

The TANDEM Euratom project Small Modular ReacTor for a European sAfe aNd Decarbonised Energy Mix



CONTEXT

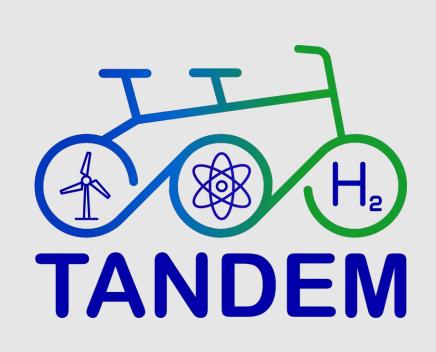
<u>Needs:</u> achievement of energy sovereignty, security and affordability as soon as possible, and greenhouse gas (GHG) net-zero emission by 2050, considering that:

- ☐ Electricity supply will double by 2050.
- Decarbonisation of the electricity sector is not enough to successfully meet the EU energy transition targets: today, heating and cooling represent about half of the total final energy needs in EU. The hydrogen use is expected to increase rapidly.

Contribution brought by TANDEM to answer these needs:

- Development of an integrated vision of the energy systems based on the hybridization of nuclear and renewable energy sources with thermal/power storages and downstream applications (district heating, hydrogen production, etc)
- Analysis of the role/benefits of multipurpose Small Modular Reactors (SMRs) integrated into hybrid energy systems as reliable, resilient, and affordable clean energy options in Europe.





HIGH-LEVEL OBJECTIVES

- ✓ Assess the safety compliance of SMRs to be integrated in the future European energy mix: extend the current reactor safety approach to cover safety considerations coming from the coupling of a nuclear reactor with non-nuclear systems for energy production, storage and conversion.
- ✓ Provide guidance in a deployment perspective for the future integration of Generation-III SMRs and Generation-IV AMRs into well-balanced hybrid energy systems: techno-economics and operationality of hybrid energy systems, flexibility of energy production, citizen engagement.
- ✓ Create an enabling environment for the development of hybrid energy systems based on SMRs and AMRs: education and training to develop technical young engineers' skills and extend experienced engineers' ones, stakeholder engagement (nuclear and high GHG emitter industrials, policy makers, nuclear regulatories, R&D teams, NGOs, ...)

<u>Ambition:</u> become a pioneer initiative in gathering efforts and expertise around the development of SMR integration into hybrid energy systems in Europe.

METHODOLOGY OUTCOMES ACTIVITIES PHASE - Analysis of the European energy PHASE 1 Characterization of two hybrid energy scenarios Identification of hybrid systems - Configuration of two hybrid systems to study incorparating SMRs to study systems for the selected scenarios - TANDEM model library PHASE 2 Development of new tools, - Hybrid system simulator Development and implementation modelling in existing tools, - CATHARE/ATHLET safety modelling of tools for SMR assessment numerical coupling between tools Coupling for safety /techno-economics - Safety assessment PHASE 3 Safety and feasibility studies for Safety recommandations, technical and - Techno-economics and economical guidance, policy briefs, etc. SMR integration into hybrid operatinonality analysis - Citizen engagement systems - Scientific training - Improved scientific cooperation PHASE 4 Interaction with SAC and IUG - New project ideas identified Building enabling environment for Outreach activities - Increased public acceptance future projects and initiatives - Organisation of workshops Raised awareness of stakeholders

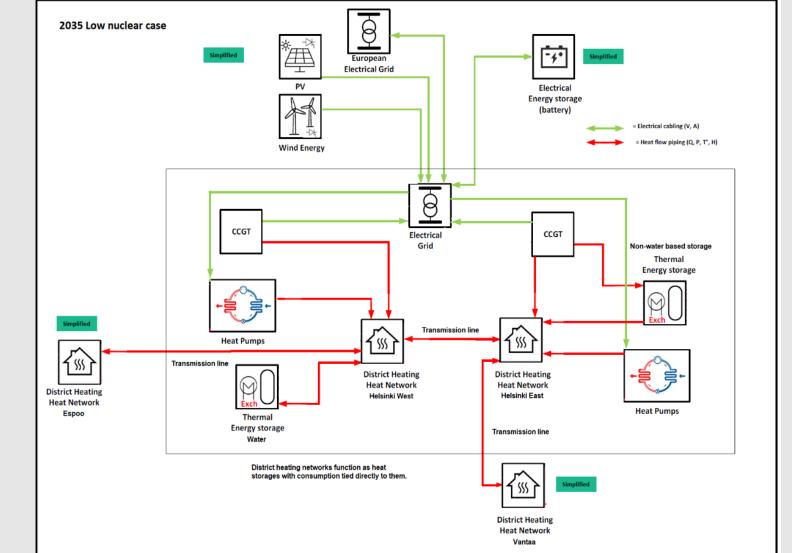
SMR use-case in TANDEM: the light-water **E-SMR** academic concept developed in the framework of the ELSMOR Euratom project

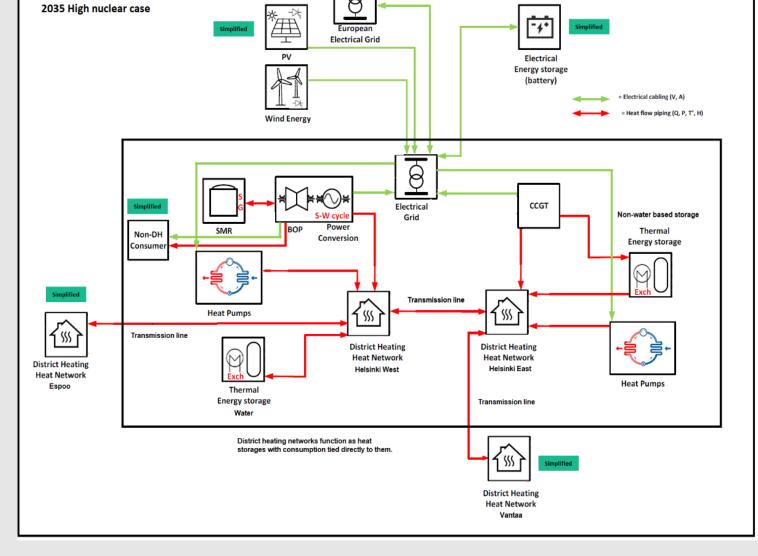
SIMULATION TOOLS **Nuclear safety** Hybrid system TANDEM opensimulator source library: CATHARE numerical models **ATHLET** of components Coupling Techno-economics **BACKBONE** PERSEE Tools developed by TANDEM **Existing Softwares**

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CONFIGURATION OF HYBRID ENERGY SYSTEMS SYSTEMS

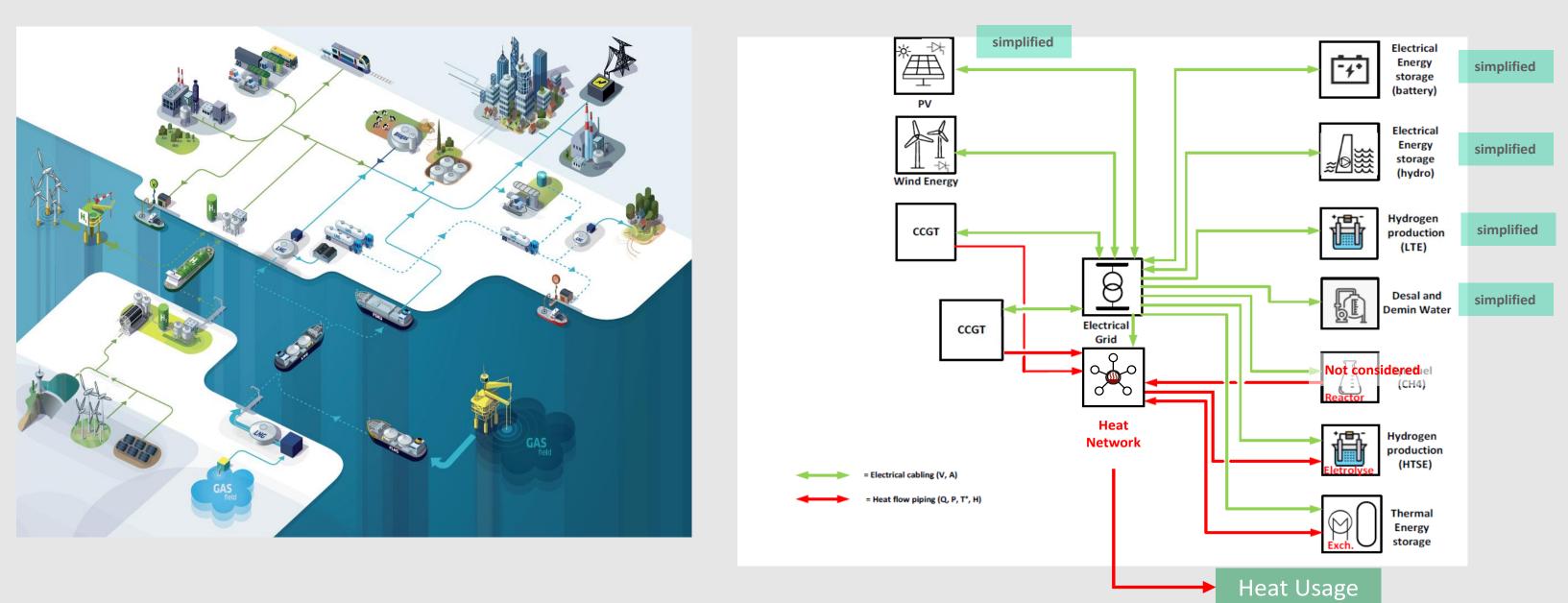
1/ Hybrid energy system for district heating and electricity supply
Studies in two EU local contexts: urban areas in Finland
and Czech Republic





2/ Hybrid energy system for energy hub

Study in a EU local context: definition of a virtual harbor-like infrastructure in Southern Europe, inspired from the Dunkirk harbor (data coming from the "Toile énergétique®")



Two timeframes: 2035 (considering two energy scenarios: no SMR deployment or start of the deployment) and 2050 (all fossil-fired energy plants replaced by carbon-free energy plants)

Duration: 3 years (2022-2025) | Budget: 3.8M€ (including EC grant: 3.4M€) | Consortium: 18 partners from 8 European countries

