Federal Ministry
for Economic Affairs
and Climate Action

MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

OVERVIEW ON STORAGE TECHNOLOGIES IN GERMANY & APPLICATIONS

Simon Steffgen
Senior Expert Commercial and Industrial
German Energy Storage Systems Association

implemented by
renac
renewables academy

BVES

Energy Storage Systems Assoc.

- **Founded in 2012 by industry-pioneers**
- **350+ (international) member companies:**
  - Technology providers
  - Project development
  - Financing institutions
  - Research Institutes

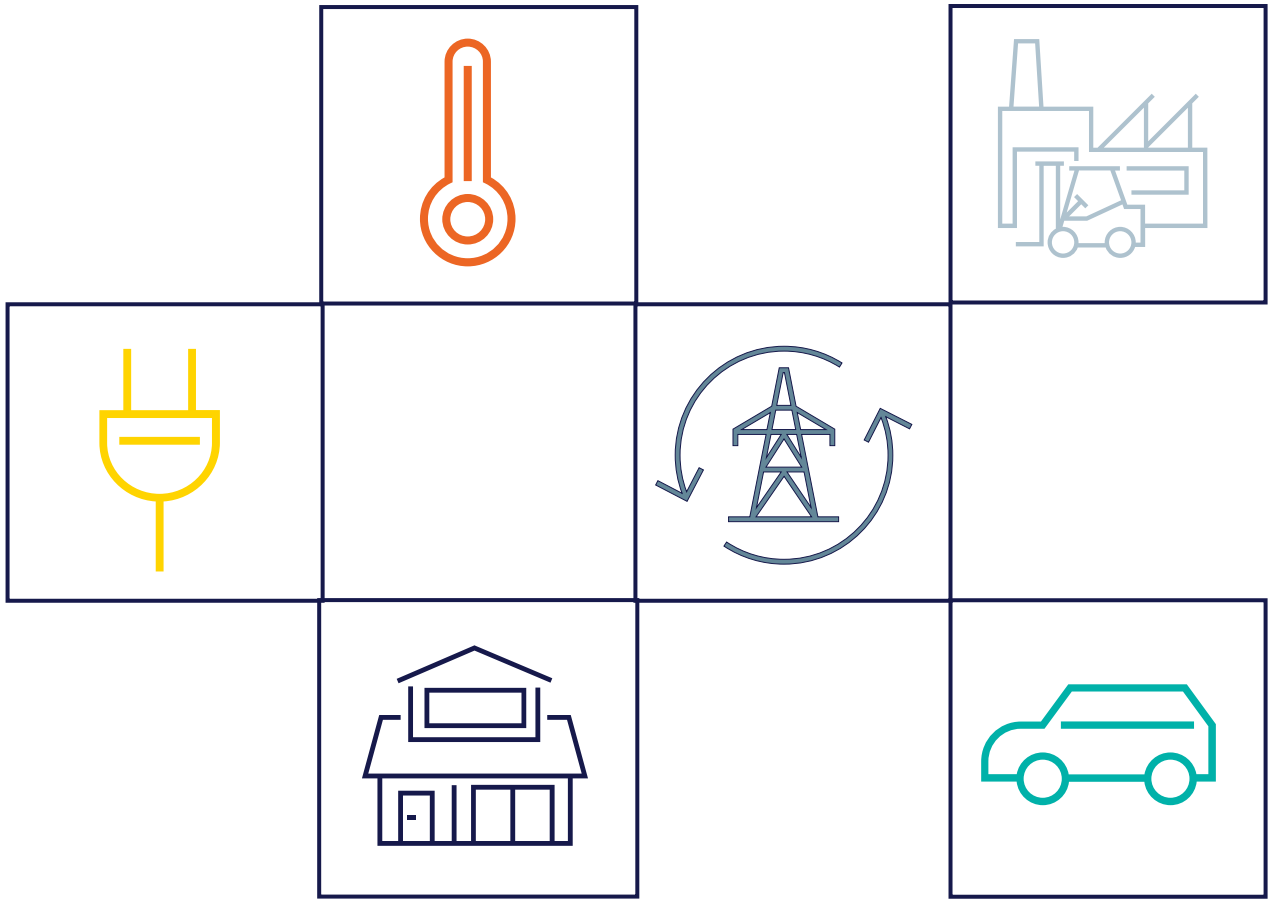
- We are a **dialogue partner** for politics, administration, science and the public. With **targeted lobbying** at the interfaces of political decision making, we are working for the improvement of the regulation and policy framework for energy storage (nationally and internationally).

THE APPLICATION DETERMINES THE STORAGE

- **Exact use-case** determines the technical and economic configuration of the storage-system

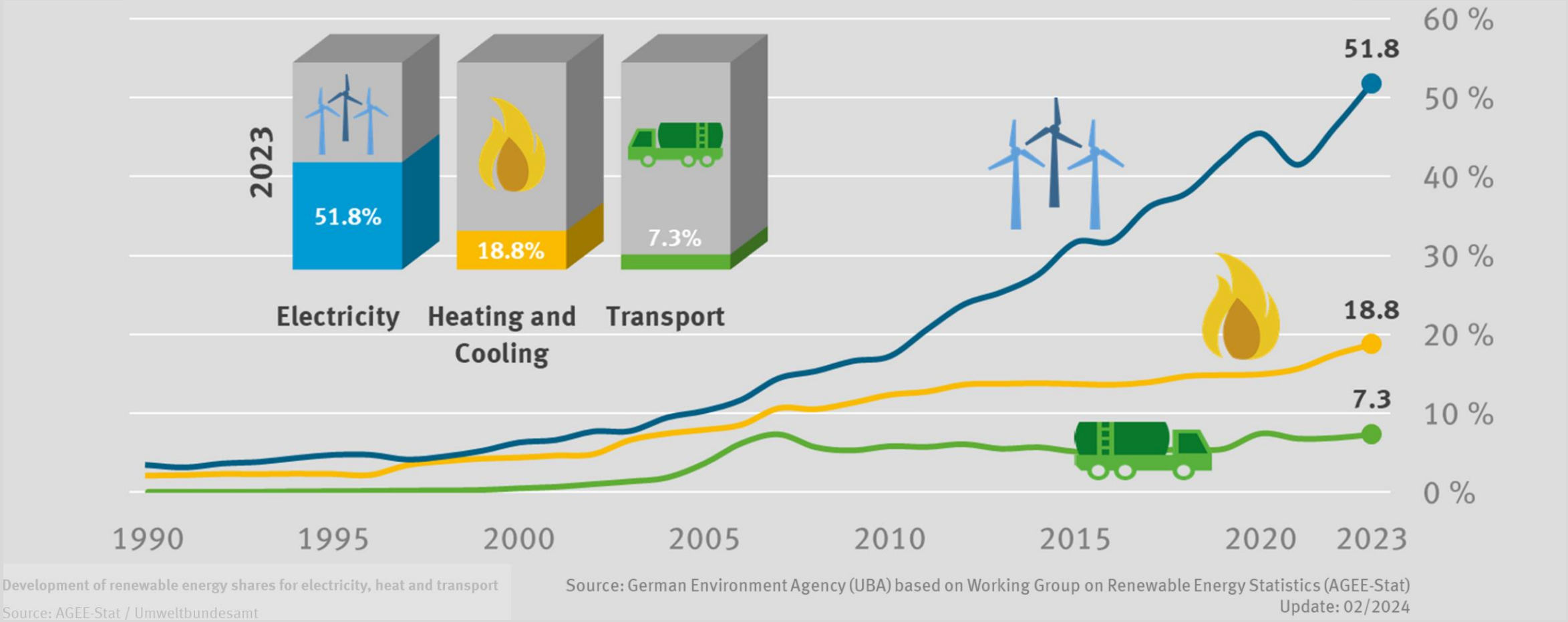
➢ An assessment of different storage technologies (and a comparison) can only be conducted on the basis of a **specific applications**.

- Technical variables
  - form of energy
  - Power
  - storage capacity
  - response time
- **Economic environment**: which energy prices can be set, depth of use, etc.



ON THE WAY TO 100% RENEWABLES

RENEWABLES SHARE IN ELECTRICITY, HEATING AND MOBILITY



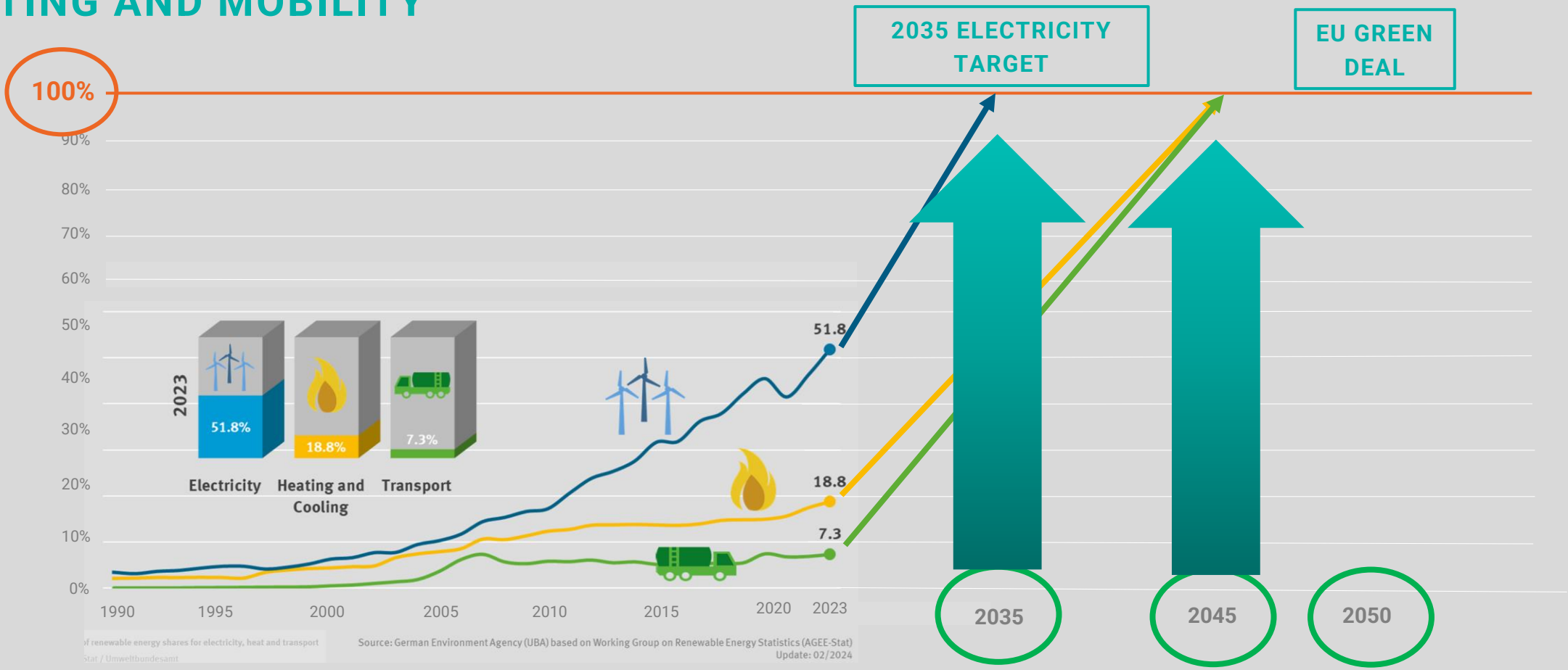
Development of renewable energy shares for electricity, heat and transport

Source: AGEE-Stat / Umweltbundesamt

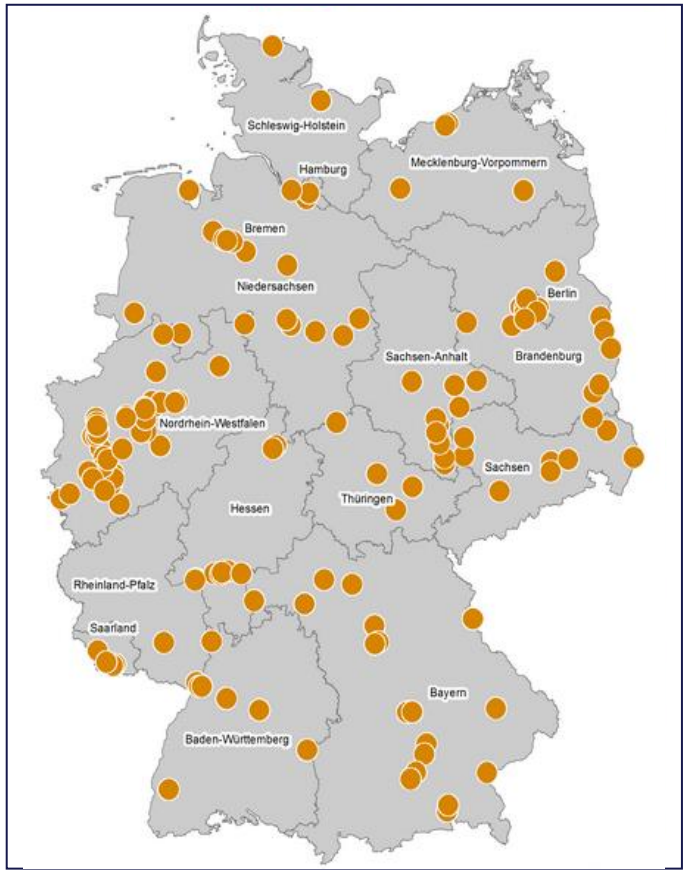
Source: German Environment Agency (UBA) based on Working Group on Renewable Energy Statistics (AGEE-Stat)
Update: 02/2024

ON THE WAY TO 100% RENEWABLE ELECTRICITY

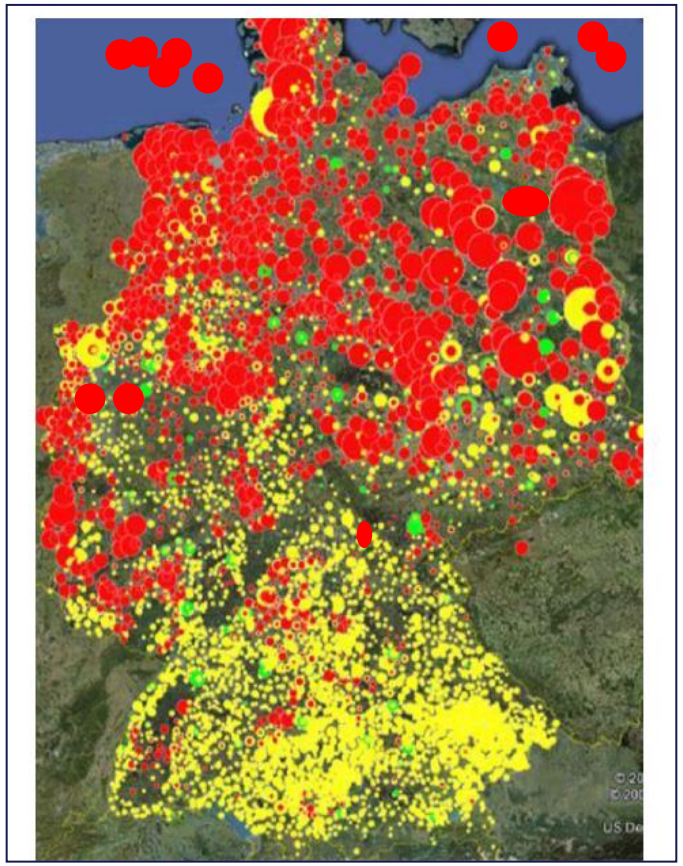
RENEWABLES SHARE IN ELECTRICITY, HEATING AND MOBILITY



ENERGY TRANSITION:
RESULT NO. 01 = DECENTRALIZATION

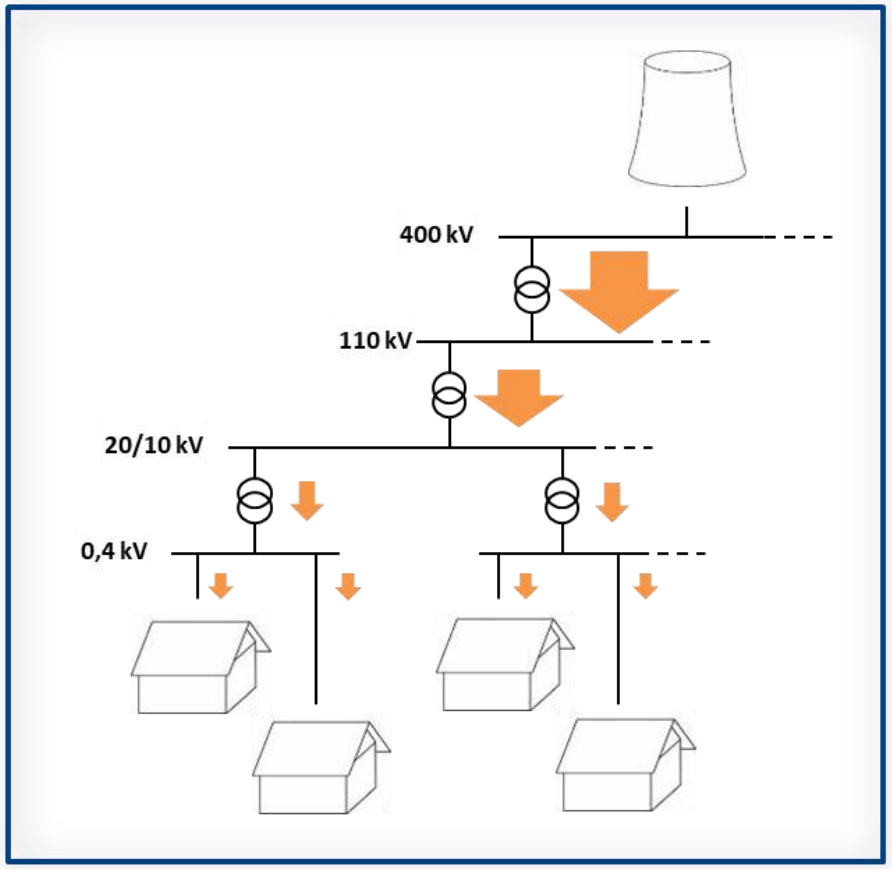


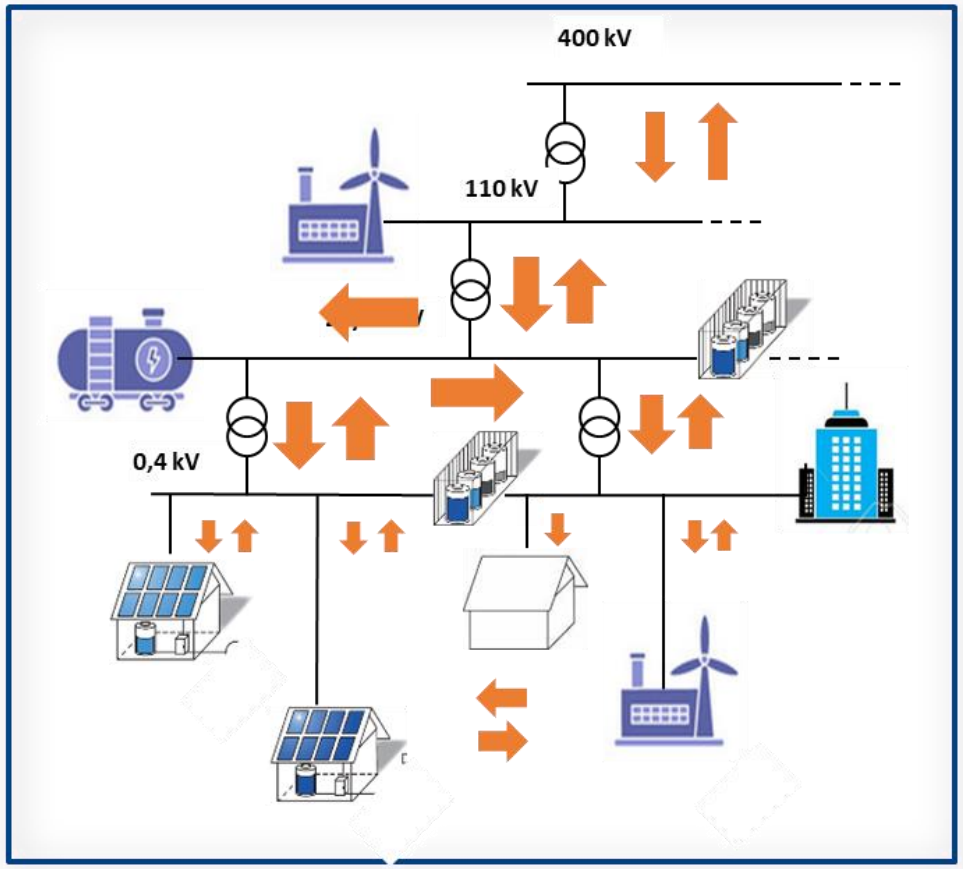
Fossil Power Plants



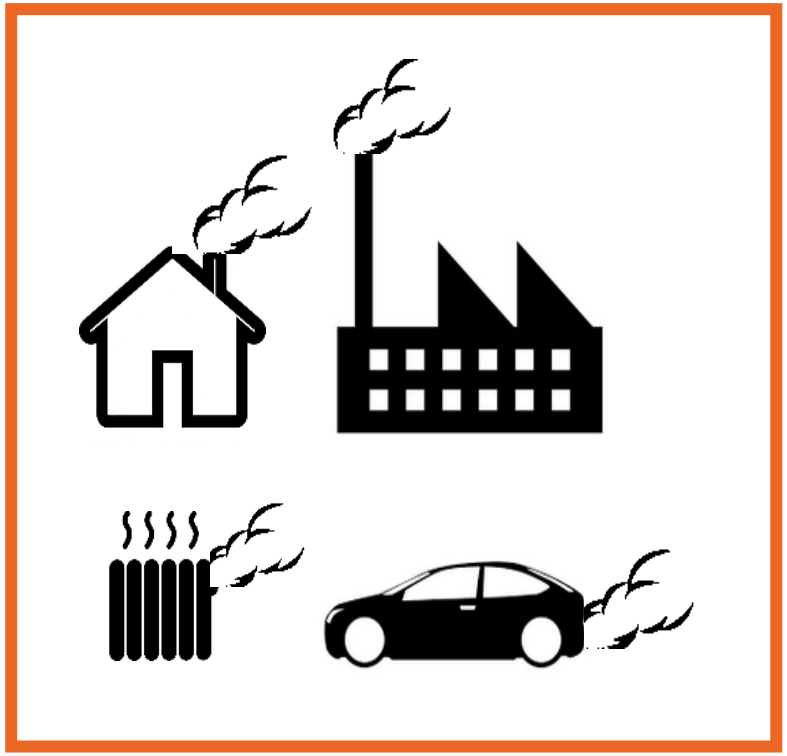
Renewable Generation

ENERGY TRANSITION:
RESULT NO. 02 = NEW STRUCTURE, NEW TASKS, NEW ISSUES

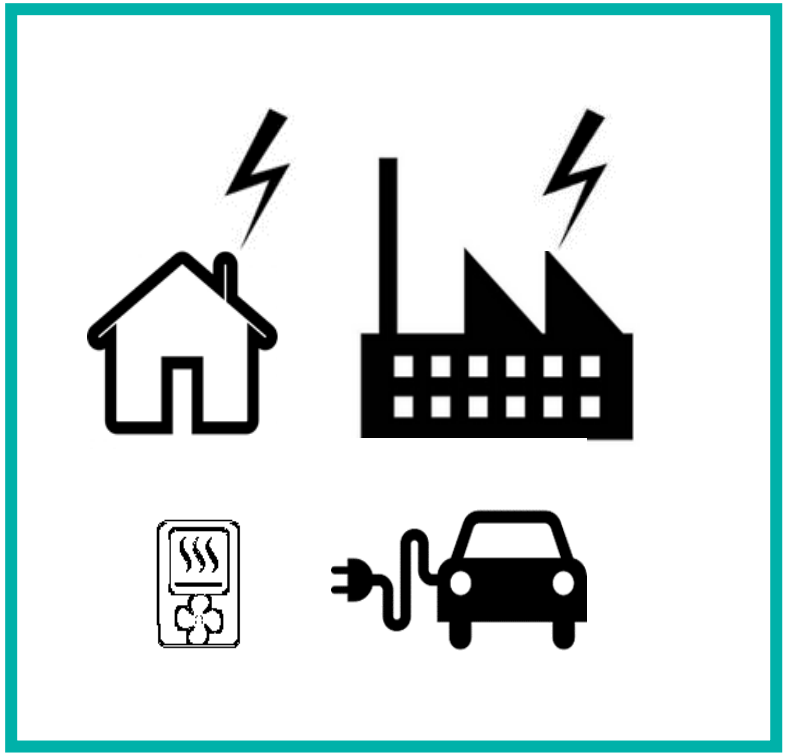




ENERGY TRANSITION:
RESULT NO. 03 = POWER IS THE NEW CURRENCY



FOSSIL AGE:
Energy is sufficient.

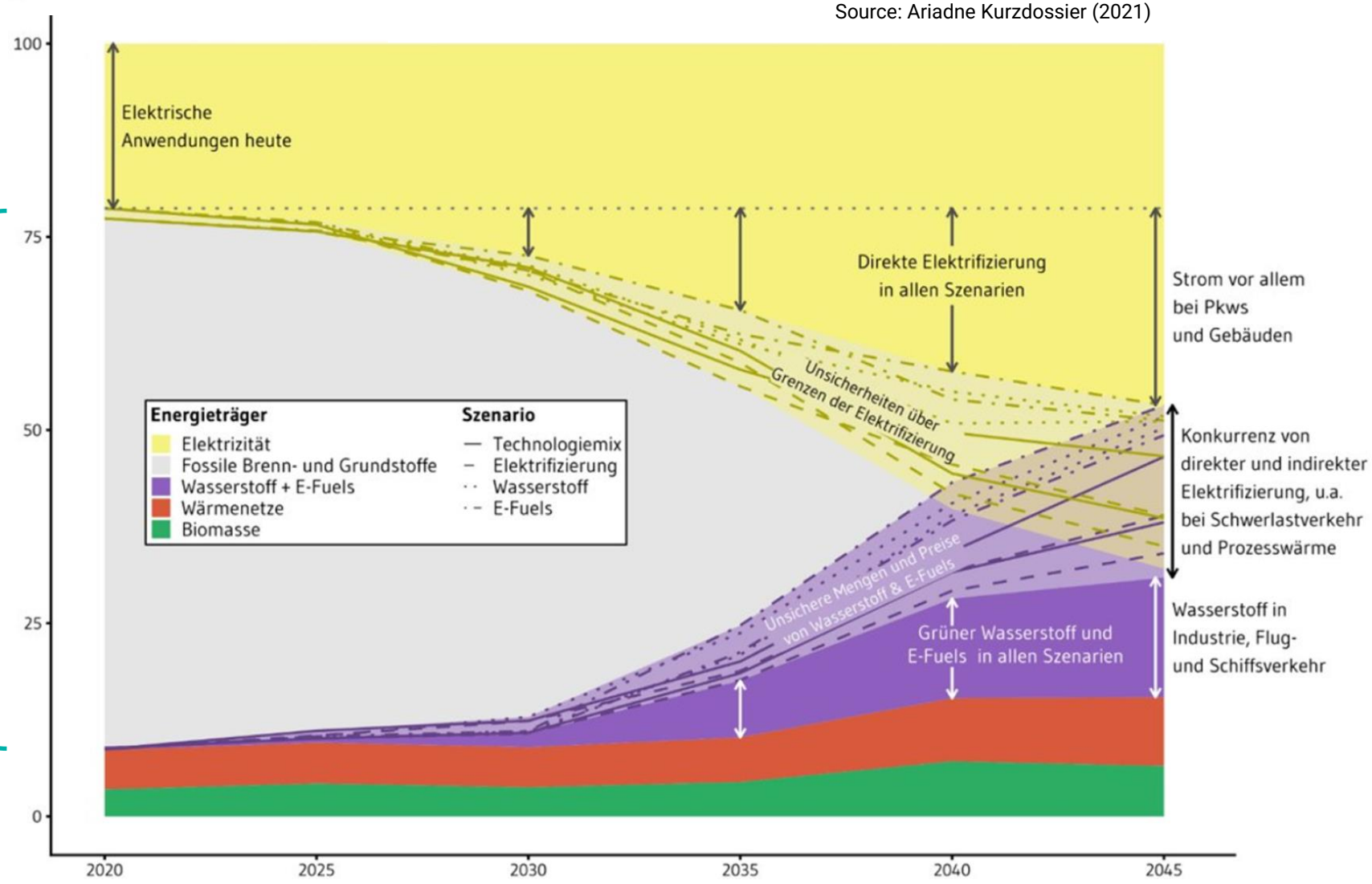


ELECTRIFICATION WAVE:
Power is needed.

ENERGY TRANSITION MEANS (MOSTLY) ELECTRIFICATION

a shares of final energy

Source: Ariadne Kurzdossier (2021)



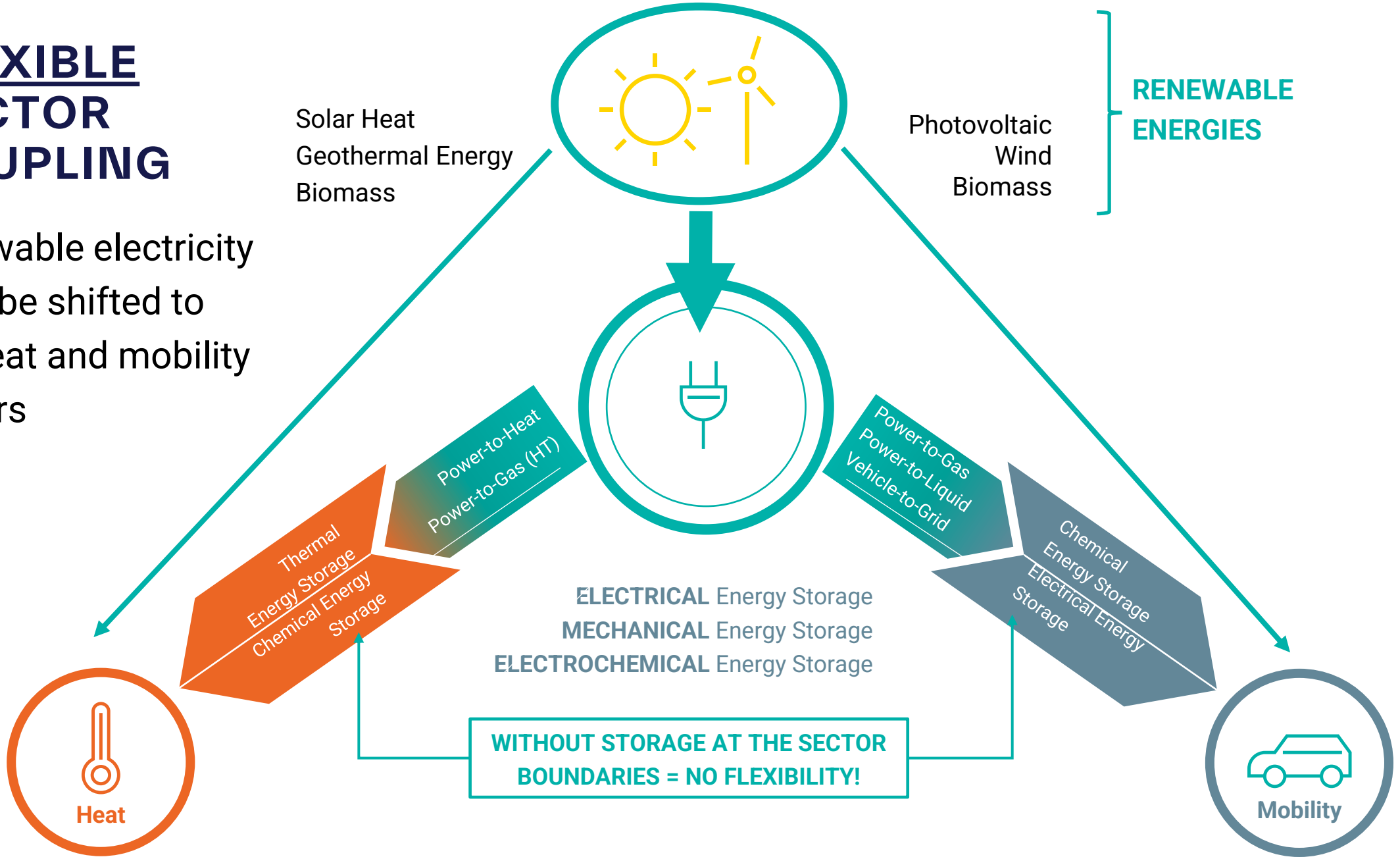
~ 80 % fossil fuels

~ 75 % via electrification

~ 25 % via H2, biomass, etc.

FLEXIBLE SECTOR COUPLING

Renewable electricity must be shifted to the heat and mobility sectors



WHAT IS THE SHIFT ALL ABOUT?

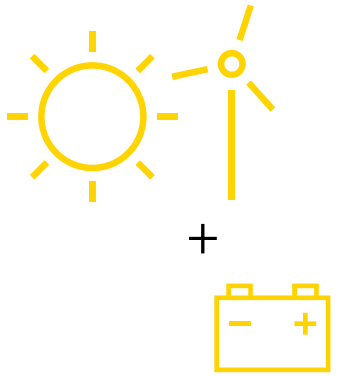
Local availability >> Temporal availability

- Renewable Energies can be generated **ANYWHERE**.
- But not **ANYTIME**.
- **ANYTIME** Availability: **ONLY** with storage.

FLEXIBILITY

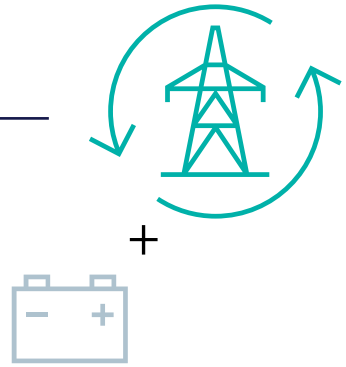
TO SECURE A RENWABLES-BASED ENERGY SYSTEM AND THE ENERGY DEMAND – FLEXIBILITY IS NEEDED

GENERATION



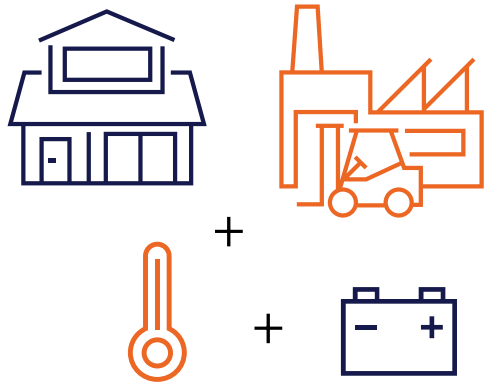
TO FLATTEN THE CURVE

GRID



TO BALANCE THE FREQUENCY

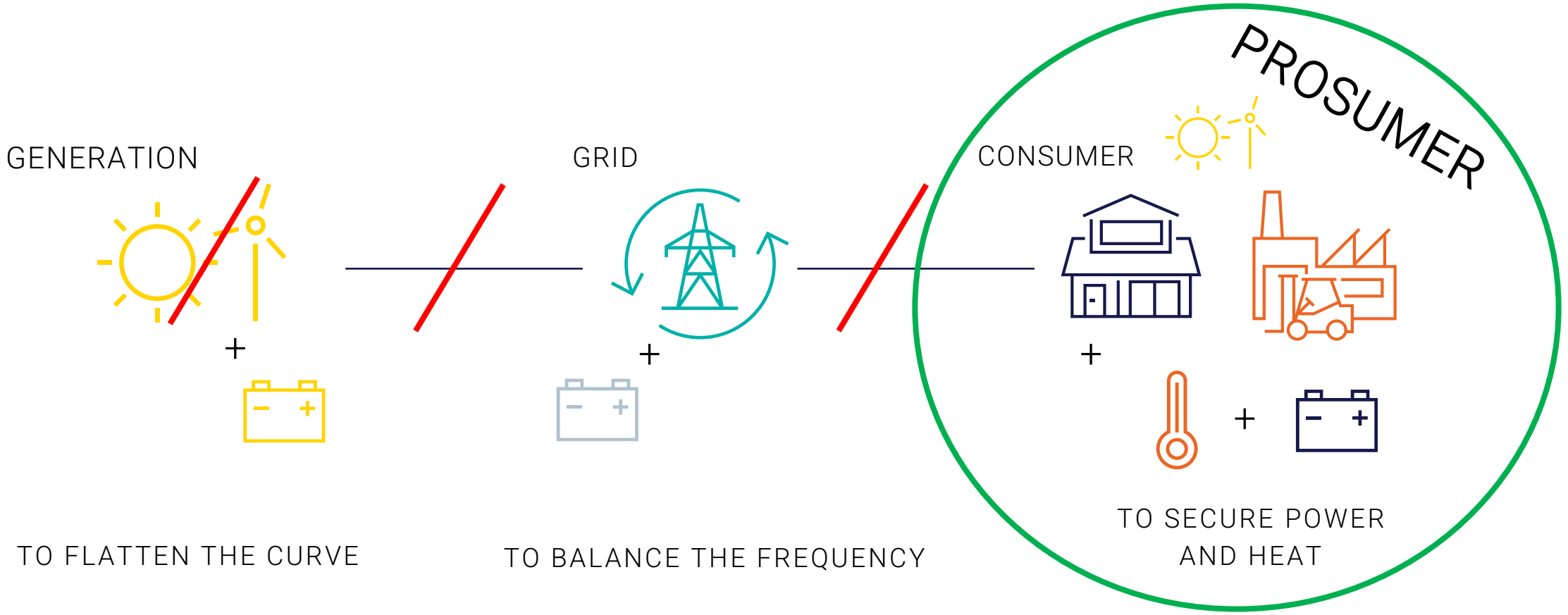
CONSUMER



TO SECURE POWER AND HEAT

FLEXIBILITY

TO SECURE A RENWABLES-BASED ENERGY SYSTEM AND THE ENERGY DEMAND – FLEXIBILITY IS NEEDED



ENERGY STORAGE TECHNOLOGIES

ELECTRICITY STORAGE

STORAGE OF ELECTRICAL ENERGY

e.g. Supercapacitator, Capacitators

ELECTROCHEMICAL STORAGE

e.g. Lead-Acid Battery, Redox-Flow Battery, Li-Ion Battery

MECHANICAL STORAGE

e.g. Pumped Hydro, Compressed-Air Storage, Flywheel

CHEMICAL ENERGY STORAGE

PRODUCTION AND STORAGE OF GREEN HYDROGEN

usage of fuel cell, electrolyzer

THERMAL ENERGY STORAGE

STORAGE OF SENSIBLE HEAT

e.g. hot-water, minerals, steel

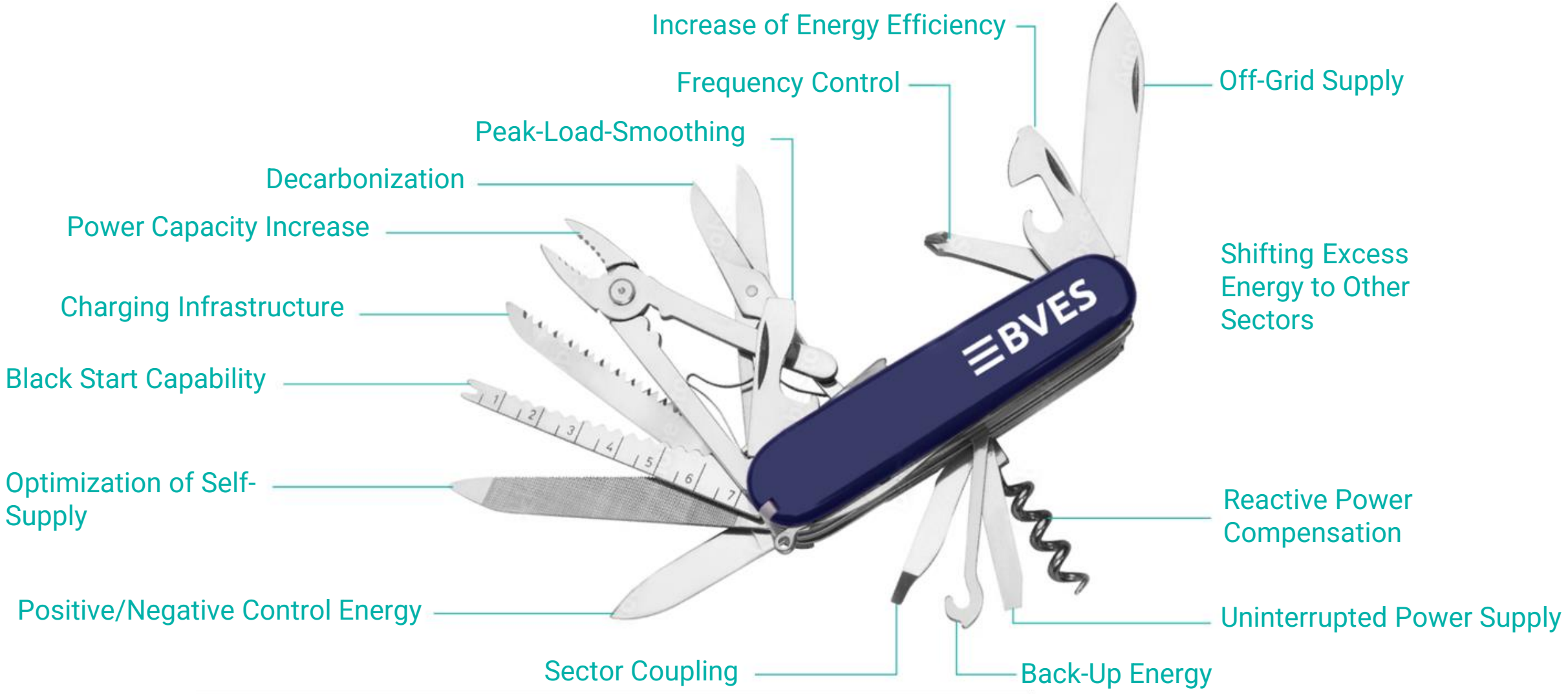
STORAGE OF LATENT HEAT

e.g. phase-change material (PCM), slurries

THERMOCHEMICAL STORAGE

e.g. sorption storage, thermochemical material (TCM)

MULTI TOOL ENERGY STORAGE – FOCUS ON POWER



MULTI TOOL ENERGY STORAGE – FOCUS ON HEAT

Seasonal Heat Storage

Waste Heat Recovery

Process Optimization

Mobile Heat-Transportation

Thermal Heat

Electricity Storage – PtHtP

Decarbonization

Fuel-Switch

Process Heat

Steam Production

Optimization of Self-Supply

Quality of Process Heat

Electrification

Load Shifting

Positive & Negative Controlenergy

Sector Coupling

BEST PRACTICE

1. RESIDENTIAL

HOME GENERATION AND CONSUMPTION OF ELECTRICITY AND HEAT + E-MOBILITY

Residential

- 1 Mio. Storage Systems installed (06/2023)
- 300.000 new installations per annum
- Installations mostly incl. Heat pumps
  + Charging station
- Huge retrofit potential of existing Rooftop-PV (~ 2 Mio.)

… ALSO IN URBAN AREAS

Example: Project in Darmstadt/ Germany in housing complex with 43 flats + shared spaces

Specifications:

- 80 kWp PV plant
- 76,8 kWh, 18 kW Lithium-Ion battery

Benefits:

- Lower energy prices
- 22% increase of self-consumption
- provision of high-power charging for e-mobility

Source: TESVOLT, https://www.tesvolt.com/de/projekte/vom-dach-in-die-wohnung.html

RESIDENTIAL/MOBILITY
BEST PRACTICE

Application: Vehicle to home- Car as an energy storage

Technology: Bidirectional charging with direct current

Concrete benefit: Use the car as home storage, increase the efficiency of self-supply, peak load capping

Further Information:
https://thedriven.io/2018/10/19/v2g-whats-the-state-of-play-with-vehicle-to-grid-vehicle-to-home-technology/

Vehicle-to-home (V2H)

BEST PRACTICE

2. COMMERCE & INDUSTRIAL

INDUSTRY/ELECTRICITY
BEST PRACTICE

Application: Industrial storage in Echte, Lower Saxony

Completion: 2019

Company: smart power GmbH

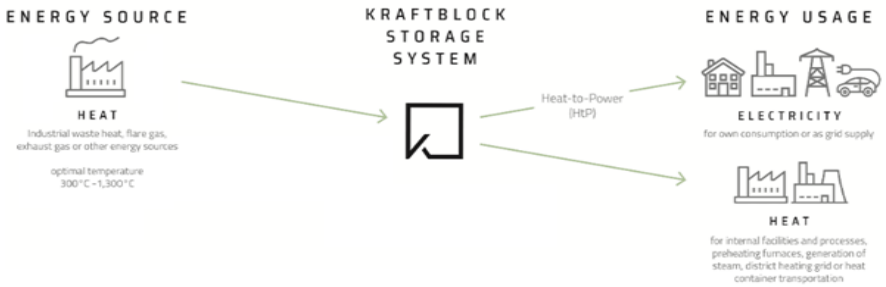
Technology: Container with battery stacks as diesel hybrid system with Samsung SDI cells (lithium-ion battery)

Power / Capacity: 1100 kVA; 1370kWh

Concrete benefit: Peak shaving

Further Information:
https://smart-power.net/portfolio/113/

INDUSTRY/HEAT
BEST PRACTICE



Application: Power-to-heat storage system to decarbonise process heat in potato chip production

Technology: Granules with heat transfer media such as air, flue gas, liquid salt or thermal oil, up to 1,300°C storage temperature

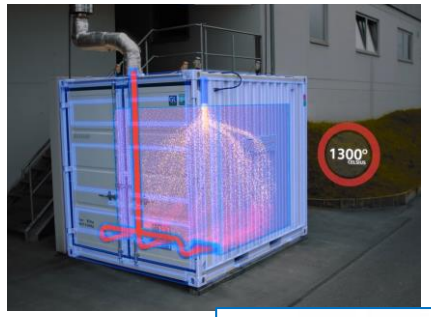
Company: Kraftblock GmbH

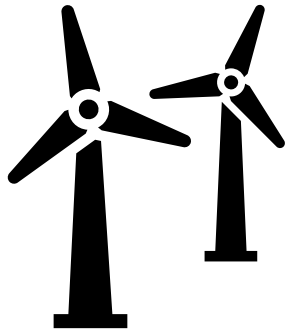
Capacity: 22 MW, > 150 MWh

Storage temperature: > 800°C

Concrete benefit: replacement of gas boiler, enable renewable process heat delivery 24/7, 8,500 t CO_2 reduction/year, enable use of local renewable resources

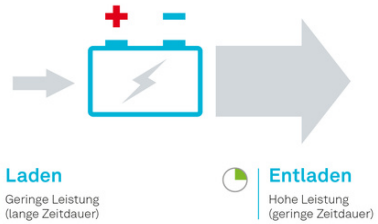
Further Information:
https://kraftblock.com/de/applications/industrielle-abwaerme.html





© PepsiCo

BEST PRACTICE
CHARGING INFRASTRUCTUCTURE MOBILITY



Application: Power Booster for fast charging stations

Technology: Battery stacks with Samsung SDI cells

Company: ads-tec Energy GmbH

Power / Capacity : 280kW/240kWh per Container

Direct Benefit: Scalable, increase in the power capacity of the charging columns, grid services (voltage maintenance, frequency regulation, peak capping, reactive power).

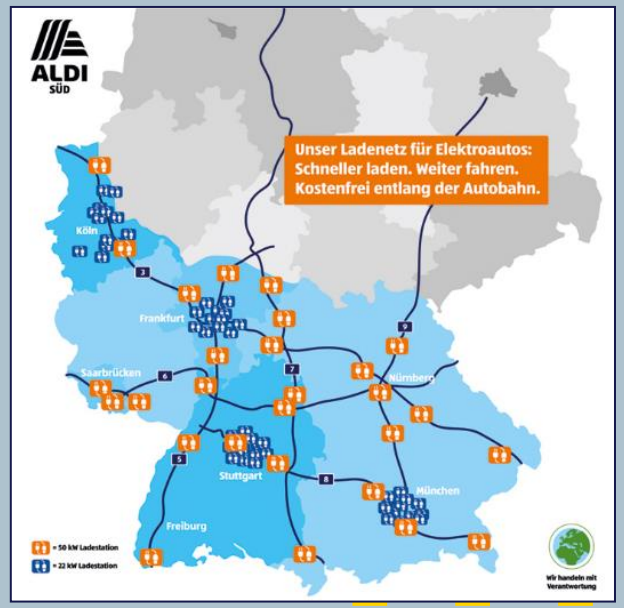
Further Information:

https://www.ads-tec-energy.com/commercial-industrial/powerbooster/technische-daten.html

NEW BUSINESS MODELS – NEW OPPORTUNITIES

NEW PLAYERS

NEW ADDED VALUE



AGRICULTURE
BEST PRACTICE

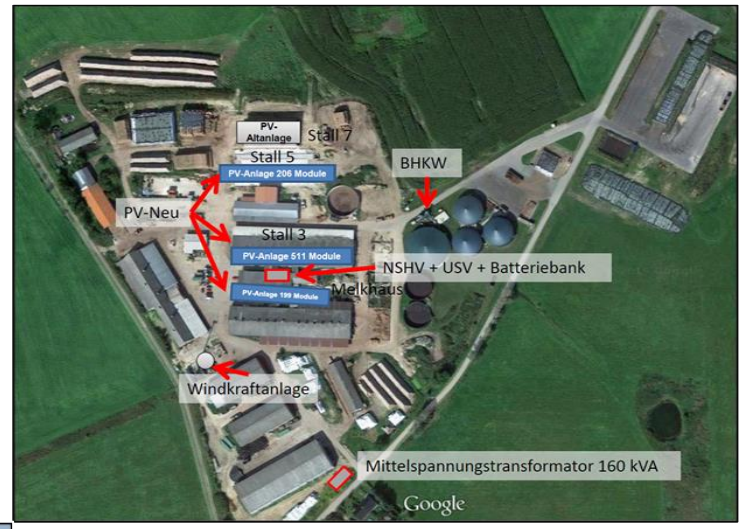
Application: Dairy farmer in Brandenburg

Completion: 2019

Technology: Container Flow-Battery, Heat-Storage, Heat-Pump

Direct Benefit: Reduction of
Energy Costs (- 0,3 € Cent/litre milk)

Power & Cooling = 100% Self-Sufficiency



ELECTRICITY, POWER, HEATING, COOLING + MOBILITY IN THE INDUSTRY

AROUND 5000 PROJECTS IN GERMANY

APPLICATIONS

3. INFRASTRUCTURE

BEST PRACTICE
SYSTEM INFRASTRUCTURE MOBILITY

Application: Europe's largest charging park at the Hilden interchange between the A3 and A46 motorways

Technology: 20 Superchargers of the new V3 generation from Tesla and 16 fast-charging stations from the Dutch provider Fastned

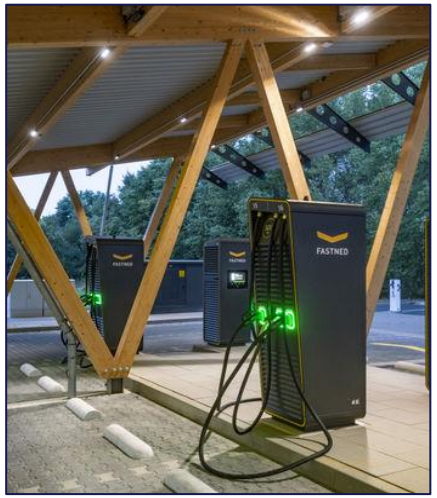
Company: Tesvolt GmbH

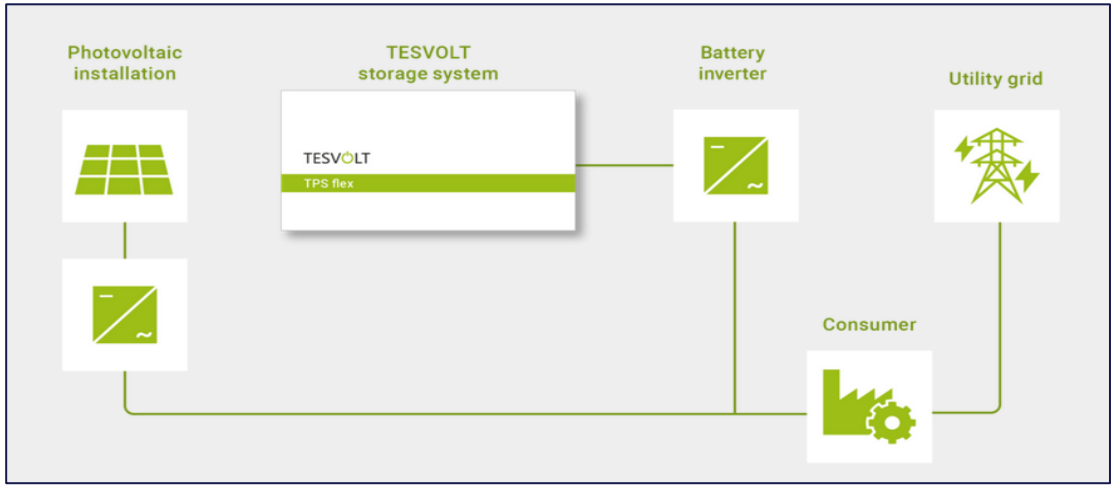
Completion: 2021, currently building the extension

Power / Capacity: 114 charging points with 300kW charging capacity, up to 2 MWh total capacity

Direct Benefit: Peak shaving, expandable, long-lasting, system services, only one hour (un)charging time

Further Information:
https://www.tesvolt.com/_media/07%20PROJEKTE/Ladepark_Hilden/Use_Case_Lastspitzenkappung_Ladepark_DEU.pdf



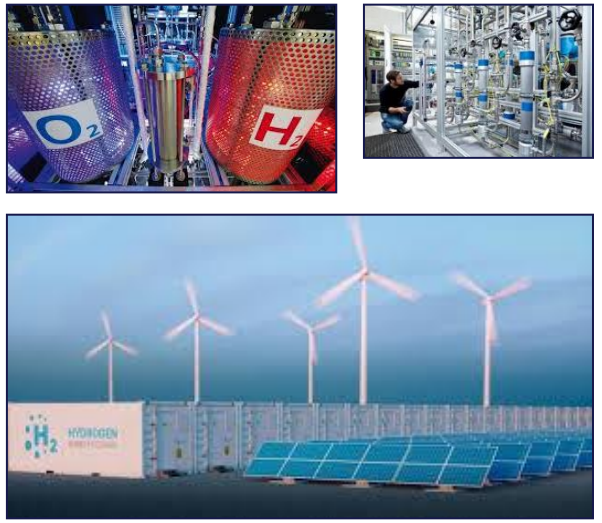


UTILITY/LARGE STORAGE MARKET FOR ELECTRICITY INFRASTRUCTURE

CONTROL ENERGY | SYSTEM SERVICES | FLEXIBILITY

PUMPED HYDRO STORAGE CA. 7 GW

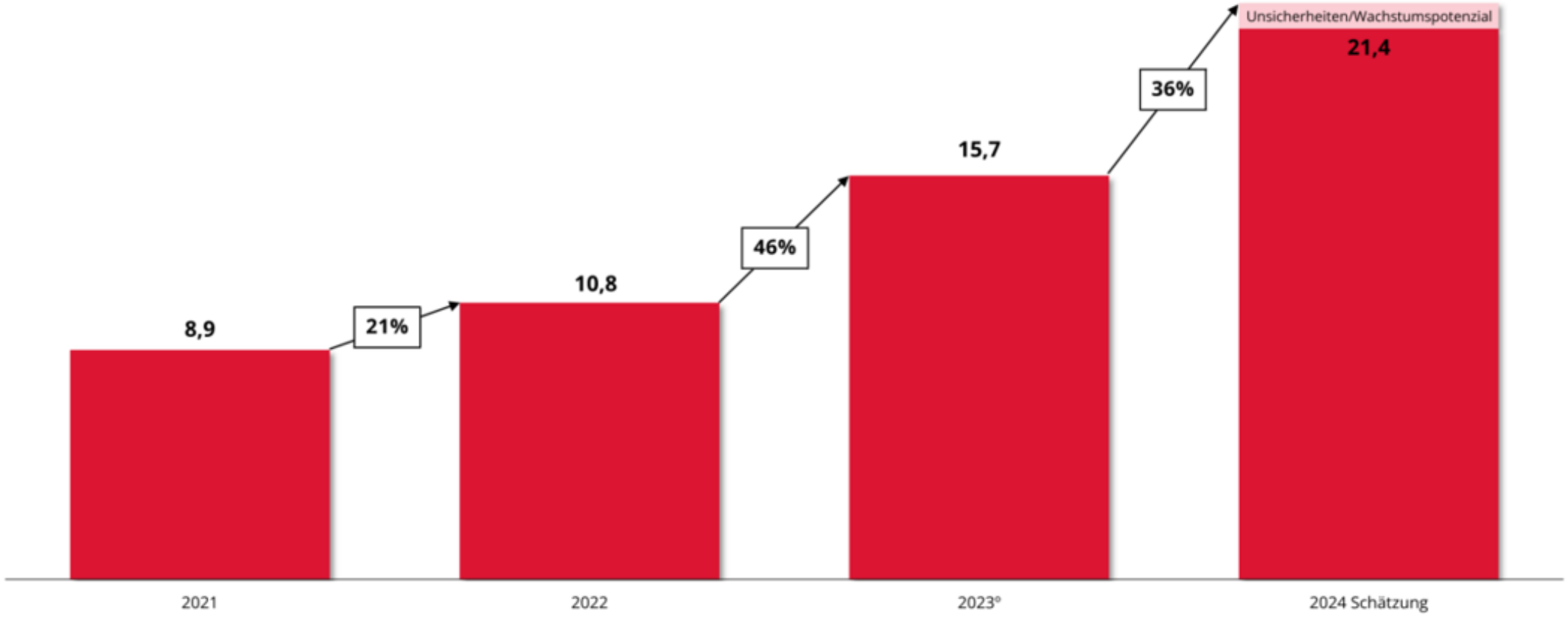
BATTERY STORAGE CA. 1100 MW



HYDROGEN/ PTX

GERMAN ENERGY STORAGE INDUSTRY
REVENUES AND OUTLOOK

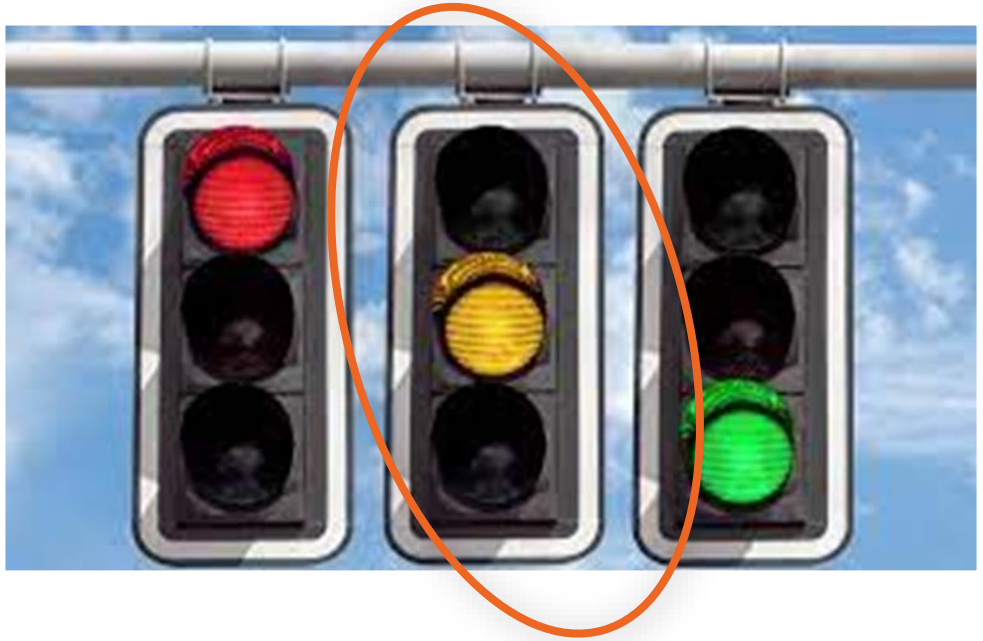
GROWTH RATES ARE ACCELERATING
ENERGY STORAGE INDUSTRY REVENUES IN GERMANY 2021-2024 (IN €B)



COMPILED FOR BVES

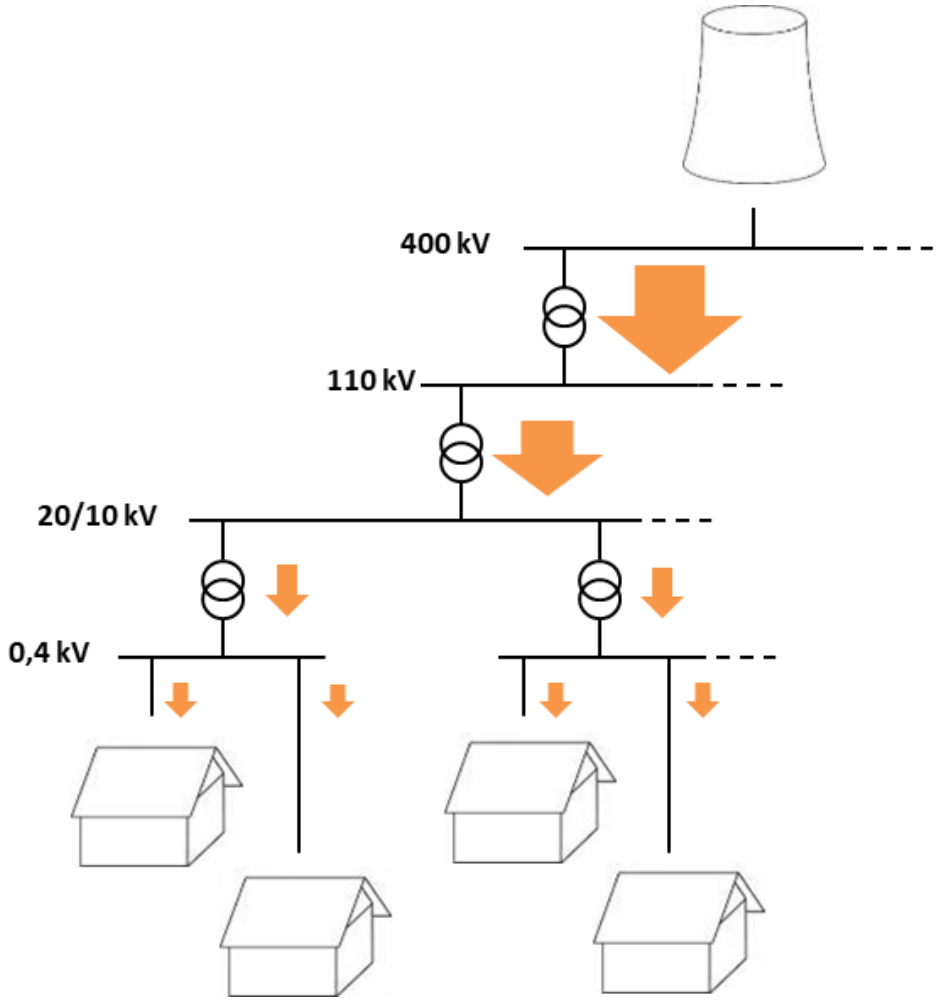
THE LEGAL FRAMEWORK – AND ITS PROBLEMS

TECHNOLOGIES ARE READY, BUT ...

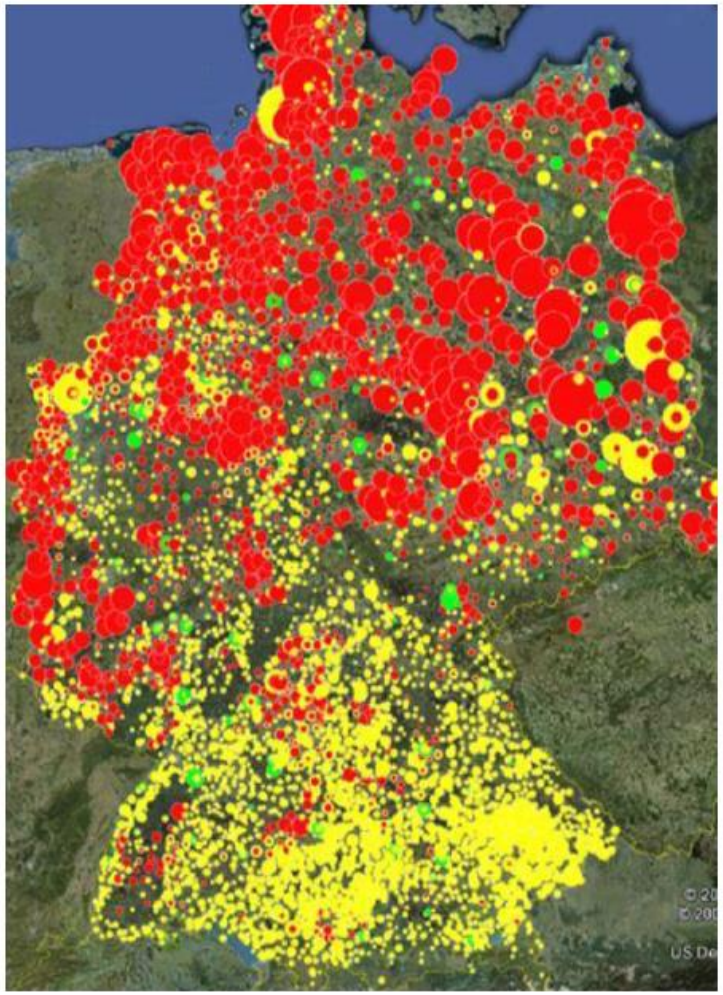


... THERE IS MOSTLY NO SUITABLE LEGAL FRAMEWORK

ENERGY LAW IS MAINLY STILL BASED ON THE OLD ENERGY SYSTEM...



… AND NOT SUITABLE FOR THE NEW ENERGY REALITY!



PREVENTIVE AND PROTECTIVE FIRE SECURITY WITH LARGE-SCALE LITHIUM ION STORAGE SYSTEM

DOWNLOAD HERE

BVES
Bundesverband Energiespeicher Systeme e.V.

ANY QUESTIONS ABOUT ENERGY STORAGE OR A MEMBERSHIP AT THE BVES?

Contact us:

Bundesverband Energiespeicher Systeme e.V.
Energy Storage Systems Association

Oranienburger Str. 15
10178 Berlin
T. +49 (0) 30 54610 634
info@bves.de

bves.de

Federal Ministry
for Economic Affairs
and Climate Action

MITTELSTAND
GLOBAL
ENERGY SOLUTIONS
MADE IN GERMANY

Thank you for your attention!

Simon Steffgen
Senior Expert Commerce & Industry
Contact: s.steffgen@bves.de

17.09.2024, Bukarest

implemented by
renac
renewables academy