



Clever

A Collaborative Low Energy Vision
for the European Region



**Climate neutrality,
Energy security
and Sustainability:
A pathway to bridge
the gap through
Sufficiency,
Efficiency
and Renewables**

FINAL REPORT

Executive summary

June 2023

The CLEVER vision

Europe faces a dramatic **climate emergency** and needs to achieve twice more greenhouse gas (GHG) emissions reductions in the next 20 years than it has in the past 30. This emergency is aggravated by untenable **disruptions to ecosystems**, an unprecedented energy **security crisis** and mounting **social inequalities**. It is in answer to all of these interconnected challenges that CLEVER – a Collaborative Low Energy Vision for the European Region – was developed. Indeed, CLEVER proposes a **decarbonisation pathway for Europe that is both ambitious and realistic**.

This scenario aims to reconcile the **long-term climate and sustainability imperatives** with the **short-term energy security constraints** and concerns regarding both **equity** and the practical **feasibility** of such a transformation.

To achieve this, the scenario assesses and mobilises the **energy demand reduction potential made possible through sufficiency and efficiency**, and the energy that can be supplied by **renewable energy development**, at both national and European levels.

→ National scenarios aggregated into a European vision

The CLEVER scenario covers a total of 30 countries (EU27, the United-Kingdom, Norway and Switzerland). It was developed through a 4-year technical dialogue between **26 partner organisations** (think-tanks, research institutes, technical universities, civil society organisations, etc.) from **20 European countries**, under the leadership of

the **négaWatt Association** in France. Its **unprecedented bottom-up construction aggregates national pathways into a European vision and scenario**, which take **national circumstances** into consideration and abide by the principles of **fair effort sharing** and increased equity between and within the countries covered.

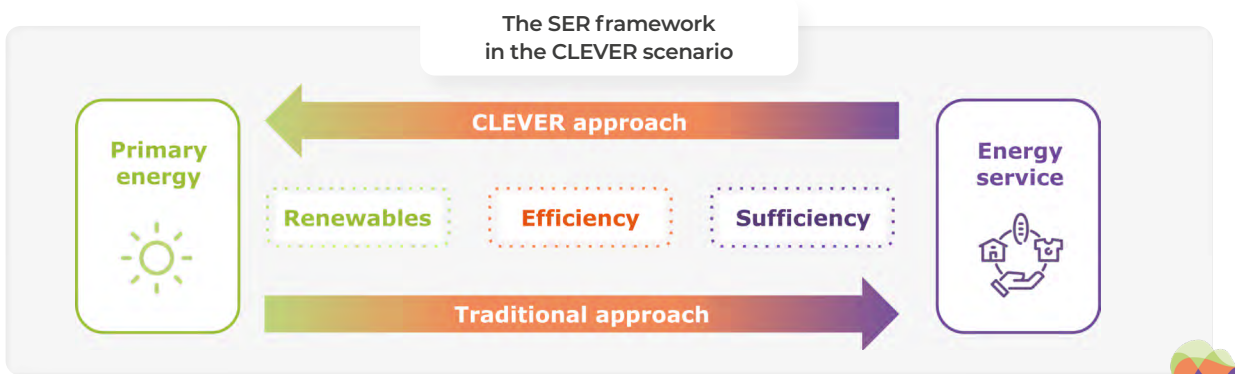
→ The organisations behind CLEVER

<p>Project lead</p> 	<p>Active partners</p> 
<p>Commenting partners</p>	
<p>Observing partners</p>	

The "Sufficiency-Efficiency-Renewables" framework

The CLEVER scenario is based on the **Sufficiency-Efficiency-Renewables (SER) framework**. This framework focuses on the **demand-side** by first scaling energy needs to **what is considered essential to provide a decent level of services** to all (*sufficiency*). Then, sufficiency is combined with a **reduction in energy intensity** through **technological improvement** (*efficiency*), thereby lowering the amount of energy required to

satisfy this tailored level of services. Finally, the actual energy demand remaining is supplied with **renewable energies**. This approach contrasts with the more traditional approach adopted by most scenarios, which prioritise energy supply decarbonisation potential, then complement it with efficiency, and only perhaps look at sufficiency as an ultimate adjustment option.

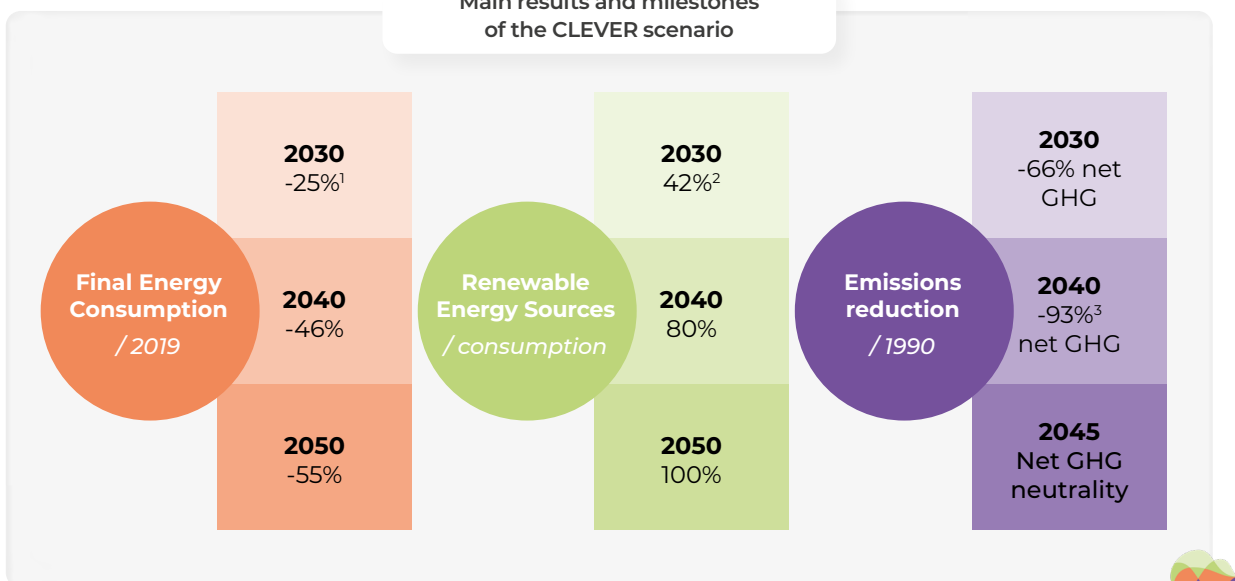


Scenario construction followed **strong sustainability principles**, addressing a broader set of environmental issues, such as **raw material depletion**,

beyond the central climate imperative in the integrated framework of the United Nations Sustainable Development Goals (SDGs).

Global results for the EU

Main results and milestones of the CLEVER scenario



1 | Reduction calculated for the EU27 based on the perimeter of the Energy Efficiency Directive (EED), compared to a 2019 data.

2 | 42% in CLEVER corresponds to the 42.5-45% target of the Renewable Energy Directive (RED), as the CLEVER scenario does not rely on imported biofuels or hydrogen (H₂), contrary to what is currently intended and planned in the RED negotiations. REPowerEU considers renewable H₂ imports at approximately 2% of consumption in 2030.

3 | This figure does not include emissions from international maritime transport. The emission reduction in 2040 modelled in CLEVER when international maritime transport is included is 92% net GHG.

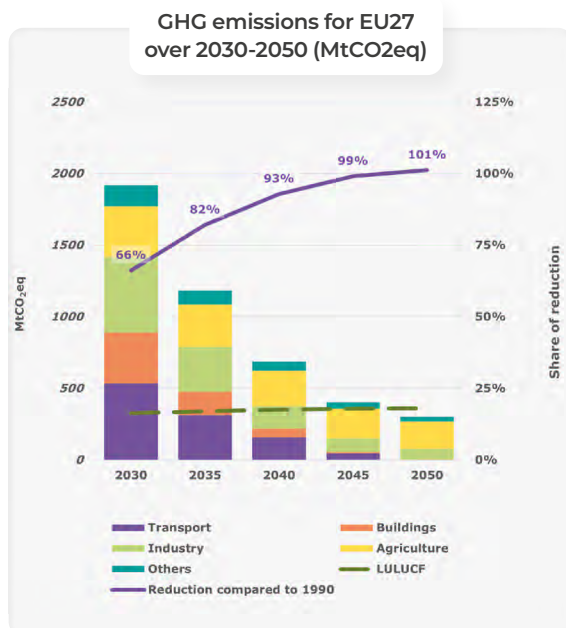
Key lessons for Europe

1 Europe can be fully independent from energy imports

Through rapid deployment of **sufficiency, efficiency and renewables**, fossil fuel consumption decreases fast and import diversification becomes redundant. **By 2050, Europe can be entirely independent from all form of energy imports**, including hydrogen/power-to-X.

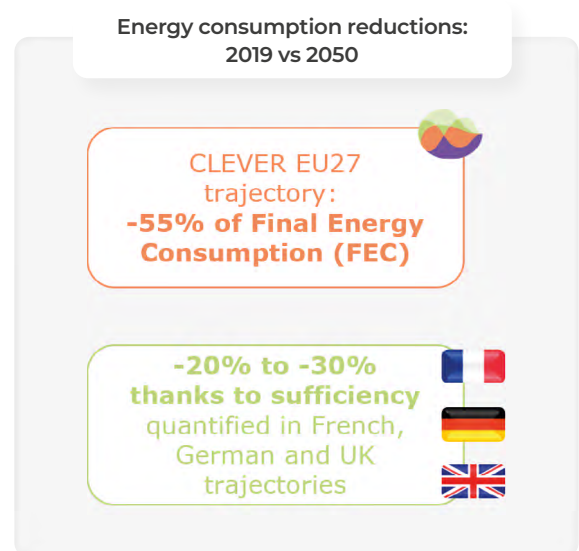
2 Europe can reach climate neutrality by 2045, with -90% net GHG in 2040 as a key minimum milestone along the way

Net-zero greenhouse gas emissions by 2045, based on a conservative carbon sink approach, can set Europe on track towards a **fair contribution to limiting global warming below 1.5°C**. A net reduction of -65% by 2030 is necessary, by which time three quarters of the remaining carbon budget will already have been consumed. -80% in 2035 and -90% in 2040 are further minimum milestones on the way to neutrality, with gross reduction levels such as -85% in 2040 minimising risks around carbon sinks.



3 Europe's energy demand can be reduced by -55%, with sufficiency as a core enabler

A **reduction of final energy demand to -55%⁴ by 2050** compared to 2019 levels can set Europe on a resilient and strongly sustainable transition pathway. -25% in 2030 and -45% in 2040 are milestones along the way. Energy efficiency improvements alone can deliver hardly more than half this final energy demand reduction. **The other half of the reduction, depending on the country or sector, can be delivered by sufficiency.**



Implementation of strong sufficiency policies and their mainstreaming across all sectors can safeguard Europe during the coming winters and is required to achieve the 2030 targets just agreed in the Fit For 55 package.

By providing a framework for the definition of minimum decent consumption levels per capita at the national level, as well as the maximum consumption levels required by a 1.5°C pathway towards strong sustainability, **sufficiency can offer an equitable transition between countries** and with the rest of the world. Sufficiency convergence corridors as proposed by CLEVER may provide tools for the EU to increase equity in its future energy transition policy making.

4 | This figure may vary depending on the choice of perimeter. Within the EED perimeter (i.e. EU27, including international aviation, excluding ambient heat and international maritime), CLEVER's 2050 reduction corresponds to -55% final energy consumption (FEC). Within a EU27 plus UK, NO and CH perimeter including international aviation, international maritime and ambient heat, CLEVER's 2050 reduction corresponds to -51%.



BUILDINGS

The large-scale rollout of deep renovation is the key to **buildings sector** decarbonisation. This must be complemented by **sufficiency measures**:

- ▶ targeting the **limitation of rising consumption levels**;
- ▶ **ensuring greater equity between countries**, in terms of dwelling size, as well as consumption patterns *within* dwellings.



TRANSPORTS

Sufficiency is a **no regrets lever in the transport sector**, enabling the **reduction of travelled distances**, the **increase of occupancy rates**, and the **shift** from road and air mobility **to rail and active mobility**.

Small shared electric vehicles are essential to reach strong sustainability objectives.

Biogas-fuelled trucks can further alleviate the **pressure on critical resources**, such as lithium needed for vehicle batteries.

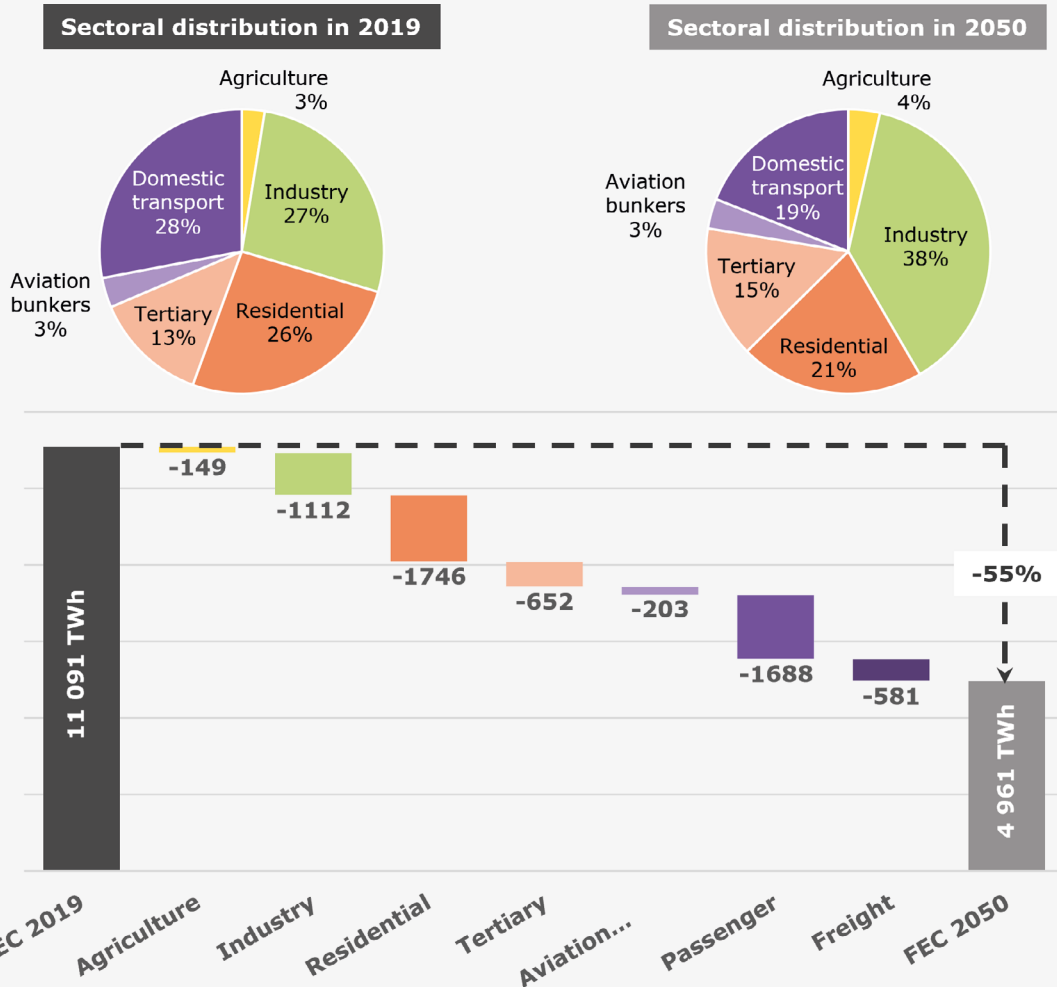


INDUSTRY

A **sufficiency and circularity-based decarbonisation of industrial sector** removes the **need for any Carbon Capture and Storage (CCS)** technology contribution at any point between now and 2050.

Heavy industrial process electrification enables efficiency gains, while **hydrogen completes decarbonisation** of the remaining primary steel and feedstocks, particularly for the chemical industry.

Contribution of each sector in the EU27 Final Energy Consumption (TWh) reduction modelled in the CLEVER scenario between 2019 and 2050⁵



FEC: final energy consumption

5 | The sectoral shares in the graphs are calculated at the EU Energy Efficiency Directive (EED) perimeter and do not include ambient heat.

4 Europe can be 100% renewable by mid-century

By harnessing its energy demand reduction potential, Europe can reach a 100% renewable energy system by 2050 at the latest on the basis of the existing 2030 renewable energy deployment targets, rather than relying on risky and costly energy supply options such as new nuclear power or CCS. Individual countries can reach 100% renewable energy earlier, and 42%⁶ in 2030, 65% in 2035 and 80%⁷ in 2040 are milestones on that pathway, providing security to investors and all levels of governance.

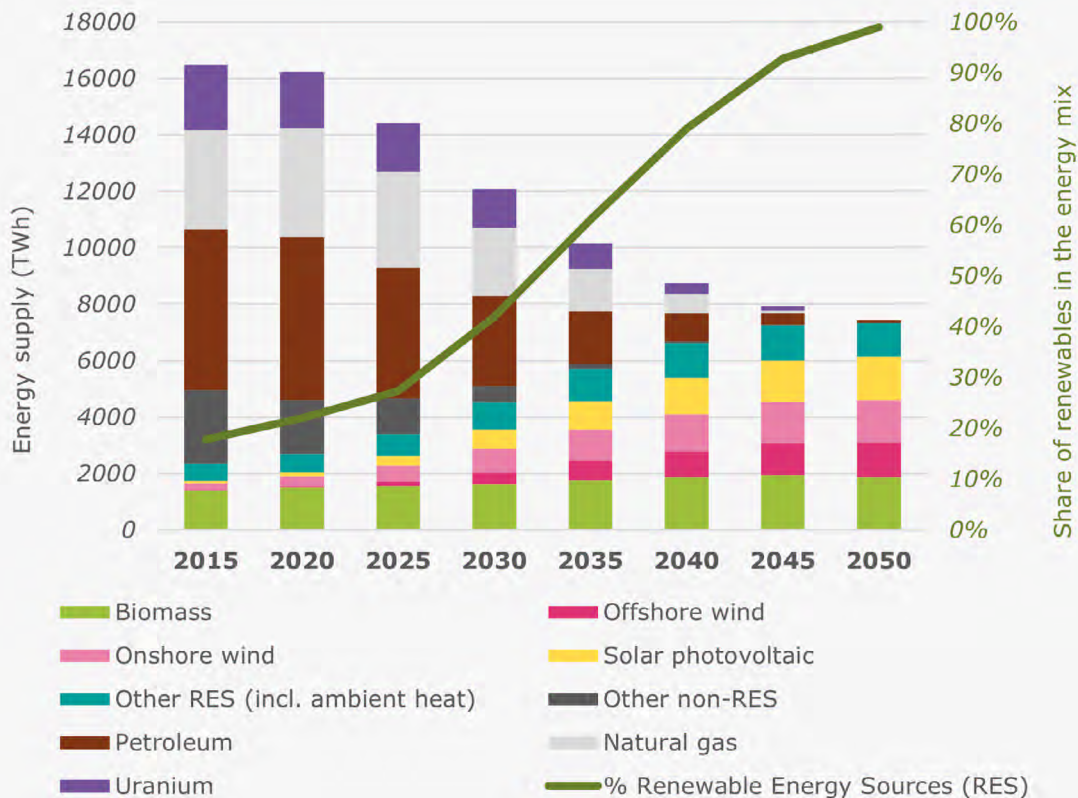
Europe’s power sector can be almost fully renewable in 2040, with wind and solar as the backbone. Electricity becomes the dominant carrier in all major consumption sectors. However, CLEVER’s approach based on energy savings and a balanced carrier-to-use allocation allows:

- ▶ electrification to be kept at a sustainable level, thereby minimising infrastructure development and maximising acceptance;

- ▶ hydrogen and Power-to-X to be prioritised in the sectors in which they are indispensable (mainly primary steel, ammonia and olefins, and water freight), thereby minimising further pressure on electric renewables;
- ▶ containment of the variation levels the electric system must cope with in order to deliver stable supply at all times.

Sustainable biomass has an essential role to play in certain critical sectors: sustainable biofuels are a precious carrier for aviation and international bunkers, and biogas is particularly valuable for decarbonising long-distance road freight and certain industry uses.

Evolution of primary energy supply by source and share of renewables in final energy consumption for the EU27 in the CLEVER scenario



6 | 42% in CLEVER corresponds to the 42-45% RED target, see note 2.

7 | This figure may vary slightly depending on the choice of perimeter. In the current RED perimeter (i.e. EU27 including international aviation, excluding international maritime), the renewable energy share of the CLEVER scenario in 2040 reaches 80%. In the EU27 plus UK, NO and CH including both international aviation and international maritime, the renewable energy share of the CLEVER scenario in 2040 reaches 77%.

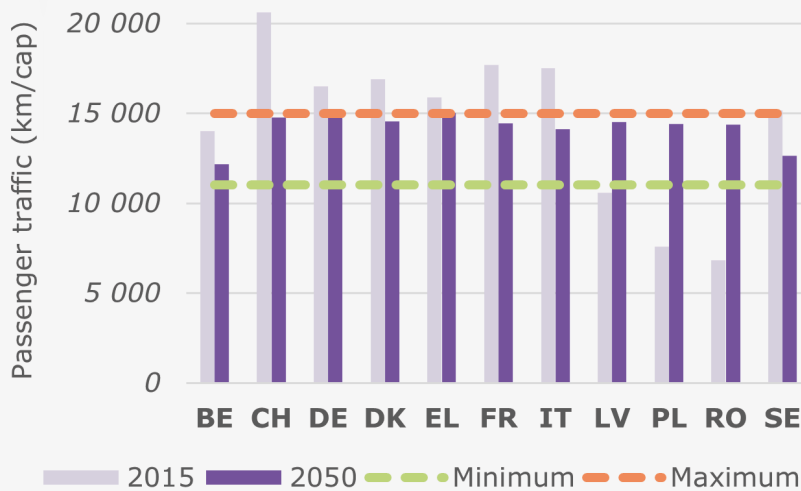
5 Equity and European integration are major enablers

Equity and solidarity are indispensable to smoothen the transition and facilitate its social acceptance. In the CLEVER scenario, equity and solidarity are supported through convergence of consumptions per capita between European countries. Fundamentally inequitable lifestyles and modes of transportation within individual countries should be further targeted at policy level to increase equity.

Solidarity is also critical for Member States to collectively reach decarbonisation in a safe and sustainable manner: both the production of electric renewables and the use of carbon sinks are pooled between countries according to their potential, enabling the easing of effort sharing. Thus, by increasing efficiencies and optimisation, Europeanisation acts as a facilitator.

The CLEVER pathway is based on both **EQUITY** and **SOLIDARITY** between countries.

Distance travelled per capita per year in 2015 and modelled for 2050 by CLEVER



EQUITY

Minimum decent living standards and maximum environmental impacts are used to define converging corridors of average consumption levels between countries.

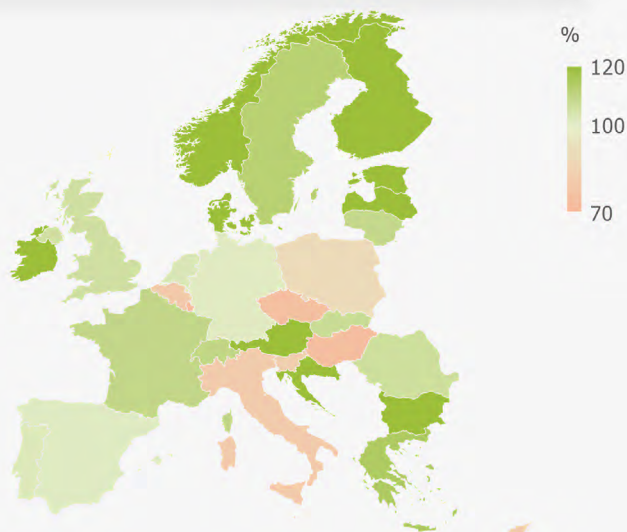
The modelling followed either an environmental imperative to reduce travel below the upper limit (e.g. France and Italy) or a social imperative to increase travel above the lower limit (e.g. Romania, Poland).

Locally produced renewable electricity divided by gross electricity consumption in European countries in 2040

SOLIDARITY

Exports of surplus production from some countries towards others make it possible for Europe as a whole to near 100% renewable electricity in 2040 in a more equitable manner.

Countries with a high potential for renewable electricity production produce surplus electricity, which is then exported to countries where the potential is lower.





Main policy recommendations

Designed to provide a **systemic answer** to the multiple challenges faced by Europe today, CLEVER's proposed scenario can provide Europeans with **multiple benefits** in terms of health, well-being and social justice. All stakeholders will have to be mobilised to enable change and concrete implementation at all levels of governance. **This change**, together with the necessary evolution of social standards, **will have to be steered and accompanied, and EU energy and climate policy must lead the way** in this regard.

A fundamental shift in European funding targeting this transformation is essential.

Through its modelling of change up to 2050, **the CLEVER scenario demonstrates what kind of ambition needs to be fulfilled by 2030 and 2040 in order to reach long-term objectives**, and how much change must be implemented in the shorter term to set Europe on track towards these objectives.

In terms of EU energy and climate policy recommendations

2040 targets

In its upcoming 2040 Communication and Climate Law revision, the European Commission should propose a **net GHG emissions reduction target of at least -90% compared to 1990 levels, including a gross reduction of at least -85%** to keep carbon sink assumptions conservative.

2040 targets of -45% energy savings in terms of final energy consumption (FEC) **compared to 2019 levels** and **80% renewable energy share (RES)** should serve as the basis for legislative proposals in the upcoming legislature. Just transition should be at the core of future legislative proposals, with equity between and within Member States standing as a central value to smoothen the transition.

2030 implementation

National implementation of 2030 targets and Fit For 55 legislation should be as ambitious as possible if Europe wants to remain on a safe Paris-compatible pathway. The Energy Performance of Buildings Directive (EPBD) revision must integrate strong requirements for deep renovation of existing buildings. Member States should implement RED requirements and REPowerEU wind, solar PV and biogas targets, while the target for hydrogen should be readjusted downwards at a more realistic level.

In order to sustain these needed short-term and long-term changes, CLEVER highlights the key role of a dedicated focus on sufficiency



The European Commission should explicitly integrate sufficiency into its modelling and assumptions, not solely as an adjustment measure, but as a lever working in synergy with efficiency and renewables in the various sectors (from buildings to transport, to industry and materials, and food and agriculture). To this end, the Commission should **properly assess the EU's sufficiency potential and gap, and propose an EU sufficiency strategy and action plan.** With Eurostat, the Commission should make sufficiency data at the EU and national level available.

In addition, **the Commission should propose the inclusion of a sufficiency chapter into the upcoming revision of the Energy Union's governance** towards 2040 and integrate sufficiency into European legislation, in all sectors (from buildings to industry and products).



Member States should mainstream sufficiency both in their national scenarios and their transition planning and legislation, including in the implementation of the Fit For 55 package. **National Energy and Climate Plans (NECPs) should have a specific chapter dedicated to sufficiency.**