12 LENR Technology Assessment

When LENR will finally hit the market, it will be disruptive to many established businesses and power structures. One can expect hefty resistance from established forces against a quick adoption of this powerful technology. The political and economic dimensions of LENR are certainly worth a detailed analysis. However, this is beyond the scope of this document.

In the following an attempt is made to assess the consequences of the future market adoption of LENR. Only those aspects will be assessed, which can be derived from the physical properties of CPs.

12.1 Can LENR be Weaponized?

At the beginning of LENR research there was no way to judge upon the dangers of LENR as a potential "low-cost hydrogen bomb". In light of the theory on CPs this prospect seems to be an unlikely development:

- CPs cannot be stored safely for longer periods of time. They have instead to be produced at the time of their use.
- CPs cannot be produced in large quantities, without spending a lot of electrical energy in their creation. This would render the sudden amassing of CPs for achieving an atom-bomb-scale destruction rather impractical.

However, LENR can be used for generating a smaller-scale explosion by charging a large bank of capacitors with high voltage and switching this charge to a thin wire or spark gap mounted under water. An underwater arc will occur, the current will produce CPs, which release nuclear energy. The nuclear energy will cause radiolysis of the surrounding water, forming compressed HHO gas, vapor and heat. The rest of the water will be forcefully driven aside with high velocities [36].

The rapidity of the energy release from underwater arc explosions is surprising, because it is the result of tunneling (of nuclei through the Coulomb barrier). Tunneling is a probabilistic process and the reaction is rate-limited by the tunneling probability of the nuclei.

So yes, LENR can be weaponized, but the technology looks inferior compared to the established explosives.

12.2 Will LENR Reactors Produce Dangerous Waste and Radiation?

From the past experience with LENR, there are almost no radioactive remains from the reaction. Some spurious amounts of tritium and some neutrons have been detected under some "abnormal" conditions.

A mixture of all sorts of elements is created by LENR. Some of these elements are toxic and need to be recycled or deposited with care.

In light of the theory on CPs there are two different outcomes from two different cases:

The first case is a LENR reaction with long-living CPs. This case will typically be found in devices, where the self-sustained growth of CPs is effective. This mode is desirable, because it produces practically no radioactive residues, no hard x-rays and no gamma radiation. The CPs stay intact long enough, that the nuclear energy is "cooled away" by the electrons.

The second case can be observed in plasma focus devices. These devices are optimal for the sudden creation of very many CPs, which will be smashed against the anode and destroyed. This mode of LENR operations will cause significant amounts of hard x-ray and gamma radiation, as well as neutrons. It also produces long-living radioactive isotopes. In this mode of operations the CPs don't live long enough to provide proper "cooling" of the excited nuclei. The hard x-rays are stemming from bremsstrahlung emitted during the destruction of the CPs.

In summary, the design of a LENR device needs to be optimized for the longevity of CPs, if one wants to reduce unwanted radiation and waste.

LENR devices with a high energy output are producing intense amounts of soft x-rays and vacuum UV radiation. Shielding against this radiation is an absolute requirement for protecting people against health hazards.

LENR devices can produce strong electromagnetic pulses, i.e. radio-frequency emissions. Without proper shielding, the devices would disturb wireless communications and delicate electronics.

LENR devices of all kinds will create and potentially emit CPs (previously dubbed "strange radiation"). These emissions should not be called "radiation", because it is not corpuscular or electromagnetic. LENR devices have to be properly shielded against CP emissions, because CPs are harmful to biological tissue and pose a serious health risk. They are also destroying electronics and might have other unwanted effects to all sorts of material. Please refer to chapter 1 for advice on shielding against CPs.

In summary, there are some ecological and health dangers from LENR. In comparison to the monstrous radioactive inventory of a fission reactor or the dangers from CO_2-based climate change, the dangers from LENR seem to be very manageable.