Title (en)

OPTIMIZATION AND CONTROL METHOD FOR A DISTRIBUTED MICRO-GENERATION ENERGY PLANT

Title (de)

OPTIMIERUNGS- UND STEUERUNGSVERFAHREN FÜR EINE ENERGIEANLAGE MIT VERTEILTER MIKRO-ERZEUGUNG

Title (fr)

PROCÉDÉ D'OPTIMISATION ET DE COMMANDE POUR UNE INSTALLATION D'ÉNERGIE À MICRO-GÉNÉRATION RÉPARTIE

Publication

EP 2919079 A2 20150916 (EN)

Application

EP 15159163 A 20150316

Priority

IT MI20140411 A 20140314

Abstract (en)

A control method of a plant for the micro-generation of distributed energy is disclosed, wherein the plant is installed in a local unit, is connected to an electric network of an external supplier and comprises at least generation resources comprising of generators of electric and thermal energy, among which at least a co-generator in the form of fuel cell and photovoltaic panels, and energy storage resources, among which at least an electric battery and a thermal accumulator (boiler), wherein the following steps are provided: acquiring status variables comprising at least an adjustment of said fuel cell (M (k)), a loading status of said battery (S (k)) and a status (H(k)) of said thermal accumulator, chasing a time sequence (k=1, ...N) of reference values comprising at least, from an electric production from photovoltaic panels (P FV (k)), an electric load (L EL (k)) and a thermal load (L TH (k)) demanded by a user, through a predictive model defined for minimising a cost function which includes a total electric power (P EL (k)) and a total thermal power (P TH (k)) produced by said generators of electric and thermal energy, so as to obtain a sequence of optimised variables, comprising at least adjustment/modulation of said fuel cell (M REF), power delivered by said thermal accumulator P H (k) and a slack variable µ(k) to be used as input variables for said fuel cell and said electric battery and wherein said status variables (M (k), S (k), H (k)) are put in relationship with the relative input variables (M REF (k), P BATT (k)) through discrete-time dynamic models defined as: M k + 1 = e - T s Ä M k + 1 - e - T s Ä M REF k S k + 1 = S k - k s T s P BATT k H k + 1 = e - l H T s H k + k H l H e - l H T s - 1 P H k where T s is a sampling time, Ä is a time constant of said fuel cell, k s is a parameter of the loading and unloading dynamics of said electric battery, k H and l H are parameters of the dynamics of said thermal accumulator.

Inventor

- GUBERT MICHELE (IT)
- TAGLIONI DIEGO (IT)
- BERNARDINI DANIELE (IT)
- BEMPORAD ALBERTO (IT)

Applicant

TRILLARY S R L (IT)

IPC 8 full level (invention and additional information)

G05B 17/02 (2006.01); **G05B 15/02** (2006.01); **H02J 3/00** (2006.01)

CPC (invention and additional information)

H01M 8/04626 (2013.01); **H01M 8/04992** (2013.01); H01M 8/04559 (2013.01); H01M 8/04619 (2013.01); H01M 8/04746 (2013.01); H01M 8/04753 (2013.01); H01M 8/0494 (2013.01); H01M 2250/402 (2013.01); H01M 2250/405 (2013.01); Y02B 90/12 (2013.01); Y02B 90/16 (2013.01); Y02P 70/56 (2015.11); Y02P 90/40 (2015.11)

Citation (applicant)

- US 2012072040 A1 20120322 - KAJI MITSURU [JP]
- US 2014012427 A1 20140109 - KATAYAMA KYOSUKE [JP], et al
- US 2013190938 A1 20130725 - ZADEH MOHAMMAD REZA DADASH [CA], et al

- M. HOUWING; R. R. NEGENBORN; P. W. HEIJNEN; B. DE SCHUTTER; H. HELLENDOORN: "Least-cost model predictive control of residential energy resources when applying) CHP", PROCEEDINGS OF POWER TECH 2007, LAUSANNE, SWITZERLAND, vol. 6, July 2007 (2007-07-01), pages 291
- MICHELE ARNOLD; RUDY R. NEGENBORN; GORAN ANDERSSON; BART DE SCHUTTER: "Model-Based Predictive Control Applied to Multi-Carrier Energy Systems", THE IEEE PES GENERAL MEETING 2009, 2009
- MICHELE ARNOLD; GORAN ANDERSSON: "Model Predictive Control of Energy Storage including Uncertain Forecasts", 17TH POWER SYSTEMS COMPUTATION CONFERENCE, STOCKHOLM, SWEDEN, 2011

Cited by

US9677493B2; US9650934B2; WO2017050915A1

Designated contracting state (EPC)

AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

Designated extension state (EPC)

BA ME

EPO simple patent family

EP 2919079 A2 20150916; EP 2919079 A3 20160706

INPADOC legal status

2017-07-12 [18D] DEEMED TO BE WITHDRAWN

- Effective date : 20170110

2016-07-06 [AK] DESIGNATED CONTRACTING STATES:

- Kind Code of Ref Document : A3

- Designated State(s) : AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

2016-07-06 [AV] REQUEST FOR VALIDATION OF THE EUROPEAN PATENT IN
- Countries : MA

2016-07-06 [AX] REQUEST FOR EXTENSION OF THE EUROPEAN PATENT TO
- Countries : BA ME

2016-07-06 [RIC1] CLASSIFICATION (CORRECTION)
- IPC : G05B 17/02 20060101AFI20160602BHEP

2016-07-06 [RIC1] CLASSIFICATION (CORRECTION)
- IPC : H02J 3/00 20060101ALI20160602BHEP

2016-07-06 [RIC1] CLASSIFICATION (CORRECTION)
- IPC : G05B 15/02 20060101ALI20160602BHEP

2016-06-22 [RIN1] INVENTOR (CORRECTION)
- Inventor name : BERNARDINI, DANIELE

2016-06-22 [RIN1] INVENTOR (CORRECTION)
- Inventor name : GUBERT, MICHELE

2016-06-22 [RIN1] INVENTOR (CORRECTION)
- Inventor name : BEMPORAD, ALBERTO

2016-06-22 [RIN1] INVENTOR (CORRECTION)
- Inventor name : TAGLIONI, DIEGO

2015-09-16 [AK] DESIGNATED CONTRACTING STATES:
- Kind Code of Ref Document : A2
- Designated State(s) : AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

2015-09-16 [AV] REQUEST FOR VALIDATION OF THE EUROPEAN PATENT IN
- Countries : MA

2015-09-16 [AX] REQUEST FOR EXTENSION OF THE EUROPEAN PATENT TO
- Countries : BA ME