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Renewable-Energy-Driven Desalination, Water Security and Decentralised Infrastructure: Introductory Note to the Presentation on Seawater Distillation

The presentation introduces a concept for a seawater distillation device powered by renewable energy, specifically by wind. The proposed system combines a wind turbine, vacuum pump and mechanical vapour recompression process to produce distilled water from seawater or polluted water. Its basic operating logic is that lowering the pressure in the evaporator allows water to boil at a much lower temperature, approximately 25°C, while mechanical vapour recompression raises the pressure and temperature of the vapour so that condensation heat can be recovered and returned to the process. The presentation argues that a 50 kW wind-turbine-based system could operate off-grid and produce between 40 and 120 m^3 of water per day, depending on efficiency, with possible applications in coastal communities, tourist facilities, agricultural irrigation systems and humanitarian or crisis operations. As with the other project presentations in these proceedings, these figures should be read as project-side technical and commercial claims rather than independently verified performance data.

The wider significance of the concept is clear. Water security has become one of the central development, climate and infrastructure challenges of the present period. The WHO/UNICEF Joint Monitoring Programme estimated that in 2022, 2.2 billion people, or 27 per cent of the global population, lacked safely managed drinking water, meaning water available at home, when needed, and free from contamination. It further estimated that 703 million people lacked even basic drinking-water services, including 115 million people who took untreated water directly from rivers, lakes and similar surface sources. This gives water-supply innovation a strong public-policy rationale. It also explains why decentralised water technologies attract attention not only as commercial products, but as potential tools for resilience, adaptation and humanitarian response.

The United Nations World Water Development Report 2024 frames water as a factor in prosperity, peace, sustainable development, climate action and regional integration. This is useful for understanding the policy relevance of a project such as the one presented. Water access is not simply a technical service issue. It is a condition for public health, agriculture, tourism, settlement viability, energy planning and local economic activity. In regions exposed to drought, salinisation, fragile infrastructure or seasonal pressure from tourism, additional local water-production capacity may become part of broader resilience planning. This is particularly relevant in coastal and island contexts, but also in arid and semi-arid areas where conventional surface or groundwater resources are insufficient or increasingly unreliable.

Desalination is one of the most visible technological responses to this problem. The European Commission's Blue Economy Observatory defines desalination as the process of removing dissolved salts and impurities from saline water, including seawater, brackish water and mineralised groundwater, in order to produce water suitable for human consumption, irrigation, industrial applications and other uses. It also describes desalination as one of three pillars supporting water resilience, alongside water-use optimisation and water storage. This is an important distinction. Desalination should not be treated as a universal substitute for better water management, leakage reduction, water reuse or demand-side efficiency. Rather, it is most defensible where conventional resources are insufficient and where environmental and energy impacts can be controlled.

In technological terms, the presentation belongs to the thermal-desalination family, but with a strong emphasis on energy recovery. Conventional desalination technologies are commonly divided into thermal distillation and membrane processes. Thermal processes evaporate and condense water, while membrane processes, especially reverse osmosis, use pressure to separate salts and contaminants through semipermeable membranes. Reverse osmosis has become dominant because it is typically less energy-intensive, more modular and less costly to operate than many thermal systems. The European Commission notes that thermal distillation is more energy-intensive and that few significant new thermal projects have been developed in recent decades, while reverse osmosis has become the most widely used and suitable desalination technology because of its modularity, declining costs and reliability.

This does not make the proposed concept irrelevant. It makes the choice of technology and operating niche critical. Mechanical vapour compression and mechanical vapour recompression systems seek to reduce the energy penalty of evaporation by reusing latent heat. Instead of repeatedly supplying new heat to evaporate water, vapour is compressed, its temperature rises, and the heat released during condensation is recovered to support further evaporation. Recent review work on renewable-energy desalination notes that thermal desalination processes generally consume more energy than membrane-based systems because of the energy required for water vaporisation, but it also discusses wind mechanical vapour compression among renewable-energy-assisted desalination options. The same review emphasises that renewable-energy desalination still faces technological, economic, storage and intermittency barriers. This is directly relevant to a wind-driven device. The concept is promising precisely where it can convert intermittent mechanical energy into useful water production without relying on expensive electrical storage, but its real value depends on validated efficiency, operational reliability, maintenance needs and local wind conditions.

The project's emphasis on direct mechanical transfer from wind turbine to vacuum pump and MVR compressor is particularly interesting from an engineering and investment perspective. The presentation argues that this approach eliminates conversion losses and allows the system to operate without grid electricity, high-voltage pumps or industrial installations. Conceptually, this speaks to a wider problem in renewable-energy desalination: the need to match variable renewable power with continuous or semi-continuous water production. Electricity-based renewable systems often require power electronics, storage, grid backup or flexible operation. A mechanically driven system, if technically viable, may reduce some of these needs by converting wind energy directly into process work. However, this advantage must be demonstrated under real operating conditions. Wind variability, start-stop cycles, salt scaling, pump durability, compressor efficiency, brine management and maintenance capacity would all affect whether the system can deliver stable water output in practical deployments.

For FDI and partnership purposes, this means the project should be viewed as an early-stage decentralised infrastructure technology rather than as a mature utility-scale desalination plant. The presentation's estimated production range of 40 to 120 m^3 per day from a 50 kW wind system suggests a target between household-scale devices and large municipal desalination plants. This middle range may be relevant for small coastal communities, isolated islands, tourist resorts, emergency operations, small agricultural holdings or remote facilities where grid access is weak and water logistics are expensive. In such cases, the economic comparison is not necessarily with the lowest-cost large reverse-osmosis plant. It may be with tanker supply, bottled water, diesel-powered pumping, over-extraction of groundwater, or seasonal shortages that constrain tourism and agriculture. The investment logic therefore depends heavily on location, water alternatives, wind resource quality, operating autonomy and maintenance capacity.

At the same time, desalination brings environmental risks that should be addressed from the beginning. The European Commission notes that brine, the concentrated saltwater remaining after freshwater is removed, can alter salinity, temperature and chemical concentrations near discharge points, making proper brine management essential to minimise impacts on marine ecosystems. Jones et al. estimate that operational desalination plants produce around 95 million m^3 per day of desalinated water for human use, while brine production is around 142 million m^3 per day, approximately 50 per cent higher than earlier quantifications. The same study stresses the need for improved brine-management strategies to limit environmental impacts and reduce disposal costs. Panagopoulos likewise identifies brine discharge, high energy consumption, greenhouse-gas emissions, chemical use and water intake activities as key environmental impacts of desalination. These findings are especially relevant for any new desalination concept claiming environmental advantage. Low-carbon operation addresses one major concern, but it does not by itself solve intake design, brine discharge, mineral scaling, ecological effects or lifecycle impacts.

The policy importance of renewable-energy desalination lies precisely in this balance between need and risk. The world needs additional water-supply options, but desalination cannot be assessed only by the quantity of freshwater produced. It must also be assessed by energy source, environmental footprint, affordability, reliability, social acceptance and institutional fit. The European Commission notes that desalination may become essential to ease pressure on water systems under climate change, but with appropriate brine management and decarbonisation of energy use. It also notes that desalination remains more costly than many conventional sources and often requires subsidies or specific high-value applications to be competitive. These observations are directly applicable to the Hasović concept. Its claimed advantage is not merely that it produces freshwater, but that it proposes to do so off-grid and through wind-powered energy recovery. That advantage would become meaningful if confirmed through prototype testing, cost analysis, brine-management planning and field demonstration.

The investment potential described in the presentation is therefore plausible as a direction, but it requires careful framing. The global desalination sector has been expanding. Eke et al. found that global installed desalination capacity increased steadily at around 7 per cent annually from 2010 to the end of 2019, with particularly sharp increases in Europe and Africa over recent decades. This supports the presentation’s broad claim that desalination is a growing market. Yet the same evidence also implies a competitive field, with established membrane technologies, large engineering firms, utility procurement models and strong cost pressure. For a new concept to attract serious investment, it would need to show where it is distinct: off-grid operation, small and medium-scale deployment, reduced dependence on batteries, lower operating costs in windy coastal areas, robustness under field conditions, or suitability for crisis and humanitarian contexts.

From Bosnia and Herzegovina’s perspective, the project also has a broader industrial-policy implication. Although Bosnia and Herzegovina itself is not primarily a seawater-scarcity country in the way that Mediterranean islands, Gulf countries or parts of North Africa are, it has engineering talent and could use such concepts to participate in export-oriented clean-technology development. In that sense, the project should not be read only as a domestic water solution. It may be more relevant as an innovation and manufacturing proposition aimed at markets in the Mediterranean, Africa, the Middle East and South-East Asia, which the presentation itself identifies as large potential markets. This is a useful angle for the proceedings, because it links the project to the wider theme of Bosnia and Herzegovina's economic potential: moving from local technical ideas toward products that can address international infrastructure and climate-adaptation needs.

For such a transition to be credible, however, the next development steps would need to be specific. A concept of this kind would benefit from a staged demonstration pathway: laboratory validation of the vacuum and MVR cycle, a small prototype under controlled conditions, field testing in a coastal or brackish-water setting, independent measurement of energy use and water output, water-quality certification, brine-management assessment, maintenance analysis, and a basic business model comparing cost per cubic metre against relevant alternatives. Because the project is presented as wind-powered and off-grid, wind-resource mapping and performance under variable wind regimes would also be essential. The question is not whether the physics of low-pressure evaporation and vapour recompression are real. They are. The question is whether this particular configuration can produce reliable, affordable and environmentally acceptable freshwater in the locations where it is intended to operate.

The presentation that follows should therefore be read as a conceptual clean-technology and water-resilience proposal rather than as a fully market-tested desalination product. Its value lies in connecting several critical themes: water scarcity, renewable energy, decentralised infrastructure, climate adaptation and export-oriented innovation. It also raises the right kind of investment question. Future water infrastructure will not be defined only by large municipal plants and centralised utilities. There will also be demand for smaller, flexible and locally deployable technologies in coastal communities, tourism zones, agriculture and emergency response. The proposed system belongs to that conversation. Its further relevance will depend on whether the concept can move from explanatory physics and projected performance to verified prototype operation, bankable cost data and an environmental management plan adequate for real deployment.

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