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Optimization connection between photovoltaic array and electrolytic cell about

The Solar fuel energy system

Wuqi[1], Xuzhenghong[1]
[1] TaixingpowerSupplyCompany toJiangsuelectricpowerCompany,taixing225400,Jiangsu,the

Abstract: InOrder toimprovethisproperty totheSolarFuelEnergysystemwiththedistributedBattery,thisPhotovoltaic arrayandSPEelectrolyticcellwereconductedoptimizationconnectiondirectlyin thispaper.Thecalculationmethods aboutThisCharacteristicequationandI-vcharacteristiccurveof,Photovoltaicarraywerepresentedbasedon the,oreticalanalysis ofThisCharacteristicphotovoltaicArray.and,OperationeffectofThisOptimizationconnectionbetweenphotovoltaicarrayThe n theSPEElectrolyticcellwasresearched.Finally,Theresultsshowedso theoptimal matchofInputvoltamperecharacteristicsofSPEElectrolyticcelland theOutputvoltamperecharacteristicsphotovoltaicArraywasachievedBy-DesigningthisformofSPEelectrolyticCellthenPVar rayto"mostreasonable,which caneffectivelyEnhancethisDirectconnectionmodeofoperationefficiencyofPhotovoltaicarray-SPEelectrolyticcell.***Keywords:***SolarEnergy,powerstationSystem,photovoltaicArray,Electrolyticcell,optimizationconnection

Keywords: Optimization; connection; between photovoltaic; array and electrolytic

Introduction

Current,The most development potential of reusable energy isSolar fuel cell distributed energy,so,in particular worldwideis a major research institution in Europe and America.R,Especially for solar fuel cell system in-depth researchInvestigate,because the battery can be applied to the actual project,and based on this technique,have successfully developed a prototype system that can run autonomously1[].however,current China's distribution of solar fuel cellsThe study of the source system still stays in the beginning stage of the understanding[2].This article firstintroduces a distributed energy system for solar fuel cells,and then drilldown toforSPE(Solidpolymerelectrolyzer,solid polymerElectrolytic Cell),PV array;and studied the characteristics and effects of the Electrolyzeroperation factors for electrolytic cells,finally designed PV arrays andSPEpowersolution best Direct Join form,technically for laterResearch and optimize the distributed energy system of solar fuel cell to dothe The matting.

1. PV Array

because of the output current and output voltage of a single PV cellLower,so the output power of a single PV cell is often insufficient,to meet actual system requirements.so,using single lightBattery-less occasions,usually,aPV cell'sbaseUnit is a battery connection with similar characteristics and encapsulates the form.design PV system,Can be used by the current,withRequirements for electrical voltage size,by concatenating or paralleling manyPV modules are grouped together,to form a photovoltaic that meets system requirementsarray.

1.1 PV Array volt-ampere characteristics

under ideal conditions,the battery in the PV module displaystheto the same characteristics,and the entire PV module volt-ampere characteristic curve andAsingle battery's volt-ampere characteristic curve has the same shape,onlydifference is axis scale[3].when a PV module or PV arraycolumn byNPV modules or PV cells press$N_p$parallel

and$N_s$concatenation is always,the voltage of a PV module or PV array is a singlecomponent or battery$N_s$times,,current to single component or battery$N_p$times,The output characteristics of PV modules or photovoltaic arrays are described in the following expressions[4]:

Uexp-(hurt)-1](1)

type$I_{ph}$is a light current;I.reverse saturation;Qrepresents an electroniccharge;Vto_{tal}indicates load voltage;kis the Boltzmann constant;Tis a straightstream power supply Absolute temperature;NsandNPThe indicates the number of battery concatenation andParallel number;Nrepresents the quantity.

1.2 features of PV modules and photovoltaic arrays

in the PV array,Technical parameters for PV module cellsis the same,and the actual external conditions applied arethe same,becauseof thethis,for single PV module battery cellPV array[5].

simplifies in calculations(1)constant value in:

^{Cl}=^{10,Cz}all the=NKr

based on a single PV module battery,to calculate theCI,C_2,combines the number of columns in the PV array$N_s$and number of parallel,NP,and substituting(1)can get:

/w=^{N}P/P_h-^{N}P/0[(exp(nV)^)-1] =^{N}p//P_h-

NPC^exp^n^-1) (2)

/Total=?1-0.212TheExp(0.3579VTotal-1) (3)

so,in the standard test bar0.$212out

Volt-ampere characteristic curves for photovoltaic arrays.

1.3 SPEElectrolytic Cell working characteristics

The voltammetric characteristics of the electrolyzer can be obtained by experimental testsline,at Experiment,Electrolytic Cell power supply to DCpower supply,itsThe corresponding parameters are shown in table1,.DC power supply can be exportedthe voltage and current can be adjusted,to test for differentThe operation of the Electrolyzer in the case of voltage.at electrolytic temperature respectively° C°,,°Cwhen,testelectrolytic cell voltammetric characteristic curve asdiagram1show.

by comparing the diagram1Thevoltammetric characteristic curves at different temperatures in the can beto draw the following conclusion:working voltage in electrolyzer same condition

under,The water temperature is50°CThe operating current of the electrolyzer is higher than the temperature isCworking current.so,electrolytic cell at same working voltageunder,The operating current of the electrolyzer increases as the electrolytic temperature rises,that isthroughSPEThe current density of the film also increases with the plus.when the electrolysis temperatureis high,SPEThemembrane is strong in the conduction and delivery of protons,Impedancedown,at the same time,as the electrolytic temperature increases,SPEElectrolytic Pool guidebody material The resistance value of the graphite body is also decreased,reduces the pool body'simpedance, toPromoteSPEelectrolytictank electrolysis performance,This solutionrelease afterSPEThe reason for the increase in membrane current density.

2. How the electrolytic cell connects to the PV array

A direct-coupled connection between the electrolytic cell and the PV array is shown in Figure2shows.

Theconnection has the following disadvantages:PV Array output voltage and currentthe size of the cannot be easily adjusted,and PV array outputThe size of thevoltage and current directly to the efficiency of the Electrolyzeroff[6]thissystemSPEElectrolytic cellI-Vattribute curvesto2show.under the maximum operating power of the PV array,assume lightvolt array output voltage and current with electrolytic slot working voltage and powerWhen the stream does not match,will cause the power of photovoltaic array output to be far away

from the systemMaximum power point for theseries,dramatically reduces PV array conversionsfor power efficiency.

only if you understand and master each part of the system(includesSPEElectrolytic Pool compartment and PV module cell, etc.)base of the running attributes of the[],to improve PV arrays-Hydrogen production efficiency of Electrolyzer[7].vs.This same time,to reduce system initial investment,Simplify system,Lower systemLine Impedance,reduce the power converters in the system such as attachments,In the PV array-Electrolytic cell hydrogen system,skillfully use reasonablePV array design instead of using power converters to adjust lightVolt array output current and output voltage, tooutput current and outputthe voltage and the operating conditions of the Electrolyzer match each other.

3. optimized connection between electrolytic cells and photovoltaic arrays

PV Array-increase electrolytic hydrogen production in the hydrogen production system of electrolytic cells andTheEfficient and economical way to transform efficiency is to maximizeIncrease the utilization of the energy generated by the photovoltaic array in the Electrolyzer[8].onSPEelectrolytic cell withPVPV array directly connected to the system,linkover-math solverSPEelectrolyzer volt-ampere characteristic curve andPVTheintersection between the Volt-ampere characteristic curves of the PV array output,ToobtaintheTheBest working state point for the system to run,as shown in the following formula::$^{0ut}P^{ut}$/(I,V)PV=inp^{ut}/(I,[])]$_S P_e$(4)

inSPEelectrolytic cells and PV array optimized connections,SPETheoutput of the electrolyzer is characterized by the volt-ampere operating characteristic curve and the PV array outputThe maximum power curve of the will cause energy to be transmitted from the PV arraytoSPEelectrolytic cells have the following lossAPj.

$AP_{j=}p^{mPV}$[] [] [@]]_P;^{pe}(5)

typePT^{PV}represents when the spectral irradiance isS.under conditions,PV ArrayThe power value at the maximum power point of output(units to:Tile);PTGenerationtable spectral irradiance toS.under conditions,SPEelectrolytic cells from the PV arrayget power(units to:Tile);where,Jrepresents spectral irradiance(unit to,:w/per square meter)different levels of,whose value range is1,2,3~ kg,number.'The higher therating.

compared to the maximum output power of the PV array,Annual PVArray Energy lossAPcalculation method(6)shows:

N

AP=^(P^{RmPV}_P;^{pe})x/i(6)

J =^{1}

type/Theindicates that the spectral irradiance within a year is in the[S-0.5as,

S+0.5As]:time(units to:hours).

First,calculates the energy of the system at certain spectral irradianceloss,second,calculates that PV array output is in maximum power conditiontheoptimal energy dissipation,and contrast the difference between thetwoxor,then drawSPEelectrolytic cell and PV arrays optimize connection mode% energy Loss%AP.andAP%(7)shows:

P^{mPV}_$P_S$pe

ThePV array in this system is provided bythe3block PV cells in parallelto form,thenSPEelectrolytic cells and PV arrays connect directly afterultimately form this system.in PV arrays andSPEelectrolytic cells corresponding tovolt-ampere characteristic curves and work-known conditions,and knownPV Array Direct connectionSPEThe connection conductor impedance of the Electrolyzer is0,using calculation formula(5),Toderive the PV array andSPEElectrolytic Cellsv-volt characteristic curve intersection,Finally, PV arrays andSPEThe best operating point for a electrolytic cell system,The resultsof the experiment are shown inthefigure3..

According to the diagram3Know,under the condition that the spectral irradiance is not high,,PV array output voltammetric characteristic curve withSPEelectrolytic slot's Voltann feature curve no intersection,Under the condition that the spectral irradiance is low, the,because the output power of the PV array is not satisfiedSPEelectrolyzer workersRequest,soSPEelectrolytic cells not functioning.addition,fromdiagram3to know thestatus point of hydrogen

production in Electrolyzer and PV array loss

Themaximum power point out of the has a certain distance between,byFormula(6),to calculate theSPEThe Electrolyzer utilizes approximately78%PV Arrays foroutput power.through Addspeelectrolysis slotSPEElectrolytic Pool smallnumber of rooms can be increasedSPEelectrolytic cells and PV arrays Direct connectionSystem productivity,the diagram3SPEelectrolyzer Volt-ampere characteristicsThe curve moves parallel to the voltage axis on the line.calculates,[]SPEPhotovoltaic arrays formed in series by electrolytic ChichowwithSPEThe operation effect of the system directly connected to the electrolytic cell.

in this experiment,SPEThe Electrolytic cell consists of the8features are basically consistenttheSPEElectrolysis pool in series,inSPEElectrolytic SlotThevolt-ampere characteristic curve is known tobe, andtoget a singleSPEpowersolution cell voltammetric characteristic curve®?.andelectrolyticpoolcab makeupSPEelectrolytic cell volt-ampere characteristic curves as shown in diagram4andChart5:.

diagram4SPEElectrolytic Pool compartment formSPEElectrolytic Cells

Volt-ampere characteristic curve

Fig.4volt-amperecharacteristiccurveofSpe

ElectrolyticCellMake upoftenSPEElectrolytic

CellSmallroom

in the resultingTenandSPEAn electrolytic pool compartment consists ofSPEthe Volt-ampere operating characteristics of the Electrolyzer,based on different spectraPV array voltammetric operating characteristics curve,Get Lightv arrays vs.SPEElectrolytic Chichow compositionspeElectrolysisslots directly optimized for connections and PV arrays with theSPEElectrolytic Pool

The CAB consists ofSPEElectrolytic Cell directly optimizes the connection's test results,On thediagram6and figure7isshownin.

diagram6PV Arrays andTenSPEElectrolytic Chichow

consisting ofSPEElectrolytic Cell directly optimizes the connection

Fig.6direct-optimizedconnection-PVArrays andSPEelectrolyticcell(TenSPEElectrolytic

CellChambers)

diagram7PV Arrays andSPEElectrolytic Chichow makes up

forSPEelectrolytic Cell Direct optimization connection

Fig.7direct-optimizedconnection-PVArrays

andSPEelectrolyticcell(aSPEElectrolytic

CellChambers)

from Diagram6Know,uses theTenSPEElectrolytic Chichow makes up,SPEelectrolytic cells directly optimize the structure of the connection more efficiently thantheefficiency of the structure in chart 5 is greatly improved.based onformula(8),in spectral irradiance in theW/m^2, and$1W/m^2$

when,PV Arrays at maximum power runtime,SPEElectrolytic Cell Benefitsuse of PV array output energy exceeded94%;in the Spectrumirradiance inw/m^2andw/m^2,SPEElectrolytic Cell Benefitsutilization of energy output from photovoltaic arrays increased with spectral irradiance.such as,when spectral irradiance is$200w/m^2$when,on formula8findSPEThe Electrolyzer utilizes the PV array maximum workrate Point's81%Energy.when spectral irradiance is less than or equaltow/m^2,SPEVolt-ampere characteristic curve of Electrolyzer and PV array outputthe Volt-ampere characteristic curve of the has no intersectionPoint,indicates that the PV array outputEnergy not able to meetSPEThe energy requirement of the Electrolyzer is.

from Diagram7Know,diagram7The overall operational efficiency of the system is not shown in Figure6System Overall efficiency is high,however,in the less spectral irradiance of the barnext,Chart7systems utilize photovoltaic arrays more efficiently than the chart6to High.

is known from the analysis above for,temperature at a place,Humidity and lightingObjective environmental conditions such as,can be designed reasonablyoptimizedSPEThe connection form of electrolytic cells and photovoltaic arrays, tobe suresecuritySPETheinput voltammetric characteristics of the electrolyzer and the output of the PV arrayv-volt properties match,to improve PV arrays-SPEelectrolysisOperational efficiency of hydrogen production in slots.

4. closing

This article first analyzes the characteristics of photovoltaic arrays andSPEElectrolyticSlot Experimental features,optimizing lighting in Distributed energy SystemsTheConnection mode and capacity of the volt arrays and Electrolyzer match,toto further optimize the solar fuel cell distributed energy systemThe underlying is set.

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