Clever | A Collaborative Low Energy Vision for the European Region

Scaling-up energy sufficiency on a European level:

A bottom-up modelling approach

Methodological briefing note

June 2022

Energy sufficiency is a key enabler for deep decarbonisation pathways. Energy sufficiency is meant here as a mean to rethink and redesign individual and collective practices to favour activities and services that intrinsically require low energy use. Indeed, a systemic approach across sectors, encompassing sufficiency, efficiency, and renewable energies enables to address a wide range of environmental, social, and societal issues. It also provides multiple benefits beyond lowering greenhouse gas emissions, including security of supply, an issue currently at the heart of EU energy policy decisions[1].

Inadequate representations of sufficiency potentials have led to an under-estimation – or an under-stressing– of the role of sufficiency in models, scenarios, and policies. In response to this, partners in around 20 European countries, are working under the leadership of the négaWatt association in France on the CLEVER scenario, a Collaborative Low Energy Vision for the European Region. This project consists of harmonising national sufficiency-based scenarios into a pathway to meet 100% renewable energy supply and net-zero greenhouse gas (GHG) emissions on a European level as soon as possible, and by 2050 at the latest, in line with the 1,5 degrees objective.

This methodological briefing note describes the key methodological milestones in the construction of the scenario.

[1] The key place of sufficiency into energy and climate strategies is detailed in a note available on this webpage, in the "major publication" section.

ADEME Agence de la Transition Écologique | 2050 Pathways Platform | Association négaWatt

Addressing sufficiency through a technical dialogue

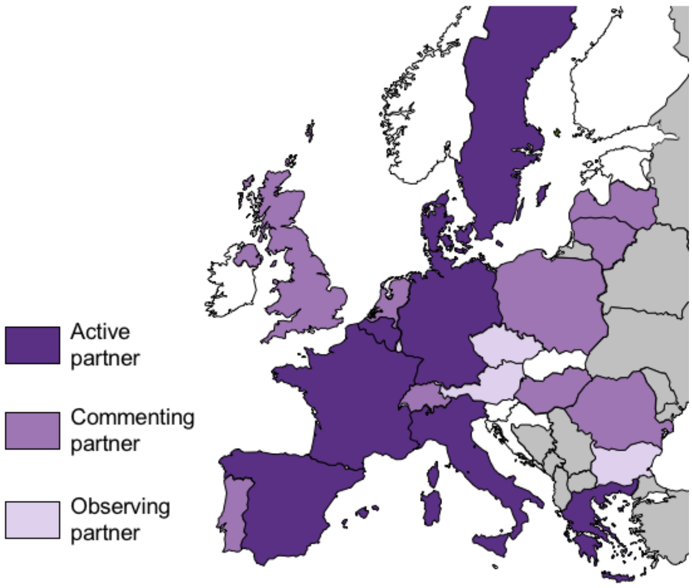
Building a partners network with a shared commitment to sufficiency as a key sustainability leverage

24 organisations from 20 European countries (including 18 EU Member States, the UK and Switzerland as detailed in Figure 1)[2] are involved in a technical dialogue around the creation of a **common European sufficiency-based vision**. While the type of organisation behind the scenarios (from technical universities to NGOs), the recency of the scenarios, the modelling tools, the level of detail and attention to sufficiency differ widely, most have developed energy and climate scenarios for their national countries or regions.

Through the dialogue, partners share **information and best practices on energy modelling and scenario building**. Their work and modelling approaches are compared, questioned, and mutually reinforced. **Collective understanding of energy sufficiency** is deepened, and capacities are strengthened throughout the network. Eventually, by fostering mutual benefits, the process is a mean to raise the ambition and **deepen national partners' modelling approaches** and accounting of sustainability, and sufficiency in particular. Active partners are working on a bottom-up trajectory, while commenting partners are commenting a top-down trajectory proposed by négaWatt.

Figure 1: The partners network of CLEVER scenario project

Country	Organisation
AT	EEG TU Wien
BE	negaWatt Belgium, ICEDD
BG	Za Zemiata; Sofena
CH	negaWatt Switzerland
CZ	Charles University Environment Centre
DE	EnSu (Wuppertal Institut; EU-Uni. 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	Positive Worlds
PL	WiseEuropa
PT	ZERO
RO	Energy Policy Group (EPG)
SE	Air Clim Coalition
UK	CREDS ; Center for Alternative Technologies



[2] The project is developed on a coherent geographical area that encompasses the EU plus UK, which was still part of the former when the project started, Switzerland and Norway.

Tools and processes for a bottom-up scenario building

A three-stage bottom-up integrating approach

To **transform national trajectories into a European vision**, while guaranteeing the **consistency of the prospective analysis** through the projected reinforcement and harmonisation work, a three-step iterative process was followed:

- **National trajectories were collected and discussed**, through a process enabling for their comparison and harmonisation, so as to raise their level of ambition and comprehensiveness;
- **National trajectories were aggregated** to inform the **need for reinforcement** at the European level;
- **Aggregated trajectories were further integrated into a coherent European vision**, enabling a further step of reinforcement through mutualisation of efforts and potentials.

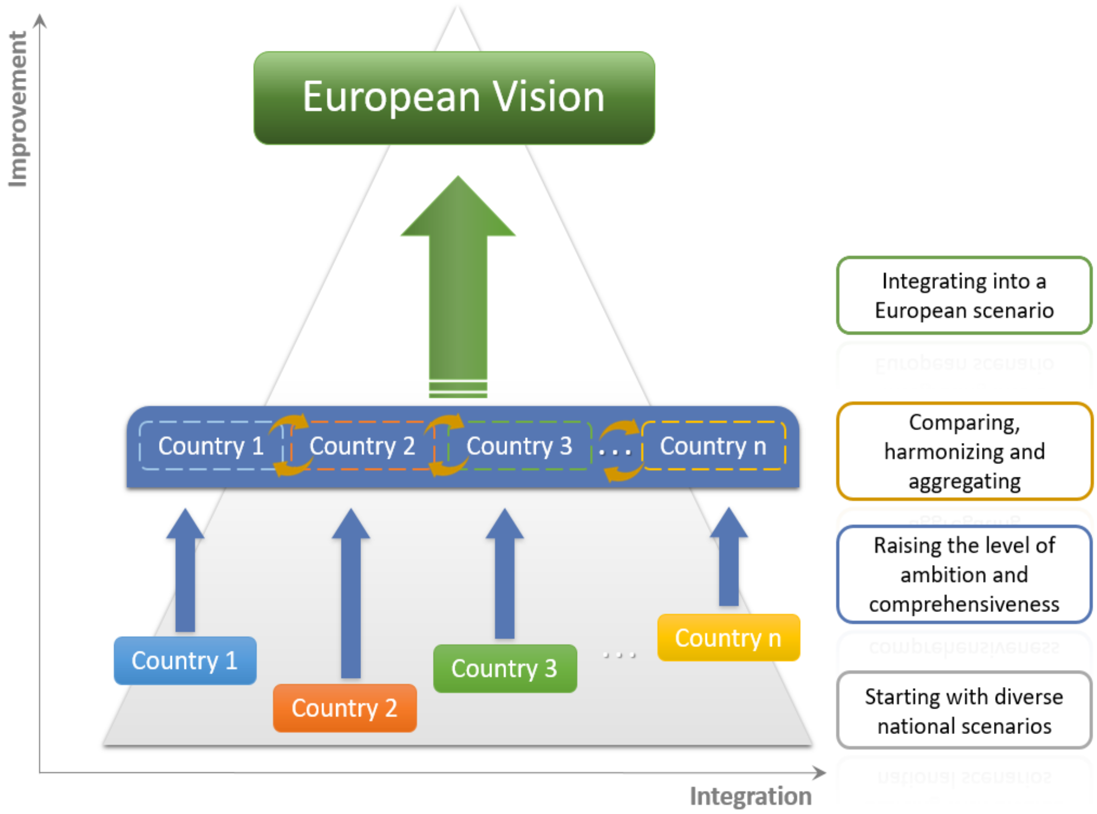


Figure 2: The three-stage bottom-up approach to building a European vision

A simple and robust modelling tool

A simple **simulation model calculating incremental changes on a 5-years basis** was developed to enable smooth aggregation. Figure 3 describes the connections between the three different tools:

- A **harmonised dashboard for each country** serves as a data entry file in which partners put **assumptions on energy demand** (with both sufficiency and efficiency levers) and **energy supply**. Each national dashboard contains a **demand module**

which calculates final energy demand, with detailed data provided by partners and a data export spreadsheet with intermediary results;

- A **national calculation model** generates energy balances for each country by cross-referencing consumption and production data provided by the export spreadsheet; and
- A **European synthesis module** aggregates the results of the calculations carried out in the national module.

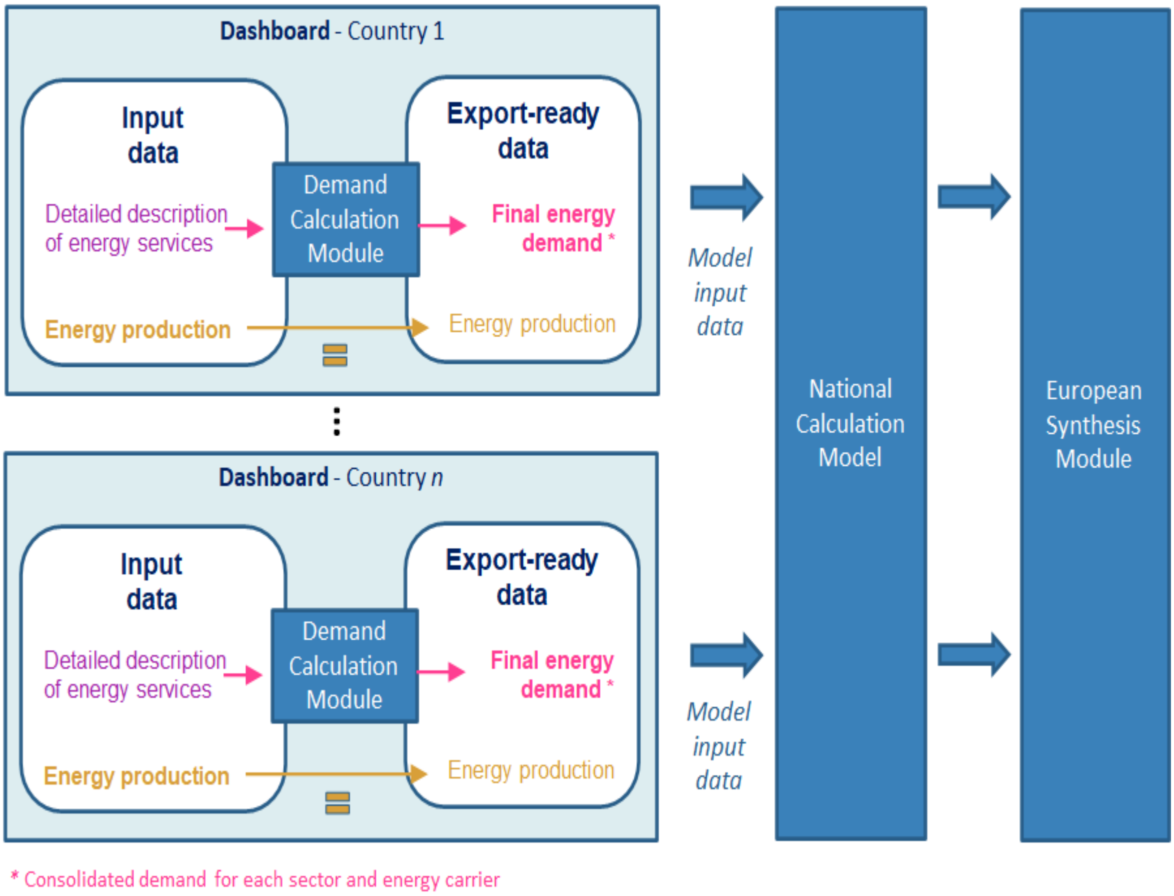


Figure 3: The modelling approach

A common indicators dashboard

A dedicated indicators dashboard was developed to "translate" national scenarios based on different methodologies, models, different scopes, various logic and level of aggregation or disaggregation of data, into a common, sufficiency-focused, language. It provides a homogenous description of national trajectories, both to allow for their comparison and serve as an interface for the modelling process.

Throughout the technical dialogue, a balance was sought in the level of detail of the dashboard to enable an **accurate enough description of energy services demand, while remaining accessible to those partners lacking part of the data**. As the sectors covered and the level of detail available may considerably vary between countries, a pragmatic approach was taken for indicators per sector, using a sort of "Russian dolls" system, using detailed indicators when available, or more aggregated indicators otherwise. The structure was also developed using available indicators from **Odyssee** and **Eurostat** databases to ensure that all trajectories are **based on a consistent and comparable starting point.**

Scenario analysis – building sufficiency-based pathway(s)

The work on sufficiency-related indicators and their relationships

At first, a key building block of the construction of a common sufficiency modelling language has been the **creation of working groups for the transport and buildings sectors** for key experts from partner organisations to define and prioritise a list of **sufficiency indicators**. Transport and buildings were chosen as key consumption, sufficiency-relevant sectors, where data and partners expertise were available. Sufficiency indicators and drivers were collected and categorised. **Through the technical dialogue, criteria were set to prioritise key indicators for scenario building.** Quantitative indicators were distinguished from qualitative indicators which cannot be easily quantified (e.g. "safe bike parking facilities"), and were prioritised according to their possible integration in the model.

The work on sufficiency-related indicators was deepened in the framework of the **CACTUS** project ("Consolidating Ambitious Climate Targets through end-Use Sufficiency"), involving four of the partners around the integration of sufficiency in climate and energy strategies in Central and Eastern Europe, with Hungary and Lithuania as focus countries[3].

Comparison of national trajectories

Building of service-based sufficiency corridors, in light of national situations and specificities

Convergence in the buildings and transport sectors

A **contraction and convergence approach**[4] was applied to energy consumption through dedicated comparison indicators relating to the level of energy services. **Sufficiency corridors were discussed in the technical dialogue for indicators based on population** (eg., residential floor area in m^2/capita and passenger traffic in passenger-m/capita.): this enables a search for convergence in living standards[5], while certain constraints linked to lifestyle (harsher climate implying more time indoors and therefore a greater need for space, larger share of rural population implying different mobility needs, etc) or starting points (existing housing stock complex to reorganise, state of public transport infrastructure, etc.) make this convergence more complex.

In addition to corridors on targets, other indicators were used to refine the analysis and inform the level of change. A yearly evolution (Compound Annual Growth Rate, CAGR or a percentage of the value in 2015) enables analysis of the stage at which efforts are made. The percentage of reduction in comparison to a reference year (e.g. 2015) enables comparison of countries with diverse initial conditions to characterise the level of effort.

[3] More information available on the CACTUS project webpage

[4] This approach has been documented, for instance, through the calculation of convergence and compression factors in the EUCalc project (Climact, 2019).

[5] "minimum consumption standards allowing every individual to live a good life, and maximum standards guaranteeing the chance to live a good life for others" (Fuchs et al., 2021)

Convergence in the industry sector

Because of the complexity of the industry sector, most existing national scenarios had poorly covered it. To overcome this challenge, a top-down approach was implemented through the construction of prospective stories for key basic industrial materials based on major European, French, and German reports[6] on the matter. Key energy intensive branches were prioritised according to their energy consumption and GHG emissions at the European level.

Because of the lack of data and as a means for simplification, spatial distribution of industrial production infrastructure and the relationship between production and consumption have been assumed not to evolve by 2050. Therefore, the reduction of industrial production due to sufficiency was assumed to be homogenous within a corridor across EU countries and dependent on the average level of sufficiency at the European level. The possible effect of a combination of sufficiency- with efficiency drivers (energy consumption, energy intensity, circular economy, etc.), also considering possible relocation policies, helped to develop illustrative corridors for different sectors. **National partners are using these corridors to build trajectories for industrial energy consumption tailored to the national context, filling the gap of their national trajectories**. The same bottom-up approach as for other sectors is used to integrate these trajectories into the model.

The concrete output of this work is detailed in CLEVER sectoral notes on convergence corridors for building, transports and industry available on this webpage, in the "major publication" section.

[6] See the source used in the convergence corridor technical note for industry available on this webpage, in the "major publication" section.

Quantifying the role of sufficiency and final steps towards a European strategy

The modelling and scenario building approach was designed to help identify sufficiency-related parameters available in the model and distinguish between the effects of sufficiency and efficiency in the results. Indicators were considered sufficiency-related drivers when they touch upon a **dimensional** (eg size of vehicles), **service-related** (intensity and duration of use of vehicles), **organisational** (e.g. as the development of collective transport) character.

Once the indicators were categorised as being related to either sufficiency or efficiency, the model could be run with different sets of assumptions regarding efficiency and sufficiency drivers to compare four situations: none of the drivers, efficiency drivers only, sufficiency drivers only, and both efficiency and sufficiency drivers. In theory, this could allow to assess and discuss the kind of ambitious energy consumption target that is needed to meet those goals. In practice, the level of detail of a number of bottom-up trajectories won't be sufficient for such a thorough assessment, but a comparative approach for different countries and sectors will enable to quantify the sufficiency potential in Europe[7].

With the first aggregation of national trajectories, partners are currently engaging in the optimisation and mutualisation phase, with the aim to enable to exploit synergies between different countries at the EU level and further reinforce national trajectories and the scenario's ambition towards a 1,5 degrees compatible pathway.

Partners are also engaged in a **dialogue around policies to support the development of assumptions and corridors and to pave the way towards a narrative work towards publication of the scenario between Autumn 2022 and Spring 2023.**

[7]As complementary work on the building of sufficiency assumptions in the context of "catching-up economies" of Central and Eastern Europe is being finalised within the CACTUS project, the methodological principles and tools elaborated to build CLEVER is also supporting some of the work of the Horizon2020 project FULFILL (Fundamental Decarbonisation Through Sufficiency By Lifestyle Changes), where more in-depth analysis of some social, societal and economic aspects on the micro, meso and macro-levels is being pursued.