




We've PLANNED...
We are well PREPARED...
We want to PERFORM!

**RGI Workshop · Plan, prepare, perform: Best practices for operating the system with high shares of renewables ·
7th November 2018 · Berlin · Dr. Constanze Adolf**

A person with their hair in a bun, wearing a dark jacket, is seen from behind, sitting at a desk in an office. The office has a large window with a grid pattern, through which some buildings are visible. Several indoor plants are on the desk and shelves, including a tall green plant, a pink poinsettia, and a green striped pumpkin. A small, glowing yellow light is visible on the left side of the frame.

Lumenion was founded in 2015 in Berlin and today has 15 employees. We develop high temperature grid scale storage systems to deliver heat and electricity to industries, public utilities and communities – reliably and sustainably.

What we need now....



A photograph of a rustic stone cabin with a single window, situated in a snowy mountain landscape. The cabin is built from light-colored stone and has a dark roof. The surrounding area is covered in snow with patches of dark vegetation. In the background, a steep, snow-covered mountain slope rises under a clear blue sky. A wooden fence is visible in the foreground on the right side.

We must, indeed, all hang together or, most assuredly, we shall all hang separately.

Benjamin Franklin



spends
€350 billion
every year to
import energy



is the
largest energy
importer in the world



THE EU...



buys
from third countries more
than **half** of what it
consumes



relies heavily on a
**limited
number** of
suppliers

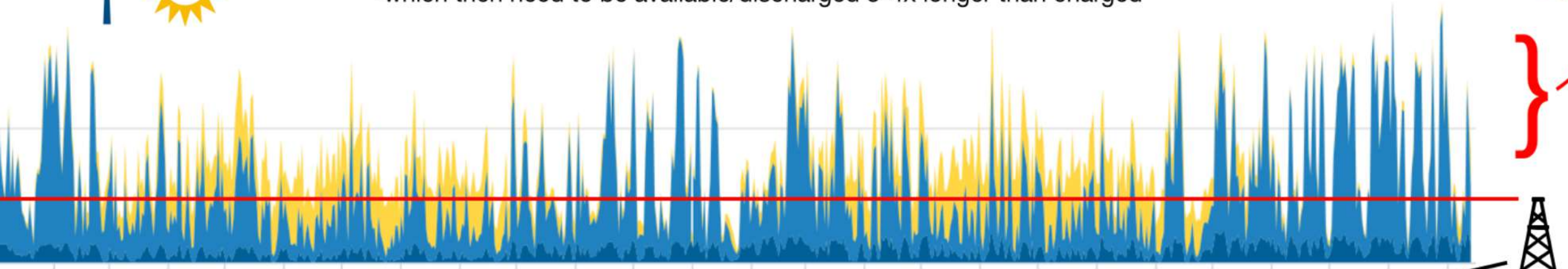


■ BUSINESS CASE FOR STORAGE

24 months of German Wind+PV production scaled to/for 80% clean energy share (simplified)




Wind and Solar (PV) generation tends to occur in spikes 3-4x higher than required
- which then need to be available/discharged 3-4x longer than charged



Source: Data based on Agora Energiewende, own extrapolations

80 GW peak load "grid" or "stability" portion
that can be absorbed by the "copper plate"



**2017:
5,2 TWh grid
balancing costs:
€1,4 bn**

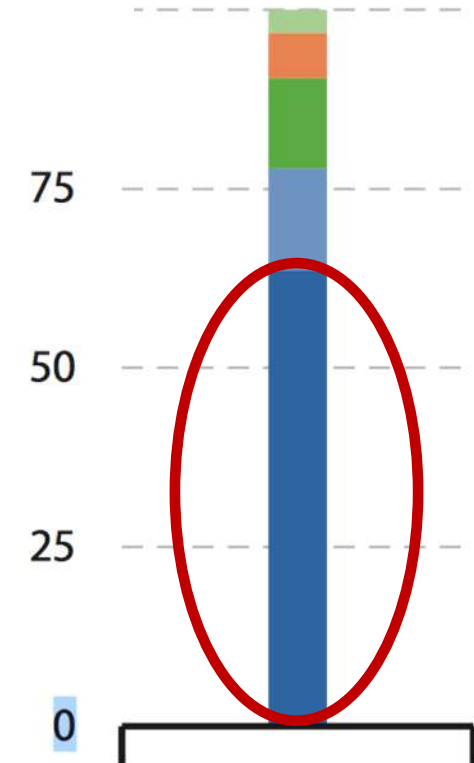
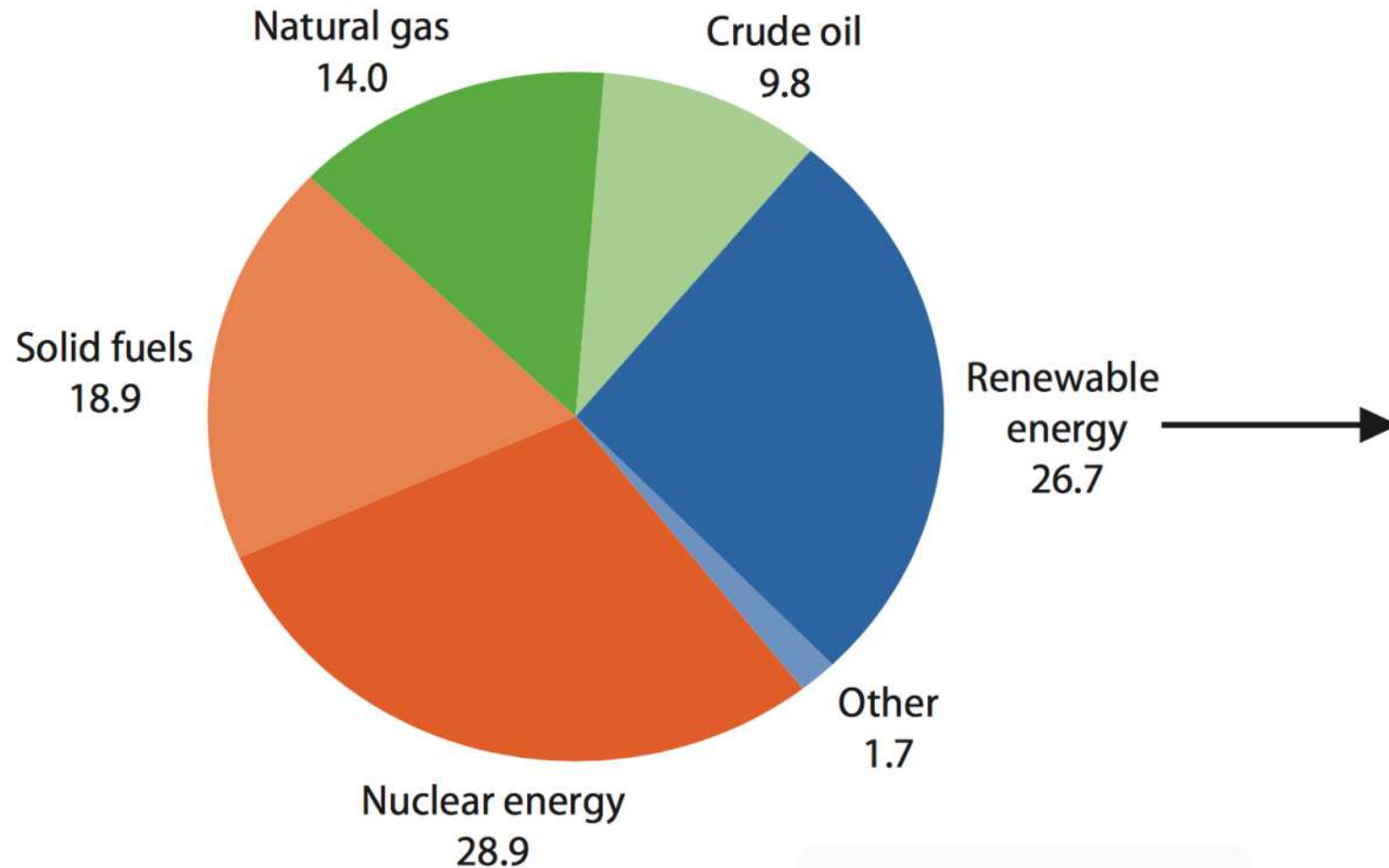
“Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development”

Paris Agreement, Article 2



Production of primary energy, EU-28, 2015

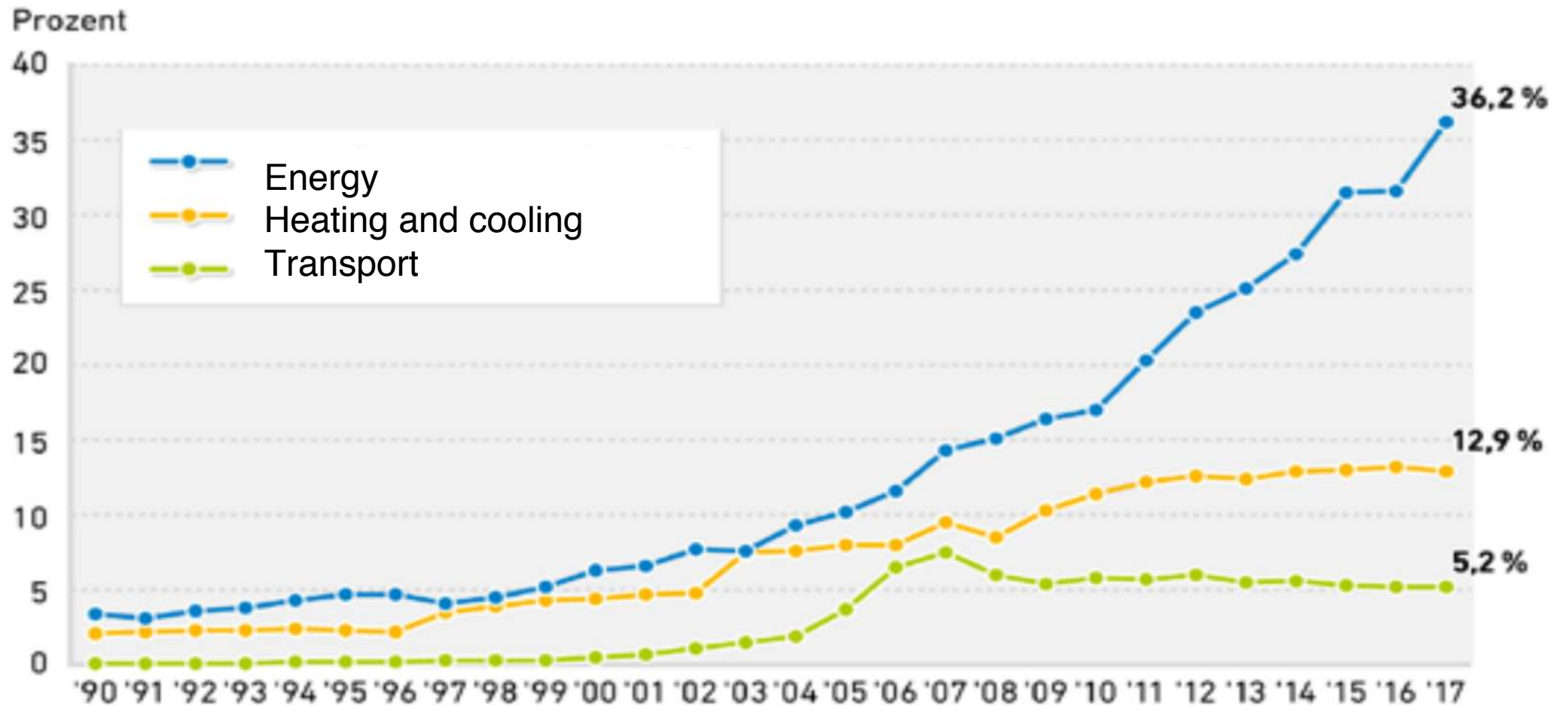
(% of total, based on tonnes of oil equivalent)



- Geothermal energy
- Solar energy
- Wind
- Hydropower
- Biomass & waste

Source: Eurostat (online data codes: nrg_100a and nrg_107a)

SHARE OF RENEWABLE ENERGY BY END USERS IN GERMANY 1990-2017

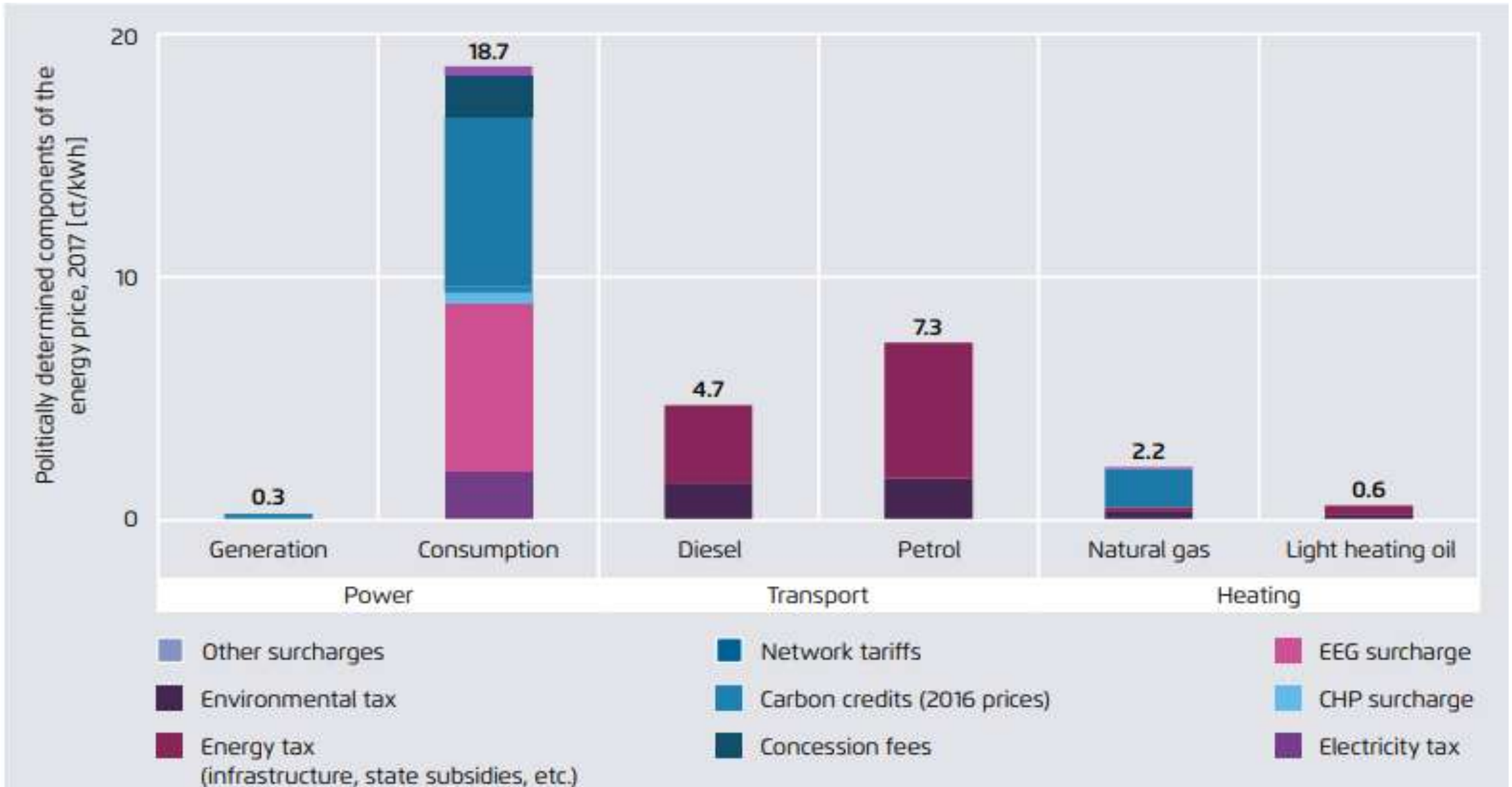


Quelle: BMWi / AGEE-Stat
Stand: 3/2018

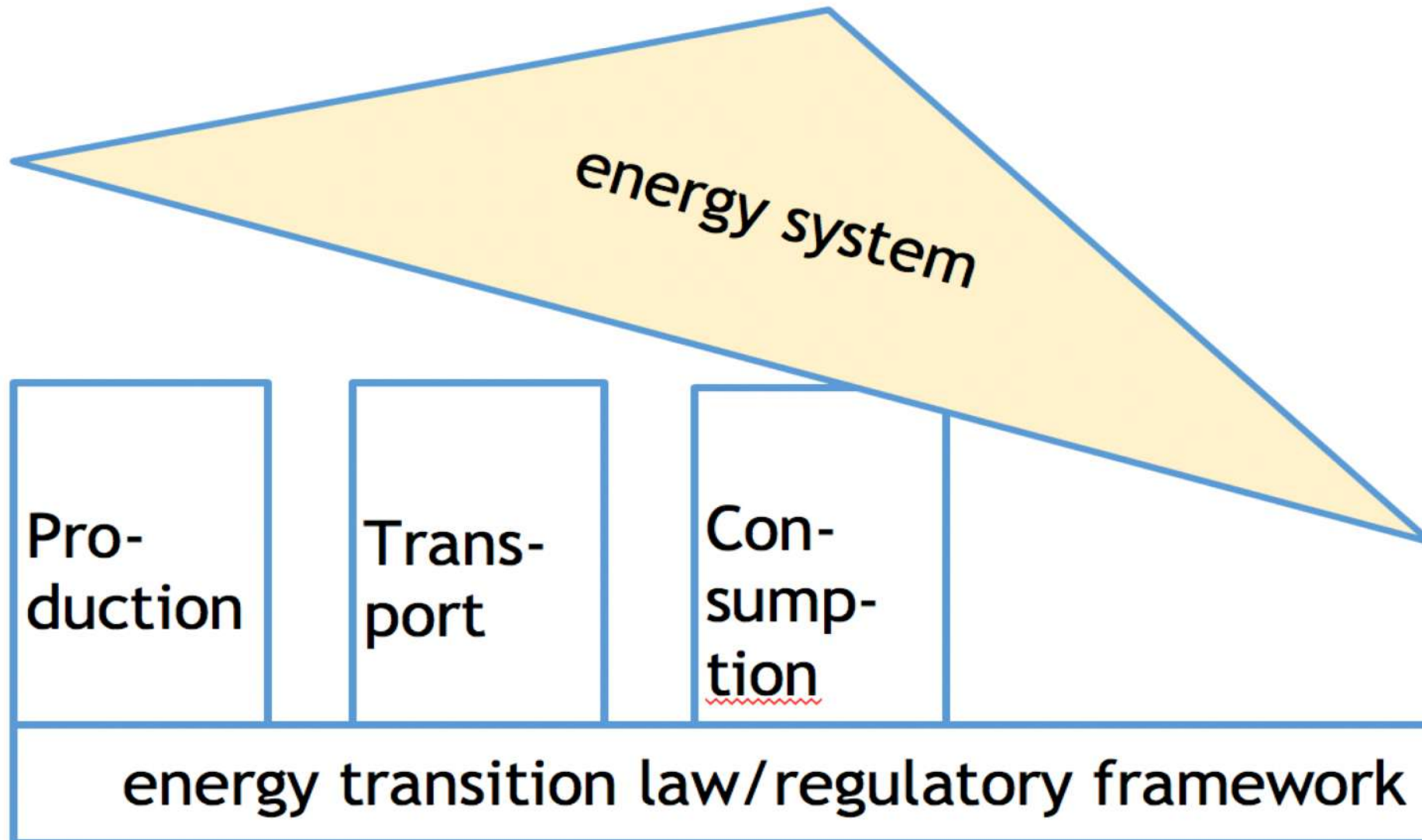
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TAXES, LEVIES, SURCHARGES AND TARIFFS IN THE ENERGY SECTOR ARE DISTRIBUTED VERY UNEVENLY, WITH THE MAJORITY FALLING ON POWER CONSUMPTION

Source: Agora Energiewende [\(2017\)](#)



3 PILLARS OF THE ENERGY SYSTEM – ENOUGH TO GO NET-ZERO?





Tell me....

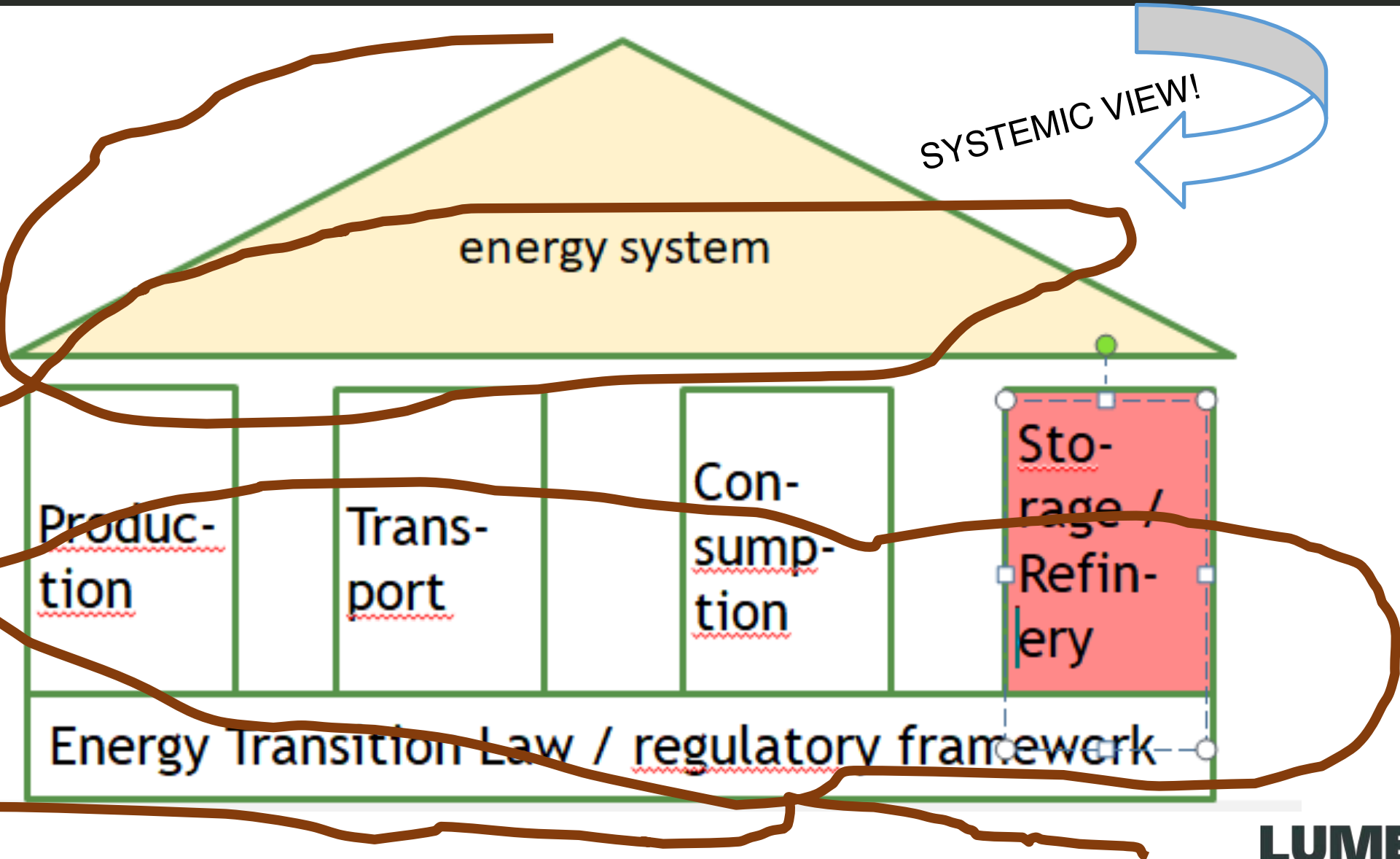
...what you tax and what you spend,
and also what you don't tax and don't spend -
and I'll tell you what your true objectives are!

Dr Ar

A low-angle photograph of a concrete bridge structure. The bridge has a metal railing with horizontal bars. The camera is positioned below the bridge, looking through a dark, shadowed opening. The sky is a clear, bright blue. The text "... overcoming barriers" is overlaid in white on the dark opening.

... overcoming barriers

3 PILLARS OF THE ENERGY SYSTEM – ENOUGH TO GO NET-ZERO?



Technology _____ +

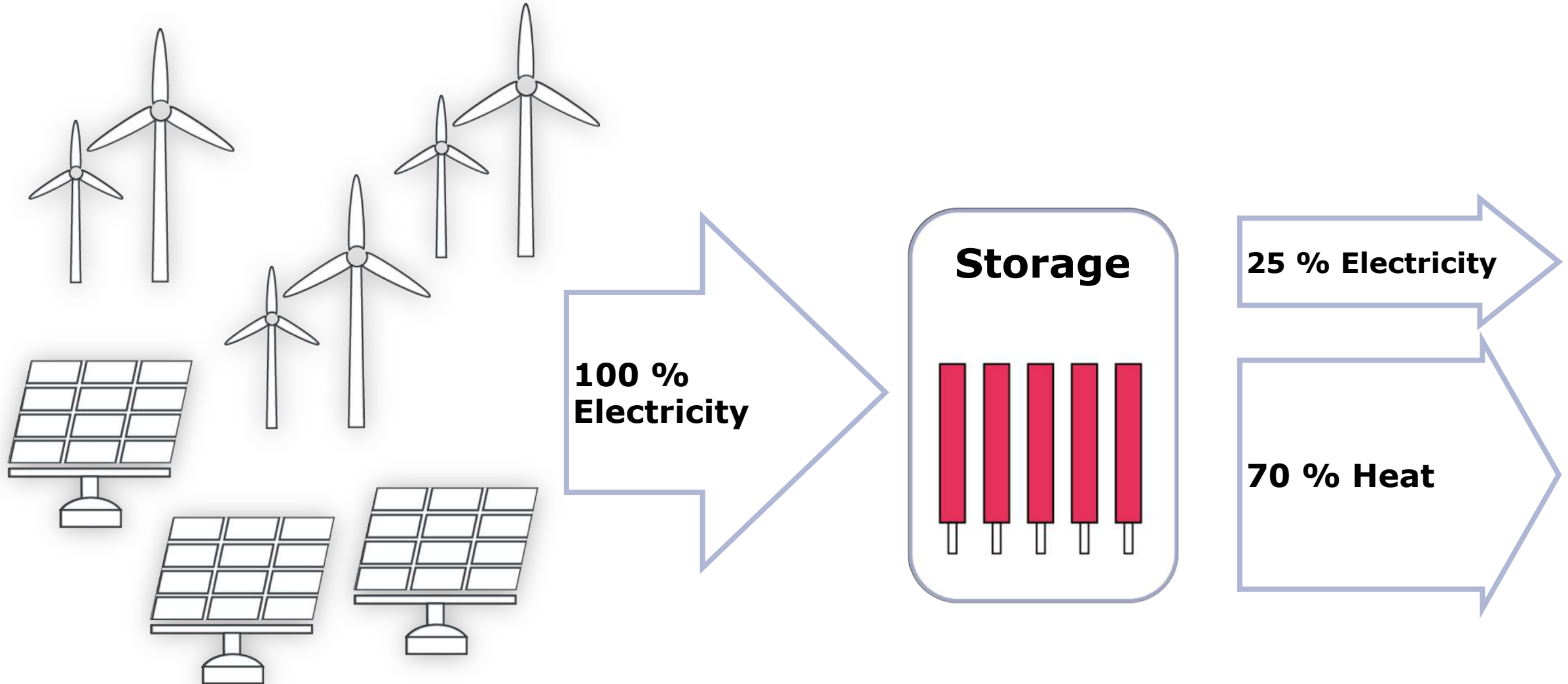
SEGMENTS OF STORAGE SOLUTIONS

Peak load storage and sector coupling make it technologically possible to implement an increasing share of renewables.

A 100% RENEWABLE ENERGY SUPPLY NEEDS A NEW SYSTEM.



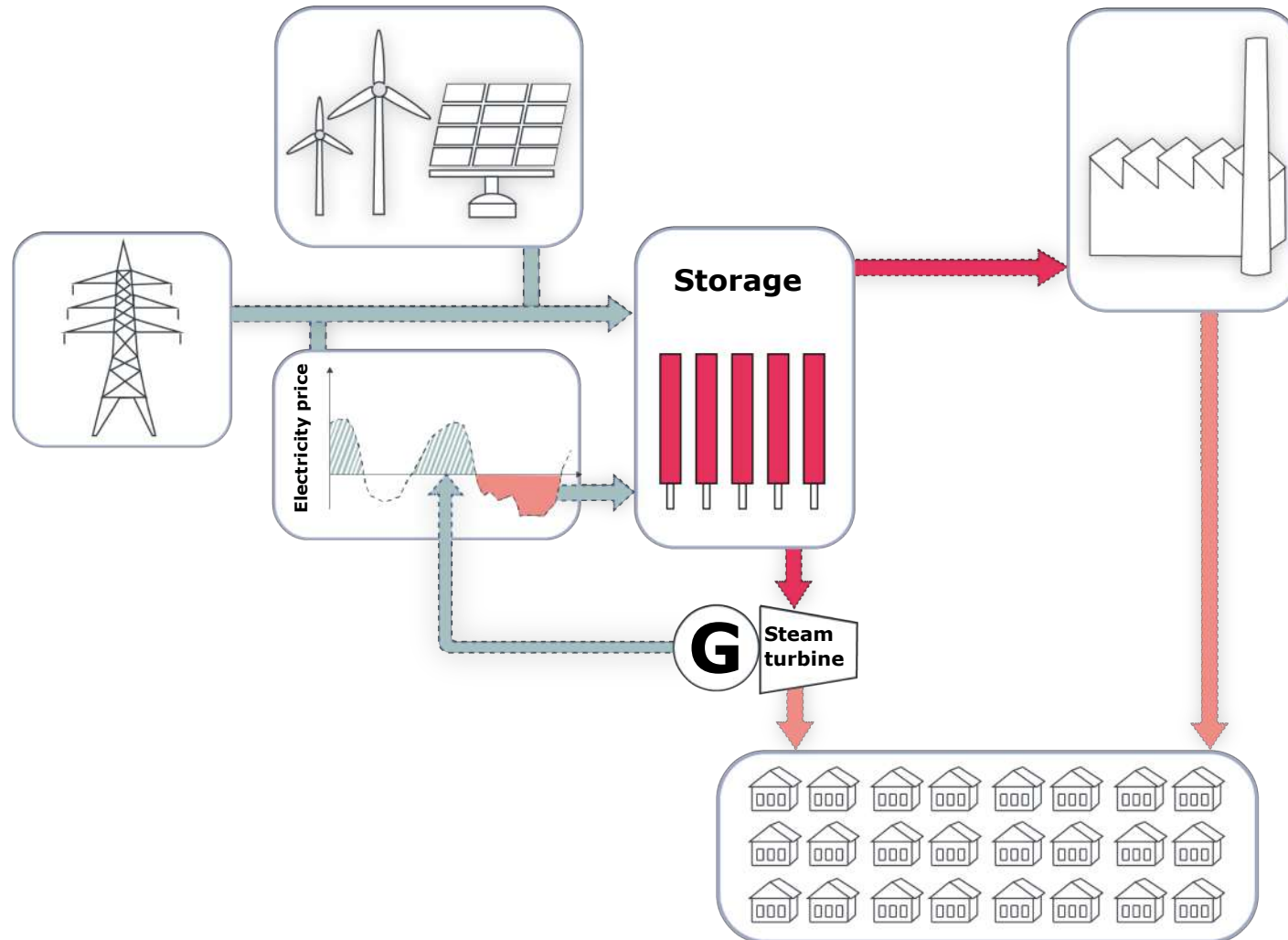
POWER-2-HEAT & POWER APPLICATION - ENERGY RATIO



MENION REFINES INEXPENSIVE FLUCTUATING RENEWABLE ENERGY INTO HIGH-VALUE, JUST-IN-TIME AND FIT-FOR-PURPOSE ENERGY

Electricity sector

Heat sector



- Storing of energy thermally
- At 650°C in storage medium steel
- Charging for 8h out of 48h allows us to continuously supply thermal energy with temperature level of 80-550°C for approximately 48 hours
- Charging to discharging ratio of 1-5 to 3-5 depending on application
- 2 modes of usage:
Power-2-Heat or
Power-2-Heat&Power

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THANK YOU!