# Passive safety advanced nuclear in support of renewables: A flexible mix is the best strategy for the energy transition.

in "Volt's Energy Transition and Climate Change Policy - A Comprehensive Green Transformation of Europe"

**Position in MOP**:
The policy is to be added in the MoP between p.10. " C. Energy Transition in the European Electrical System, 3. Nuclear Energy".

**Before:** New types of nuclear fission reactors (e.g. molten salt, fast breeder, small modular reactors) would be allowed only if deemed significantly safer than today's types and if required for the energy transition . Furthermore, citizens would be consulted about new sites, and given absolute veto rights.

Volt supports the research on advanced nuclear fission and fusion concepts such as molten salt, and Gen4, fast breeder and potentially small modular reactors, as well as the use of research reactors and nuclear radioisotopes for other low-risk applications such as medicine, food sterilization and space exploration.

**After: Despite an energy transition to 100% renewables of the world will probably be feasible in the future, the fact that this may be practically done before 2050 as proposed by Jacobson et Al**.[0] **didn't reach scientific consensus** [1,2].

One of major problems is that **the higher is the penetration of renewables, the higher the amount of storage or infrastructures needed to compensate the intermittency of wind and solar**, and that relation is non linear [3].

During last years, several interdisciplinary initiatives have emphasized the essential role that nuclear technologies can play in a clean energy transition in the world [4] and in Europe [5]. **Besides acting as a grid stabilizers, increasing fuel diversity and self-sufficiency, current nuclear energy share will make clean energy transition less expensive: without nuclear, the global transition would cost world 1.6 trillions of euros more from 2018 to 2040, and the required growth for renewables in next 20 years will have to be extraordinary** [6]**;** but current nuclear reactors fleet is aging and if not extended it will reduce significantly its power capacity by 2040 [6], so that it may take significantly longer to get rid of natural gas or other fossil fuels energy sources, producing more emissions, threatening our plans to tackle global

warming, and also implying more deaths due to air pollution: estimates of lives saved by nuclear energy generation report 1.8 millions lives saved from 1971 to 2009 [7].

**Considering that we don't want to extend current nuclear technology that is not intrinsically safe from Fukushima-like accidents, we want to stay open to new projects on advanced nuclear fission reactors** that make use of passive safety systems, i.e. in case of worst accident scenario will switch off any nuclear reaction without external intervention.

**Volt supports the research on advanced nuclear fission and fusion concepts that implement passive safety by design,** such as molten salt, GenIII+, Gen4, fast breeder and small modular reactors, as well as the use of research reactors and nuclear radioisotopes for energy generation and other all other applications such as medicine, food sterilization and space exploration.
There are other advantages of these technologies compared to Gen II-III nuclear besides being safer: in general they show advances in sustainability, economics, reliability and proliferation-resistance; they are typically more efficient, produce less nuclear waste or can even consume the nuclear waste generated by other reactors [8,9].

Main problem of new advanced nuclear technology may be its high capital cost: but small modular reactors (<~ 300 Mw of power), besides having a modularity that allow them adapt to an energy grid mainly powered by renewables, could give to nuclear technology the necessary lower capital cost and the standardization needed to benefit from economies of scale in the manufacturing, to decrease cost of production and to attract investors.
So **new types of nuclear fission reactors will be allowed only if deemed significantly safer than today's types, but these technologies should be allowed to compete in the market on the same level playing field of renewables,** until carbon neutrality is reached.
For some examples of advanced nuclear projects, see [10-15]

**Dialogue and transparency with local communities is essential, so a special european scientific agency will be created, to verify in few months safety concerns** in case of strong opposition from local communities and evaluate alternative clean energy projects that can provide same power supply, but no absolute veto right is given to the local communities: one of the Volt principle is that **the general interest should prevail over the local one in case of essential infrastructures, if the decision is scientifically grounded.**
**This principle should also be valid for the selection of nuclear waste repository sites** (like the one built in Olkiluoto [16]) **if required.**

# References

[0] Jakobson et Al., 100% Clean and Renewable Wind, Water, and Sunlight All-Sector Energy Roadmaps for 139 Countries of the World

[1] C.T.M.Clarke et Al, Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar
[2] John E. Bistline and Geoffrey J. Blanford, More than one arrow in the quiver: Why "100% renewables" misses the mark
[3] Ziegler et Al., Storage Requirements and Costs of Shaping Renewable Energy Toward Grid Decarbonization
[4] Interdisciplinary MIT study: The Future of Nuclear Energy in a Carbon-Constrained World
[5] IEA (2020) Sustainable Recovery https://www.iea.org/reports/sustainable-recovery/electricity#maintain-the-role-of-hydro-and-nuclear-power
[6] IEA (2019) Nuclear Power in a Clean Energy System – Analysis
[7] Pushker A. Kharecha, Prevented Mortality and Greenhouse Gas Emissions from Historical and Projected Nuclear Power
[8] WNA, Generation IV Nuclear Reactors: WNA
[9] Badawy M.Elsheikh, Safety assessment of molten salt reactors in comparison with light water reactors
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[12] BWRX-300 Making nuclear energy cost-competitive
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[15] NuScale NuScale Power | SMR Nuclear Technology
[16] Onkalo http://www.posiva.fi/en/final_disposal/onkalo#.XxoGX3UzYXU