

**Complex Problems of Power Systems Based on Renewable Energy Sources**

LINNYK O., KANUNNIKOVA R. (Kharkiv). **Issues to implement wind and solar power plants in the Crimea. WPP and SPP impact over performance of both Crimean power grid and Integrated Ukrainian Power Grid.**

There have been analyzed technical issues to supply sufficient capacities of renewable based electricity into the Crimean power grid and Integrated Ukrainian power grid. Daily charts of WPP and SPP have been overlapped. Wind power plants and solar power plants are scheduled to be built till year 2020 in the Crimea. An option to add WPP and SPP capacities into 24-hour load curves of Integrated Ukrainian Power Grid has been considered. The impact of powerful WPP and SPP performance over the Crimean PG and Integrated Ukrainian PG operation modes has been determined.

TKALENKO D., KUDRYA S., TKALENKO M., BUD'KO V., VYSHNEVS'KA Y., STASUYK O. (Kyiv). **Modeling an oxygen electrode of high temperature electrochemical energy generators.**

There have been substantiated the nature and mechanism of oxygen cathode recovery in high temperature electrochemical energy converters. It was demonstrated that current could be generated on oxygen (positive) electrode current sources. And that current has got density 100 times more than in water electrolyte solutions. This effect happens due to high oxygen alkali combinations participation in cathode process. In accordance with the suggested scheme the role of high oxygen combinations in cathode process leads to active oxygen transfer from the margin division oxygen/melt to electrode surface. Such scheme is the fundamental one in qualitative analysis of cathode oxygen recovery. The recovery is based on considering a set of equations that reflect mass transfer process, chemical and electrochemical reactions in the near-electrode layer. By using this model it became possible to trace ionic composition of electrolyte near-electrode layer during electrolyses or energy generation processes. Also due to the model it became possible to obtain rated volt-ampere electrode parameters.

DENISOVA A. (Odessa), DRAGANOV B., SYROVATKA M., GERASYMCHUK S. (Kyiv). **Complex solar-accumulating and pump type heat supply system in public utilities.**

There have been presented an analysis of a solar accumulating heat supply source based on a heat-pump system performance. Efficiency estimation method of an above/mentioned heat supply system performance in public utilities and agriculture has been illustrated.

GAMARKO A., RYEZTSOV V., SURZHYK T., SHEVCHUK V. (Kyiv). **Stability analysis of solar batteries.**

Based on Gauss' theorem there have been obtained an equation about solar batteries average temperature change in time. There have been also analyzed instability terms after heating as a result of chemical reactions and ohmic current heating.

PUKHOVYI I. (Kyiv). **Test research of small water consumption dispersion and cooling processes when icicles formation and air heating by crystallization heat.**

There have been studied hydrodynamic and temperature parameters of water dispersion and cooling for icicles formation being fixed on firm nozzles. Gravitational dispersion with water head up to 350 m ensures necessary water cooling for icicles formation down to 0-3 oC. Two types of gravitational dispersion with water consumption about 1 gram per second and the injector from 3,5 to 68 grams per second have been studied.

**Solar Energy**

DZENZERSKIY V., SOKOLOVSKIY I., KRAVCHENKO A., PLAKSIN S., POGORELAYA L., SHKIL Yu.

(Dnipropetrovsk). **Studying options to construct microwave radiation converters being transmitted from orbital cell microwave power installations into current with commercial frequency based on active solid-state semi-conducting structures.**

The high-performance method of high power microwave radiation transformation into current of commercial frequency based on the use of active solid-state semiconducting structures with external negative resistance in high electric fields has been offered.

BEKIROV E., KARKACH D. (Simferopol). **Calculation and analysis of a PC heat balance.**

In order to define equilibrium temperature there has been considered heat change process between a PC element and its environment. Heat balance equation has been solved. There has been defined PC element temperature dependency over environment temperature and density of concentrated solar radiation. For an accepted marginal temperature 85°C of a PC element a maximum concentration coefficient has been defined. It has been revealed that with ambient temperature at 25°C the maximum concentration coefficient wouldn't exceed  $K=3$  if the PV is installed at any place. But if it is concerned roof PV module, the concentration coefficient would be as much as  $K=2,5$ . Concentration coefficient rise up by one point in summer increases equilibrium temperature by 18-22°C depending on installation type.

KHOMENKO I., SAFONOV V., KHOMENKO A. (Sevastopol). **Determining analytical dependency of direct solar radiation incidence angle over free oriented solar panel as a function of zenith, azimuth and Eulerian angle.**

The article works out a formula to determine direct solar radiation incidence angle over free oriented solar surface depending on five angles: zenith, azimuth and three rotation angles in relation to own axes. To solve the problem there were used vector algebra methods. Solar ray and panel normal were fixed in a specially selected unified system of axes. The ray and panel normal mutual alignment was made by sequence of single vector rotation relatively to panel system of axes. Several multiplications of vector rotation matrix and a single vector resulted in obtaining a universal formula that considers all possible solar ray orientation and solar panel as well.

SOKOL E., KLOCHKO N., KHRYPUNOV G., KOPACH V., MOMOTENKO O., KOPACH A., NIKITIN V., VOLKOVA N. (Kharkiv). **Using electrochemical method based on copper indium gallium diselenide for solar cells industrial manufacture.**

In order to create cost-effective and promising method for high-efficient solar cells production based on copper and indium diselenide there was carried out a comparative analysis of structure and surface morphology of copper, indium and selenium films, electrodeposited in stationary modes (without stirring) and under ultrasonic electrolytes stirring. The option of using both economically beneficial and suitable for large scale production method of cathode electrochemical deposition of copper indium diselenide precursors under ultrasonic electrolytes mixing for further solar cell base layers manufacture was proved experimentally.

BOLONENKOVA L., GABRINETS V., NAKASHYDZE L., ZARIVNYAK G., MYTROKHOV S. (Dnipropetrovsk). **Selecting components for solar collectors.**

Properties of polycarbonate materials have been discussed in this article. Comparative analysis of polycarbonate and glass has been performed and practical recommendations on the use of polycarbonate materials as a constructive material for the solar collectors have been offered.

**Wind Energy**

KUDRYA S., PERMINOV Yu., BUDYONNIY V. (Kyiv).

### Self-excitation process of autonomous asynchronous generator.

The article analyses autonomous asynchronous generator self-excitation subject to condenser capacity, residual rotor magnetization and rotor rotation speed.

### Hydroenergy

GOLOVANOV I. (Kyiv). **Hydraulic pumps utilization features in turbine modes for small hydro power.**

The article considers fundamentals to use parameters series centrifugal hydraulic pumps in turbine mode and under variable rotation frequency.

### Geothermal Energy

MOROZOV Yu., MEINAROVYCH E. (Kyiv). **Analytical solution of a task to evaluate massif temperature after the well thermal effect was stopped.**

Analytical solutions have been gained to evaluate massif temperature after the well thermal effect was stopped. Approximate solution formula has been obtained.

### BIOENERGY

PUKHNYUK A., MATVEEV Yu., KUTSYI D. (Kyiv). **World experience analysis of landfill gas utilization for energy production.**

The overview of the landfill gas-to-energy technologies is

presented. Technical and economic analysis of landfill gas-to-energy projects in Ukraine is provided.

BUD'KO M. (Kyiv). **Thermal effect calculation of sunflower oil transesterification reaction by methyl alcohol.**

The article suggests an algorithm to calculate thermal effect as a result of sunflower oil transesterification by methyl alcohol based on combustion heat process. Thermo chemical equation has been made and emitted heat amount resulted from sunflower oil transesterification reaction was estimated.

GOLUB N., ZHURAKHOVSKA D. (Kyiv). **Microorganisms fermentation for biohydrogen generation during anaerobic cellulose destruction.**

There have been considered conditions for hydrogen generation during cellulose use. Microorganisms for cellulose destruction have been selected. Microorganisms' communities have been used and chosen from various sources. There have been shown the influence of prior raw material treatment over hydrogen output during cellulose destruction.

VOLOD'KO A., NOVAK A., TSYGANKOV S. (Kyiv). **Sweet sorghum as energy crop for bioethanol production in Ukraine.** The main advantages of sweet sorghum as energy crop in comparison with traditional crops for liquid alternative fuels production in Ukraine have been shown.

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