SOLID-STATE THERMOISOTOPIC ELECTRICITY GENERATOR BASED ON BLACK SCREENS

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Today we have many different ways of producing electrical power. They include TPPs, HPPs and other alternative power sources, each having its own efficiency. For instance, Kazakhstan produces 87.7% of its power at TPPs and another 12.3% are produced at HPPs. 70% of this power is produced by burning coal, which is considered a bad index due to the fact that fossil fuels are technically nonrenewable and not as efficient as nuclear isotopes are. Nuclear isotopes last longer and have higher mass to energy coefficient. A good example of Nuclear Power users are France, Japan and USA. The amount of electrical power produced at NPPs (out of the total power produced) in these countries is 76.9%, 30% and 19%. If compared, total power of all power stations in Kazakhstan is nearly 3 times smaller than all the nuclear power station of France (19GWts against 63GWts). Even though uranium and thorium deposits of Kazakhstan are estimated over hundreds of thousands of tons, the country doesn't use any kind of NPP to produce power.

Definitely, nuclear power plants are the most perspective way of power production. They use small amounts of fuel, produce high amounts of energy and complete many other tasks. But despite all these facts, many countries refuse to use this kind of power stations. The explanation for this mass decision is a harmful influence of environment and NPP workers. Most NPPs require nuclear waste repositories, high level of national safety and enough scientific resources. In today's reality, such strategic objects demands proper safety measures as it might be attacked.

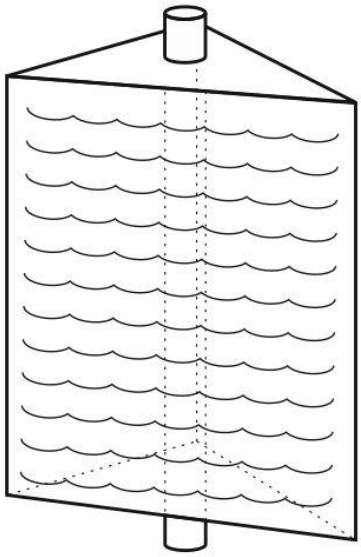
The main idea of the project is to design a new, nontraditional, compact and mobile solid-state thermoisotopic generator by using black screens and principals of radiation and heat conversion. The estimated isotopes are Uranium 232 or Thorium 228 (research on that topic is still not finished). The suggested solution would reduce environment pollution, high risk of oncological diseases among NPP staff, exclude psychological pressure on NPP staff, extraneous usage of isotopes and volatile heat-transporting liquids.

$$^{228}_{90}\mathrm{Th} \rightarrow {}^{224}_{88}\mathrm{Ra} + {}^{4}_{2}\mathrm{He}; {}^{232}_{92}\mathrm{U} \rightarrow {}^{228}_{90}\mathrm{Th} + {}^{4}_{2}\mathrm{He};$$

The estimated generator is based on alpha decay of isotopes in non-sustained reaction. The assigned task of the generator is to absorb alpha particle and radiation energy and convert it into electrical power using black screens, heat to electricity and radiation to electricity conversion principals.

A black screen is a surface covered with a material close to the ideal black body, this kind of screen can provide good absorption of IR radiation and convert it into heat, which is then converted to electricity.

Below is an approximate design (future design might differ) of 1 generator cell (they might be stacked) containing 1kg of isotope. The height of the cell is 1 meter, the triangle is circled in the circle of 20cm radius.



$$P = A \times E; \quad (1)$$

(1) – Radiation power, where A – isotope activity in Becquerel, and E – energy of 1 disintegration in MeV

$$A \approx N \div T; \quad (2)$$

(2): N – amount of isotope atoms, a T – half decay period

$$N = \frac{m \times N_A}{M} \times 10^3; \quad (3)$$

(3): m – mass, Na – Avogadro constant, a M – isotope molar mass

Approximate calculations of power of decay of Uranium and Thorium: 716,7 Wt; 19,34 kWt.

This kind of mobile generators might be used in distant localities, MOE service and in the military. They would provide a high index of safety, durability, cut expenses on wire power transfer and improve the ecological condition of the environment.

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ELECTRICAL RESONANCE

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Electrical resonance is a resonance that occurs in RLC circuit at a particular resonant frequency when reactances cancel each other.

Series resonance occurs in series RLC circuit at a frequency ω_0 in which inductive reactance

$$X_L = \omega_0 \cdot L \quad (1)$$