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Research Article

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New Energy Power System Based on Multi-Objective Optimization Scheduling Model

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ABSTRACT

It is shown how the optimization model can be used as a viable tool for supportingproduction planningand scheduling innew energy power system, and that it is possible to analyze schedulingscenarios of realistic sizes. It is also shown that the model can support shipment planningand strategic decisions concerningnew products and investments in storage capacity. A number of modifications and extensions of the model are also discussed.

Keywords: New energy, power system, optimization scheduling

INTRODUCTION

We consider production planningat the oil refinery in Taiyuan, china.The production plant consists of one crude distillation unit and two hydro-treatment units, where crude oil is distillated and further processed and/orblendedinto variousoil products, such as bitumen, naphthenic special oils and fuels.The productionplanning includes the aggregated production planning decidingwhere and when production should occur, the shipment planningwhere customer demand is transformed to schedules for the tankers transportingthe products, the schedulingof the processingunits, and finally the realizationof the plans and the scheduleswithrespect to the utilization of tanks and pipes. In this paper we focus on the process schedulingproblem, i.e. on the question of how to utilize the processingunits in an optimal manner given a specified demand. The schedulingis strongly related to the planningat the other levels, and it affects many types of decisions in the company. The ability to efficiently construct high-quality (low- cost) schedules is therefore crucial for the refinery in order to be competitive.

The schedulingproblem concerns the question of which mode of operation to use in each processing unitat each point of time, in order to satisfy the demand for a given set of products. A maincharacteristic of refinery schedulingis that a set of processingunits concurrently produce multiple products, and a product obtained as output from one processingunit can be used as input to another processingunit. A mode of operation for a processingunit is specified by the combination of products consumed and produced in the process, and by the yield levels for each of the products. Changeovers between modes of operation cause disturbances and extra costs to the production process. Hence, longsequences of the same mode of operation (few changeovers) are preferred. Long sequences imply, however, larger inventory levels for some products and an increased need for storage capacities (tanks) with associated larger holdingand capital costs.

We formulate a mixed integer linear programmingmodel for thenew energy power schedulingproblem. Theplanninghorizonisdividedintoasetof discrete time periods, and the model concerns decisions about which mode of operation to use in each of these time periodsfor all processingunits.The objective is to minimize costs of changing modes and costs of keepinginventories, given demands for a set of products,storagecapacities,andsafety

stock levels. The optimization model can be regarded as a generalized lot-sizing problem, where more than one product is obtainedfor some modes of operation and where inventory capacities are considered.

Mathematical description of algorithm are as follows: Assumptions made up of M particle group of n d (that is, the dimensions of the each particle) space search. Each particle's position is expressed as: $X_i = (x_{i1}, x_{i2}, \cdots x_{ij} \cdots, x_{in})$, Each location corresponding to related to the optimization of objective function for F fitness function, Each particle can be expressed as $V_i = (v_{i1}, v_{i2}, \cdots, v_{ij} \cdots, v_{in})$ corresponding speed

$$v_{id}^{k+1} = wv_{id}^{k} + c_1 r_1 \left(pbest - x_i^k d\right) + c_2 r_2 \left(gbest - x_{id}^{k}\right) \quad (1)$$

$$x_{id}^{k+1} = x_{id}^{k} + v_{id}^{k+1} \quad (2)$$

For the maximum number of iterations type, $N_{\max}$, N_i for the current iteration number, w_0 for initial inertia weight, w_1 is the particle inertia weight of evolution to maximum algebra.

Parameters are analyzed, and the convergence of PSO algorithm parameters is given.

The static economic scheduling model

Static in the research of economic dispatch is uncertain in unit combination, meet the system load balance constraints, After the wind farm access, general requirements wind priority scheduling. The basic mathematical model is as follows:

$$\min \sum_{i \in S_G} (a_i P_{Gi}^2 + b_i P_{Gi} + c_i) \quad (3)$$

$$st. \sum_{i \in N_G} P_{Gi} + P_W = P_L \quad (4)$$

$$P_{Gi.\min} \le P_{Gi} \le P_{LGi.\max} \quad (5)$$

DYNAMIC ECONOMIC DISPATCH MODEL

Dynamic economic dispatch is an extension of the static economic dispatch, studies the optimization problem of the output of generating unit is more time. Therefore constraints need to be considered in the unit output at different times of the said, at least need to increase the climbing speed constraint unit. Basic mathematical model for:

$$\min \sum_{t \in T} \sum_{i \in N_G} (a_i P_{Gi}^2(t) + b_i P_{Gi}(t) + c_i) \quad (6)$$

$$st. \sum_{i \in N_G} P_{Gi}(t) + P_W(t) = P_L(t) - r_{Gi.d} \le P_{Gi}(t) - P_{Gi}(t-1) \le r_{Gi.u} \quad (7) \quad P_{Gi.\min} \le P_{Gi}(t) \le P_{LGi.\max} \quad (8)$$

THE APPLICATION OF NEW ENERGY POWER SYSTEM OPTIMAL OPERATION

With the further development of the smart grid technology, the new energy power system will appear a large number of centralized or decentralized, and a series of new energy power generation cluster schedulable load cluster. After they are connected to the electricity grid that will bring, control the operation of power system protection influence, grid mode of power grid operation and management is facing with many technical problems. Under the drive of low carbon smart grid, virtual plant technology organic fusion technology such as communication, automatic control, has functions of self-management, self-control. Virtual power plant through the multi-layer distributed energy management system to new energy power generation cluster, the organic integration of controllable load cluster for a particular plant involved in electric power system, the operation of effectively coordinate the intermittent power units between individuals and the contradiction between the upper grid, to solve the intermittent energy access, regional power grid safe operation, and a variety of problems such as intermittent energy comprehensive utilization

has the important enlightenment function. Virtual plant technology as a new form of demand response, in the integration of clean renewable energy, improve power supply reliability and flexibility etc. showed great potential. Some European countries are actively developing demand response mechanism based on virtual power plant technology research and practice, set up demonstration project and test platform, has made many achievements. Research in this area is in its infancy, there are a lot of technology, policy and management issues to be solved. The smart grid development of our country is based on virtual plant technology of new energy power system dispatching mode with low carbon. With the further development of smart grid and new energy power generation technology, virtual plant technology will be spread more widely and practice.

PRODUCTION PLANNING AND SCHEDULING

The planningand scheduling of the production processatthe Taiyuaniscarried out sequentially, as illustratedin Fig. 1.

At the top level, we have the aggregated production planning. Based on forecasted aggregated demandat depotsandcustomerareas, the aim of theplanningistodecidewhich productsshould be producedwhere and when. In this planningstep the transportation #ows, the inventorylevels, and the quantitiesof crude oil to be bought, are also considered.

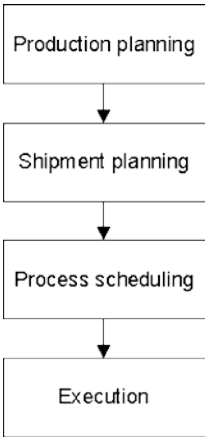

Fig.1:The planning levels

CONCLUSION

New energy power system optimization scheduling problem is proposed in the usage of smart grid and new energy development and utilization which rely on the generation of thermal power, wind power and photovoltaic power generation and other kinds of power supply .It realize the comprehensive utilization of energy resources, effective given intermittent new energy. New energy power system optimal operation mode is the traditional optimal operation mode of inheritance and development, is a new energy and smart grid power system development to the objective requirement of the strong coupling phase, promote the effective given utilization of new energy power generation, guide the science of electricity, ensure national energy security, achieve energy conservation and emissions reduction and economic and reliable operation of electric power industry.This has extensive and practical significance.

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