

MICROGRIDS INCLUDING PV AND EOLIC SYSTEMS, ENERGY ACCUMULATION AND OPERATION OPTIMISATION

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Анотація

Оптимізація споживання та накопичення енергії в мікромережах, що складаються з різних типів розподілених відновлюваних джерел енергії. Запропоновано та випробувано експериментальну систему в реальних умовах з врахуванням графіку навантаження та споживанням.

Ключові слова: мікромережа, акумулявання, ФЕС, еолічна установка, діаграма навантаження.

Abstract

The optimisation of energy usage and accumulation in microgrids consisting from various types of distributed renewable energy sources. Propose and test of experimental system in real conditions with real load chart and real consumption.

Keywords: microgrid, accumulation, PV plant, eolic plant, load chart.

Introduction

This paper focuses on optimisation of energy usage and accumulation in microgrids consisting from various types of distributed renewable energy sources. The main task is to develop the strategy of charging and discharging depending on actual power consumption, prediction of following consumption and power generation from the utilised renewable energy sources.

The simulations are based on real long term data measured on photovoltaic system, eolic power plant and meteo station during period 2004 – 2021. Dataset from meteo station is used for the input to the simulation and for prediction of the future power production. The real data from PV plant and eolic plant are used either for simulation of the actual production and for verification of the simulated results.

The main task is to propose and test experimental system in real conditions with real load chart and real consumption originating from measurements on model building and integrated renewable energy sources. The system is proposed to be used in general installations on commercial or residential buildings.

Energy accumulation – results of 2 variants

Set of various battery systems was designed for the purposes of this study. Particular storage systems could be connected with existing energy sources in the Minipark RES. These batteries differ in design (ie economic parameters), capacity and performance of the battery inverter. The design comes from parameters of emergency system, that should be backuped (emergency elevator, emergency lighting, etc.). Table I. shows results of production for the variant 1 (36 pc Rolls 4CS 453 Ah) and Table II. of the variant 2 (3 pc BlueSky Multigrid 20kWh). The simulation again assumes that the battery is fully charged at the beginning of a cycle and is continuously being charged.

Table I.: Simulation of Variant 1

	GlobHor	DiffHor	T_Amb	GlobInc	GlobEff	EArray	E_Grid	EBatDis	PR
	kWh/m ²	kWh/m ²	°C	kWh/m ²	kWh/m ²	kWh	kWh	kWh	ratio
January	25.3	13.71	-0.68	52.3	51.4	991	896	4.024	0.811
February	44.3	22.32	0.29	77.7	76.3	1467	1341	3.038	0.817
March	86.8	49.64	4.19	115.3	112.7	2134	1961	0.912	0.805
April	125.9	65.02	9.28	140.9	137.0	2521	2316	8.505	0.779
May	157.7	78.86	13.74	152.1	147.5	2854	2429	2.319	0.756
June	165.6	83.30	17.10	152.2	147.5	2831	2406	0.568	0.748
July	168.1	83.05	18.97	157.7	152.8	2693	2465	0.830	0.740
August	142.6	67.59	18.74	150.9	146.6	2577	2363	0.535	0.741
September	96.4	50.74	13.74	119.6	116.4	2103	1926	2.295	0.762
October	58.8	37.29	9.06	85.5	83.5	1564	1424	0.074	0.789
November	28.1	17.95	4.28	48.5	47.5	903	805	0.000	0.786
December	19.3	12.74	0.75	39.9	39.0	763	680	0.000	0.808
Year	1118.8	590.22	9.17	1292.7	1258.1	23001	21012	23.100	0.770

Table II.: Simulation of Variant 2

	GlobHor	GlobEff	E_Avail	EUnused	E_User	E_Load	SoiFrac
	kWh/m ²	kWh/m ²	kWh	kWh	kWh	kWh	ratio
January	25.3	51.4	115.7	0.017	347.5	341.7	0.270
February	44.3	76.3	173.7	0.000	312.7	308.7	0.501
March	86.8	112.7	253.7	0.027	345.1	341.7	0.623
April	125.9	137.0	299.9	0.017	333.9	330.7	0.824
May	157.7	147.5	314.6	0.027	344.8	341.7	0.794
June	165.6	147.5	311.6	0.009	333.7	330.7	0.941
July	168.1	152.8	319.2	0.034	345.1	341.7	0.812
August	142.6	146.6	305.8	0.010	344.9	341.7	0.813
September	96.4	116.4	249.5	0.000	334.2	330.7	0.680
October	58.8	83.5	164.8	0.000	345.6	341.7	0.480
November	28.1	47.5	104.7	0.000	336.1	330.7	0.243
December	19.3	39.0	88.5	0.036	347.9	341.7	0.134
Year	1118.8	1258.1	2721.7	0.177	4071.5	4023.8	0.593

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