

The TANDEM Euratom project

Small Modular Reactor for a European safe and Decarbonised Energy Mix

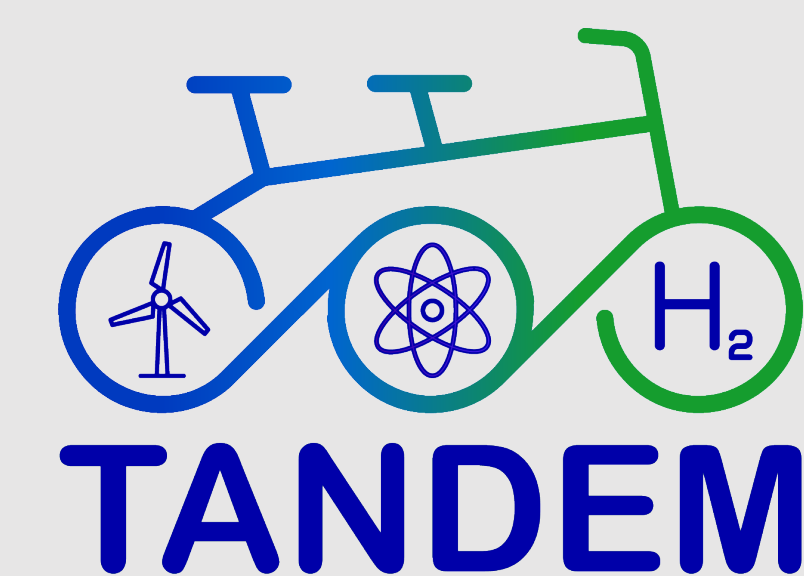
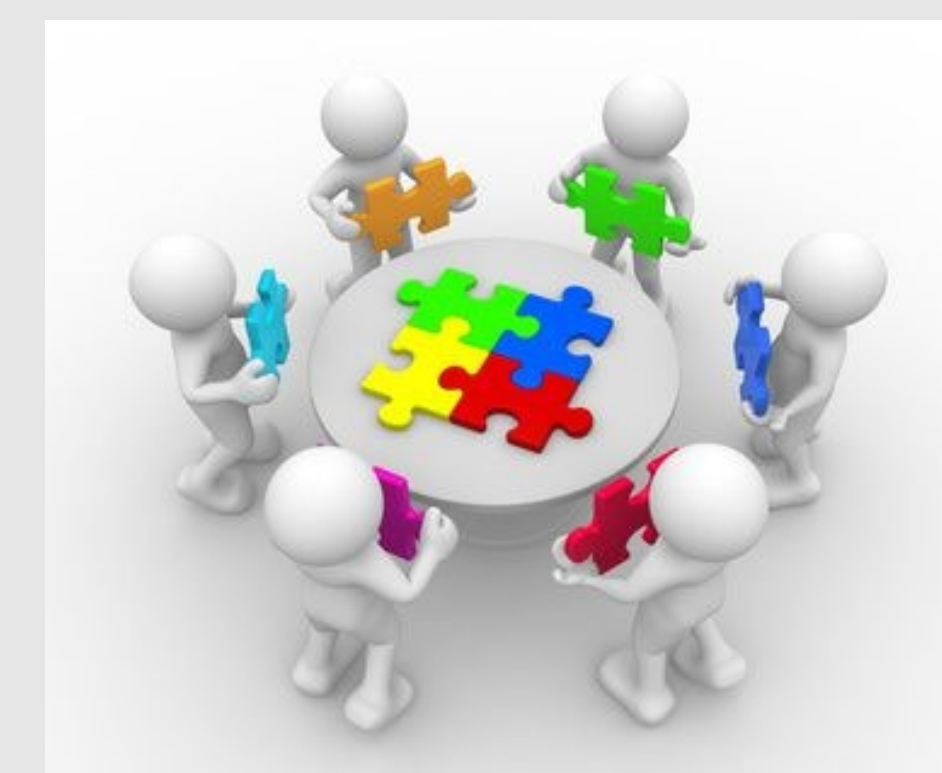
CONTEXT

Needs: 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 regulatory, R&D teams, NGOs, ...)

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

METHODOLOGY

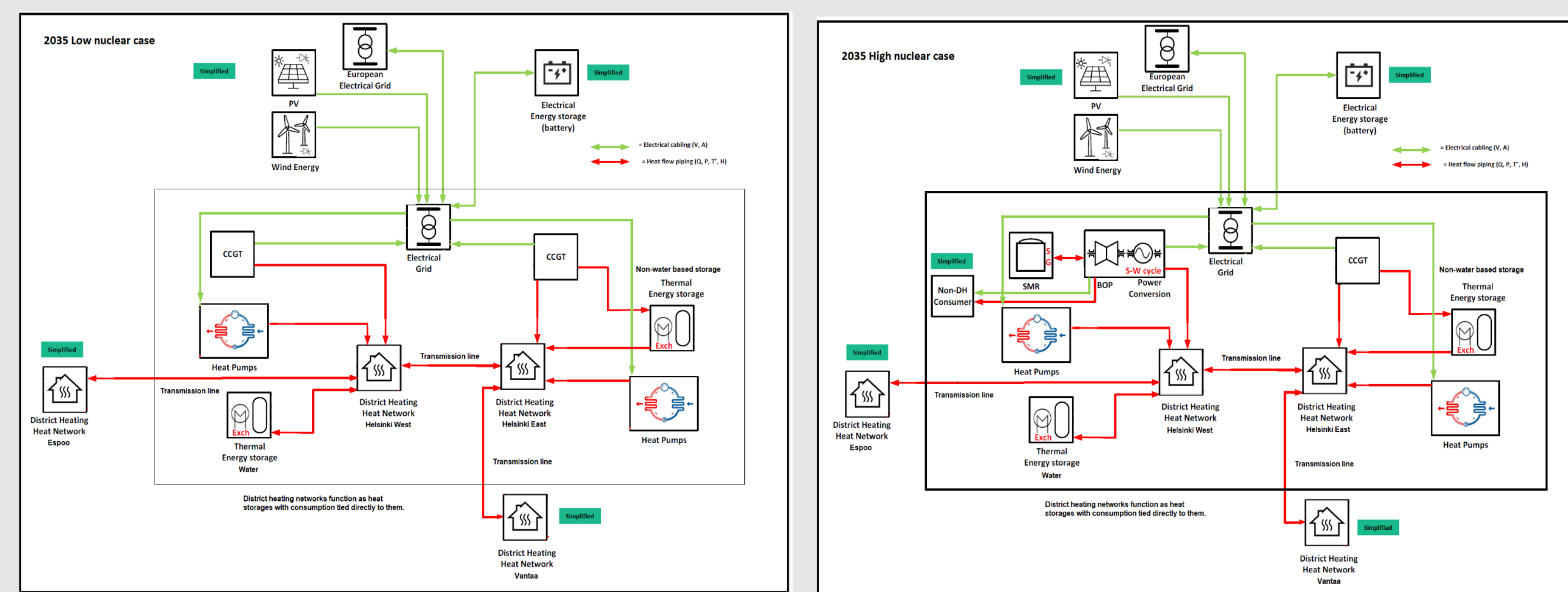
PHASE	ACTIVITIES	OUTCOMES
PHASE 1 Identification of hybrid systems incorporating SMRs to study	- Analysis of the European energy scenarios - Configuration of two hybrid systems for the selected scenarios	Characterization of two hybrid energy systems to study
PHASE 2 Development and implementation of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

CONFIGURATION OF HYBRID ENERGY SYSTEMS

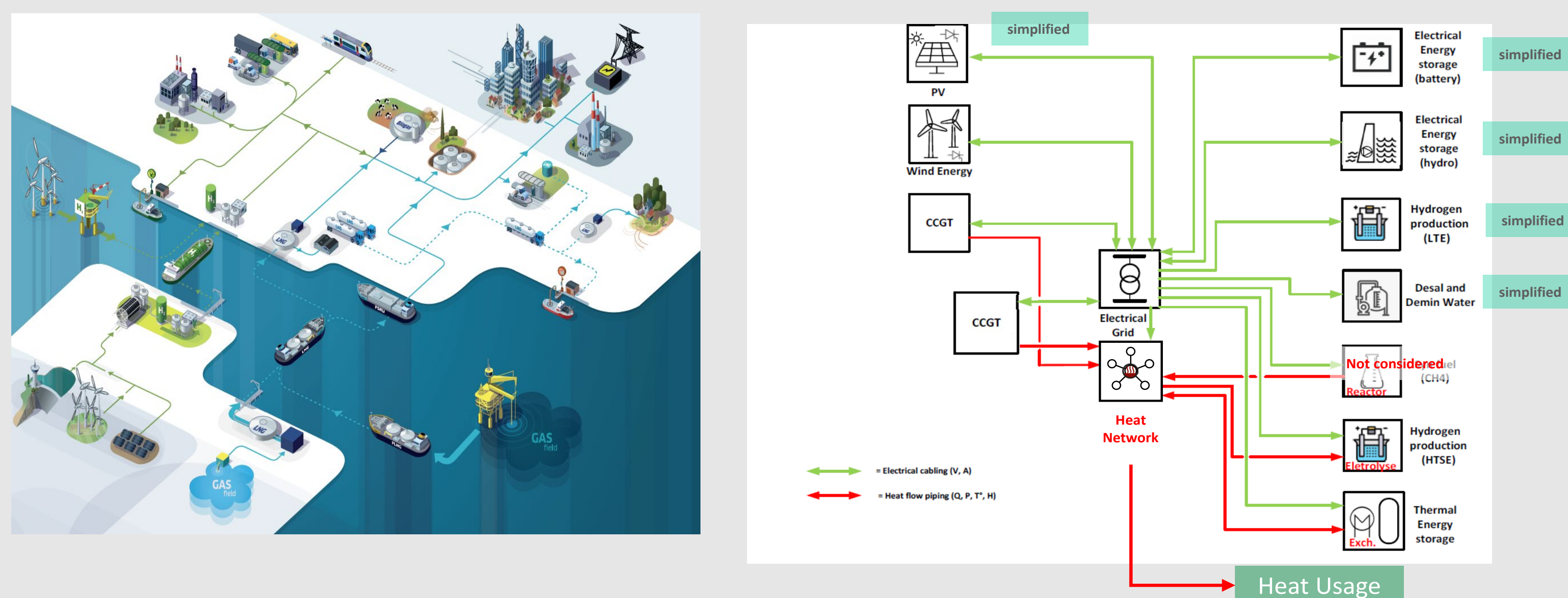
1/ Hybrid energy system for district heating and electricity supply

Studies in two EU local contexts: urban areas in Finland and Czech Republic

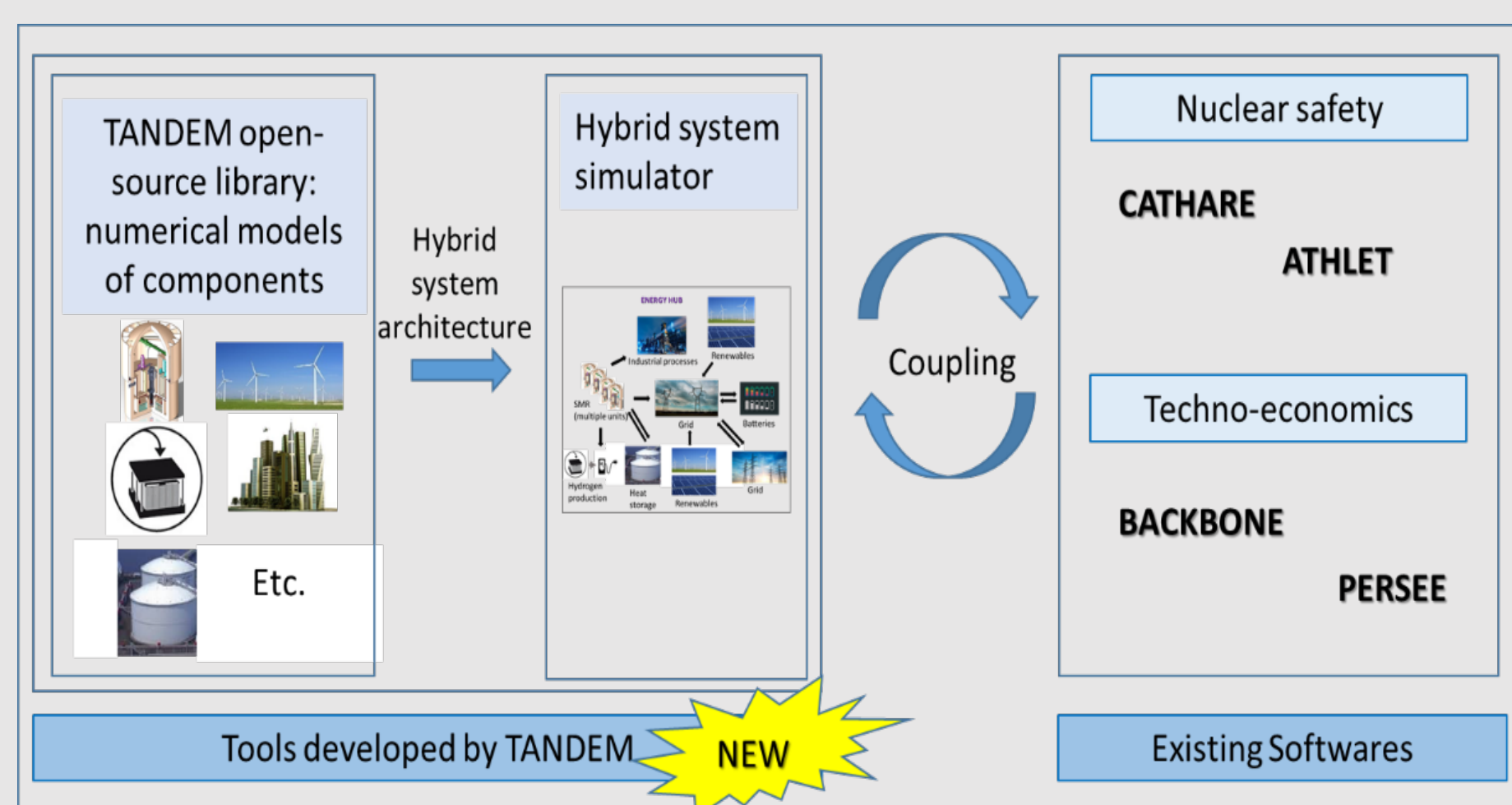


2/ Hybrid energy system for energy hub

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®")



SIMULATION TOOLS



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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

