CLEAN AIR TASK FORCE

Energising the EU: How Nuclear Energy Can Help Decarbonise European Industry

Introduction

Heavy industries account for over half of Europe's energy consumption, much of which goes toward heat production – a sector that still widely uses fossil fuels and is thus a major risk to the EU's ability to decarbonise. Emissions from heavy industries are mostly attributed to **high-temperature heat** and **round-the-clock energy needs** that are hard to meet with variable renewables alone. Nuclear energy can play a critical role in decarbonising industry while supporting long-term economic competitiveness and growth of EU's industries, greater resilience, and Europe's energy sovereignty.

Industrial decarbonisation entails reducing or eliminating greenhouse gas (GHG) emissions from the industrial sector. This, among other things, means shifting away from the use of fossil fuels to energise an industrial site, towards cleaner energy sources with a lower carbon footprint.

Lower carbon footprint: Heavy industrials require large amounts of continuous power and heat. Co-locating nuclear power generation at industrial sites enables supply of reliable baseload heat and power while significantly reducing emissions.

Energy security and stability: Nuclear-industrial co-location reduces reliance on fossil fuels, including imports, lowering exposure to volatile fossil fuel markets and strengthening grid resilience through stable and reliable power supply.

Table 1: How can nuclear energy help industry decarbonise?

Industrial application	Nuclear energy's supporting capability
24/7, clean firm energy	Nuclear energy, a clean firm energy source, can generate electricity and heat on-demand, regardless of the weather or time of day, with minimal GHG emissions and a very high-capacity factor, making it well suited to energise industrial processes.
Alternative fuel production	Nuclear energy can be utilised for the high-temperature heat and electricity processes required in the production of synthetic fuels.
Co-generation	Nuclear power plants can be designed to produce both electricity and heat, increasing energy efficiency and meeting multiple industrial energy needs. An excellent example of nuclear co-generation is the utilisation of nuclear energy to provide hot water for industrial and district heating. For instance, the Gösgen Nuclear Power Plant in Switzerland supplies heat to a nearby cardboard and paper factory as well as to a local district heating network.
Desalination	Nuclear desalination plants can benefit industries which require large quantities of fresh water for their operations, offering a cost-competitive alternative to fossil fuels and a viable solution to potable water scarcity.
Heat processing	Industrial processes with high heat requirements (e.g., manufacturing, drying, refining, or coal to liquids), can benefit from the high temperatures provided by nuclear energy, especially from advanced reactors. Nuclear energy can also be applied directly to heating processes in industry, such as material processing and chemical reactions. This heat can then be used for steam generation in applications such as refining and chemical production.

Nuclear-industrial co-location: A potential pathway for industrial decarbonisation

Nuclear industrial co-location refers to siting industrial facilities (and other energy intensive facilities such as data centres) and nuclear power plants in close proximity to directly utilise their electricity output. This provides convenient on-site power for critical operations such as water treatment and high-temperature steam generation. Industrial users can also benefit from lower costs by avoiding transmission and distribution losses associated with importing energy from the grid.

Table 2: Historical examples of industrial co-generation:

Country	Reactor	Commercial Off-taker	Generation Specification
Norway	**Halden Reactor**	Paper Mill	20 MWth delivered to adjacent site
Switzerland	**Gösgen Nuclear Power Plant**	Cardboard Factory	45 MWth delivered to site two km away
Canada	**Bruce Nuclear Generating Station**	Heavy-water production plant	Several GWs of heat for heavy water production for reactor use

The potential of small modular reactors (SMRs) for industrial co-location

Small modular reactors (SMRs), a type of nuclear fission reactor that can be largely assembled at a factory and delivered to sites with reduced on-site construction, offer a new vision for nuclear-industrial co-location: siting SMRs near or within existing clusters of industrial facilities with virtually no exclusion zone outside of the nuclear site boundary.

The co-location of SMRs and industrial facilities is gaining momentum among EU nuclear projects developers, with Polish company ORLEN Synthos Green Energy (OSGE) aiming to deploy SMRs across six sites in Poland, and Romania's Doicești SMR project, led by Nuclearelectrica, planning to deploy six NuScale VOYGR modules at a former coal site.

Actionable paths forward for co-locating nuclear and energy-intensive industrial facilities:

- **Licensing and permitting:** Governments must facilitate nuclear-industrial co-location in their zoning and permitting regulations. Streamlined processes for co-located projects can significantly reduce project delays – i.e., quicker review for applications using technological solutions from a previously approved project.
- **Regional industrial coalitions: energy-intensive industrials** can collaborate with **peer companies** to co-develop new generation, etc. Such regional coalitions can lead to the formation of buyers' clubs, demand-side stakeholders who can coordinate on purchasing multiple units of the same reactors. Coordinated buyers' clubs send positive signals to suppliers and investors, and can speed up deployment while potentially driving down project costs.
- **Infrastructure planning and integration:** Successful co-location requires joint planning for supporting infrastructure, including transmission lines, heat pipelines (for process or district heat), water access, and waste management systems. Early coordination between industrial users, utilities, and nuclear developers is essential to optimise site layout and minimise additional infrastructure investments.
- **Policy support clarity from governments on nuclear heat and electricity:** Clear regulatory frameworks should support the use of nuclear energy not only for electricity generation but also for process heat and hydrogen production. This includes recognition of SMRs and advanced reactors as eligible sources for industrial decarbonisation targets and incentives.
- **Public-private partnership models:** Governments can facilitate co-location by offering support to **private companies** in technology down-selection and through risk-sharing mechanisms, such as loan guarantees, tax incentives, or regulated revenue structures, particularly for first-few-of-a-kind or high-impact demonstration projects.
- **Community engagement and workforce development:** Since co-located nuclear and industrial facilities are often sited in regional hubs, proactive engagement between **industrial actors, governments, and local communities** is critical. This includes building local workforce capacity through education and training programmes aligned with clean transition needs.