

White Paper Factsheet

Clean Energy Transition

The latest EU climate commitment is to reach climate neutrality by 2050 with an intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. The process of transitioning to climate neutrality is generally referred to as Clean Energy Transition (CET).

The European Energy Research Alliance (EERA) White Paper on the Clean Energy Transition highlights the systemic, cross-sectoral and multidisciplinary implications of the CET. Aiming to contribute to already existing knowledge, the paper provides a CET framework that can be instrumental in defining the best pathways to transition towards a just, environmentally sustainable, competitive and climate-neutral society.

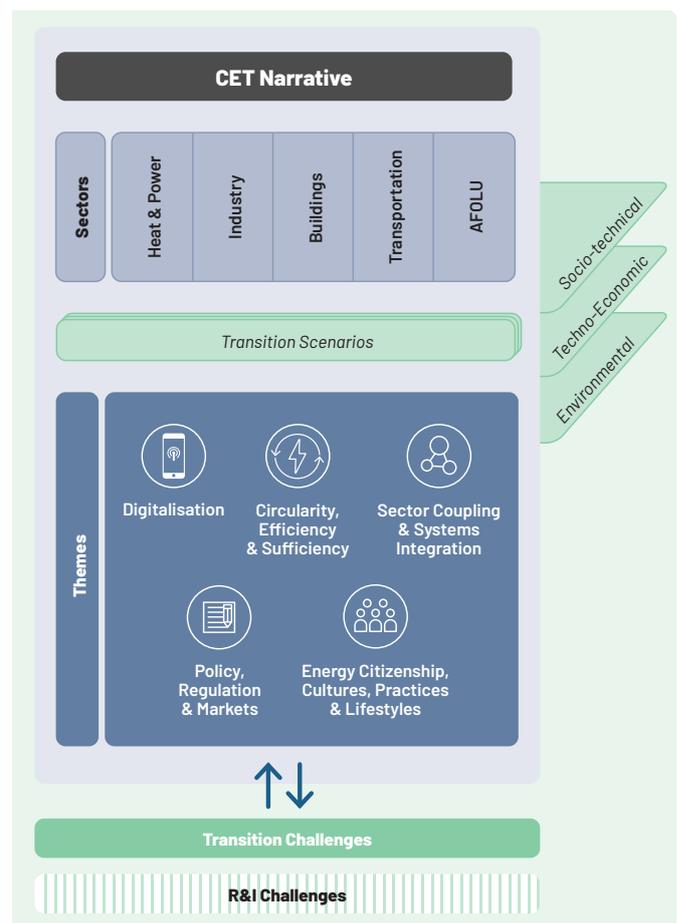
► Definition of the Clean Energy Transition

“The widespread transformation of the energy system to achieve a fair, environmentally sustainable, competitive and climate-neutral society by 2050”. Such a transformation will impact the way humans eat, live, travel, produce and consume in the 21st century.

The proposed conceptual framework incorporates techno-economic, socio-economic, legal and environmental perspectives into a holistic and interconnected approach across all economic sectors of society to achieve the goals of the CET. As such, it addresses the fundamental overarching issue: «How to design fully integrated CET solutions compatible with the principles of environmental and social sustainability, leading to an increase in social welfare, in full respect of the planetary boundaries¹ and climate objectives, while preserving Europe’s geopolitical leadership».

1. Nature: <https://doi.org/10.1038/461472a>

EERA’s CET Framework



The **CET Narrative** refers to the overarching, coherent, robust and appealing storyline outlining transformation pathways and connecting individual imaginaries towards a desirable common future. It is the fundamental motivational tool enabling citizens and society to envisage, endorse, concur with and eventually drive the complex transition process.

The **Transition Scenarios** describe possible pathways to a fair, sustainable, competitive and climate-neutral society while integrating and optimising the complex systemic interactions across interrelated economic **Sectors**. These scenarios are expected to differ widely between regions and countries, depending on economic activities, natural resources, industrial and energy infrastructure, and political choices.

The Transition Scenarios are analysed through the prism of **Themes**. They cover essential cross-cutting aspects that enable and guide the CET and have a strong structuring impact on the design of the Transition Scenarios and on how the Transition Challenges are defined.

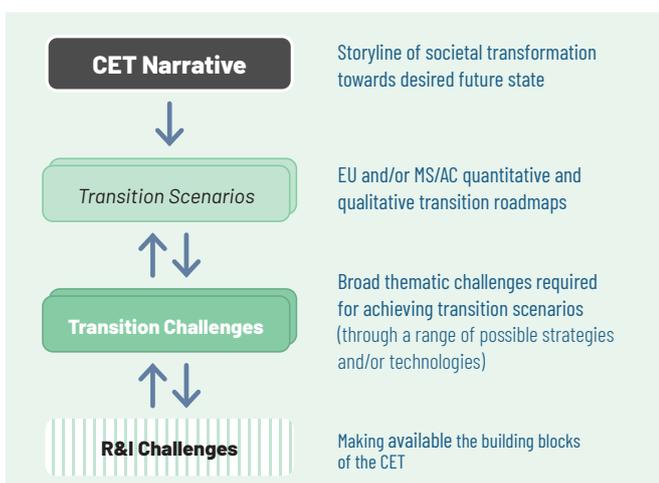
The key Themes addressed in the paper are:

1. Digitalisation
2. Circularity, Efficiency & Sufficiency
3. Sector Coupling & Systems Integration
4. Policy, Regulation & Markets
5. Energy Citizenship, Culture, Practices and Lifestyles

Finally, the conceptual model suggests that the required research and innovation activities needed to reach the CET objectives should be framed as **Transition Challenges**, defined as broad multidisciplinary and technology-neutral research challenges that are key to achieving the CET goals. Transition Challenges state the objectives to be attained without prescribing any specific implementation strategy or technology choice. Some examples of relevant Transition Challenges are “developing smart and climate-neutral cities”, “decarbonising power generation” and “providing robust, resilient and flexible energy networks”.

The choice of a technological pathway will give way to defining a set of dedicated and concrete **R&I Challenges**, covering environmental, legal, socio-economic and techno-economic research domains. They constitute the basis for policymakers to direct research efforts through appropriate policies and dedicated funding instruments.

Deriving R&I Challenges from the CET Narrative



High-level policy recommendations

On the policy side, EERA's White Paper suggests that more significant and decisive political action is needed to address the limitations of market forces, and to drive the transition at the speed dictated by the climate emergency. The following **high-level policy recommendations** must be considered an essential prerequisite to successfully drive the CET:

1. Develop a strong CET Narrative
2. Dramatically scale-up investment in R&I and technology deployment across all TRLs
3. Defragment policymaking across disciplines, activity sectors and energy carriers
4. Accelerate the innovation cycle
5. Ensure a fair transition at global, national, regional, local and individual levels
6. Reduce energy demand
7. Set up effective economy-wide carbon prices for clear market signals
8. Step up the level of ambition and challenge the dominance of current economic paradigm
9. Strategically increase international collaboration

Conclusion

This conceptual framework constitutes a robust analytical tool to translate the broad societal objectives of the CET into a comprehensive set of concrete R&I Challenges needed to implement the selected Transition Scenarios. We expect this framework to be instrumental for better recognising and integrating the systems-level and cross-cutting dimensions of the strategies required to achieve a fair, environmentally sustainable, competitive and climate-neutral society by 2050.