

Single wire electric power system for renewable-based electric grid

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Renewable-based electric grids are increasingly being viewed as an attractive alternative for providing power to rural communities. Technology options include small hydropower, biomass-powered generators, small geothermal, PV, solar-thermal, wind turbines and hybrid systems with back-up diesel generator, which may be connected to the social utility. Implementation of renewable-based technologies for rural electrification would contribute to the social and economic growth of the rural communities and would serve sustainable progress of the remote regions.

The electric grid faces specific problems of non-efficient operations, including transmission losses and the high cost of grid extension in remote sparsely populated areas. For example off-shore wind turbine, micro-hydro or geothermal generator are often located far from consumer and requires costly installation of long distance transmission line which usually has from 6% to 10% electric losses.

Hybrid system, with jointly operating small power generators of equal capacity, faces the problem of joint electromagnetic operation stability during renewable energy potential or electric load variation.

The objective of this paper is to introduce low cost and low losses single wire electric power system for renewable-based electric "rid.

The new technology [1,2] uses idle operation regime and reactive capacitive current for transmission of active electric power.

We develop and investigate single-wire power system instead of three-phase line and apply steel conductor or even non-metal conductive media instead of traditionally used aluminum or copper conductor. Three different single-wire power systems were tested: 230V, 10³V and 100³V, 1 ³W capacity each. It was experimentally proved that the single wire electric transmission line has quasi-superconductivity properties for reactive capacitive current flow along the line even at high operation temperature of the conductor. The principle of single electric power system's operation is based on the fact, that in no load operation mode the active current and the magnetic field of the line are equal to zero, while the electric field has maximum value and it is created by reactive displacement current which is charging the capacitance of the line. It is well known, that the displacement current is not affected by Ohm's law and Joule's law, that is why

Joule (resistance) losses are equal to zero. The results of the theoretical calculations and experimental study of parameters of single-wire transmission power system as well as description of electrical apparatus and application possibilities are discussed.

References

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