Clever | A Collaborative Low Energy Vision for the European Region

CLEVER Webinar

First scenario results and lessons for Europe

15.12.22

Agenda

Moderation, introduction & conclusion: Stephane Bourgeois, négaWatt Association, France

10:00-10:05 — **Welcome and introduction**

10:05-11:00 — General session
CLEVER construction and first global results

10:05
The CLEVER construction and approach

- Frauke Wiese *(EnSu/Europa Universität Flensburg, Germany)*
- Mathilde Djelali and Yves Marignac *(nW Association, France)*
- Gunnar Boye *(INFORSE, Denmark)*
- Krista Petersone *(Zala Briviba, Latvia)*

10:25
CLEVER first global results

- Nicolas Taillard *(nW Association, France)*
- Johannes Thema *(EnSu/Wuppertal, Germany)*
- Andrea Roscetti *(Politecnico di Milano, Italy)*
- Krzysztof Kobyłka *(Wise Europa, Poland)*

10:45 **Q&A session**

11:00-11:55 — Technical session
Main assumptions and first results per sector

11:00
Main assumptions and first results for consumption sectors (industry, mobility, buildings)

- Nicolas Taillard and Adrien Toledano *(nW Association, France)*

11:20 **Q&A session**

11:30
Main assumptions and first results for energy production and carrier balances

- Nicolas Taillard *(nW Association, France)*

11:45 **Q&A session**

11:55-12:00 — **Conclusions and next steps for CLEVER**

Clever | A Collaborative Low Energy Vision for the European Region

General session

Introduction and first global results

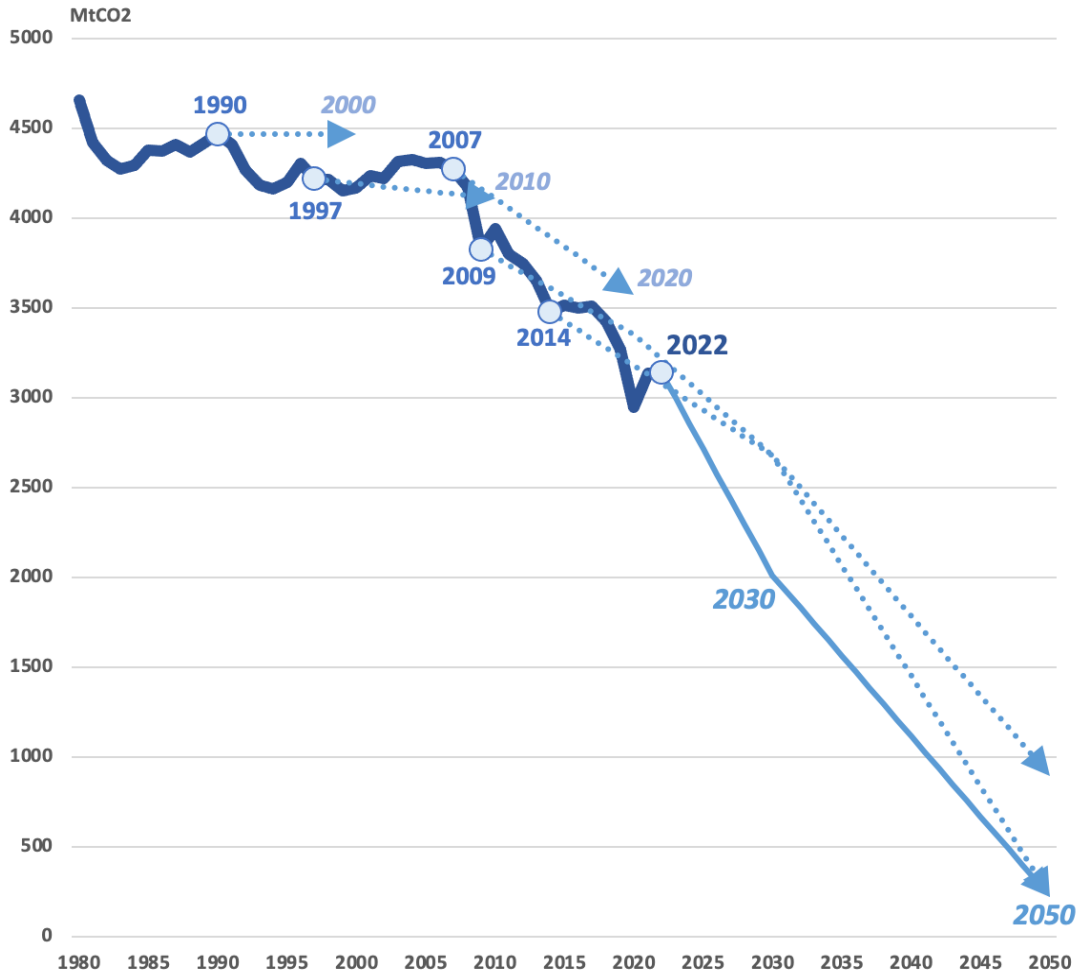
The CLEVER construction and approach

CLEVER in context

Stephane Bourgeois
négaWatt association

The missing leg of EU climate and energy policy

EU GHG emissions (EU28) VS EU emissions targets



An ongoing story of reinforced

- climate and ecological urgency
- level of targets
- depth of ambition
- mobilisation of levers

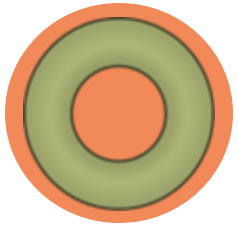
Low carbon supply — Renewables

Efficiency first principle — Efficiency

Time for sufficiency? — Sufficiency

CLEVER approach

CLEVER in context : an introduction to sufficiency



Frauke Wiese
EnSu — Europa-Universität Flensburg

Sufficiency embedded in a global equity framework

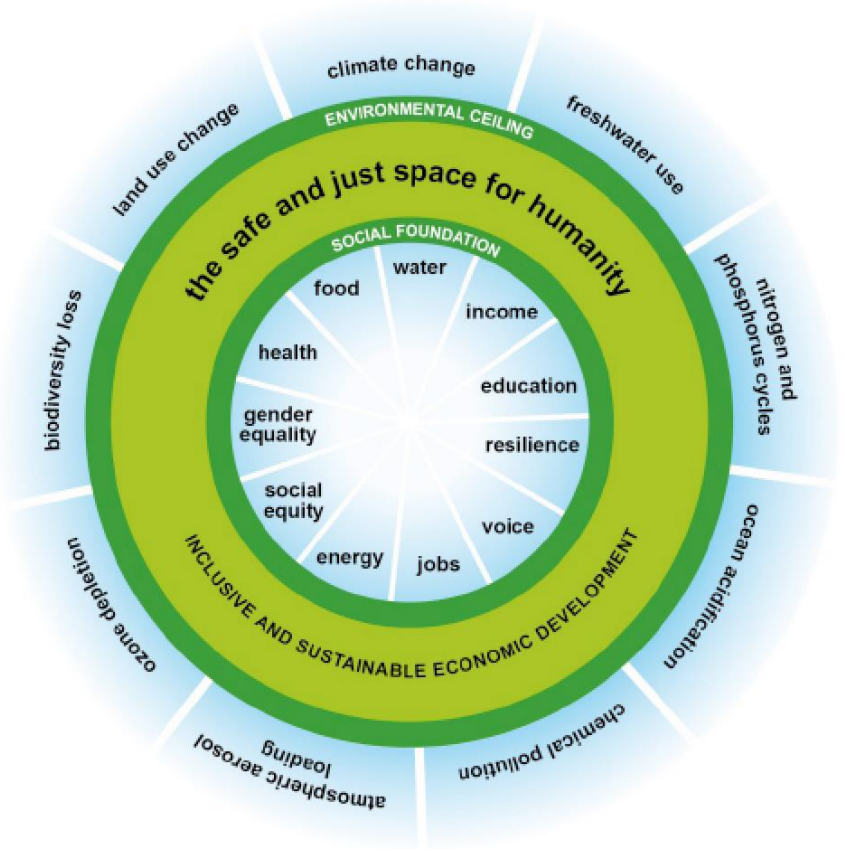
(AR6 – WGIII, 2022)

Sufficiency policies are a set of measures and daily practices that **avoid demand** for energy, materials, land and water while **delivering human well-being** for all **within planetary boundaries**.

Fulfilling everyone's needs for **services** to live **a decent life**

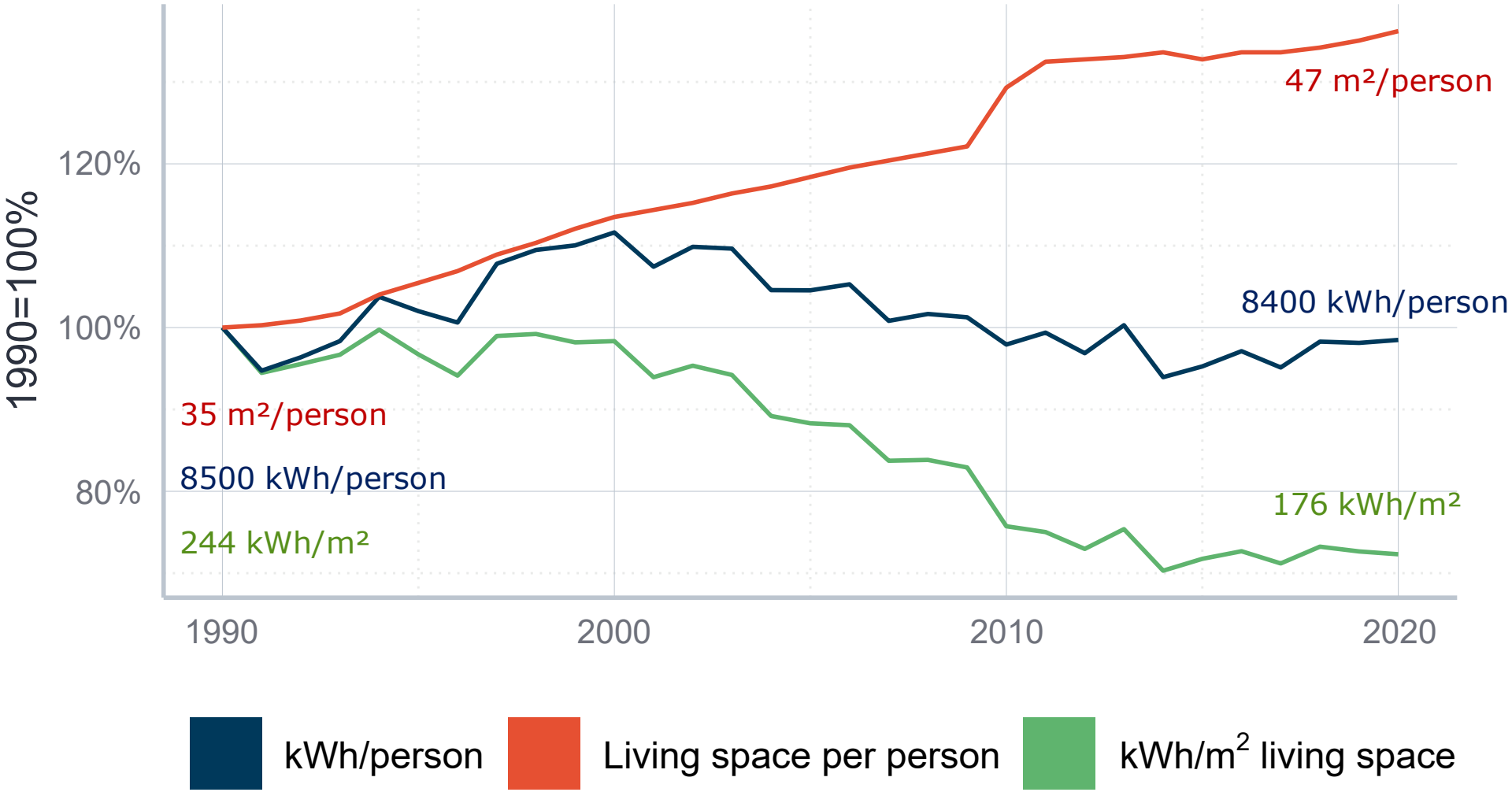
Adjusting nature and **amount** of **services** to keep demand impact below planetary limits

A fair and sustainable transition



Doughnuts economics (Raworth, 2018)

Sufficiency and Efficiency: combination is key



Development of **heat demand indicators** in Germany over the last 30 years

Data: German Federal Statistical Office (2000, 2021) and Working Group on Energy Balances (Arbeitsgemeinschaft Energiebilanzen 2021)

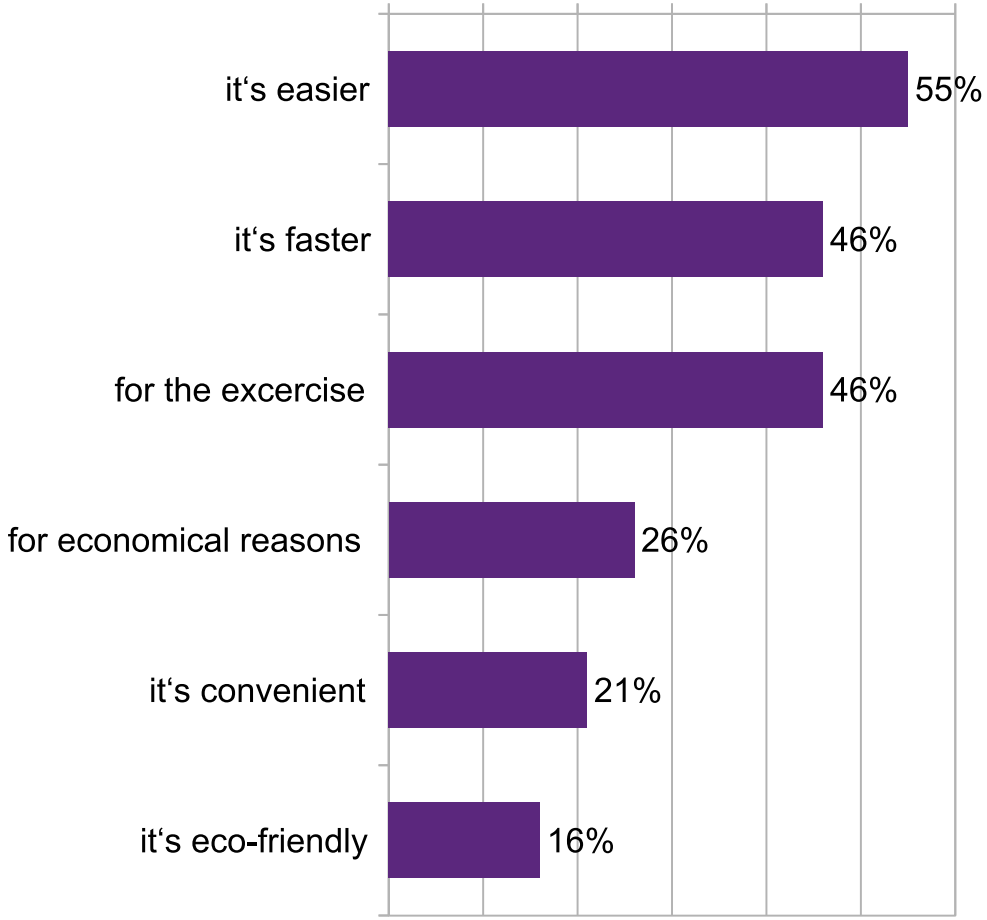
Sufficiency policy is crucial

Politics must set the **framework conditions** so that energy- and resource-saving choices become the more obvious option.

The **current framework conditions make sufficiency choices more difficult.**

Sufficiency is **not a question of individual lifestyles and behaviours** but of political framework conditions and, just like other strategies, requires **concrete political measures** on the production and consumption side.

Why do people in Copenhagen cycle?



Reference: City of Copenhagen 2019

CLEVER construction and approach

Yves Marignac, Mathilde Djelali
négaWatt association

Sustainability objectives

	Short term	Long term
Climate & sustainability	Fast reduction of emissions	Carbon neutral and reduced environmental footprint
Energy security & independence	Cut of sensitive energy imports	Energy supply based on local and affordable resources

Out of the crisis, towards global sustainability

Global objectives

Net zero emissions asap
and by 2050 at the very latest, and a 1.5°C compatible carbon budget

100% renewable energy
with no reliance on risky or less sustainable supply options (nuclear power, CCS…)

Safe pathway objectives

Balance of ambition and realism
regarding the pace and depth (affordability, scalability…)

Consistency and soundness
based on the systemic merit of options (deep sustainability)

Fair and meaningful share
between countries and within each country

Systemic approach

Modelling through the SER framework

Evolution of the demand side sets the need on the supply side

Renewables | **Efficiency** | **Sufficiency**

Losses | Losses

Resources → **Carriers** → **Services**

Bottom-up, physical construct

Biomass nexus considered through the inclusion of AFOLUB

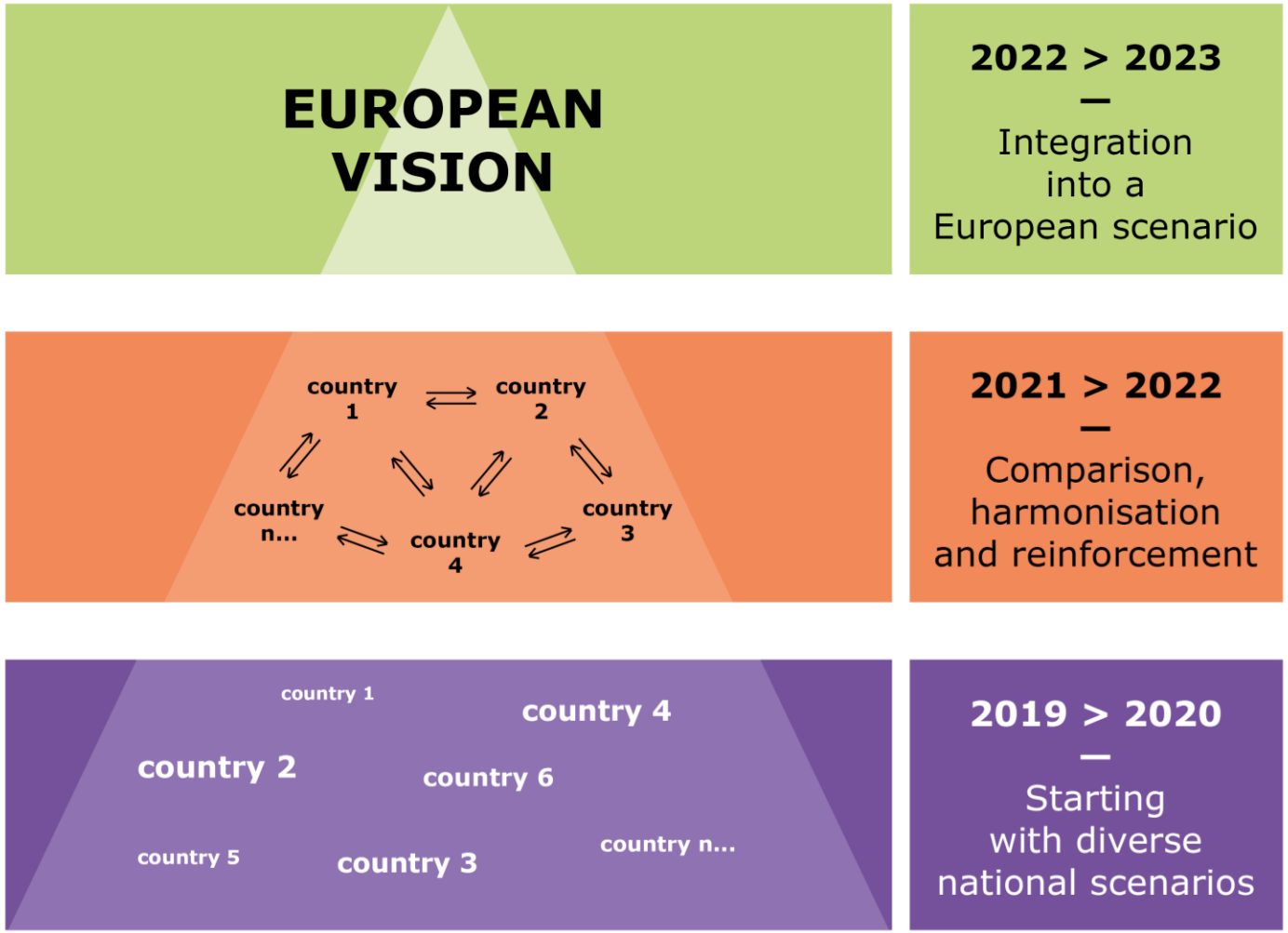
Energy carriers balanced adequately to resources / infrastructures / uses

Raw materials issues considered through industry and carriers choices

Evolution of energy services addressed through dedicated indicators

Broad sector coverage (maritime, non energy feedstocks, …)

The CLEVER bottom-up construct



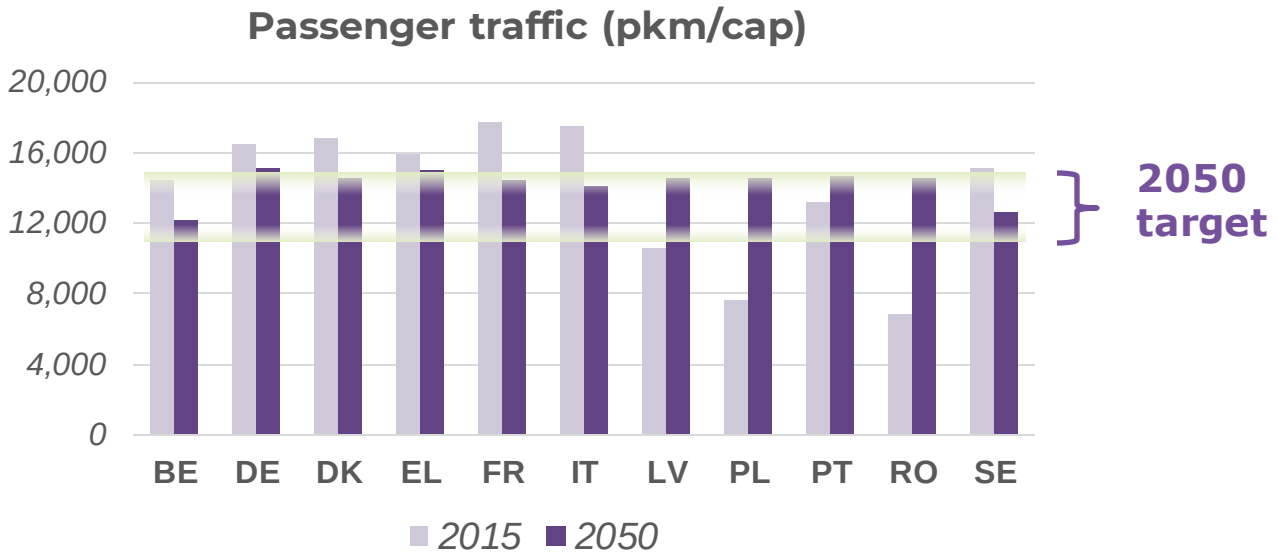
A three-stage bottom-up integration approach:

Set to progressively **harmonise** and **reinforce** national trajectories to form a **coherent European vision**

The bottom-up convergence corridors construction

Harmonisation of national trajectories through consumption corridors for 2050 for key indicators :

- Minimum: based on "decent living"
- Maximum: defining "1.5°C compatible services level"
- Aiming for a converging level of **energy services** for all



- **Construction through bi- and multilateral technical dialogue**
- **Support through policy proposals at EU, national and local level**

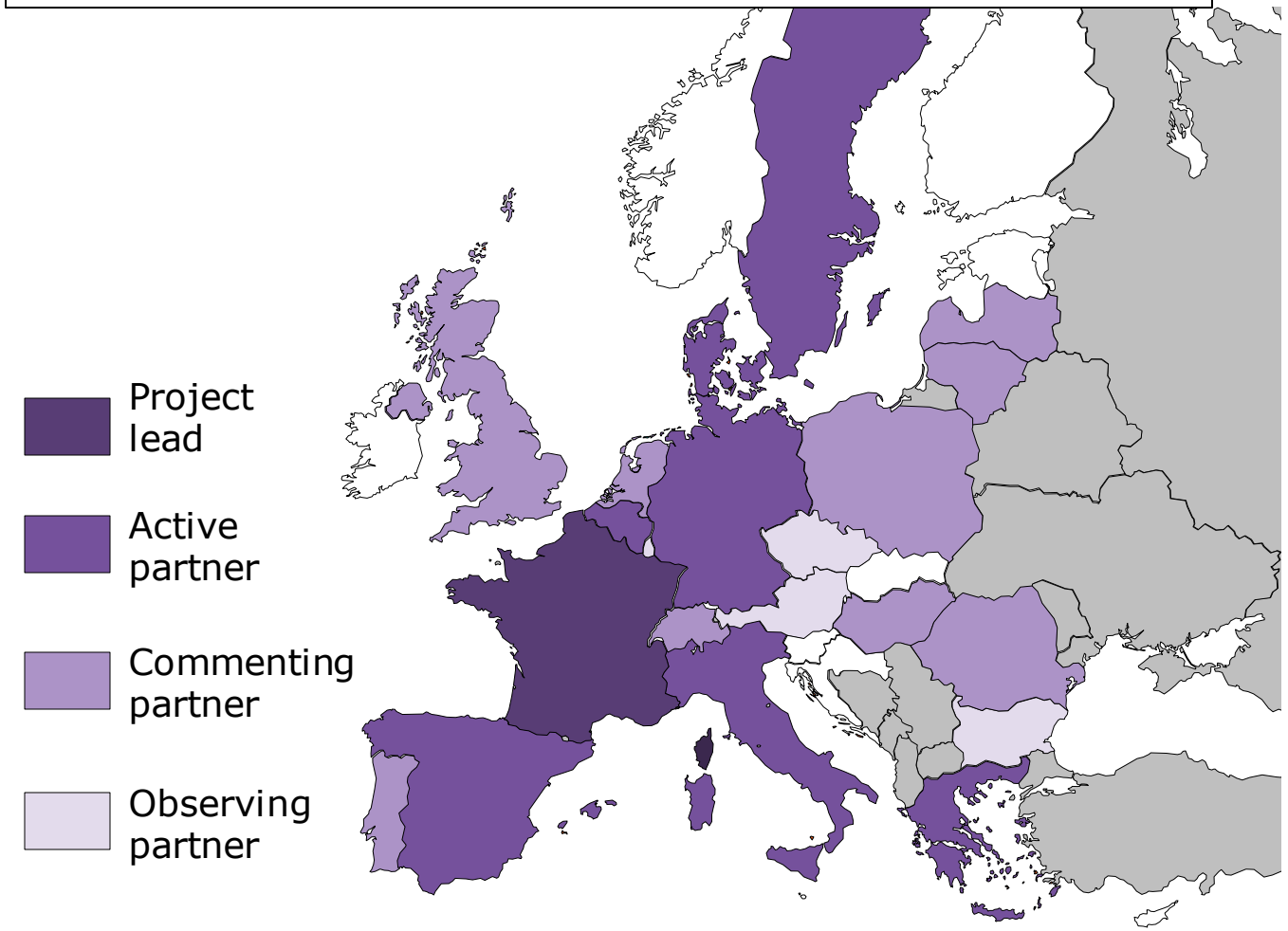
Publications

Residential *(Q4/2022)* and **Mobility** *(Q1/2023)* — national convergence corridors on key indicators

Industry *(Q3/2022)* — production corridors, consumption and energy intensity by branch

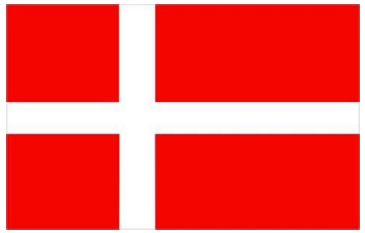
Partners network

25 organisations from **20 European countries**
(18 EU members + UK, CH)



AT	EEG TU Wien
BE	negaWatt Belgium, ICEDD
BG	Za Zemiata; Sofena
CH	negaWatt Switzerland
CZ	Charles University Environment Centre
DE	EnSu (Wuppertal Institut für Klima, Umwelt, Energie; Europa-Universität Flensburg; Öko-Institut)
DK	INFORSE Europe
ES	Ecoserveis Association
FR	negaWatt Association
EL	National Observatory of Athens (NOA)
HU	Environmental Planning and Education Network (EPEN)
IT	Politecnico di Milano
LT	Lithuanian Energy Institute (LEI)
LU	Consortium Cell/List
LV	Green Liberty - Zala Briviba
NL	Possible Worlds
PL	WiseEuropa
PT	ZERO
RO	Energy Policy Group (EPG)
SE	Air Clim Coalition
UK	CREDS, Center for Alternative Technologies (CAT)

The perspective of an active partner



Gunnar Boye Olesen
INFORSE – Europe, International Network for Sustainable Energy

Creating an ambitious national scenario

- Collecting information on past developments on ¨300 parameters
- Include trends (avoid Covid 19 anomalities)
- Review national policies and ambitions
- Include our own past scenarios
- Include new studies of development with sufficiency (transport)
- Dialogue with Clever partners on sufficiency and corridors
- Finalise Dashboard

Now we have the most comprehensive economy-wide description of past and future energy demands, demand drivers and supply that are comparable internationally (v.1)

A B C D	E	F	G	W	AB	AC
	Indicators	**Unit**	**Indicator Code**	**2015**	**2020**	**2025**
RESIDENTIAL						
Housing stock description						
• *Total*						
	Number of households	k	men	2.628,338	2.728,000	2.778,0
	Non-household population rate	%	pophmen	0,1%	0,1%	0,1%
	Total floor area	Mm2	totsurlog	295,604	307,587	313,20
	Average area of dwellings	m2	surlog	111,800	112,500	113,31
	Per capita residential floor area	m2/person	surlogcap	52,230	52,802	52,81
	Average household size	nb of people	capmen	2,153	2,135	2,135
	Total stock of dwellings	k	nbrlog	3.001,474	3.113,345	3.169,8
	Stock of dwellings permanently occupied	k	nbrlpr	2.628,338	2.728,000	2.778,0
	Additional FEC related to heat uses for secondary or vacant dwellings (as a share of total residential FEC)	%	psulnotoccfres			
• *Disaggregation per existing / new-build*						
\-> Existing						
	Total number of existing occupied dwellings	k	nbrlex	2.560,583	2.654,784	2.700,8
	Total m2 of existing occupied dwellings	Mm2	totsurlex	286,273	299,460	304,63
	Average area of existing occupied dwellings	m2	surlex	111,800	112,800	112,79
\-> New-build						
	Total number of new dwellings	k/year	nbrlpn	13,551	14,643	15,43
	Total m2 of new dwellings	Mm2/year	totsurlpn	1,866	1,625	1,714
	Average area of new dwellings	m2	surlpn	137,720	111,000	111,00
\-> Results from the Energy Demand Calculation Module: consistency checks						
	Existing building destructions	Mm2/year		0,000	-0,771	0,591
Description by end-uses: in the following sections, please consider only permanently occupied dwellings						
> Heating / cooling (energy consumption for...)						
• *Description of the needs of the housing stock*						
	Unit consumption per m2 for space heating with climatic corrections	kWh/m2	cutocsurchc	138,805	135,980	124,48
	Heating needs of the average housing stock	kWh/m2	coinpr	101,864	99,791	91,35

sidential | EDCM - Residential | EDCM Graphs - Residential | Tertiary | EDCM - Tertiary | EDCM Graphs - Tertiary | Transport | EDCM - Transport

How will we use Clever scenarios in Denmark

Sufficiency is not recognised in Denmark as a climate policy, we want to change that.

During 2023 we will present sustainable ways to make Denmark and EU 100% renewable energy and carbon neutral, using Clever, in many events etc.

The perspective of a commenting partner

Krista Petersone
Zala Briviba – Green Liberty

Learning to build energy scenarios for Latvia

Steps

Trace historical data, sources, & gaps → Understand assumptions in national context → Learn from partners' findings & technical results

Key benefits

Anticipate the actual transformations required for the low-energy vision

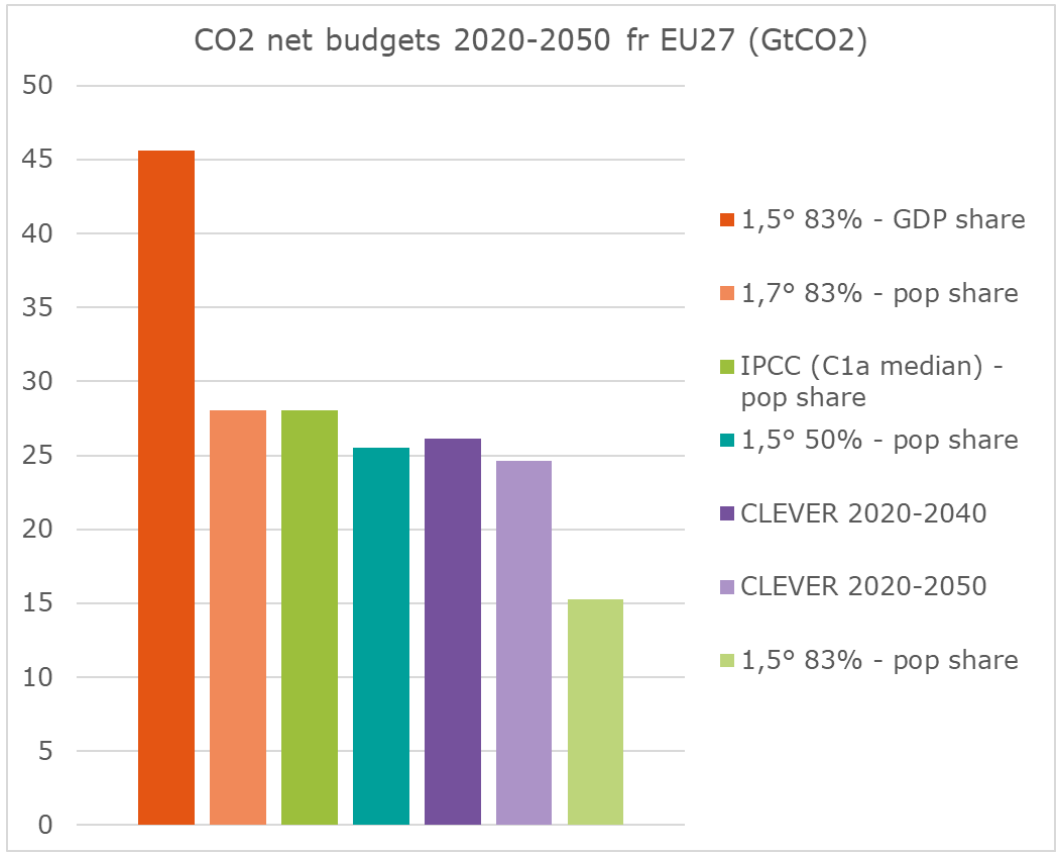
Prepare for constructive dialogues with the policy makers

CLEVER
first global results

Global results for Europe

Nicolas Taillard
Association négaWatt

A scenario that responds to the climate emergency



- **1.5°C compatible scenario**
  - *26-28GtCO2 as max EU CO2 budget for 2020-2050*
    - World cumulated CO2 emissions over 2020-2050: **500-550GtCO2** (Budget for 50% chance of remaining below 1.5°C; median of C1a scenarios of IPCC)
    - Demographic share for EU27 (**5.1%**)
  - *Methane emissions cumulated: ~25% below 1.5 trajectories from IPCC (SSP1-1.9 – pop share)*

IPCC carbon budgets:
- p.25 https://report.ipcc.ch/ar6wg3/pdf/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf
- P.29 https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

A scenario which goes beyond climate change

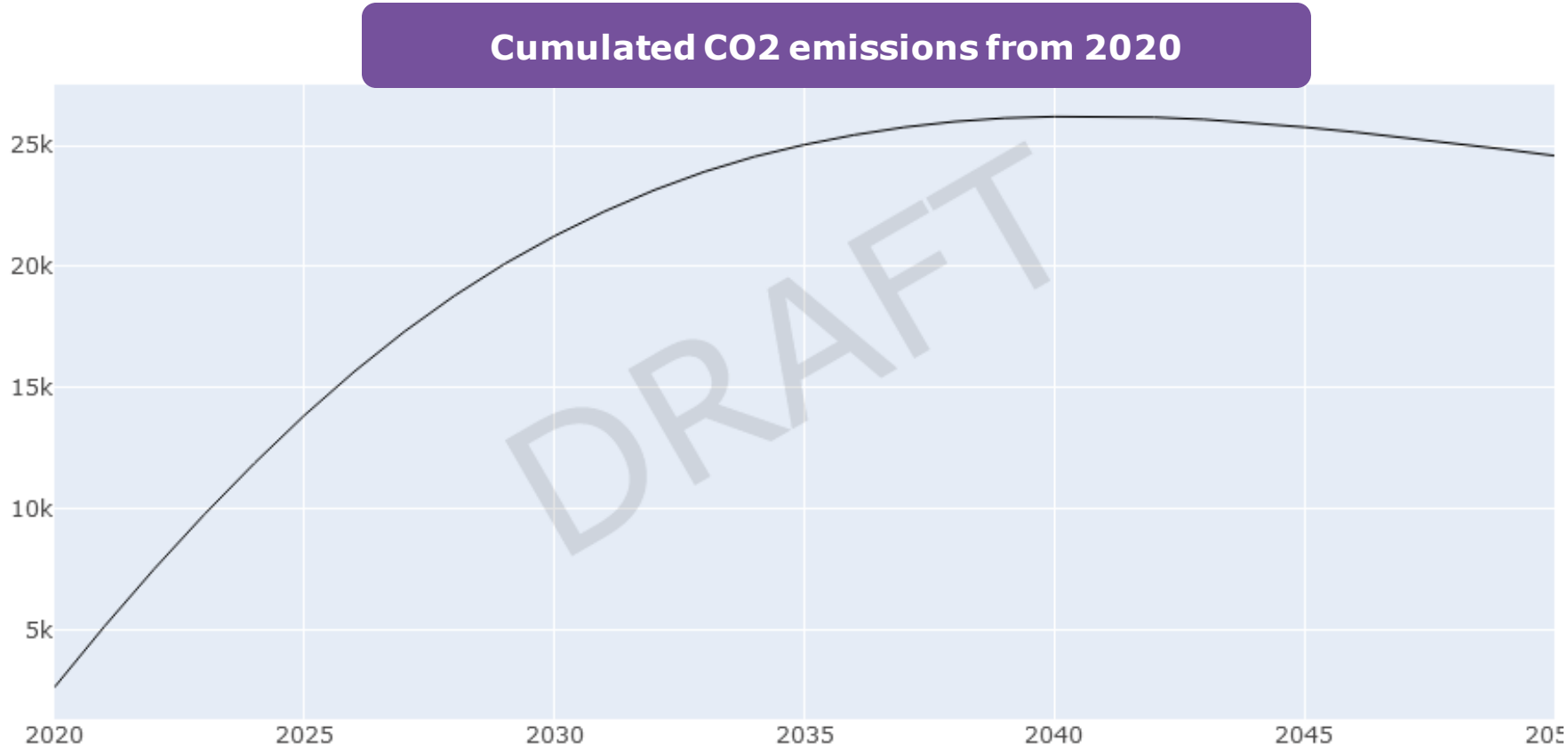
- **Limitation of uncertain assumptions**
  - *No strong disruption in deployment rates for vehicles, heating systems, RES …*
  - ***No uncertain technologies** (CCS, new nuclear …), or with very low levels (PtL, CCU)*
  - ***Natural sinks contribution** in line with agreed LULUCF EU objectives for 2030*

- **Inclusion of deeper sustainability**
  - ***Sustainable bioenergies' potential**: among the lowest EC/JRC evaluations (~2200TWh)*
  - ***Materials** (e.g. Li, Co, Cu…): Lower demand and sound electrification as recommended by detailed négaWatt analysis for France*
  - ***Energy security: no energy imports necessary** after 2045*
  - ***Equity**: convergence on energy services' levels in Europe (sufficiency)*

→ **Sufficiency as a key enabler**

The curve is steep and action is needed now

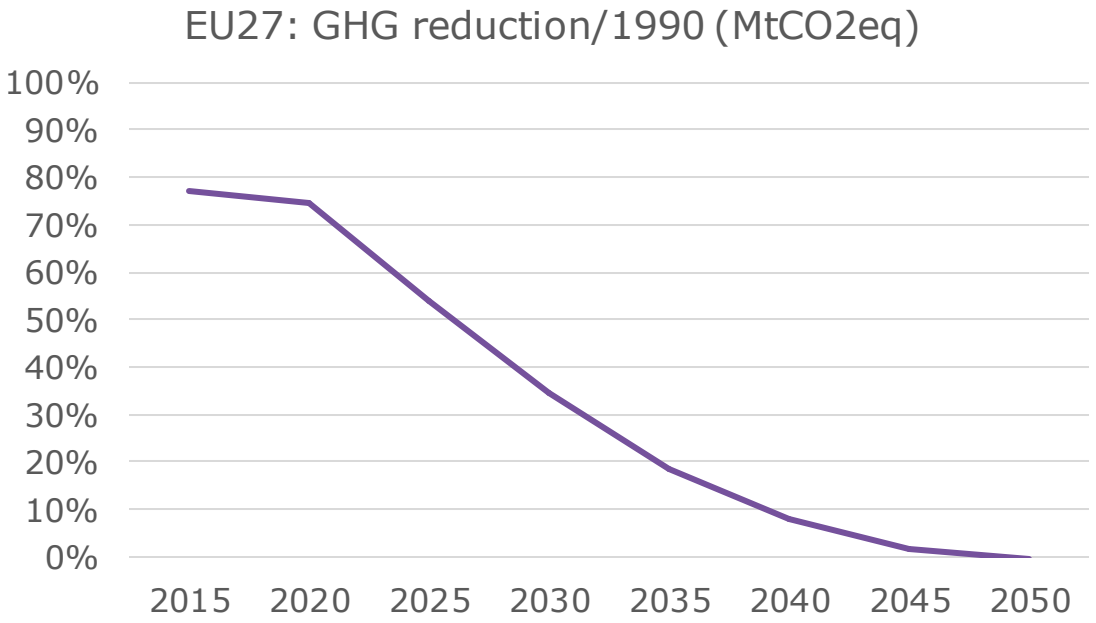
- **CO2 budget : ~26GtCO2**
- **Most of the carbon budget is "consumed" by 2035**

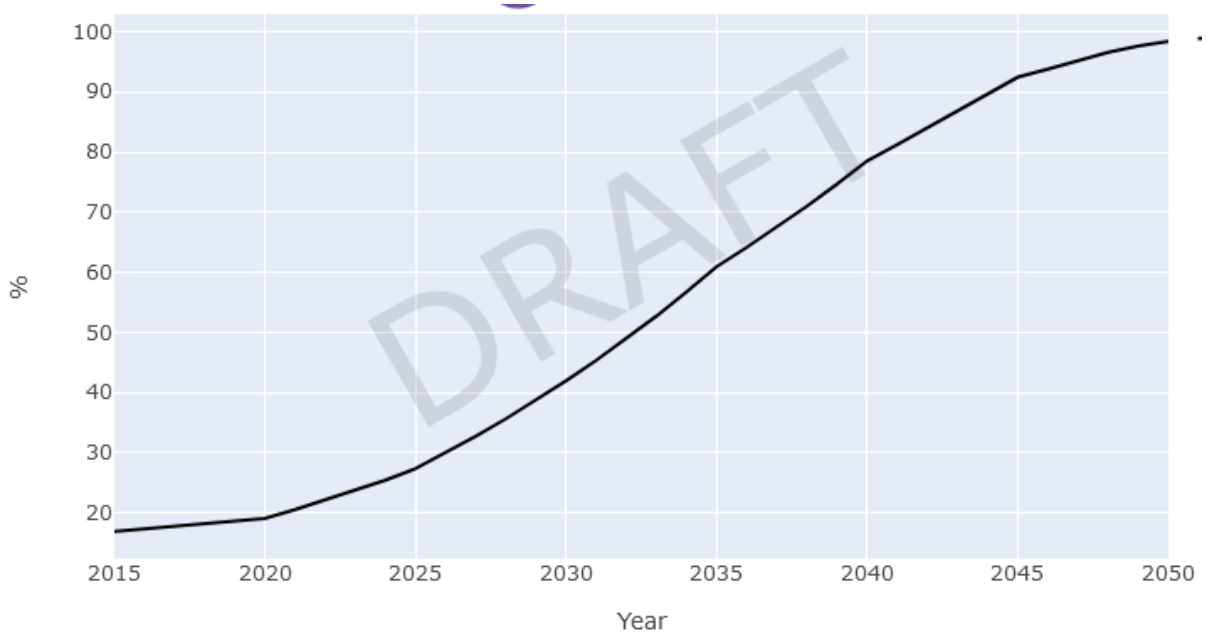


To set Europe on a sustainable and secure 1.5°C pathway

At least -90% net GHG in 2040 / 1990
2030: -65%
2045: neutrality (~-98%)

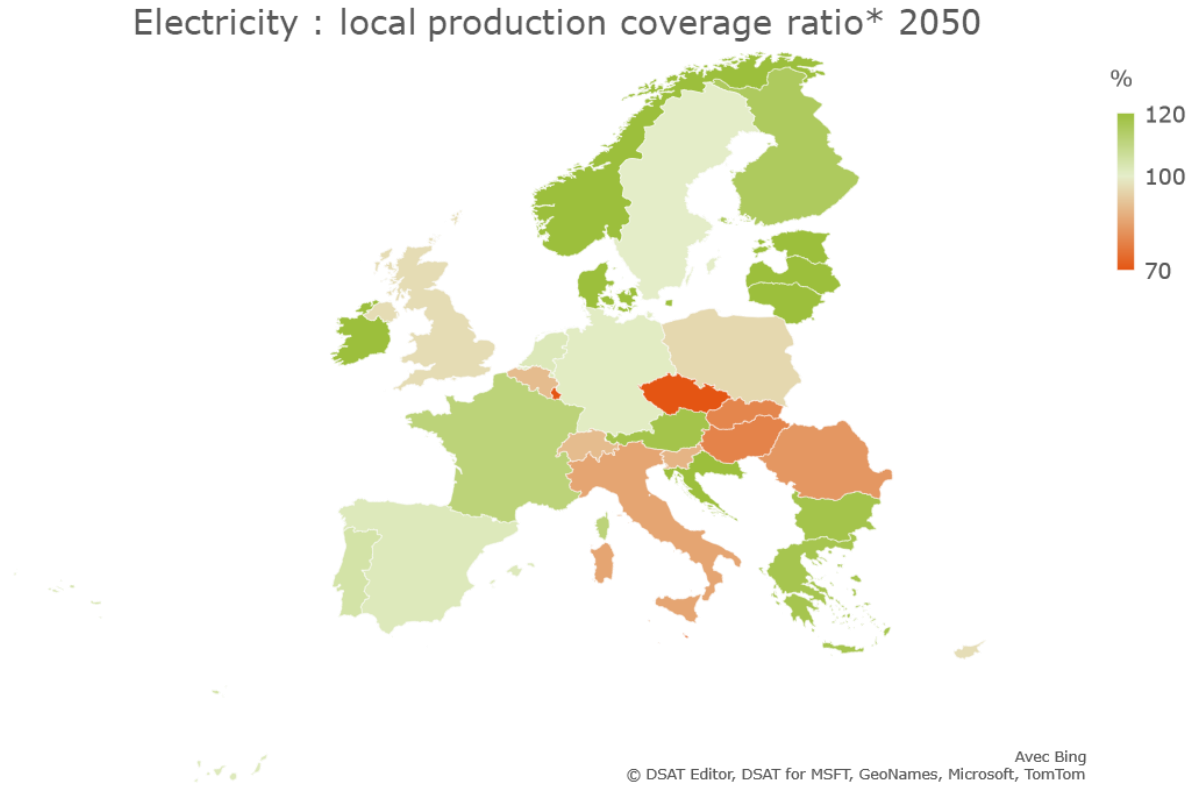
At least 75% RES in 2040 (>90%RES-E)
2030: 40-45% (under finalisation)
2050: 100%





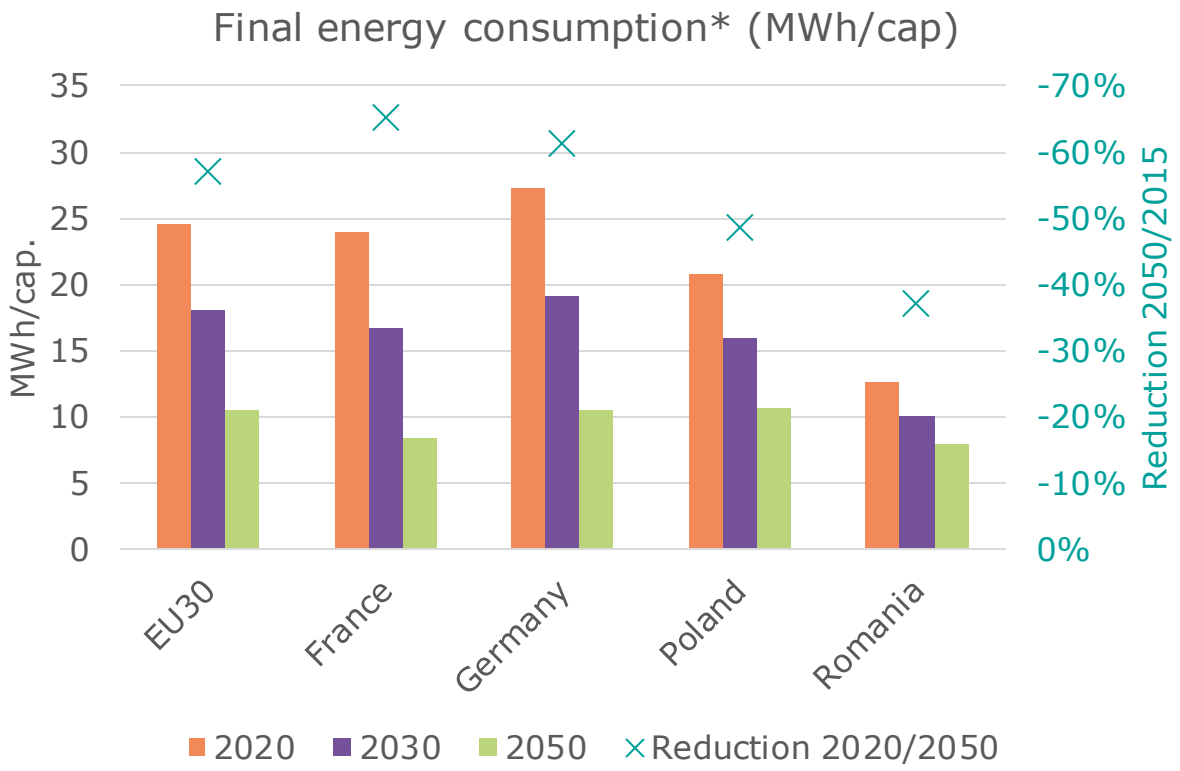
Increased solidarity across Europe

- **Example: not necessary for each country to reach 100%RES on national territory (example below with %RES-E in 2050)**



*Local production coverage ratio : Locally produced electricity divided by gross electricity consumption

Energy savings are key to reach objectives …



- **… of sustainability**
  - ***2050: 50-55% reduction of FEC/2020***
  - *2030: 20-25% /2020 (~15-18%/REF2020)*
  - *2040: ~45% /2020*
- **… of equity**
  - ***Strong convergence** of FEC reflecting energy services levels*
  - ***Remaining differences** for various reasons: climate, types of industries, …*

*This indicator is equivalent to Eurostat's "Final energy consumption (Europe 2020-2030)", it excludes ambient heat, non-energy consumption, the energy sector (except blast furnaces) and maritime bunkers from the total

Sufficiency : the indispensable complement to efficiency

- **A growing consensus over the possibility of strong energy reduction:**
  - *50% reduction in Western countries as a common output of several scenarios*

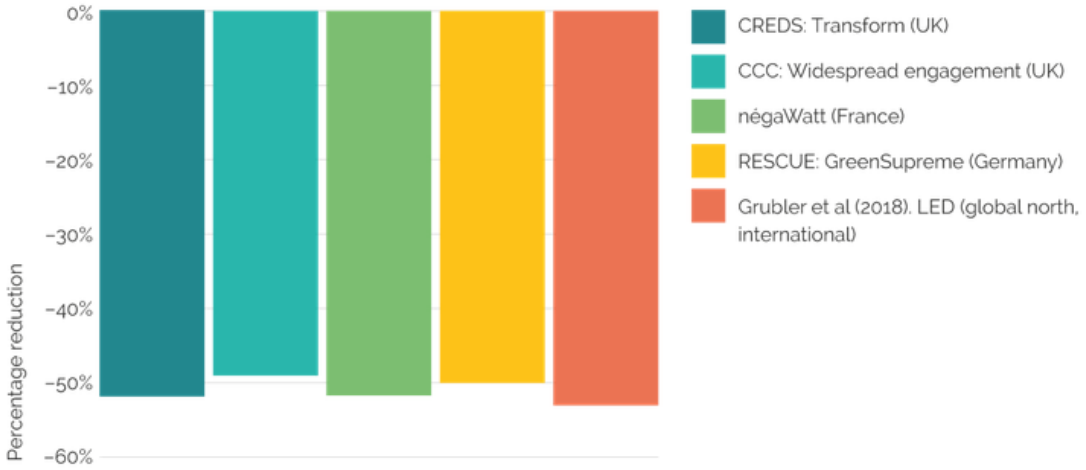
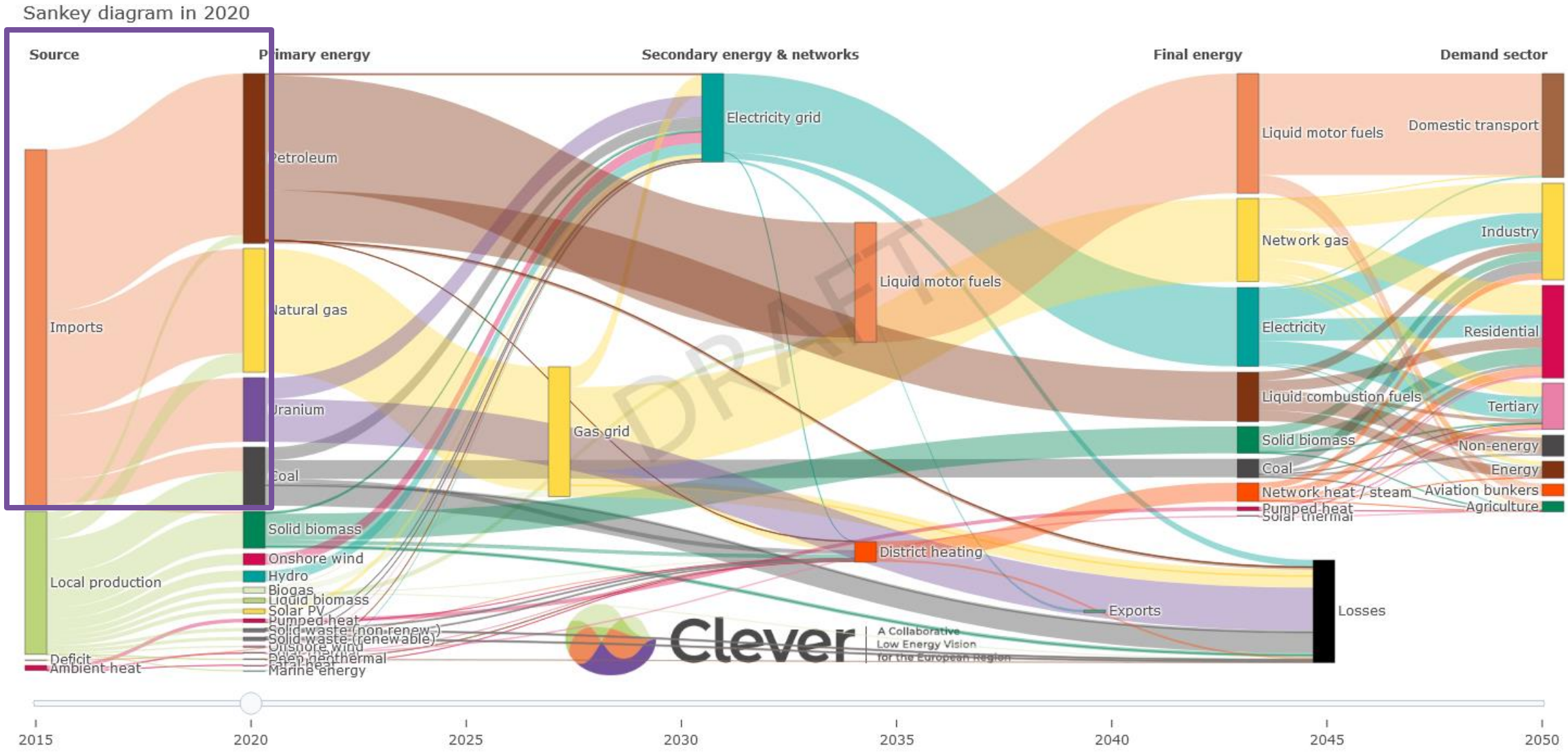


Figure 1: Energy demand reduction (2020 to 2050) in scenarios pursuing low energy demand.
https://www.creds.ac.uk/a-cross-country-comparative-analysis-of-low-energy-demand-scenarios-in-europe/

- **Sufficiency is the key to reach such levels of reduction (40-55% of reduction)**
  - *1st analysis of national scenarios (UK/FR/DE) including (or not) sufficiency*
  - *UK (CREDS scenarios) ; FR (négaWatt scenario); DE (comparison of different scenarios)*

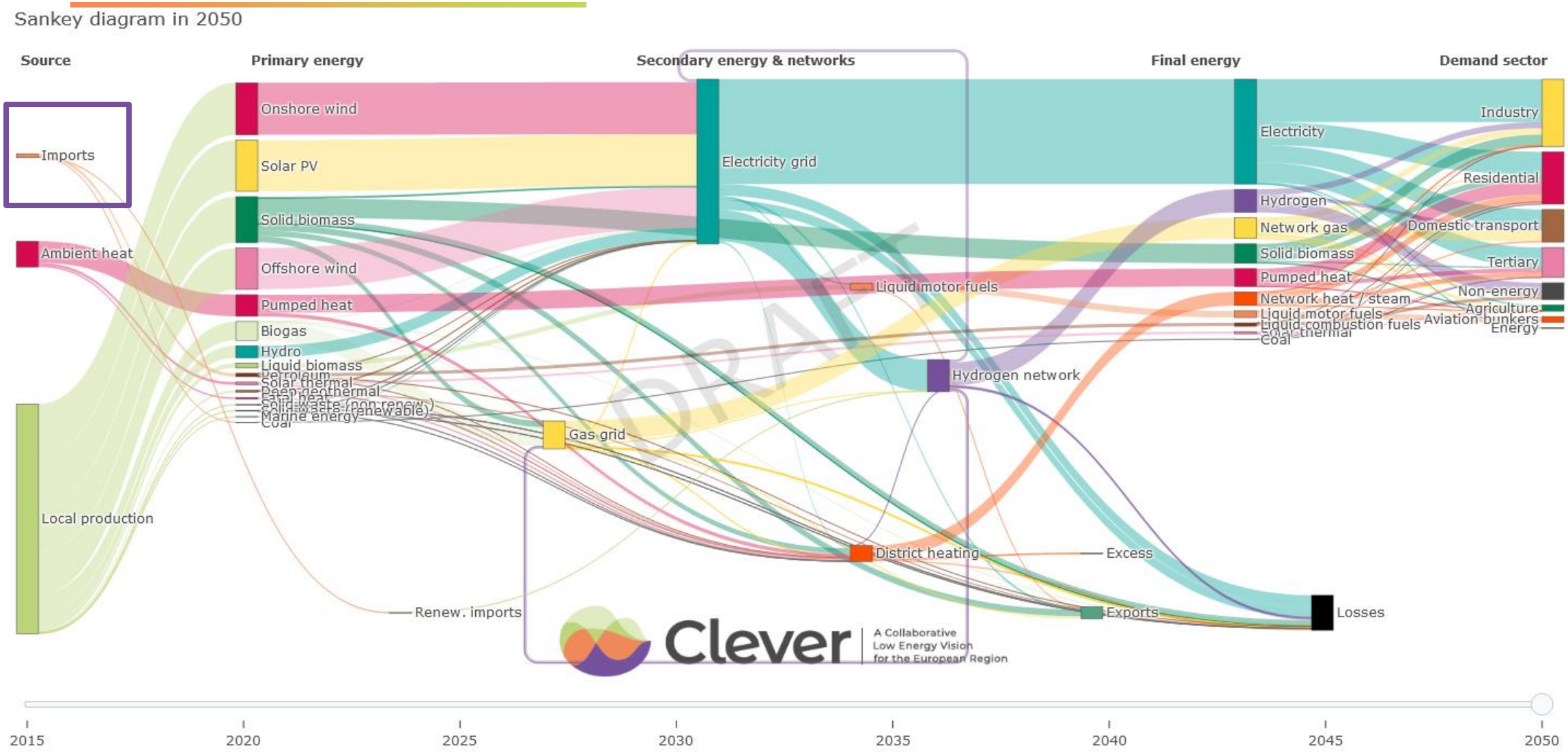
	Total reduction of FEC*	% of reduction from sufficiency
TOTAL	**50-55%**	**40-55%**
Buildings	~50%	25-50%
Transport	65-70%	30-55%
Industry	25-45%	50-80%

From ~9000TWh* net imports in 2020 ...



*~11000TWh net imports including uranium

From ~9000TWh* net imports in 2020 to ~100TWh in 2050



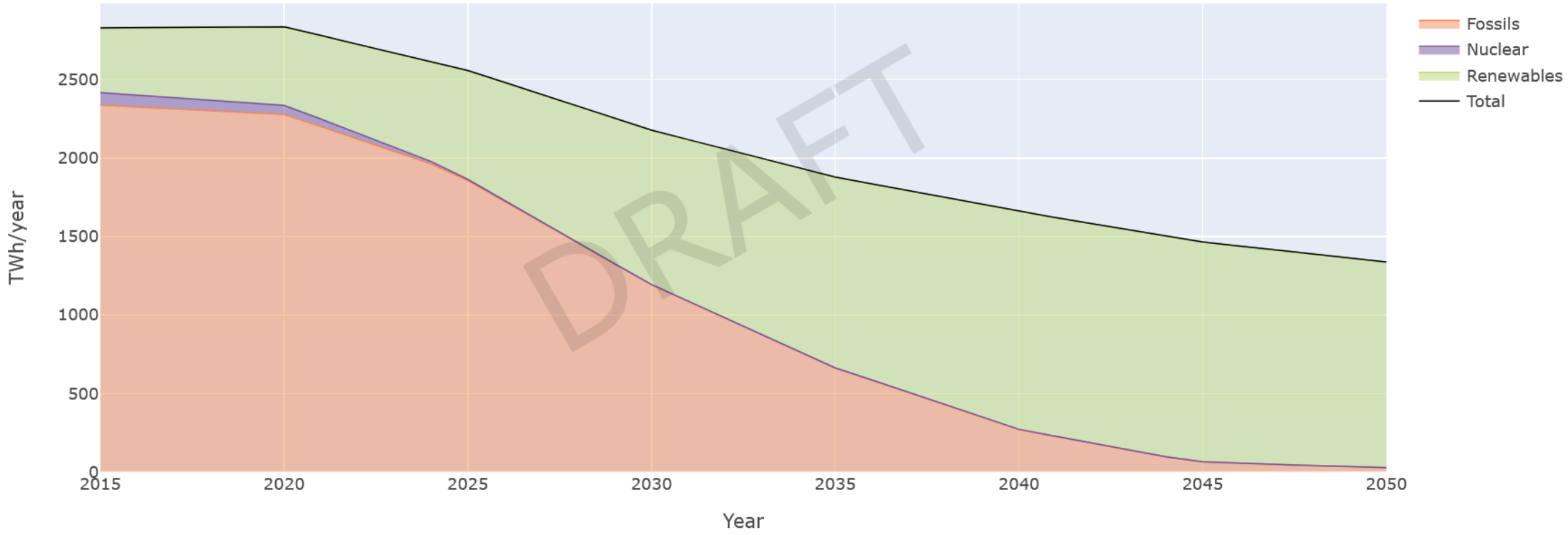
National trajectories in context

Germany, Italy and Poland

The German CLEVER trajectory in context

Johannes Thema
EnSu — Wuppertal Institut

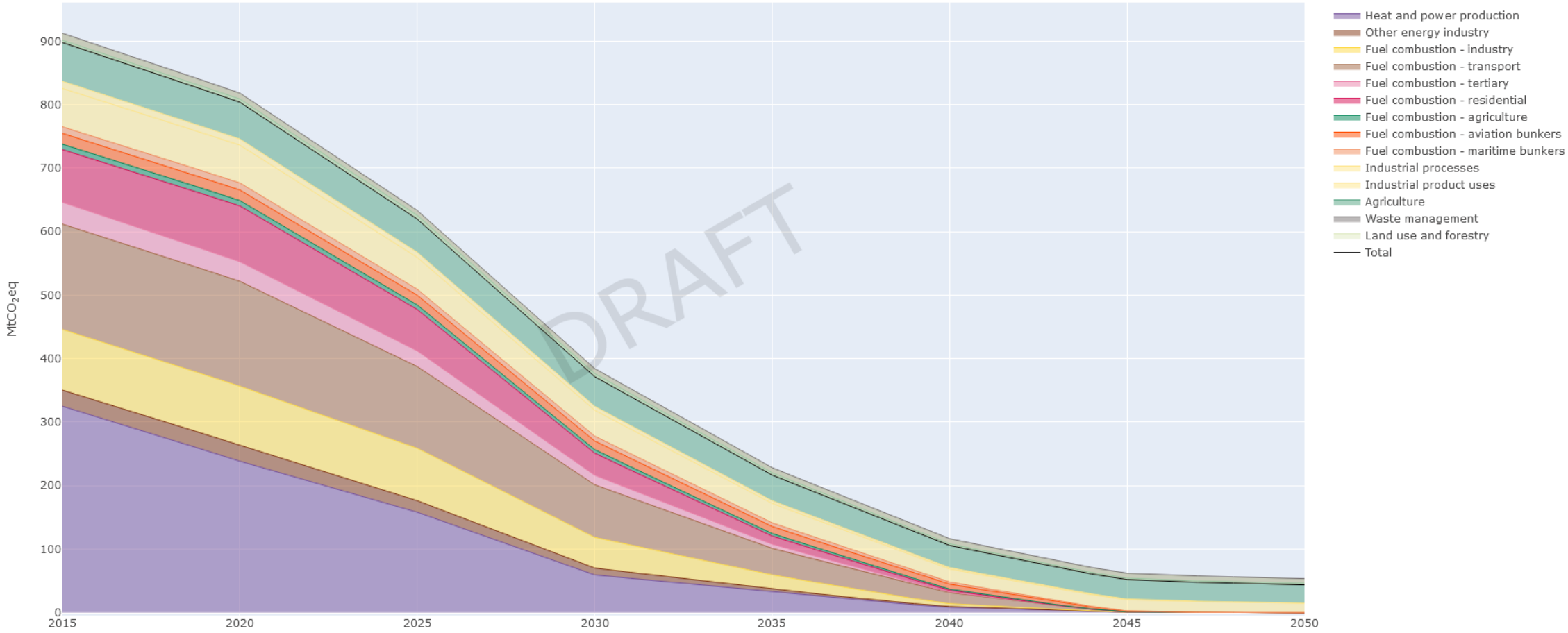
Germany — Final energy consumption in 2050



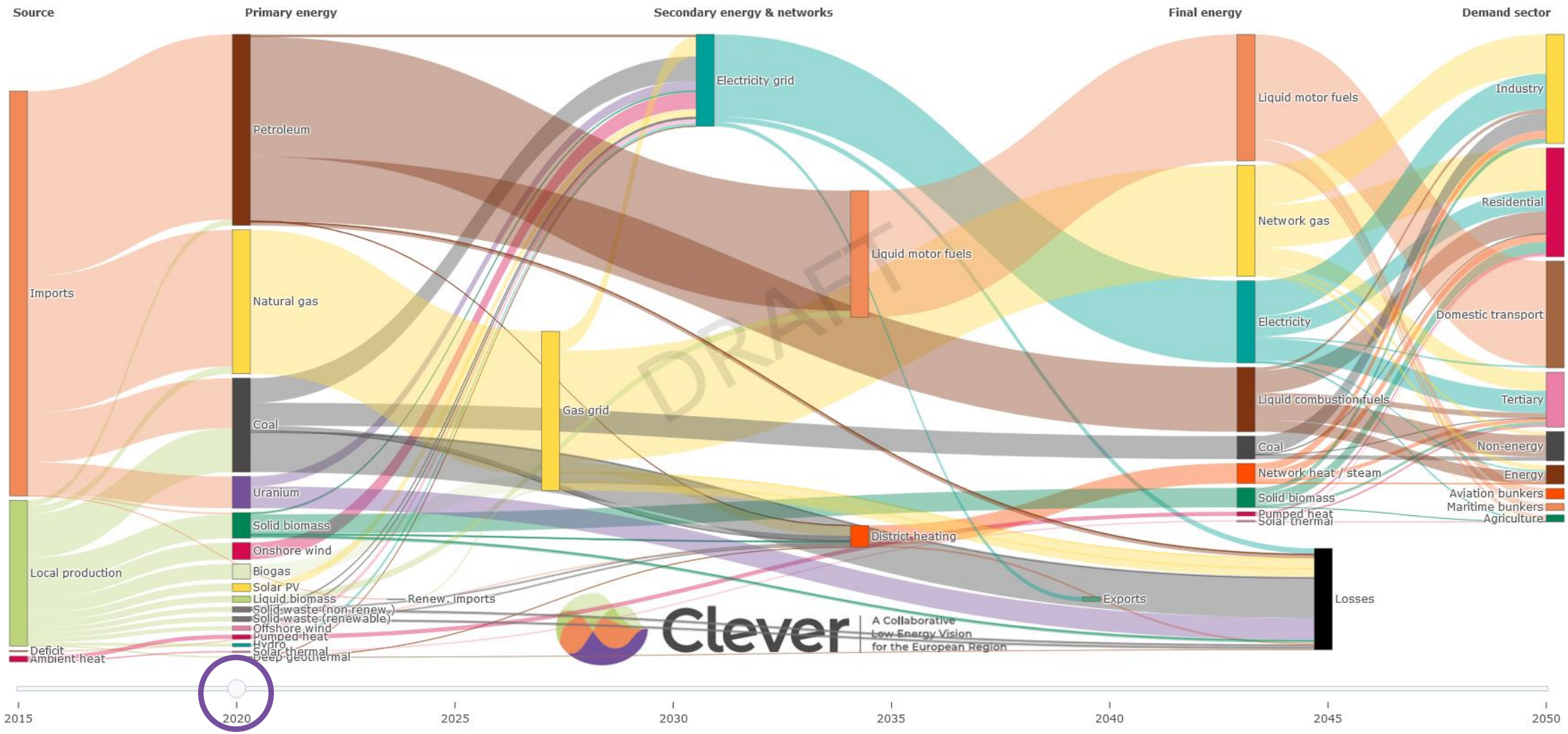
Key scenario data sources:

- Buildings, Industry: UBA/RESCUE (GreenSupreme)
- Transport: AgoraEW (KN45)

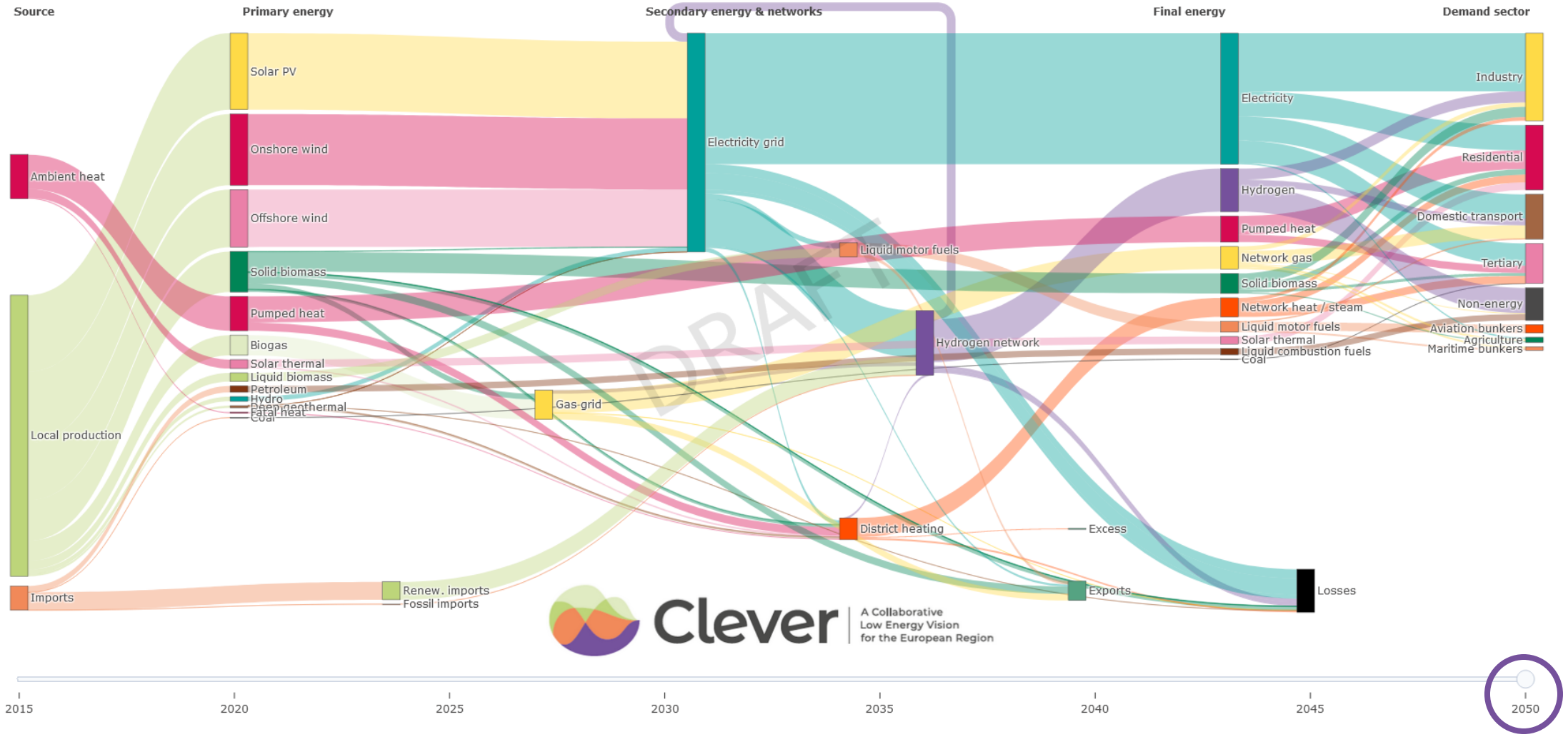
Germany — GHG emissions by sector 2015-2020



Germany – Energy flows 2020



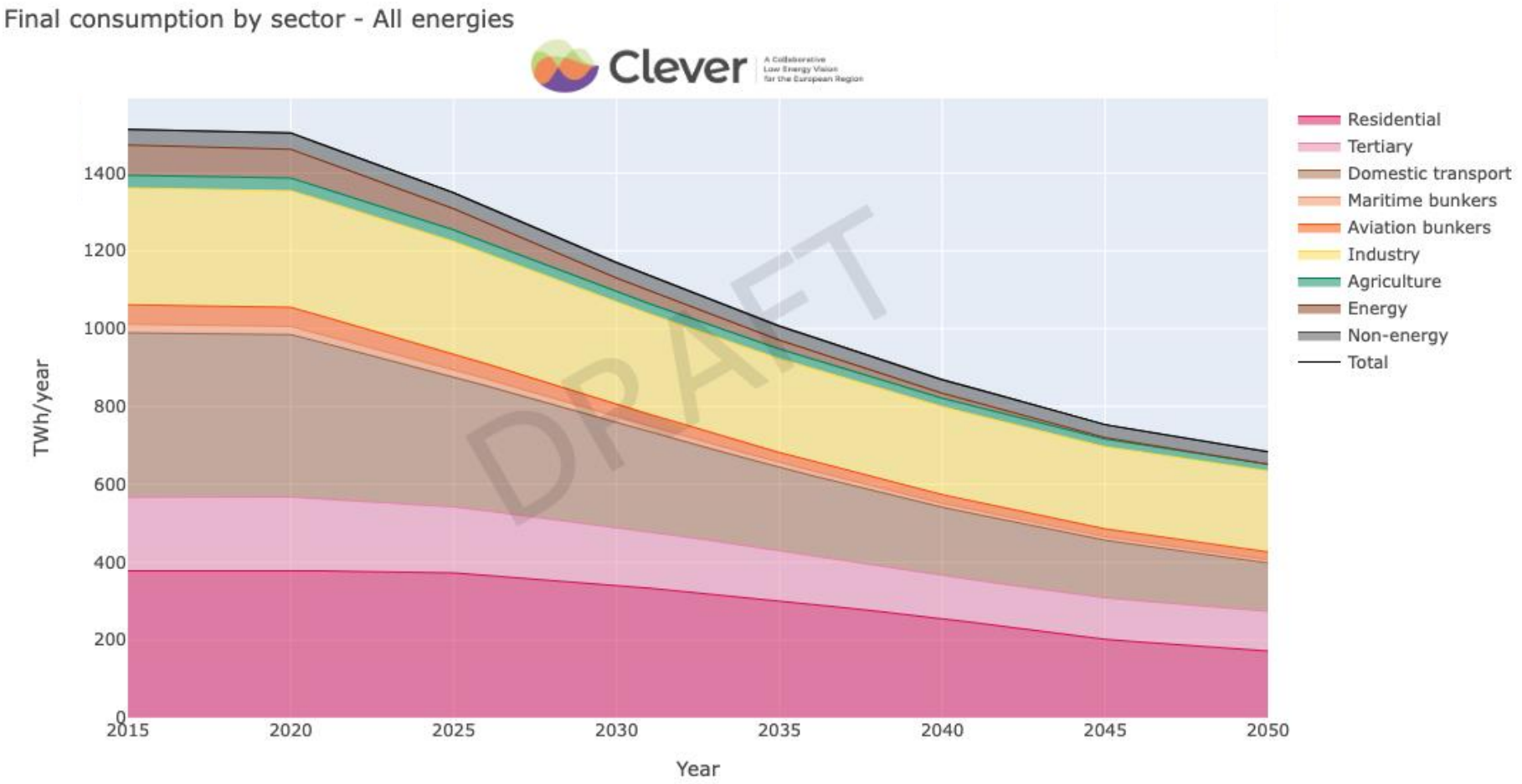
Germany – Energy flows 2050



The Italian CLEVER trajectory in context

Andrea Roscetti
Politecnico di Milano

Italy - 2050 path for reducing consumption



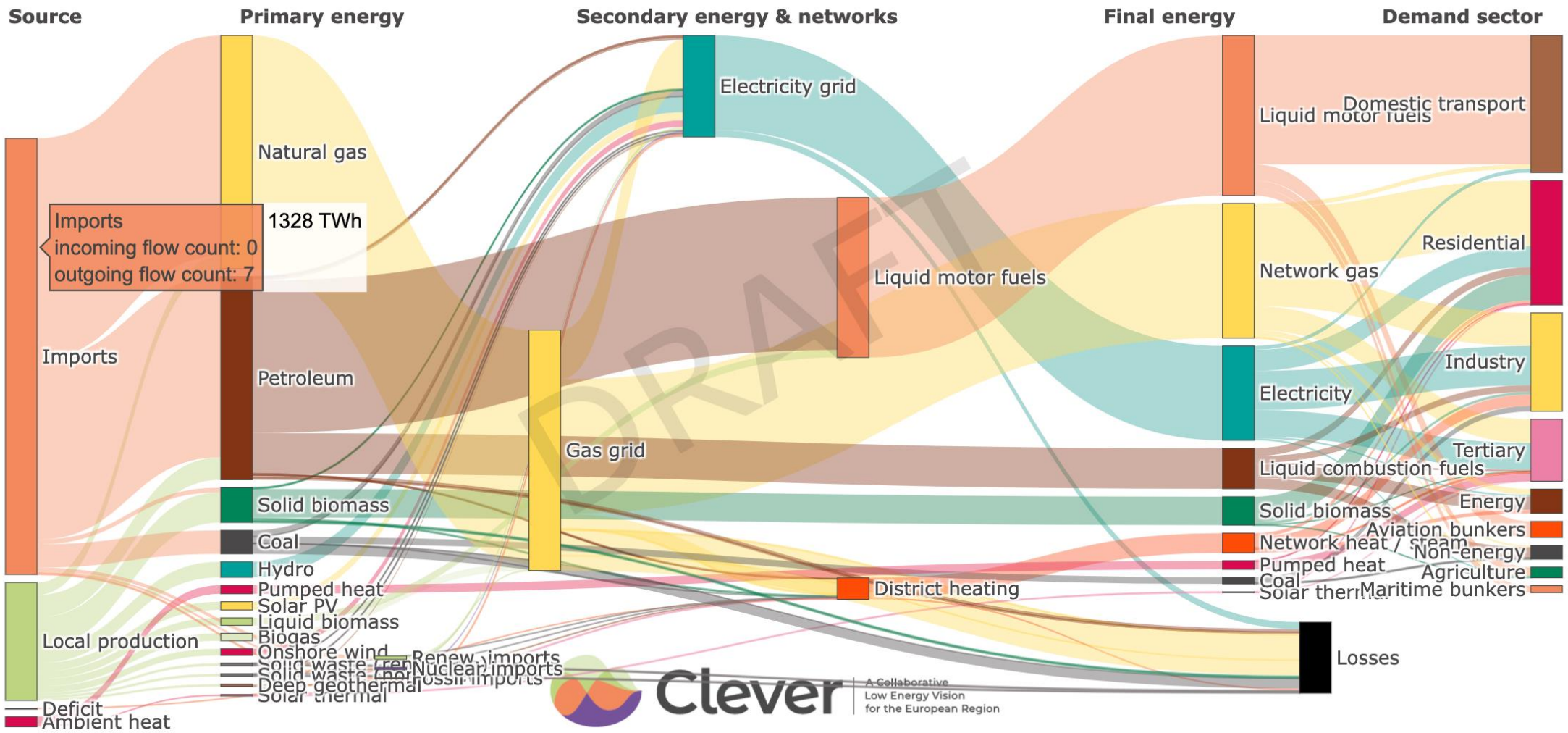
CLEVER final energy consumption:
700 TWh (-55% vs 2020)

Greenpeace – ISF Energy [R]evolution scenario:
830 / 970 TWh
(BAU: 1200 TWh)

PTE (Piano Nazionale di Transizione Ecologica – Ministry of Industry, 2021) scenario: ***930 TWH***

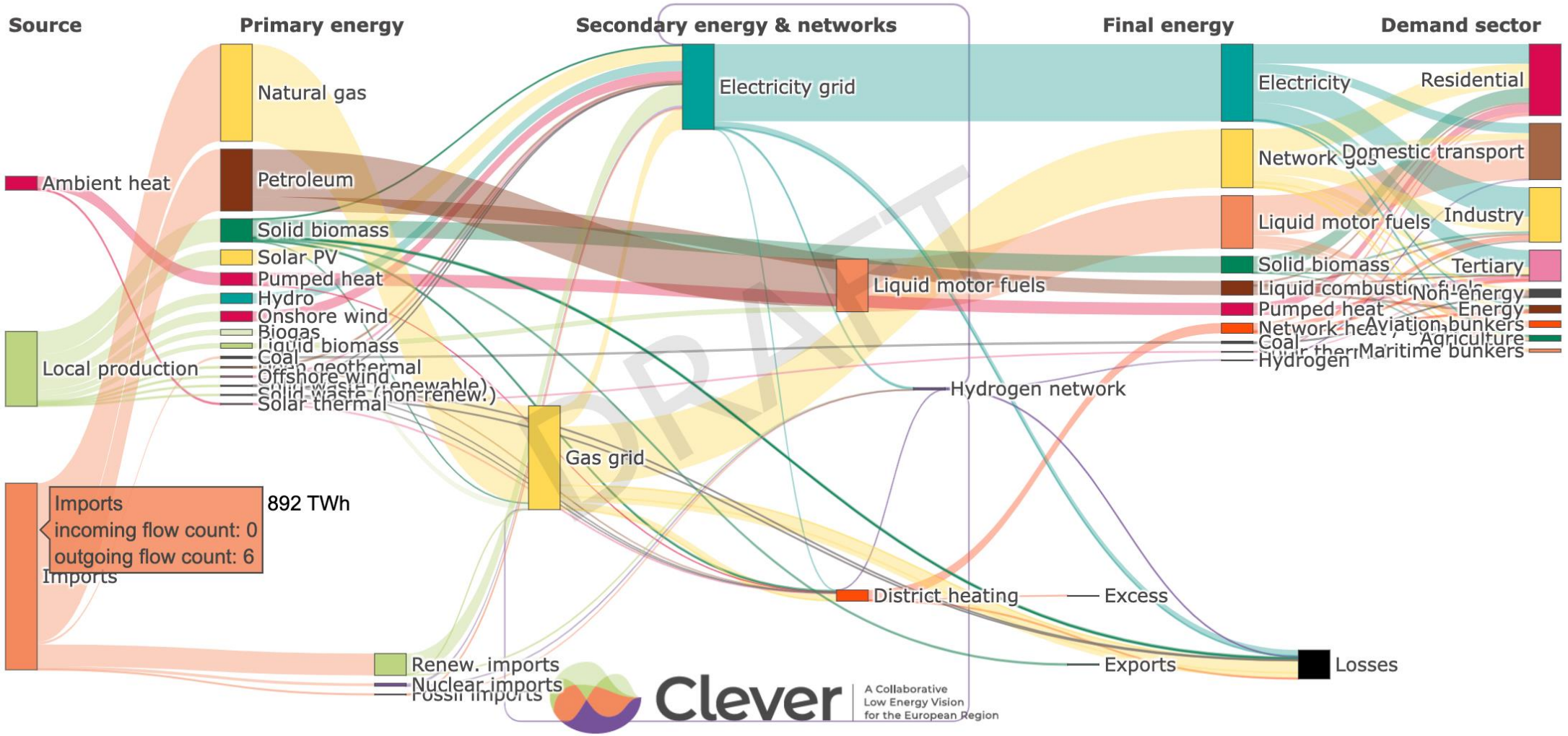
Italy - 2020: high imports dependence and some RES

Sankey diagram in 2020



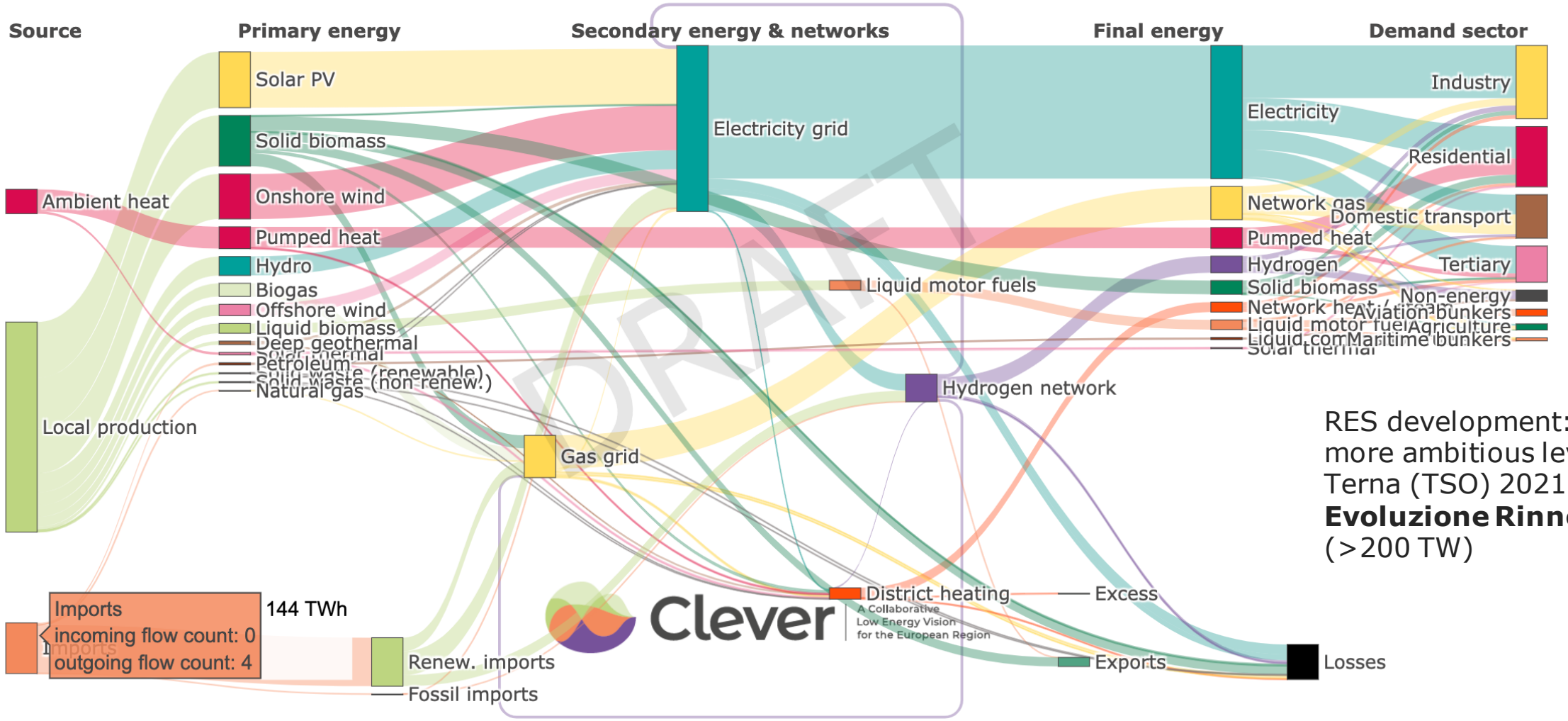
Italy – 2030: transition thanks to demand reduction

Sankey diagram in 2030



Italy - 2050: 0 CO_2 with some remaining imports

Sankey diagram in 2050

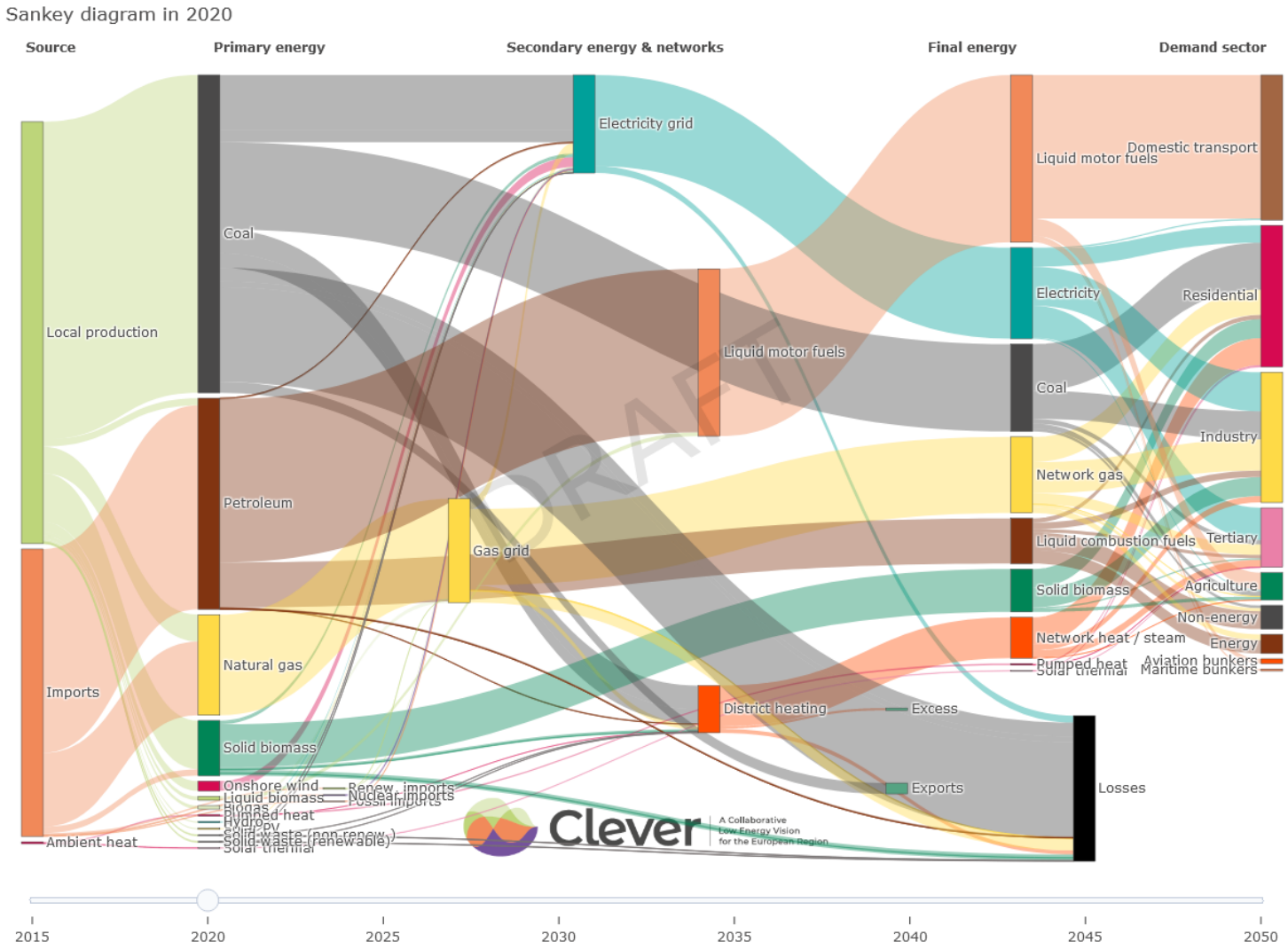


RES development:
more ambitious level vs the Terna (TSO) 2021 report **Evoluzione Rinnovabile** (>200 TW)

The Polish CLEVER trajectory in context

Krzysztof Kobyłka
Wise Europa

Reaching net-zero in PL – extraordinary challenge



Difficult starting position:

High carbon intensity

High coal use:

electricity generation (>70%)
individual and district heating (circa 50 and 70% respectively)

Sluggish start of transformation:

Big potential for RES deployment, but RES target for 2020 not achieved

Low ambitions

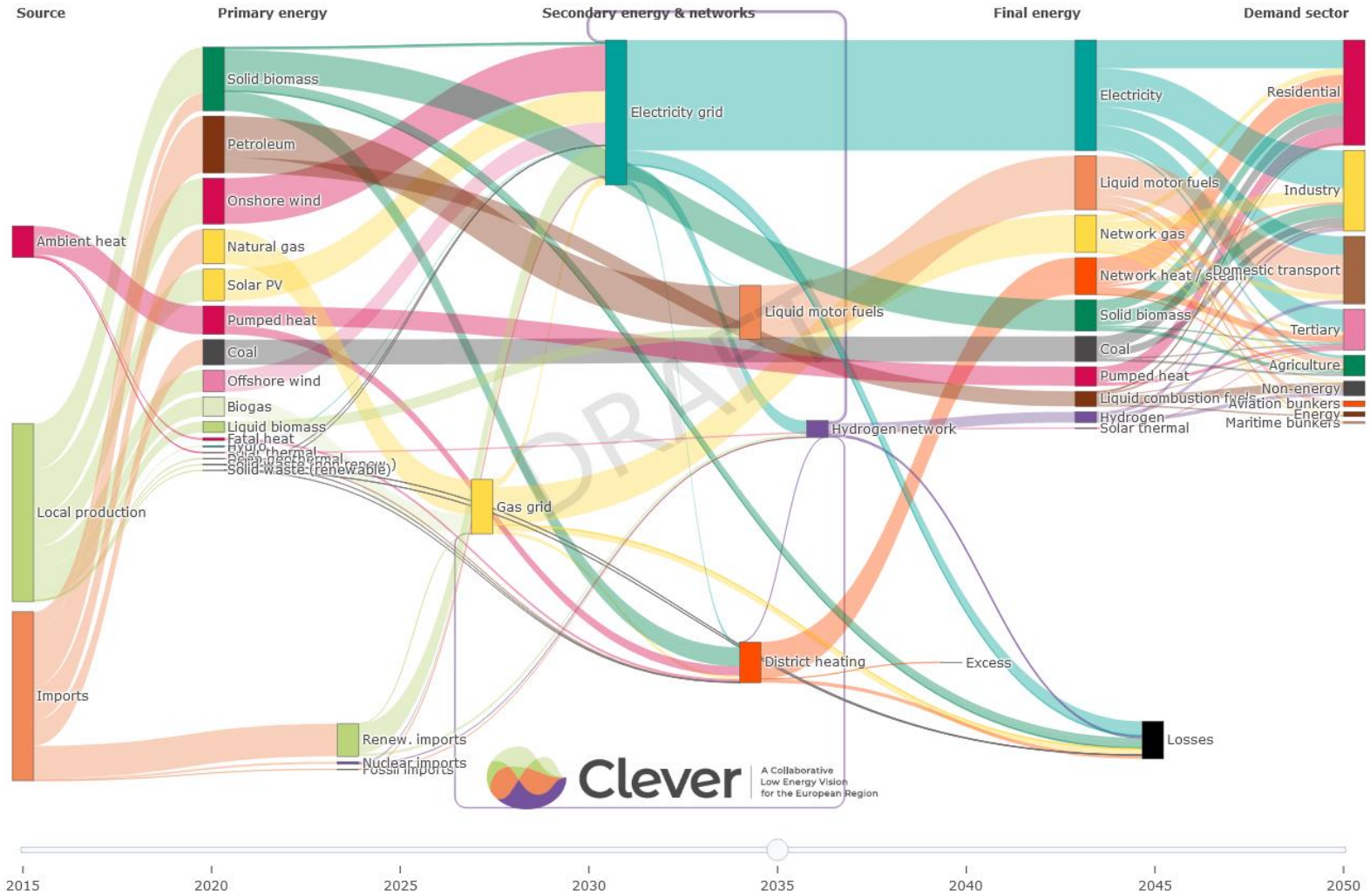
current NECP have RES target 21-23% in 2030

power capacities are low,

transformation will cause at least 50% of additional electricity demand

But there is hope for silver lining...

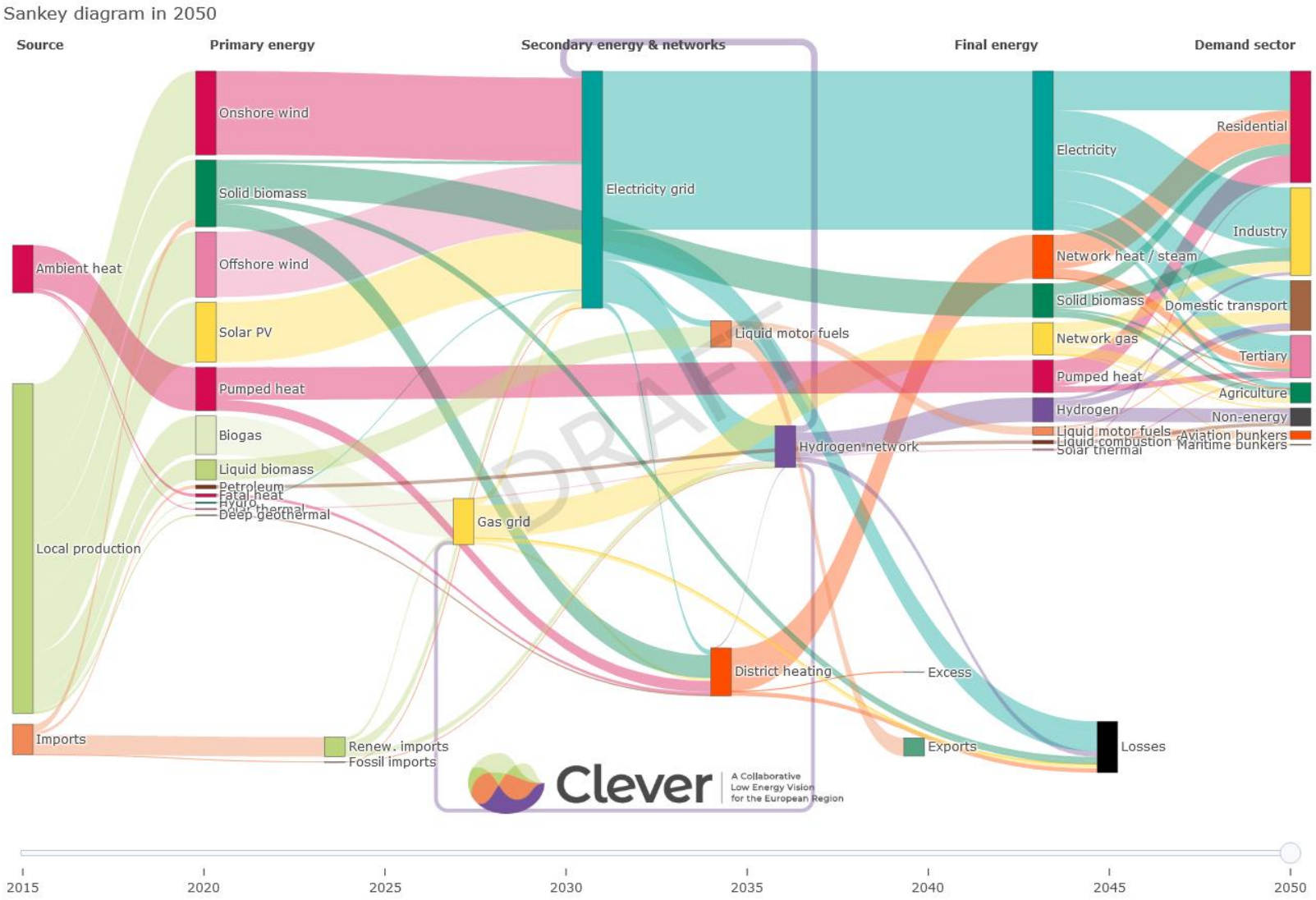
Sankey diagram in 2035



Unleashing potential: Spectacular increase in prosumer PVs - the effect of favorable regulations and financial support
Legislative barriers to the development of onshore wind energy are **to be eliminated**
Better policy and measures to improve energy efficiency, renovation of buildings, individual change of heating fuel

The Russian invasion of Ukraine allowed **a mental shift** in the approach to the transition. It made it clear that energy transition means **consistently reducing imports** of fossil fuels

How can we get there?



Phasing-out coal electricity generation to 2035 is doable. Clever scenario and other analytical institutions confirms it.

Get more ambitious – enable RES development through eliminating the legislative barriers, mobilize private investment and assure protecting vulnerable groups.

What we need
massive investments in offshore and onshore wind and solar capacities
more heatpumps, sustainable biomass and biogas to heat buildings
Transport needs rethinking

Preliminary lessons for Europe

Stephane Bourgeois
négaWatt association

EU institutions must embrace ambition and sufficiency

To set Europe on a sustainable and secure 1.5°C pathway

By 2040

- **GHG** At least **-90%** compared to 1990
- **RES** More than **75%**
- **FEC** **-45%** FEC below reference scenarios

Energy savings are essential:
Short + long-term **sufficiency indispensable complement to efficiency**

EU leadership needed

- The Council should **adopt the European Parliament 2030 targets**
  - ***EED:*** *-14,5% in 2030 below reference scenarios + binding character of primary energy*
  - ***RED:*** *45% of renewables*
- **Implementation** is key and **needs to start now**, at national and sectoral level
- Member States should **mainstream sufficiency** in their National Energy and Climate Plans (NECPs) and Long Term Strategies looking beyond 2030
- The European Commission should integrate above **2040 targets in its NDC and climate law revisions, as well as a thorough assessment of the EU's sufficiency potential**

Q&A session

Clever | A Collaborative Low Energy Vision for the European Region

Technical session
Main assumptions and first results per sectors

Consumption sectors

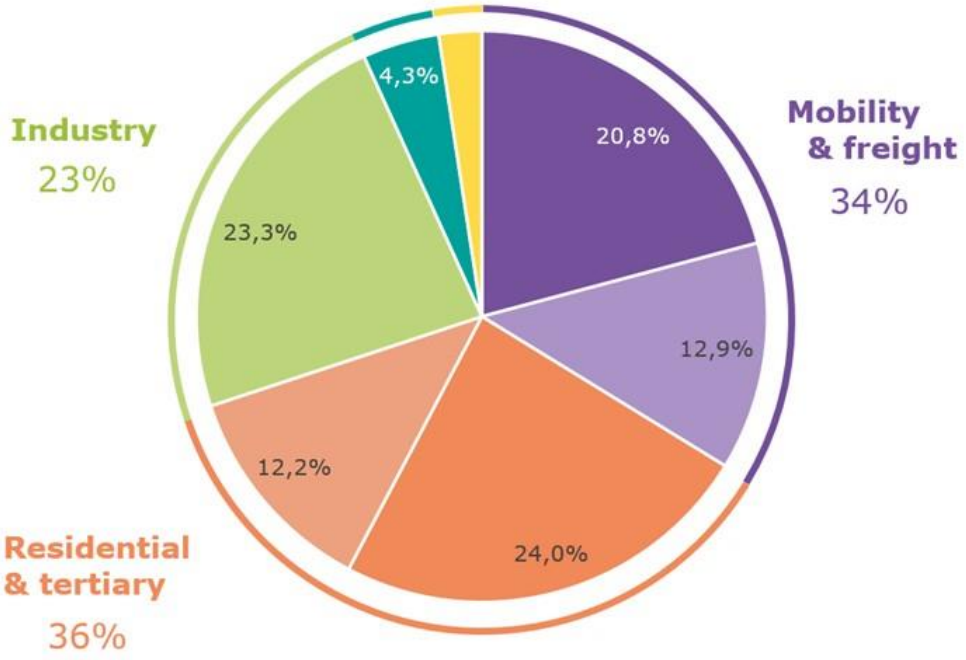
Introduction: consumption

Nicolas Taillard
négaWatt association

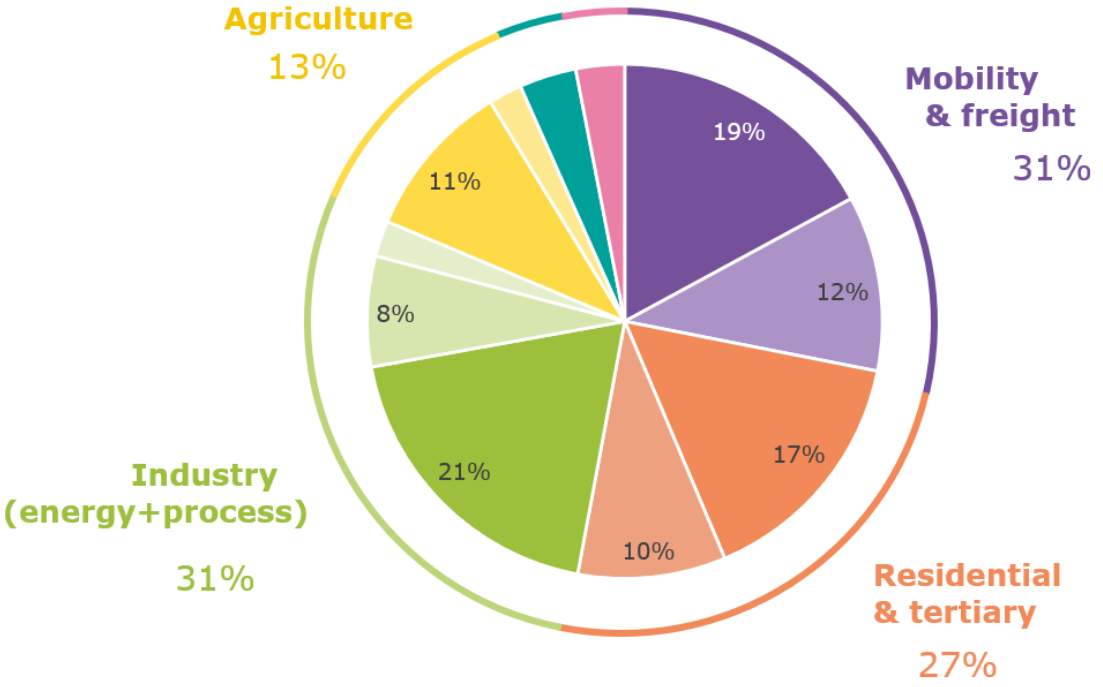
Historical sectoral shares

➢ **3 main sectors responsible of current GHG emissions and FEC consumption**

EU27 FEC (2019)

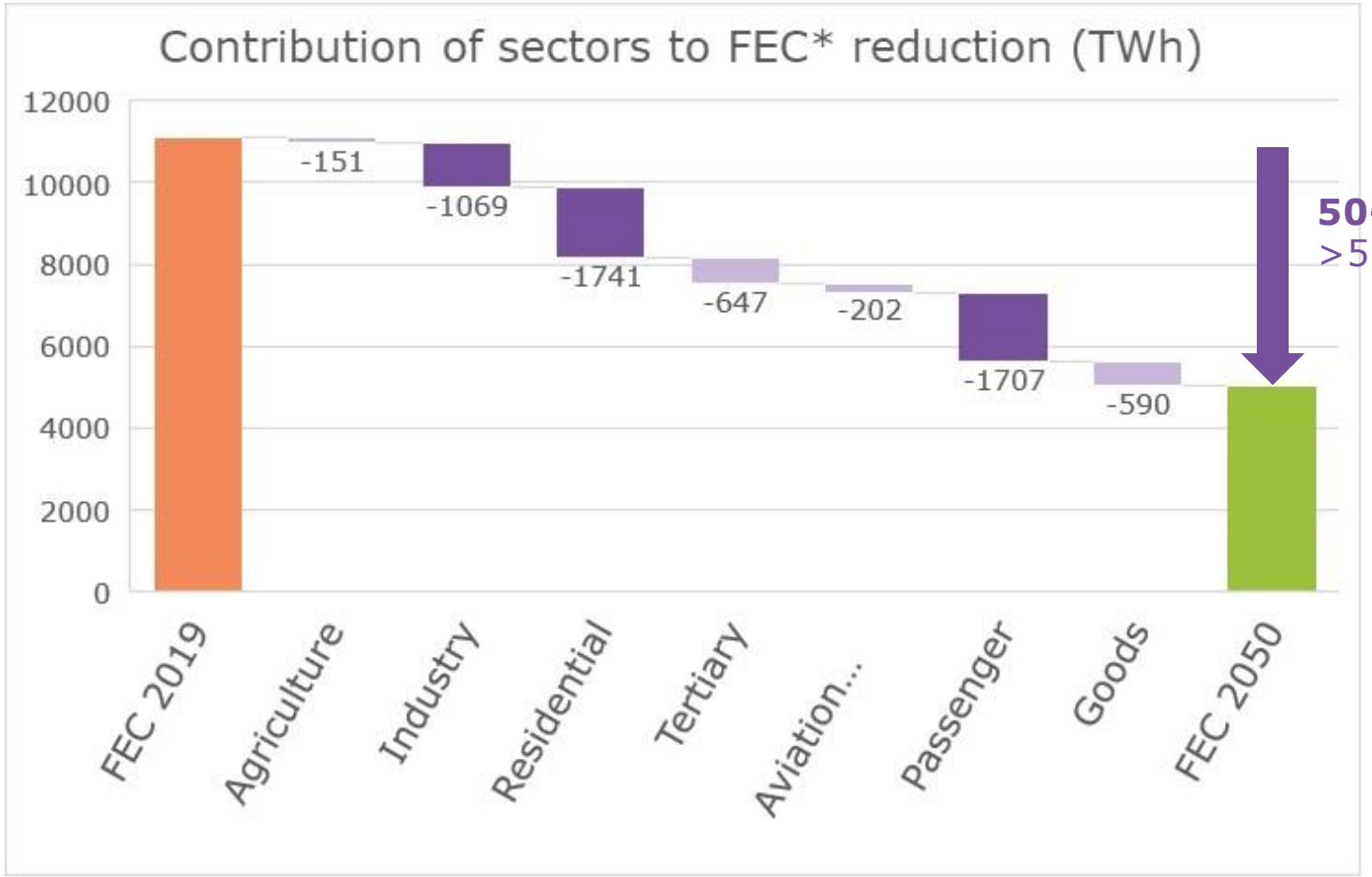


EU27 GHG emissions* (2019)



**GHG emissions of the energy sector (electricity/heat) have been distributed to each sector proportionally to their electricity/heat FEC*

Residential, mobility and Industry
with higher energy reduction by 2050

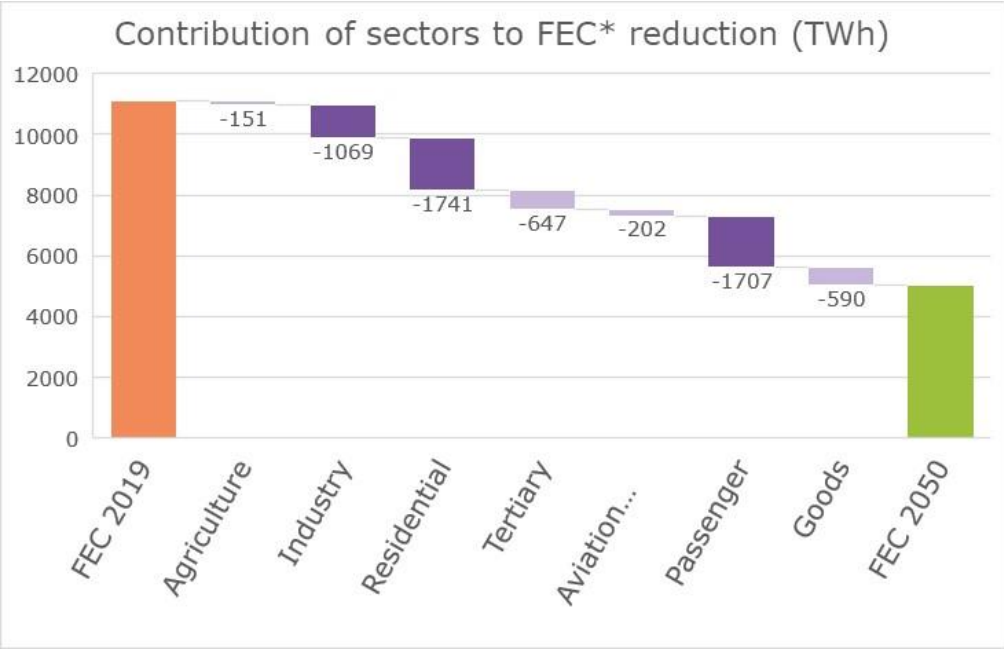


**FEC is here equivalent to Eurostat's "Final energy consumption (Europe 2020-2030)". It excludes ambient heat, non-energy consumption, the energy sector (except blast furnaces) and maritime bunkers from the total*

Residential

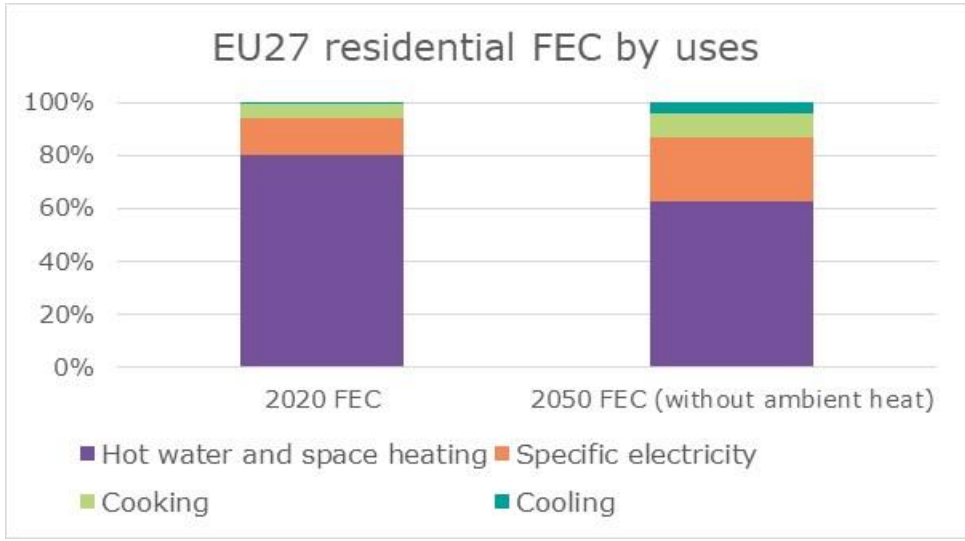
Nicolas Taillard
négaWatt association

Residential sector: results



	Total reduction of FEC*	% of reduction from sufficiency
TOTAL	**50-55%**	**40-55%**
Buildings	~50%	25-50%
Transport	65-70%	30-55%
Industry	25-45%	50-80%

- **Residential : ~30% of the FEC reduction**
  - ***Sufficiency: 30-50%*** *of this reduction in countries like DE/FR/UK*
  - *75-80% of the reduction related to space heating*
  - *Specific electricity: 14% in 2020 to 24% of FEC in 2050 (excl. Ambient heat)*



Residential: main assumptions to reach such ambition

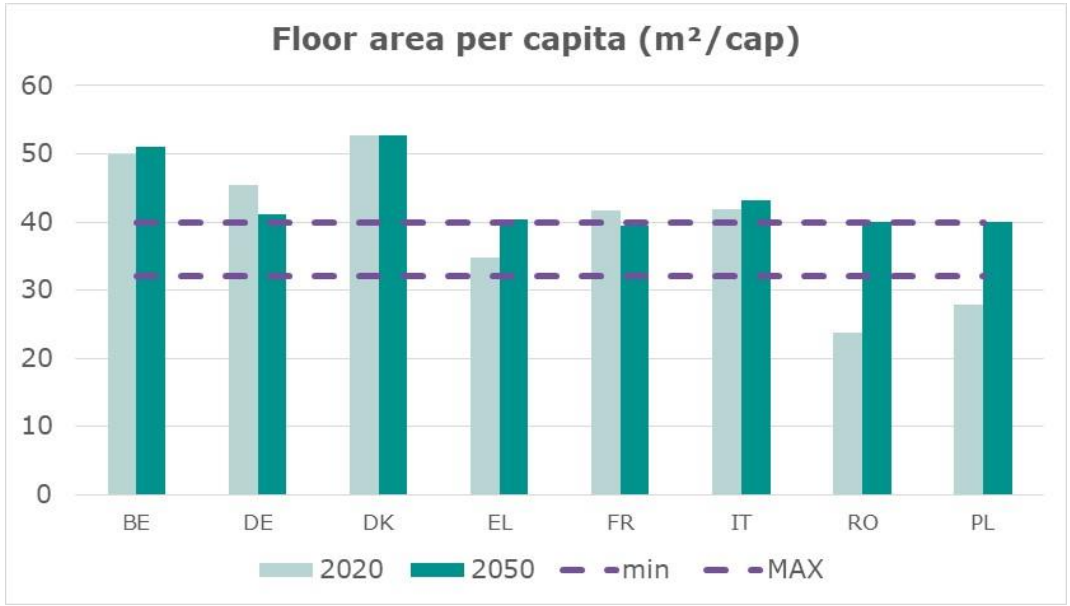
- **Deep renovation is indispensable and needs to start NOW**
  - *Must begin now to go beyond 2%/year of deep renovation from 2025*
  - *Deep renovation: defined as energy levels below 80kWhPE/m2 for 5 uses*

- **Emergency sufficiency** measures are critical in the short term
  - ***T° limited to 19°C**: 5% reduction* considered, or 90TWh** (EU27) (potential up to 270TWh)*
  - ***Hot water (limiters, insulation)**: 5-7% reduction* considered by 2025 and 30% by 2030 reduction considered, resp. 25 and 90TWh** gains*

- **Structural sufficiency** is the necessary complement to efficiency in the long term
  - *Floor area: important to at least stabilise it in countries above 40m2/pers.*
  - *Specific electricity: sufficiency indispensable complement to the generalisation of efficient appliances to avoid strong rebound effects*

**Figures given for 30-40% of households applying the measure and as a % a space heating or hot water FEC*
***90TWh represents about 6% of 2019 net gas imports from Russia*

Average floor area : an indicator which reflects CLEVER modelling approach



- **Limiting floor area increase is important**
  - *Impacts on space heating FEC and GHG*
  - *Deep sustainability : cement, land artificialisation, materials (e.g. electricity), …*
- **32-40m2/pers. can provide decent living for all**
  - *Review of litterature (Milward-Hopkins, Rao and Min. , national and EU scenarios)*
  - *Feedback from national partners*
- **A convergence to decent living standards**
  - ***DE/FR and RO/PL reaching similar levels in 2050 with very different initial levels***
  - *Some flexibility to these corridors to integrate national specificities (e.g. DK/BE/IT): current increase, high inertia of buildings' stock evolution, expected decrease of people/household… => At least stabilise m2/pers.*

More details on floor area corridors and other indicators' corridors in our note on the residential sector: https://clever-energy-scenario.eu/wp-content/uploads/2022/12/2210-Convergence-corridors-Residential.pdf

First proposals for policies to support the CLEVER ambition

Key policy: deep renovation

EU level

EPBD

Go far beyond Council ambition

- In minimum energy performance standards: aim for **reaching a C rating by 2030** and B in 2040
- **Target financial support towards deep renovation only**
- Include **emission performance indicator** for buildings (establishing a Whole Life Carbon roadmap)

Sufficiency policies

Emergency

Inform and roll-out incentives to **save heat and hot water**.

National level

- **19°C**
- **Labelling** and **rollout of efficient taps** and **boiler insulation**

Structural

Agentur für Baugemeinschaften

In Hamburg since 2003

Mandate local housing agencies to reduce **floor area**

Local level

- Agencies to **promote collective housing** through **financing, advising and informing** households

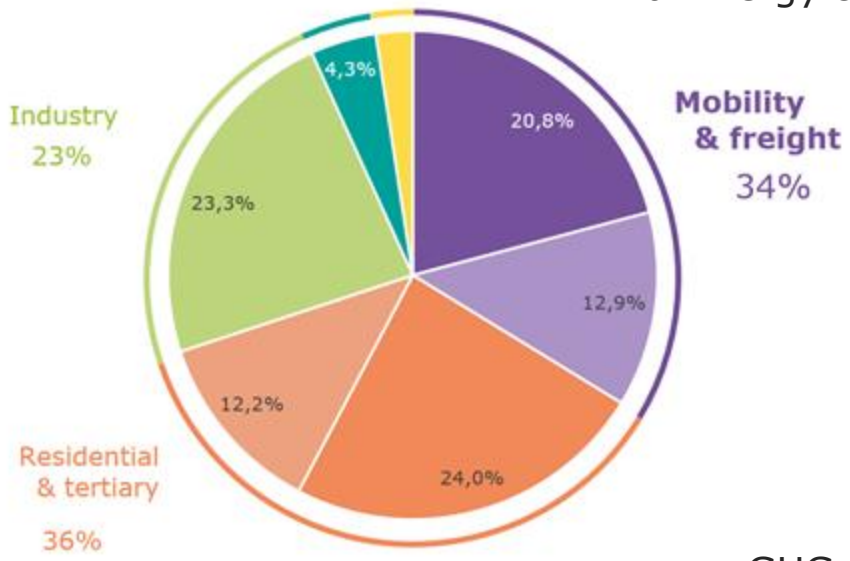
Mobility

Adrien Toledano
négaWatt association

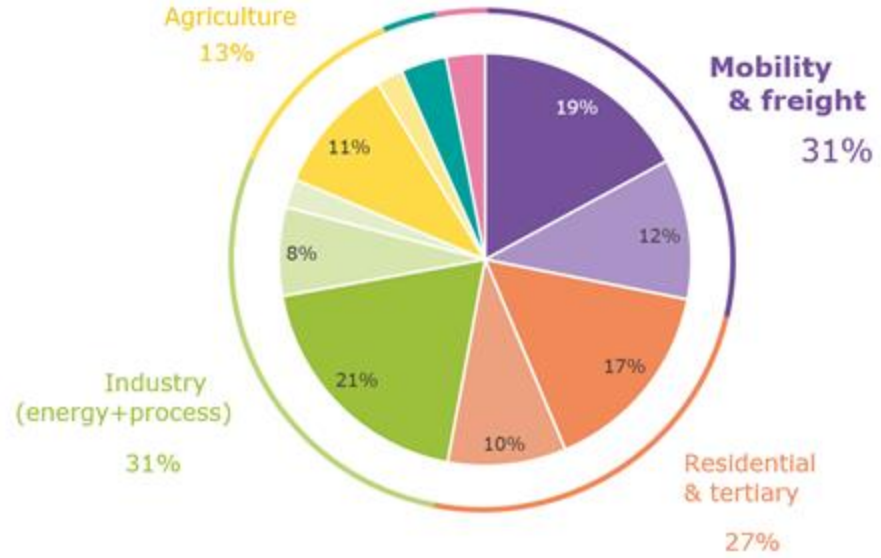
Passenger mobility: context

- **In 2019, the EU27 passenger mobility (incl. international aviation):**
  - *21% of the final energy consumption*
  - *18% of GHG emissions*
  - *high dependency on oil*
- **Main sector to decarbonise, where sufficiency plays a key role**
- **Infrastructures and public action favorising car and air mobility**

Final Energy consumption in 2019

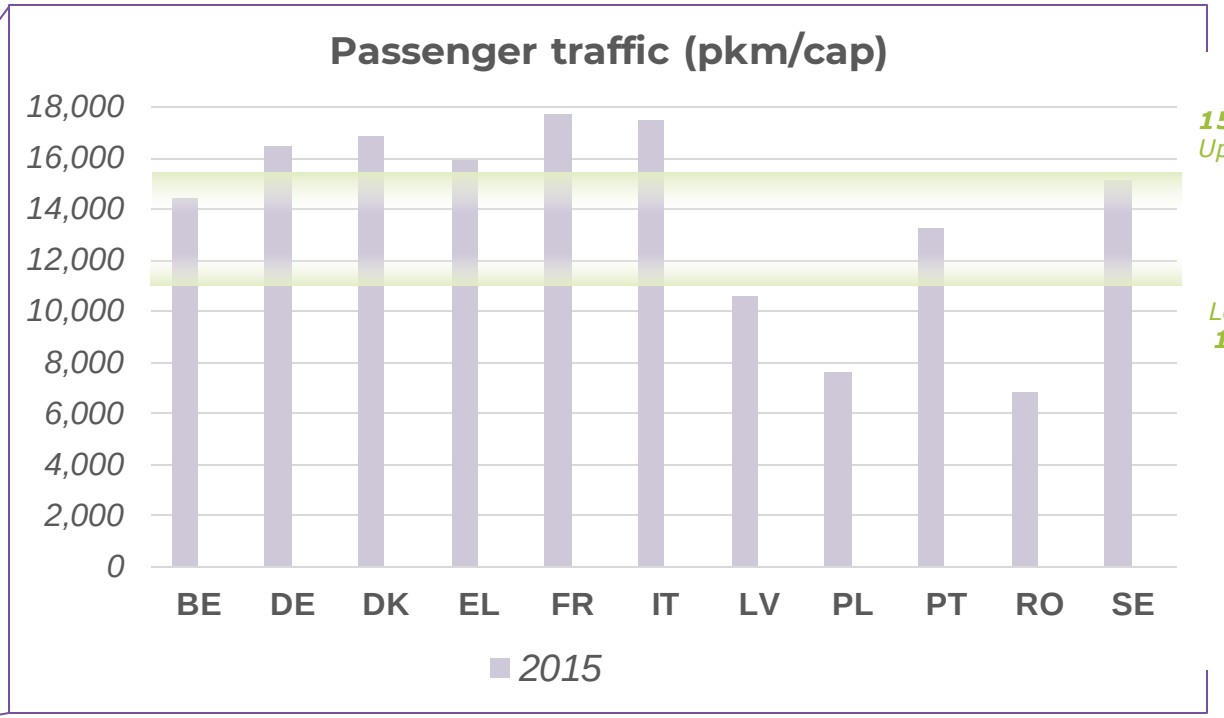


GHG emissions in 2019



Passenger mobility: main assumptions

- **Speed limit** 30 110
- **Car occupancy**
- **Modal shift**
- **Distance travelled**
- **Small shared electric cars**



CORRIDOR APPROACH

Minimum: based on "*Decent living*"
Maximum: defining "*1.5°C compatible services level*"

Passenger mobility: main assumptions

- **Speed limit** 30 110
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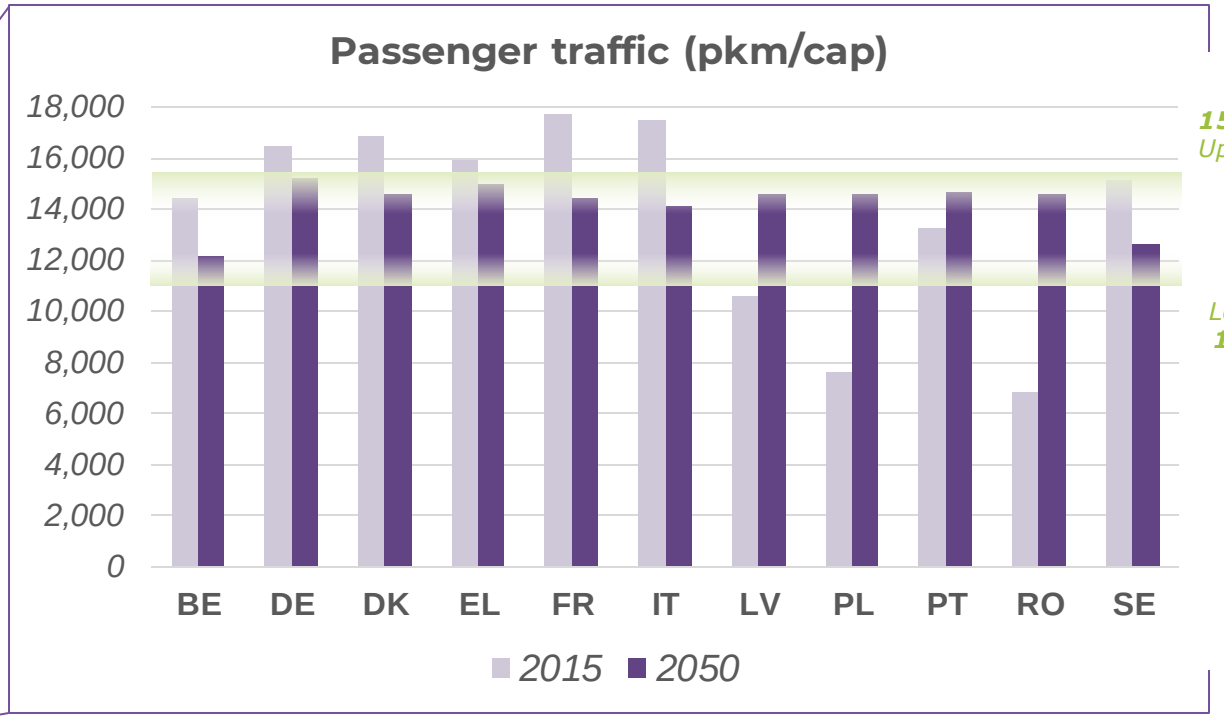


CORRIDOR APPROACH

Minimum: based on "*Decent living*"
Maximum: defining "*1.5°C compatible services level*"
Convergence within this corridor by 2050

Passenger mobility: main assumptions

Speed limit 	**110km/h** speed limit on highways in the EU27 by 2023
Car occupancy 	Convergence to **1.9 person/car by 2050**
Modal shift 	**Soft mobility**: convergence to **10% of land pkm by 2050** **Collective transport**: convergence to **35% of land pkm by 2050**
Distance travelled 	Convergence to **14.000 pkm/cap by 2050** (including air and soft mobility)
Small shared electric cars 	**Fleet electrification** including car-sharing and size reduction

Passenger mobility: main assumptions & examples of policies

Speed limit 30 110

Car occupancy

Modal shift

Distance travelled

Small shared electric cars

Short term

National level

- Speed limits:

110 km/h highways – 80km/h country roads - 30 km/h cities

→ 4% of energy savings on car traffic by 2023

Medium Long term

EU & National level

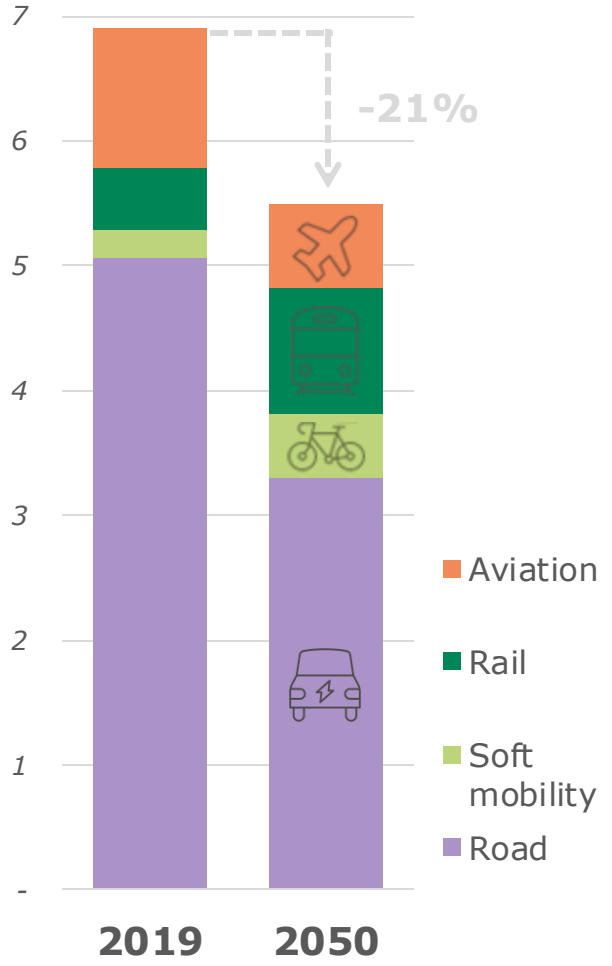
- EU leadership to progressively ban intra-EU flight when **less than 5 hours train alternative** exist

  Validated for France by the EU Commission when train alternatives <2h30 exists

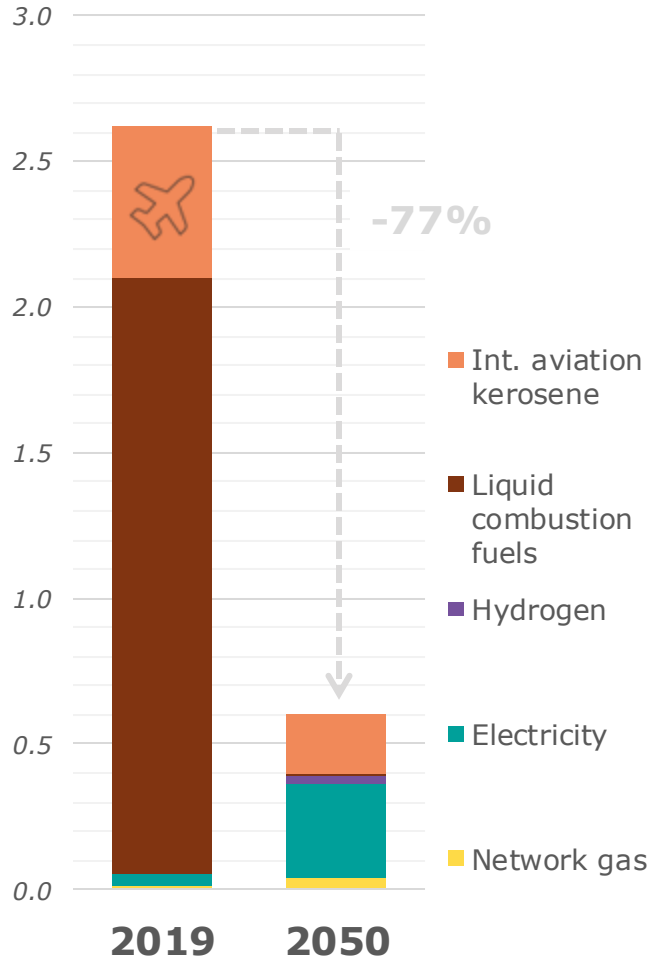
- Boost **development of train infrastructure** (TEN-T), funds to maintain and optimise the existing one, financial incentives and taxation to promote rail rather than air (e.g. frequent flyer levy)

Passenger mobility: results

Total passenger traffic in the EU27 (Tpkm)



Final energy consumption of the mobility sector (PWh)



77% reduction over 2019-2050

Sufficiency:
50-70% *of the reduction for ES, DE and FR*

KEY LESSONS :

Sufficiency is a no-regret option as the other levers, like electrification, cannot be enough

Modal shift is key and in particular the sharp **drop in air travel**, coupled with an **increase in rail**

The emergence of a **fleet of small shared electric cars**, together with **car-pooling**, is a key to achieve **deep sustainability**

Industry

Adrien Toledano
négaWatt association

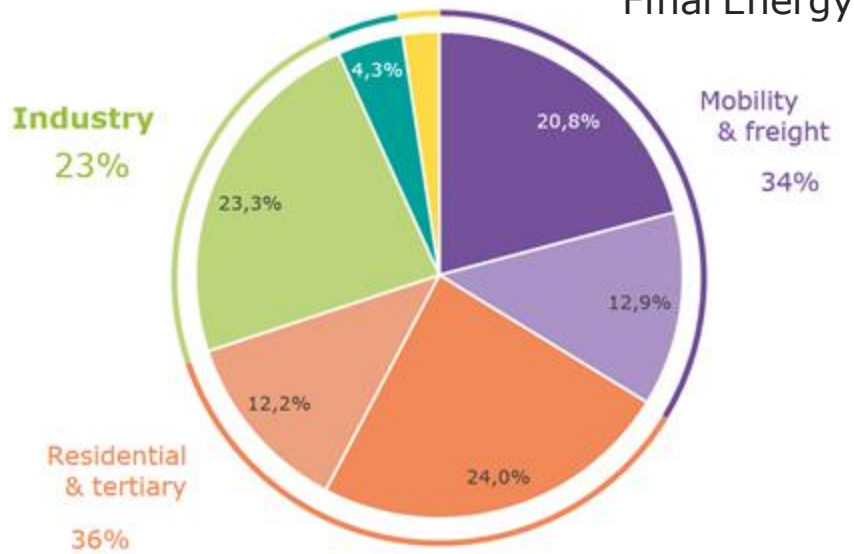
Industry: context and approach

- **In 2019, the EU27 industry:**
  - *23% of the final energy consumption*
  - *31% of GHG emissions*
  - *dependency on fossil gas imports*

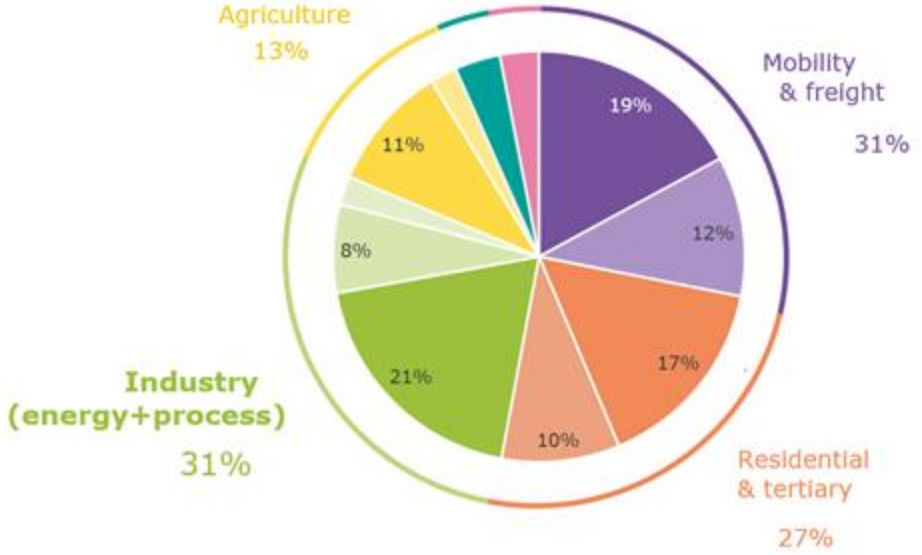
- **4 sectors representing more than 55% of industry final energy consumption**
  - *Steel*
  - *Cement*
  - *Chemicals*
  - *Pulp & paper*

- **An approach integrating corridors (based on European and national scenarios) and ensuring consistency with other sectors (residential, transport, etc)**

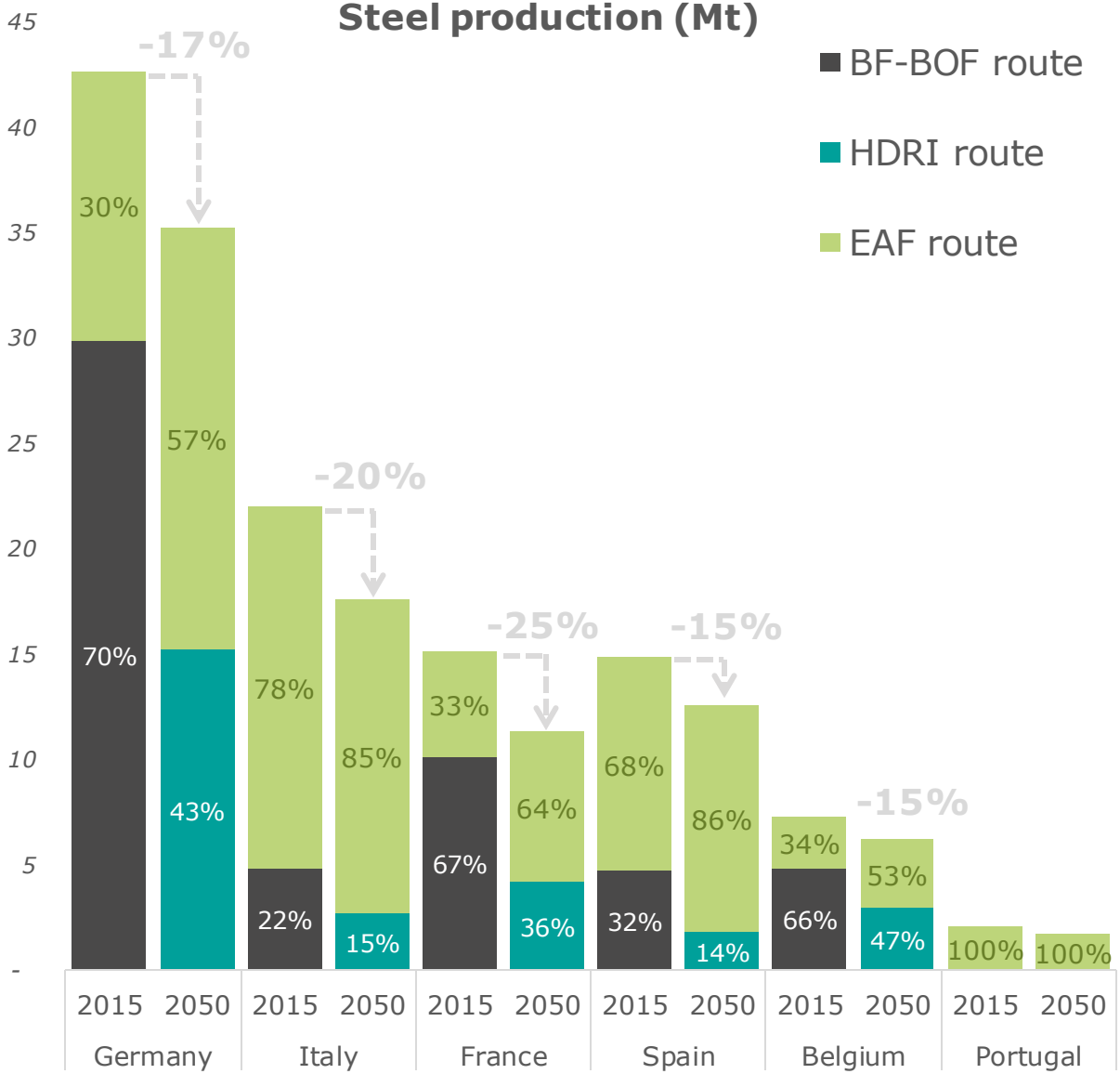
Final Energy consumption in 2019



GHG emissions in 2019

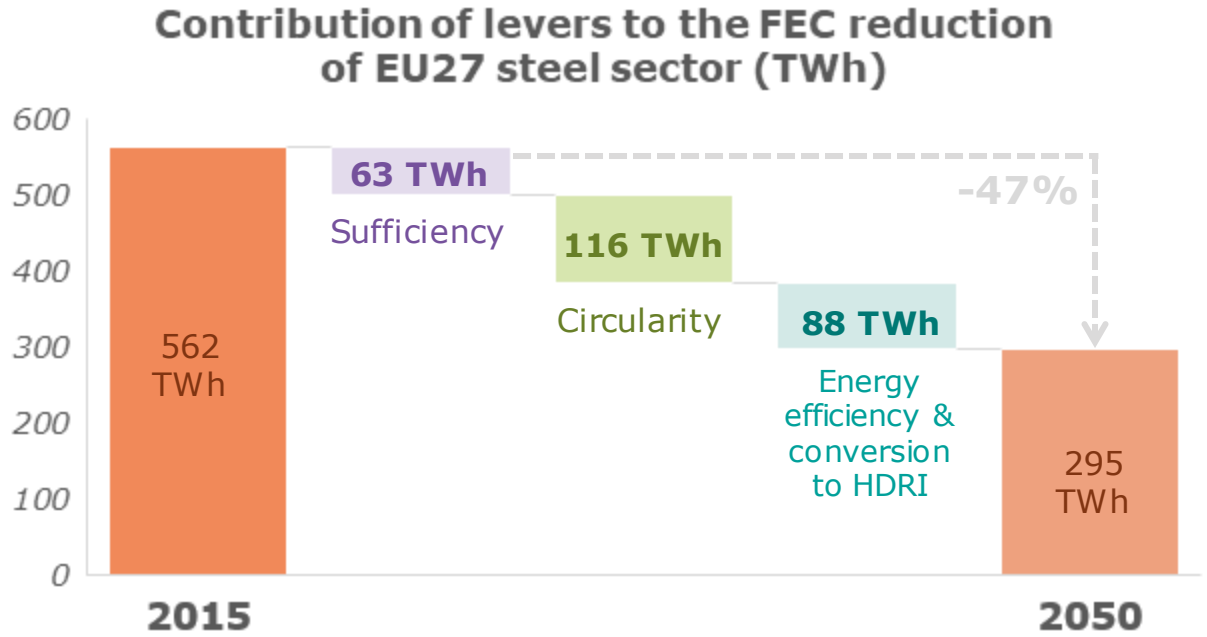


Industry: example of steel



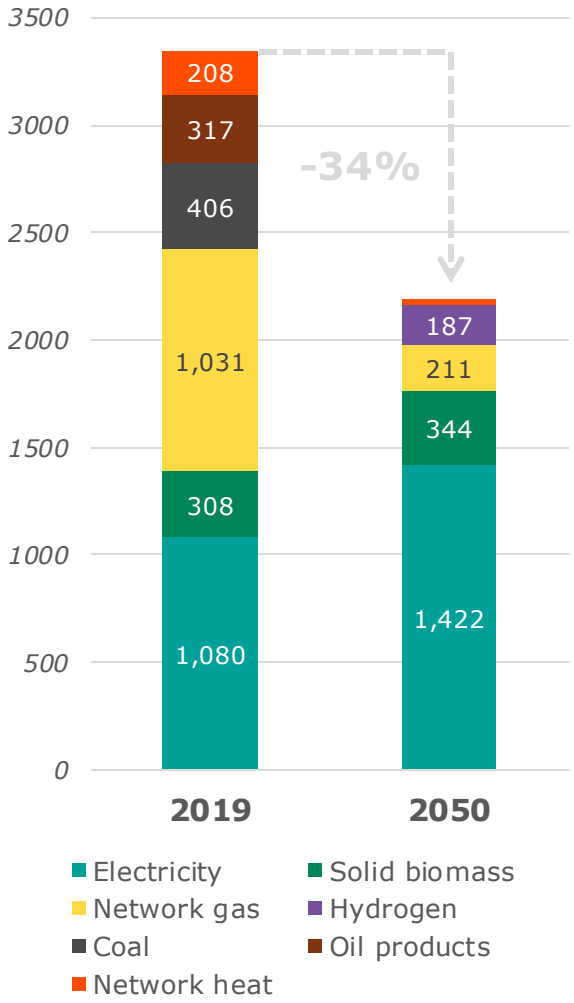
➢ 3 main assumptions:

- ***Sufficiency****: reduction in demand linked to the decrease of new constructions or car production*
- ***Circularity****: increase in the share of recycled steel (via **EAF route**) in total production*
- ***Efficiency & technological substitution****: conversion of primary steel production from fossil-based (**BF-BOF route**) to hydrogen (**HDRI route**) and energy efficiency based on Best Available Technics*

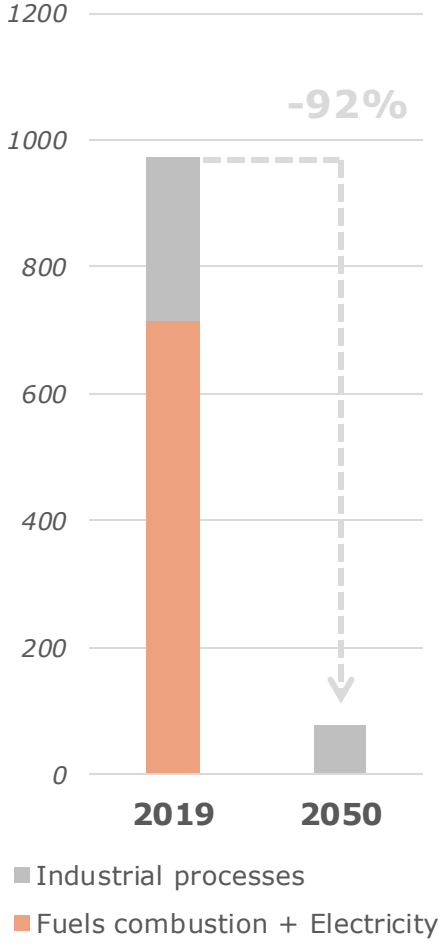


Industry: results

EU Industry FEC by energy carrier (TWh)



EU27 Industry GHG emissions (MtCO2eq)



- **34% reduction of the FEC over 2019-2050**

  Sufficiency & Circularity:

  50-80% *of the reduction for DE, FR and UK*

KEY LESSONS :

Sufficiency and circularity are essential levers of industry's decarbonisation (not relying on CCS)

Direct electrification is crucial to gain energy efficiency and ensure the balancing of energy carriers

Hydrogen is very relevant for specific applications: primary steel production and the production of ammonia and olefins (as a feedstock)

First proposals for policies to support the CLEVER ambition

EU level policies

Sufficiency policies

Structural

Increase EU leadership for Members States to reach **zero net land take target** before 2050 (soil directive)

Short term

Labelling
(reparability and CO2 beyond energy)

Tracking of each stage of the value chain (Digital Product Passport)

Circularity policies

Consumption: introduce reuse and waste prevention target in products regulation

Recycling: introduce minimum rates of recycled materials in products regulation

Efficiency policies

Support electrification through incentives and fossil fuel bans

Other sectors

Nicolas Taillard
négaWatt association

A few words on other FEC sectors

Tertiary
Main levers similar to residential

- ***Deep renovation*** *is the key*
- ***Floor area convergence*** *to provide min. public services (decent living) and limit environmental impacts*
- ***Sufficiency*** *(e.g. T° regulation) a necessary complement to efficiency*
  - *Particularly for* ***specific electricity*** *(lighting, appliances…) as growing share of FEC over 2020-2050*

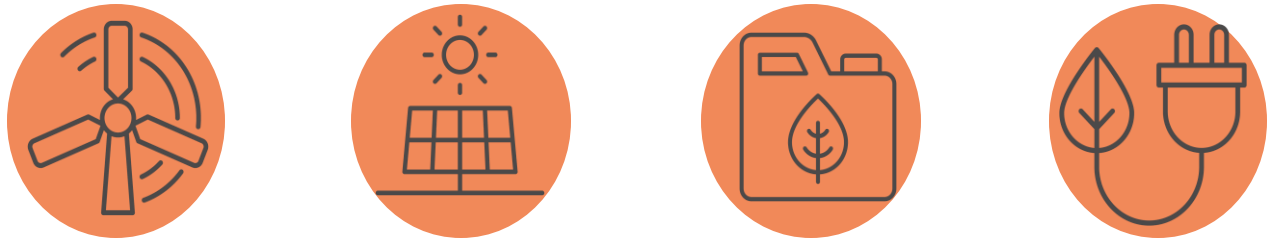
Freight
Main levers similar to Mobility

- ***Demand (ton-kilometers):*** *~10% reduction in most countries related to sufficiency in industry*
- ***Strong modal shift to rail***
- ***Vehicles renewal****: Efficiency and zero emissions (Biogas/H2/electricity)*
- *Other important levers:*
  - *Load factor optimization*
  - *Light commercial vehicles' evolution*

Q&A session

Energy production and carrier balances

Energy production and carrier balances



Nicolas Taillard
négaWatt association

Approach for carriers' balance and energy production

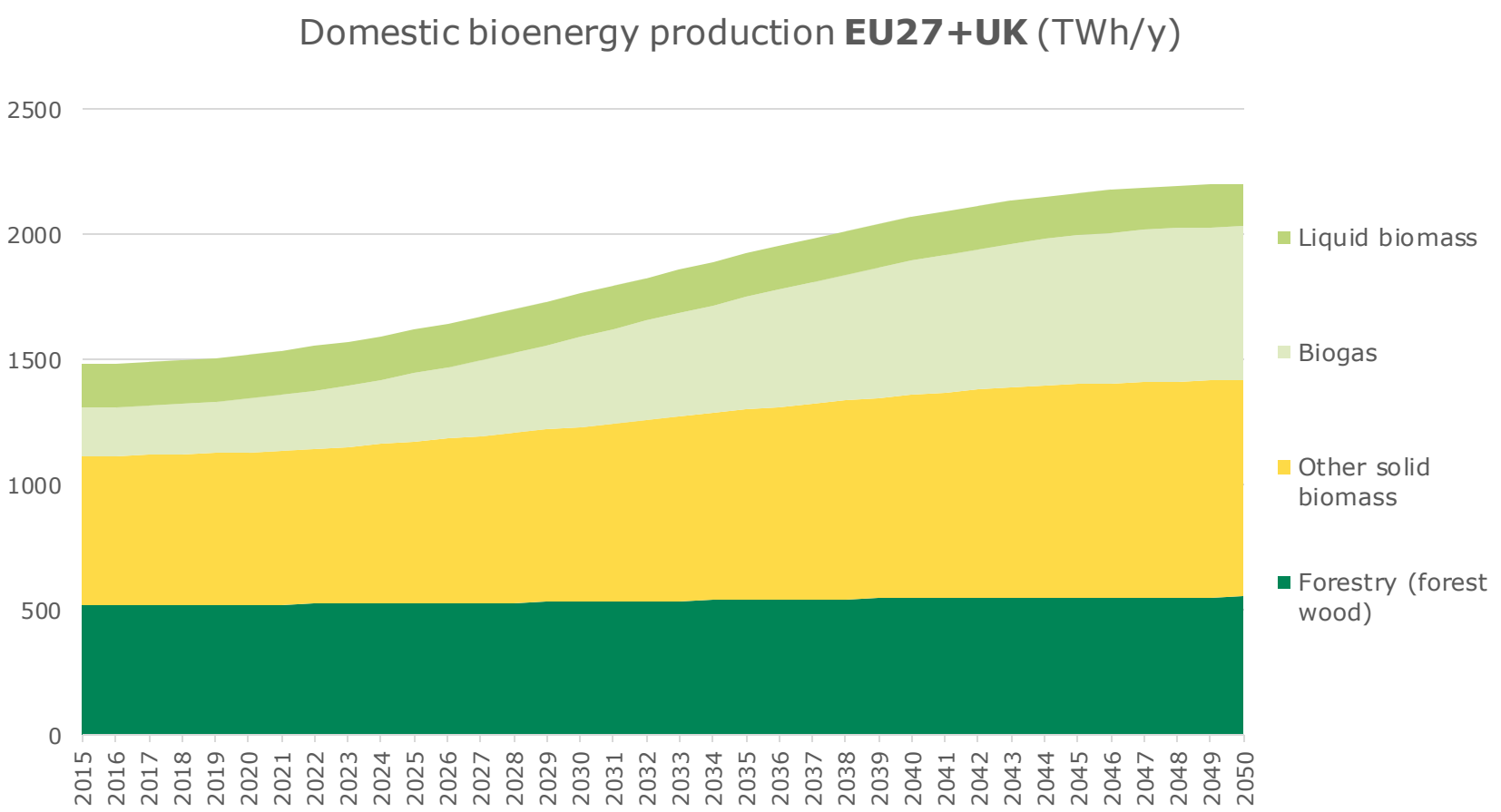
- **Carriers' availability** (renewables potential)
  - ***Evaluation of sustainable bioenergies' potentials***
  - *1st estimations of electric RES production (feedback from national partners and review of existing studies) and min. H2 needs to support 100% RE system*

- **FEC modelling**
  - *Energy needs through efficiency and sufficiency (see prev. section) and evolution of uses*
  - ***Corridors for carriers' share in FEC by uses/sector** considering sectorial constraints, costs, materials issues, TRL, historical national level*

- **Supply / demand matching :** most critical sectors (e.g. aviation) and most critical resources (e.g. liquid carrier) prioritised

- Iterations over carriers in FEC, H2 production and PtX and electric RES deployment

Bioenergy sustainable potentials



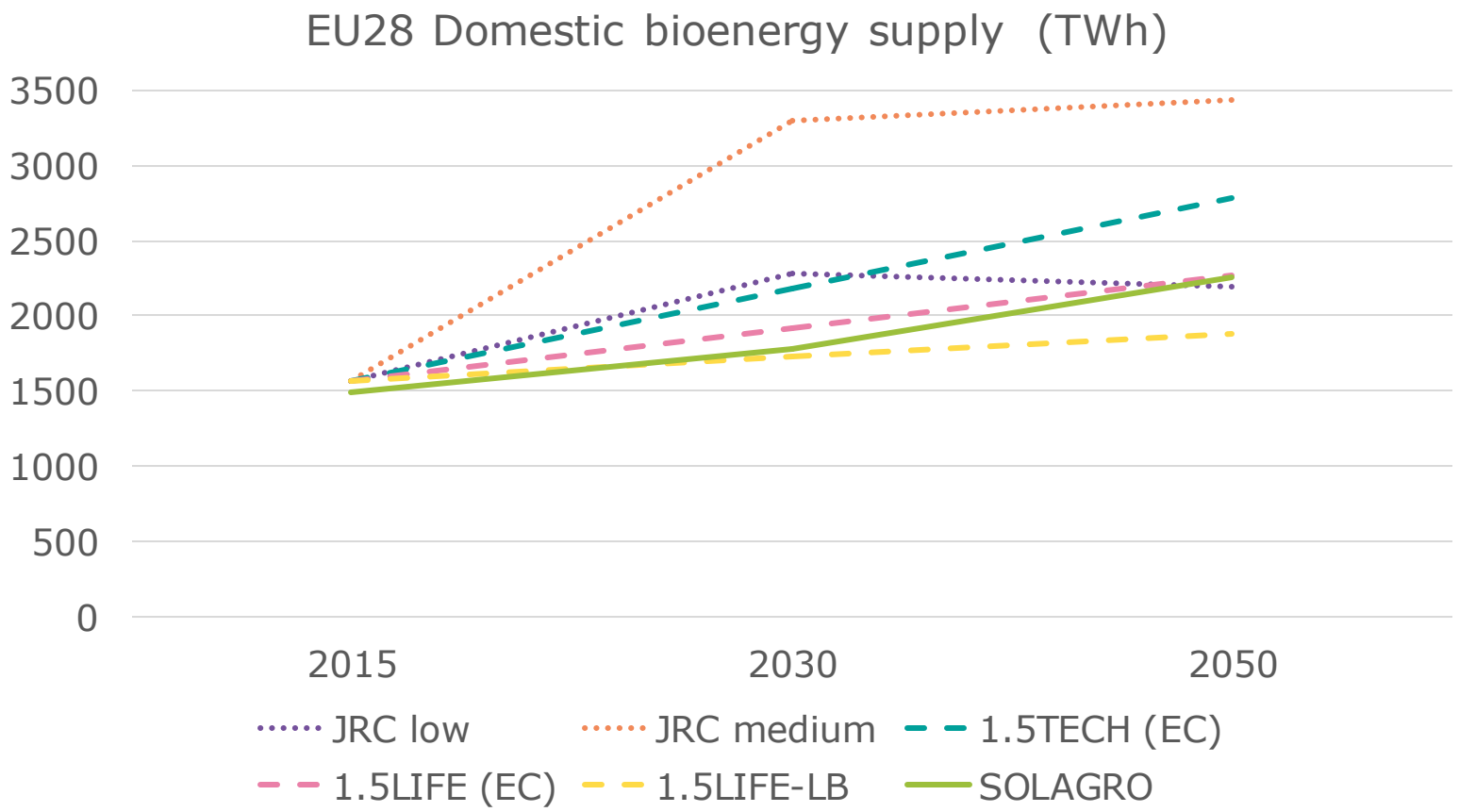
No increase in forest-sourced solid biomass and liquid biomass

Biogas upscaling in line w. 2030 EU objectives

Slight increase of other types of solid biomass (non-forest wood, straw, wood chips…)

A « realistic » / conservative bioenergy pathway

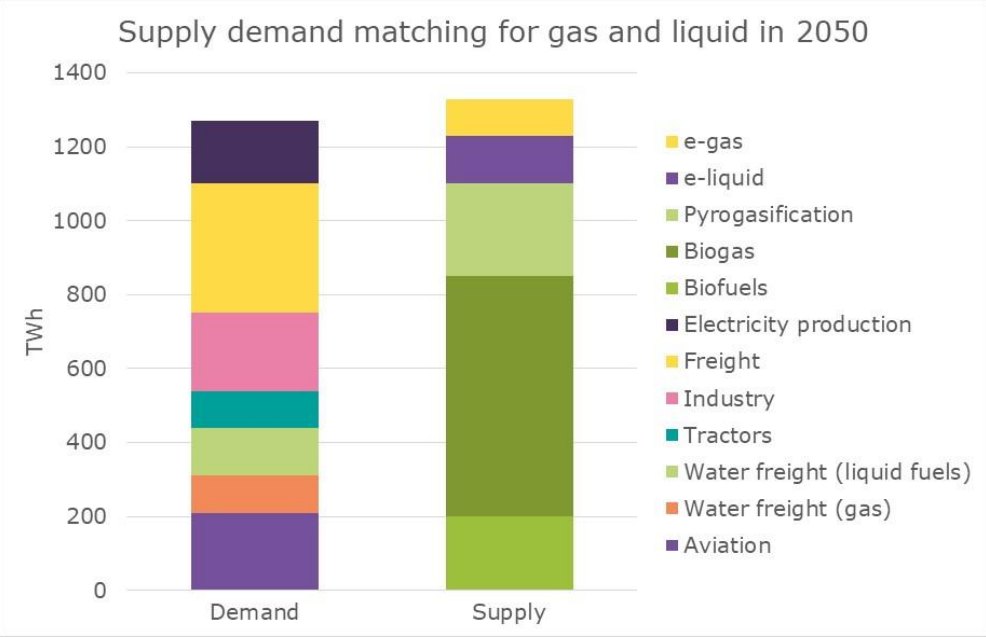
- **Very close (3%) to JRC lower boundary of sustainable potential in 2050**
- **Close to 1.5 EC pathways : +/- 20%**



Carriers' share in FEC

- **An iterative process to define corridors by uses/sectors**
  - *Collection/analysis of existing scenarios' evaluations (national and/or EU)*
  - *Technical dialogue on these evaluations considering, among others :*
    - **Sectoral constraints :** limited possibilities for specific industrial processes, district heating privileged in dense areas, …
    - **Materials concern**: inclusion of guidelines from detailed materials flows modelling for FR (e.g. on lithium in vehicles)
    - **Technology readiness level (TRL)**: only TRL above 6
    - **Costs:** H2 light vehicles expected to remain more expensive, etc.
    - …
- **Final decision through review of demand/supply matching**

Supply/demand matching (1/2) : Gas and liquid fuels



- **Prioritised in sectors with no credible alternatives**
  - ***Liquid fuels***
    - **Biofuels** where no alternatives => almost all for **aviation** (200TWh)
    - **E-fuels and e-gas** limited because of TRL and uncertain carbon sources => only for **water freight**
    - Other uses fed by other carriers
  - ***Gas (CH4)***
    - ***Water freight and tractors*** *(200TWh) because of biofuels scarcity*
    - ***Industry*** *(210TWh) and* ***road freight*** *(350TWh)*
    - ***Production of electricity*** *for flexibility (170TWh)*

- **Production**
  - ***From bioenergies (1035TWh)****: biofuels (215TWh), biogas (620TWh) and pyrogasification (200TWh)*
  - ***From electricity (230TWh):*** *e-gas and e-fuel (incl. ammonia/methanol) for water freight*

** Figures for 2050 and for EU27+UK+CH+NO*

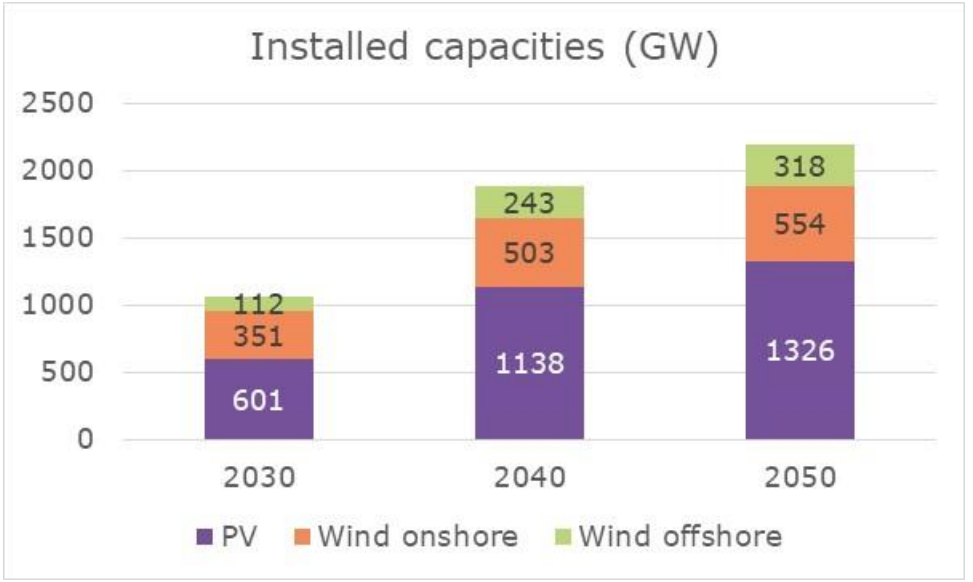
Supply/demand matching (2/2) : Biomass, H2 and electricity

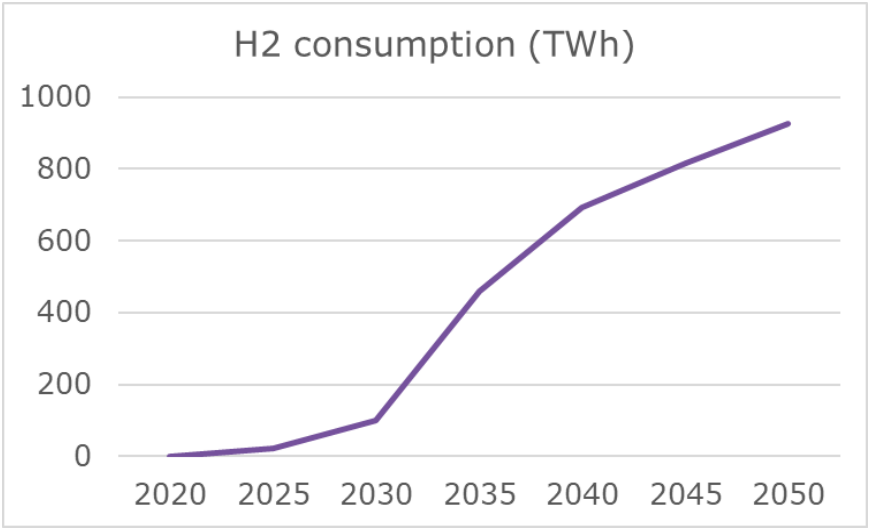
- **Solid biomass and H2:** where use is the most relevant ; limited by sustainable potentials and/or poor overall efficiency
  - ***Biomass***
    - **Some industries (350TWh)**
    - **Heating** in some types of buildings in certain countries (260TWh)
    - **District heating**: complement to other RES sources (170TWh)
  - ***H2***
    - **Industry (190TWh),** mainly for steel
    - **Feedstocks (410TWh),** mainly for olefins and ammonia
    - **Production of electricity** for flexibility (220TWh) in complement to CH4
    - **Transports (130TWh):** only if few alternatives available
- **Electricity to complement the mix with respect to sectoral constraints and deep sustainability considerations** (see section "carriers' share in FEC")

** Figures for 2050 and for EU27+UK+CH+NO*

Results on RES-E and H2

- **Electric renewables**
  - ***2030:*** *close to REPowerEU objectives*
    - Wind: 460GW (Repower EU: 510GW)
    - Solar: 600GW (Repower EU: 592GW)
  - ***2050:***
    - *Wind: 890GW (1.5TECH/LIFE: >1000GW*)*
    - *Solar: 1330GW (1.5TECH: 1000GW**)*
- **H2** ***consumption***
  - ***2030: 100TWh*** *(REPowerEU: >500TWh)*
  - ***2050: 930TWh***





** p.77-78 of "IN-DEPTH ANALYSIS IN SUPPORT OF THE COMMISSION COMMUNICATION COM(2018) 773"*
*** Same source as above. PV 2030 objective was almost doubled between 1.5TECH (320GW) and RepowerEU (592GW)*
**** Figures for EU27*

Additional results

- **No imports necessary after 2045**

- **Electrification**
  - ***Significant increase of electricity in EU27…***
    - *+75% electric production in 2050 / 2015*
    - ***+25% electric FEC** (up to +90% in countries like NL/RO)*
  - ***… but a sound increase…***
    - *Lower than other scenarios (e.g. production: +100% to +150% in 1.5LIFE and 1.5TECH*)*
  - ***… thanks to sufficiency , efficiency and bioenergies***

  → Increased resilience :
    - ***Grids challenge minimised***
    - ***Materials challenge (e.g. Cu) minimised***

**p.74 of "IN-DEPTH ANALYSIS IN SUPPORT OF THE COMMISSION COMMUNICATION COM(2018) 773"*

First proposals for policies to support the CLEVER ambition on RES

EU level

RED

Designate **priority areas** of **lower environmental impact** for a quick roll-out of renewables

Renewable energy projects must be presumed to be of **« overriding public interest »**

National and local level

Ensure integrated multi-level **planning** and **mapping** of renewables **production potential**

Make the **grid** an **essential element of planning** and permit-granting

Involve citizens and local communities in the energy transition, ensuring that they benefit economically from it

Q&A session

Conclusions and next steps for CLEVER

Stephane Bourgeois
négaWatt association

CLEVER planning towards publication in 2023

December 2022

June 2023

Trajectory finalisation

Q1 2023: batteries critical materials footprint study

Political dissemination

We are still looking for funding for 2023 !

Sectoral dissemination ?

National dissemination ?

First results and deliverables

- **Webinar presentation**
- **Sufficiency briefing note**
- **Sectoral publications**
  - Residential
  - Industry
  - Mobility *Q1 2023*
  - AFOLUB *Q1 2023*

CLEVER publication

- **Launch in Brussels**
- **Final Report**
- **Scenario results** and **technical deliverables**

THANK YOU! ☺

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