need [TWh]



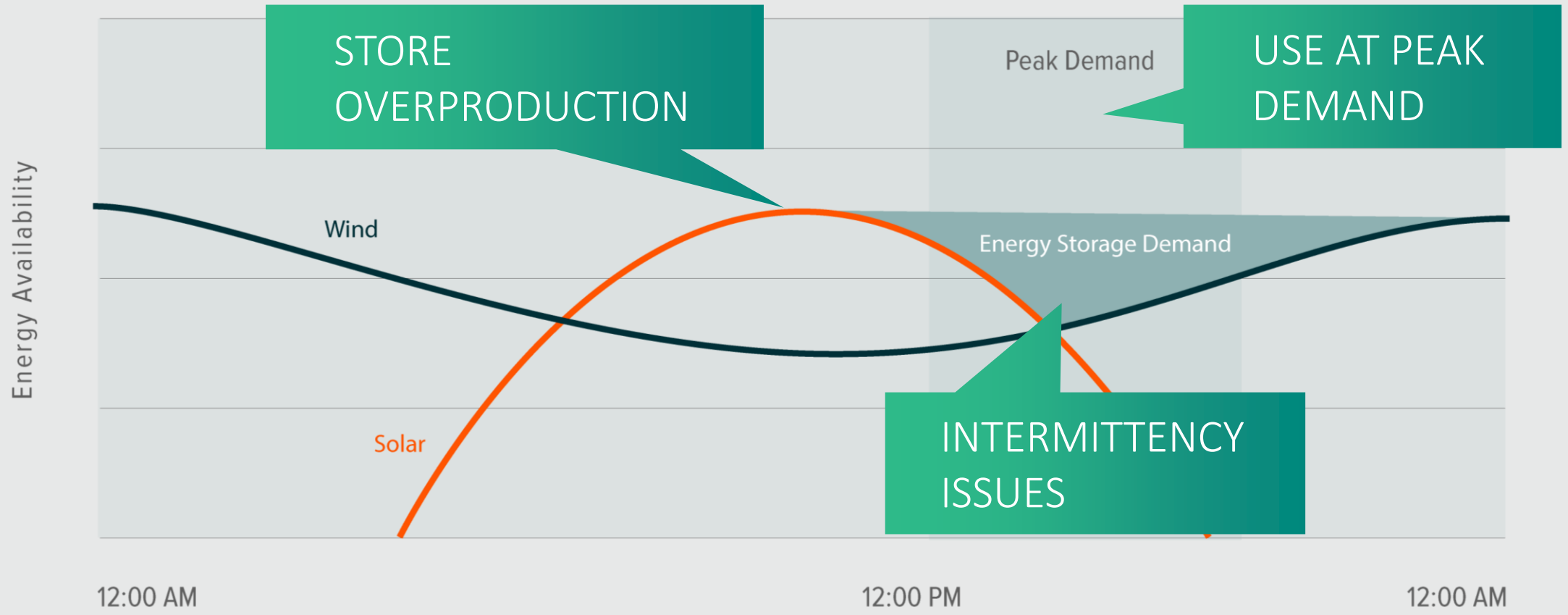


Source: European commission, McKinsey

Renewable energy sources intermittency need to be balanced by energy storage to handle demand peaks

SWEDISH STEEL PRIZE

The increased renewable energy mix intermittency issue



Source: Global X EFT

Energy storage provides the solution!

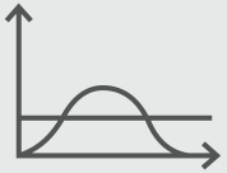
SWEDISH STEEL PRIZE

Energy storage support the generation, transmission and distribution of energy in various ways

GENERATION

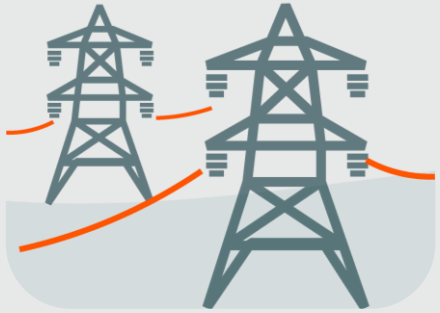
SUPPLY DISRUPTIONS

RES INTERMITTENCY



PEAK CAPACITY

TRANSMISSION



CONGESTION RELIVE

GRID STABILITY

INERTIA

DISTRIBUTION

BACK-UP POWER

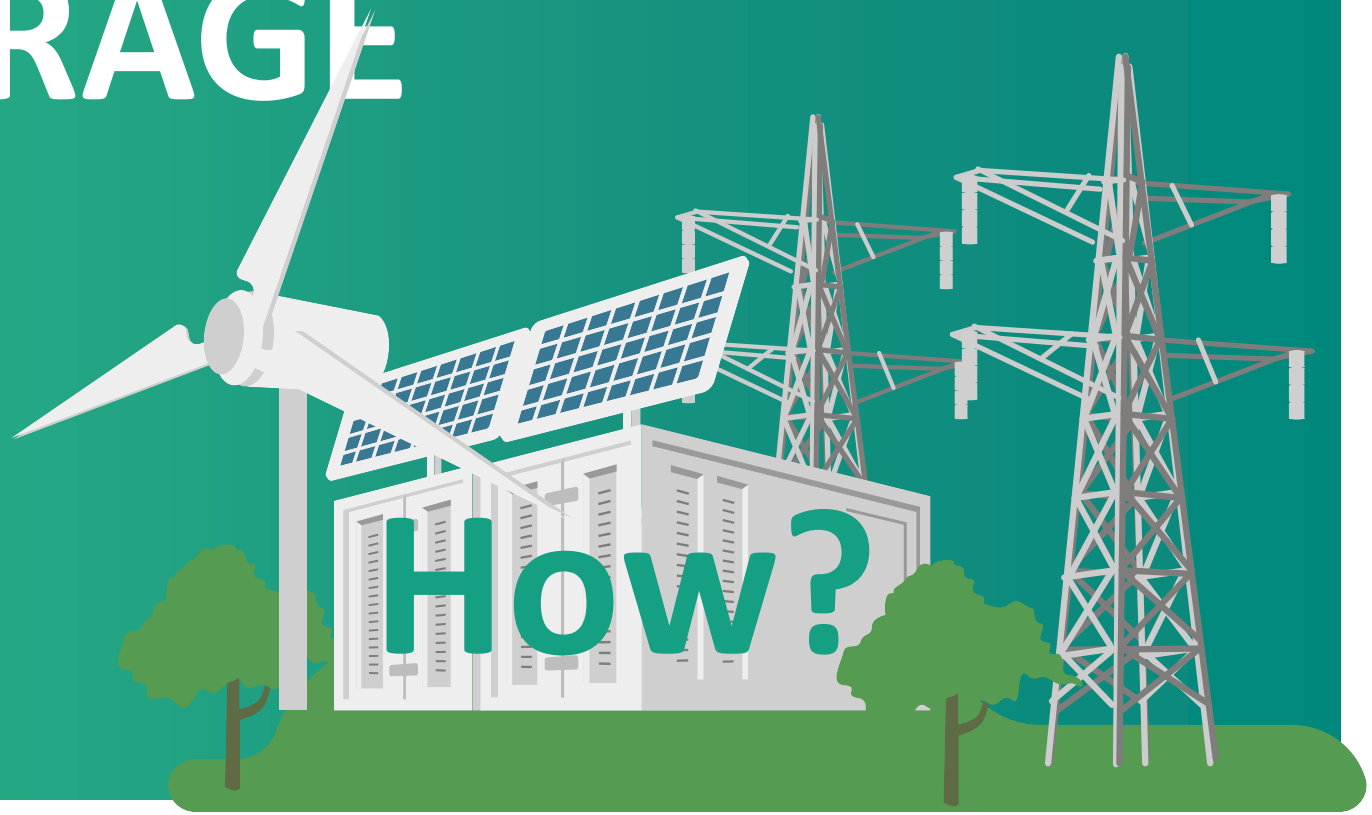
MICRO GRID

COST CONTROL

Source: Global X EFT

SWEDISH
STEEL PRIZE

ENERGY STORAGE SOLUTIONS



Different energy storage systems

SWEDISH STEEL PRIZE

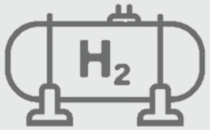
THERMAL

STORE ENERGY AS HEAT

SAND BATTERY

Curtesy of Polar Night Energy

CHEMICAL



STORE ENERGY AS AGENT/MEDIUM

HYDROGEN

ELECTRO-CHEMICAL

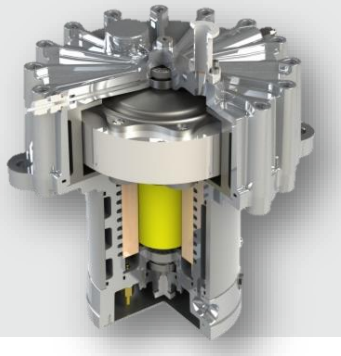
STORE ENERGY AS BATTERY

LITHIUM-ION BATTERY

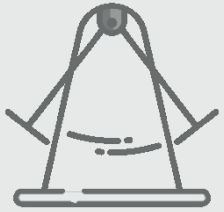
ELECTRICAL

STORE ENERGY AS MAGNETIC FIELD

SUPERCONDUCTING MAGNET



MECHANICAL



STORE ENERGY AS POTENTIAL ENERGY

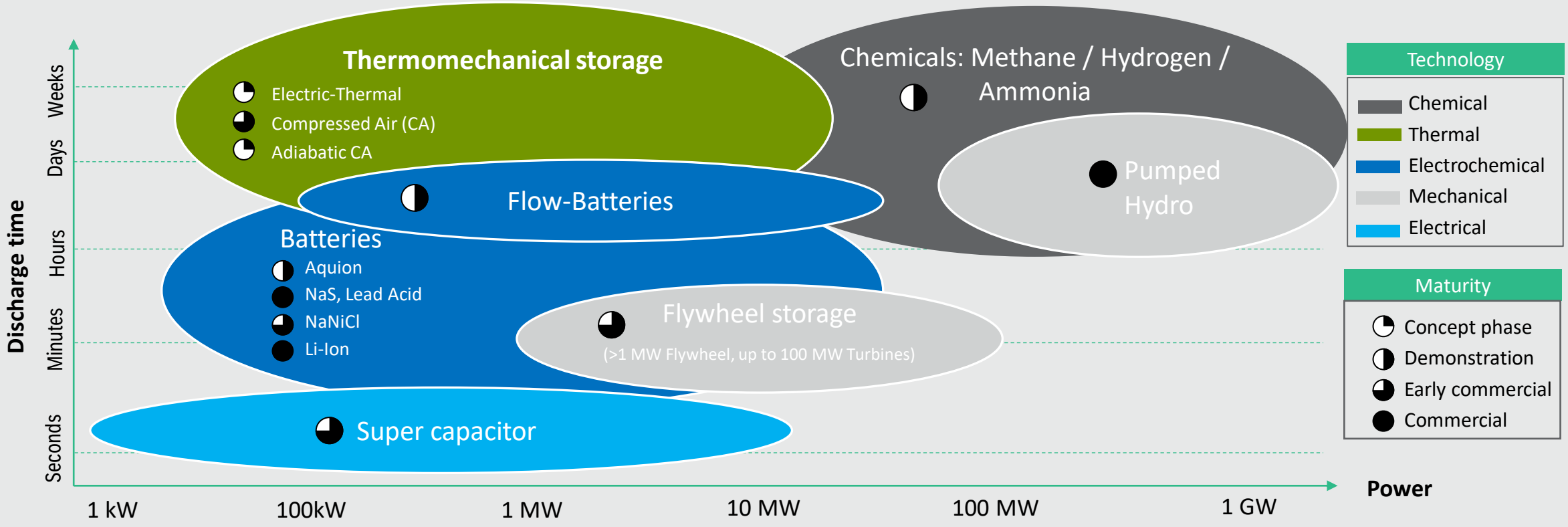
PUMPED HYDRO

Curtesy of Drax Global

Wide range of energy storage technology are currently available, or being developed

SWEDISH STEEL PRIZE

Available Energy storage technologies, their performance and maturity, Watt and time

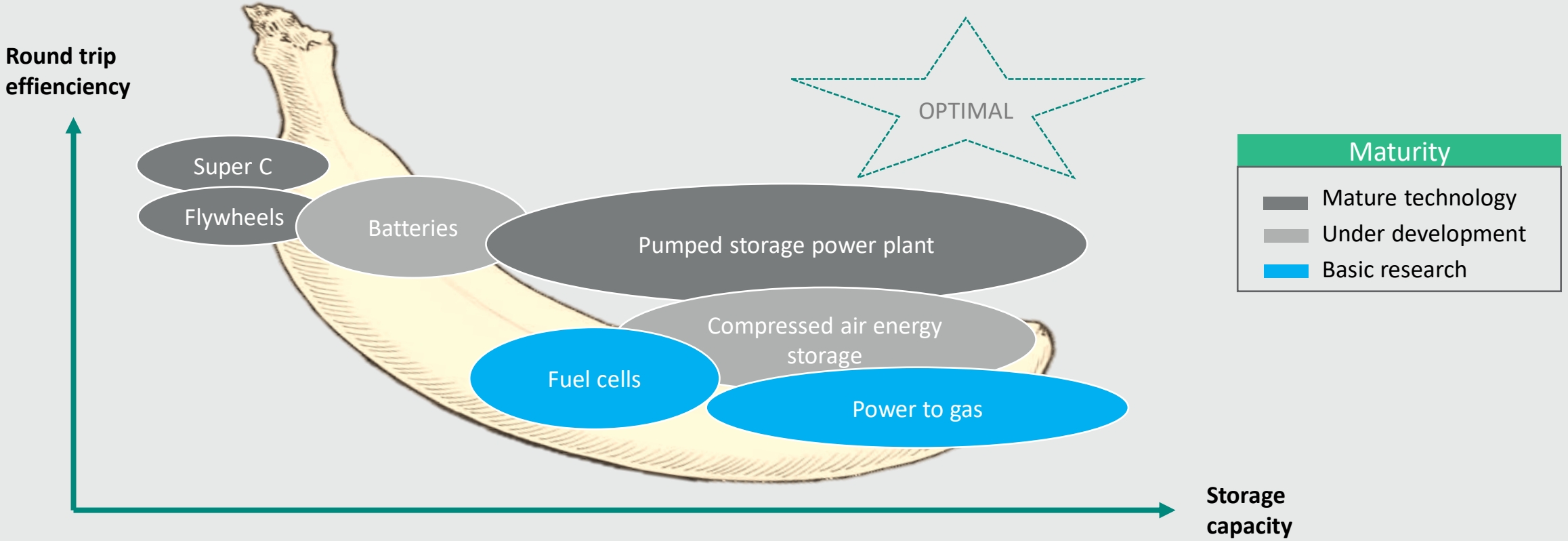


Source: European Association for Storage of Energy, BI analysis

Ideal technologies would have both, high efficiency and high storage capacity

SWEDISH STEEL PRIZE

Available Energy storage technologies, their efficiency performance maturity, Round-trip



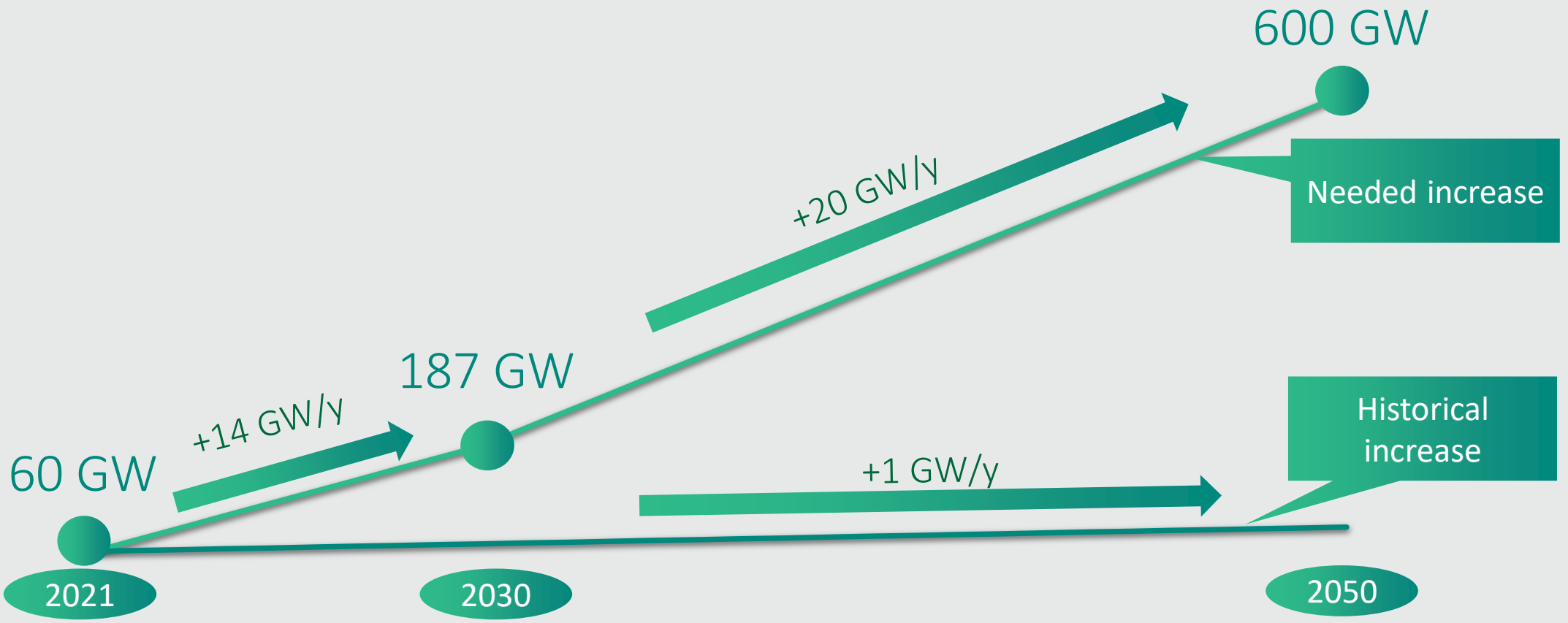
Source: European Association for Storage of Energy, BI analysis

SWEDISH
STEEL PRIZE

By 2030, energy storage capacity is due to triple in Europe, and by 2050 increase tenfold

SWEDISH STEEL PRIZE

2023-2030: EU Projected energy storage capacity growth, [GW]

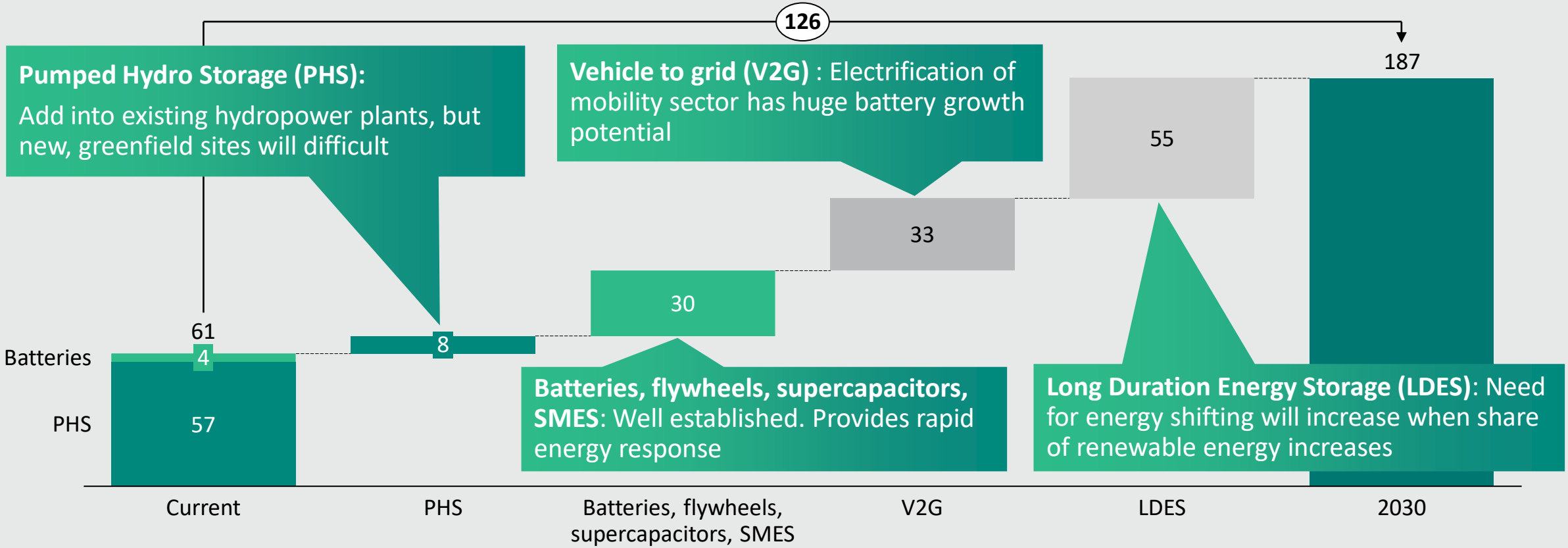


Source: European Association for Storage of Energy

By 2030, energy storage capacity is due to triple in Europe

SWEDISH STEEL PRIZE

2023-2030: EU Projected energy storage capacity growth per storage type, [GW]

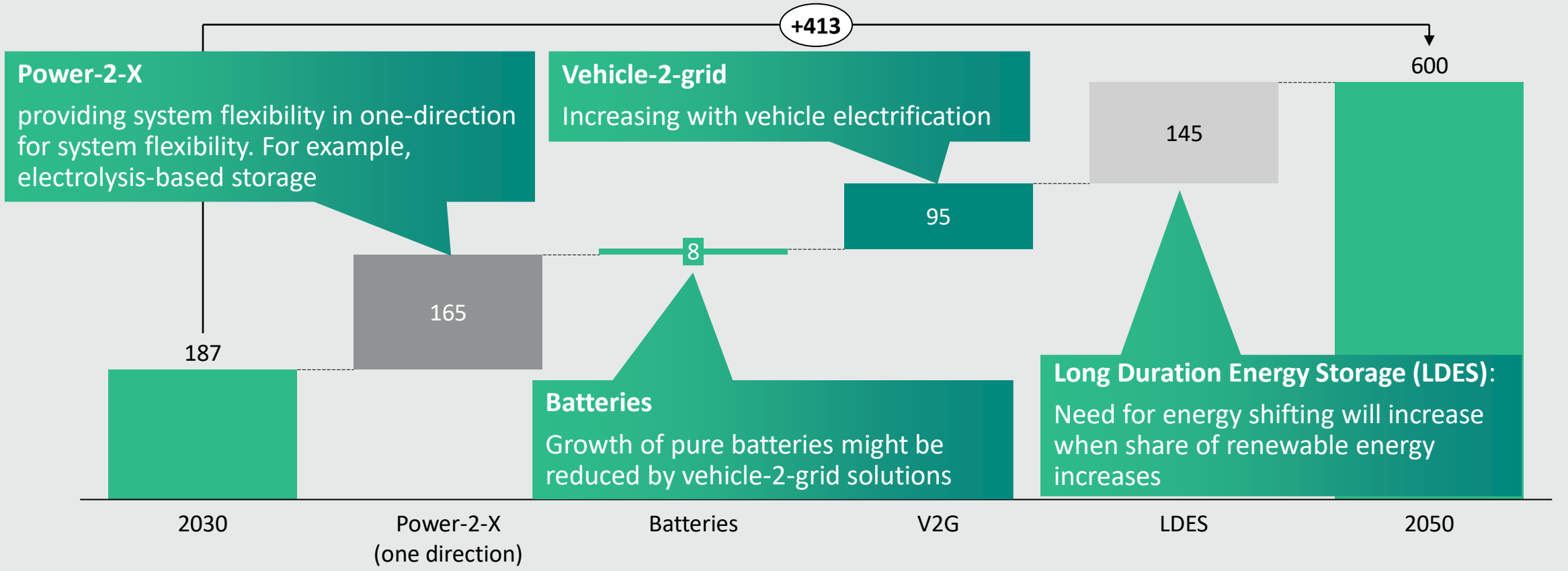


Source: European Association for Storage of Energy, BI analysis

..and beyond 2030, the capacity could tenfold until 2050

SWEDISH STEEL PRIZE

2030-2050: EU Projected energy storage capacity growth, [GW]

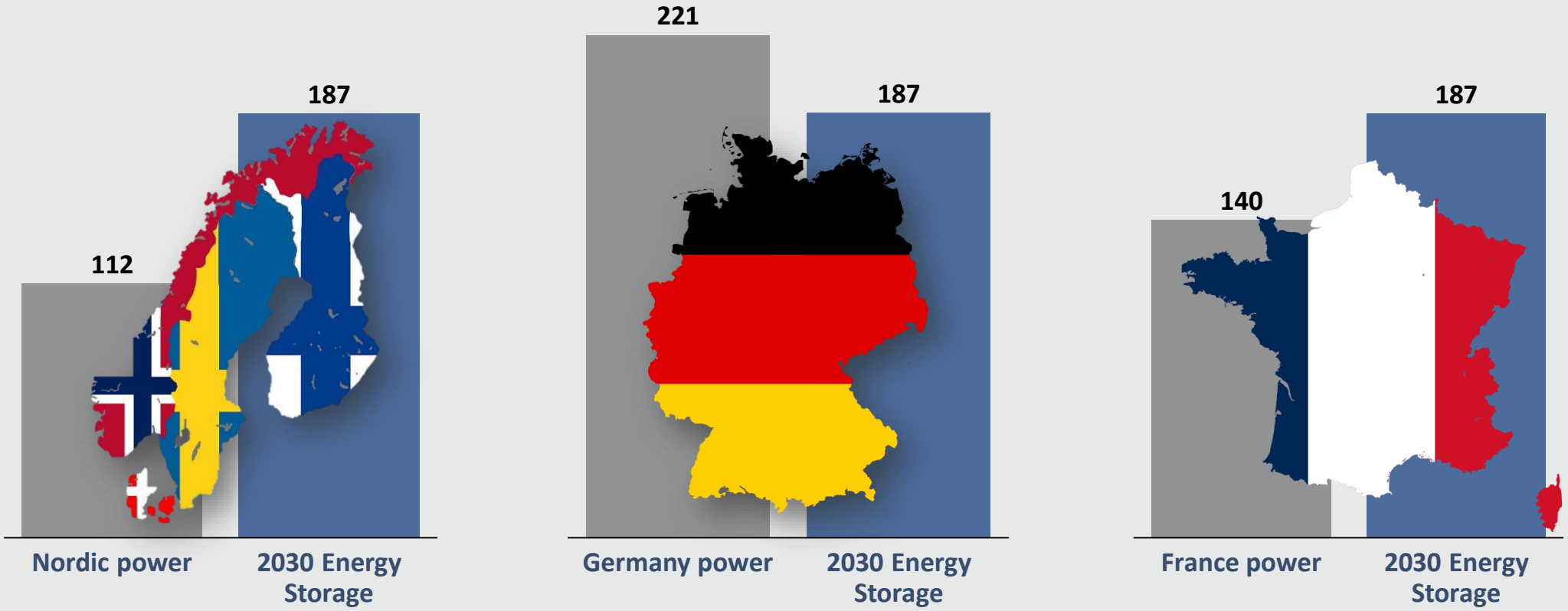


Source: European Association for Storage of Energy, BI analysis

Energy storage capacity in EU is projected to reach 187 GW by 2030, matching the need for entire regions

SWEDISH STEEL PRIZE

2030 energy storage power projection compared to other main European countries power capacity, [GW]



Source: European Association for Storage of Energy, BI analysis

SWEDISH
STEEL PRIZE

STEEL APPLICATIONS

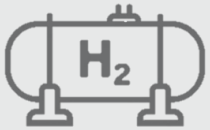
Steel application areas

SWEDISH STEEL PRIZE

THERMAL

STEEL STORAGE TANKS

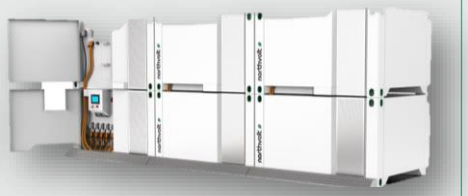
CHEMICAL



STEEL HYDROGEN TANKS AND PIPELINES

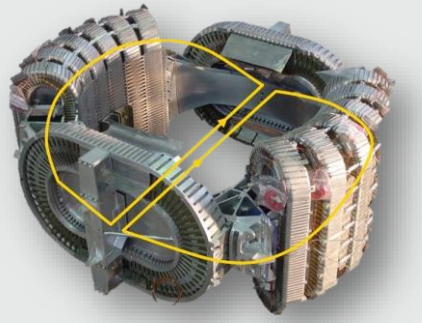
ELECTRO-CHEMICAL

BATTERY PACKS AND CONTAINERS

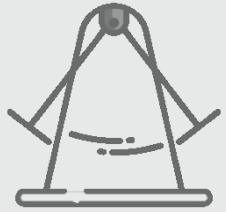


ELECTRICAL

SUPERCOND. MAGNET STRUCTURAL ELEMENTS



MECHANICAL



FLYWHEEL ROTOR AND CASING

Finalist 2023: Levistor from the UK and ZOOZ from Israel

SWEDISH STEEL PRIZE

- Mechanical battery for fast charging
- Flywheel steel design
- Mechanical batteries offer
  - Increased service life
  - No degradation and a smaller material footprint compared to chemical batteries.

SWEDISH
STEEL PRIZE

KEY TAKE-AWAYS

Key takeaways

SWEDISH
STEEL PRIZE

- WHY?
  - Increasing need for renewable energy and overall capacity increase
  - Renewable energy has intermittency issues – need to store overcapacity and use at peak demand
- HOW?
  - Energy can be stored mainly as heat, chemically or as potential energy
  - Not competing directly – serve different needs
    - Rapid response or long term bulk
- STEEL!
  - Steel is a sustainable material choice
  - Needed in order to build energy storage systems cost effectively and sustainably