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ON THE METHOD AND MODEL OF ENERGY ENTERPRISE PROJECT PORTFOLIO SELECTION AND OPTIMAL ALLOCATION OF RESOURCES

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ABSTRACT

With a series of new energy construction projects of China in full swing, such as 10 million kilowatt wind power base, solar photovoltaic power generation clean energy base, the new rural biomass energy projects and nuclear power development and construction projects, the major power generation groups, as well as the investors represented by private capital, take this opportunity to have entered the field of new energy construction. The number of new energy projects increases, each investor is bound to be faced with the problems of portfolio and investment decisions of Item sets, as well as the problems of allocation of resources and optimized combination of multiple projects in the process of building at the same time. Traditional single-project management includes the management content such as project scope, time, cost, quality, risks and so on, while project portfolio management exceeds the boundaries of the traditional project management and combines the project implementation and business strategy as a bridge between corporate projects and strategies. From the view of project portfolio selection, optimal assessment, resource optimization and so on, the article introduced the methods and models of the major aspects of the portfolio management of the new energy projects.

Keywords: *Corporate Strategy, Project Portfolio Selection, Optimal Assessment, Optimal Allocation Of Resources*

1. INTRODUCTION

Faced with fierce competition of the new energy market, developing multiple projects or item sets at the same time is the inevitable choice for energy enterprises to expand the scale and improve competitiveness. At present, the management mode of the energy enterprises for new energy power projects remains in the traditional single-project management mode[1]. Problems such as fragmentation, resources exclusion and information not sharing among various energy projects generally exist. Single-project management takes a bottom-up management style, that is to collect new energy project information from the bottom of the project, and send the information to the senior project management to analyze, and then manage and control projects. This way is unable to find projects that deviate from the business goals or go beyond enterprise implementation and control capability. This management model makes enterprise project management exist the following drawbacks:

① Project decisions relationship between projects and strategic objectives enterprises that should achieve from a strategic level;

② Enterprises lack evaluation criteria and method for project investment evaluation and selection, project decision-making almost makes subjective project decisions;

③ Enterprises pay too muc short-term gains of single energy projects, while ignoring the dynamic relationships and long-term value of projects;

④ Single project m based on distributed projects ignores the systematic principle, and lacks unified resource management and allocation for all new energy projects within the enterprise-wide, which often results in conflict and controversy among multiple projects for access to critical resources, also results in the waste of human, financial, information and other resources.

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Development and construction of multiple projects or item sets is no longer a simple and repetitive single-project management, but the deployment of corporate strategy[2]. Multi-project management not only manages each project in accordance with the traditional project management model to ensure the realization of all project objectives, but also makes a unified management for these development projects under the premise of corporate strategy to ensure the smooth completion of all projects, thus achieving the strategic objectives of the enterprise[3]. Therefore, how to make scientific planning, scientific combination and scientific decision, and how to rationally optimize resource allocation under the premise of limited resources become the strategic research topics that energy companies must face.

2. PORTFOLIO SELECTION PROCESS AND METHODS

In new energy power companies, the resources required by candidate projects are always more than what the business can provide with, different power projects must compete for limited resources. As an enterprise, it must face with a number of projects to make a choice, and make optimized combination of resources in accordance with them, so as to make utilization optimization and ultimately maximize the return. Taking the characteristics, competitive environment and market conditions of the new energy electricity industry into account, variously analyze each alternative project to determine whether they are necessary and feasible, and thus make optimized combination of viable projects based on organizational resources, on the basis of surveys and studies[4]. Therefore, the portfolio selection process of new energy power is divided into three stages: forming alternate item set; single-project evaluation; project portfolio selection, as shown in Figure 1.

First stage: forming alternate item set

In this stage, we mainly collect new energy projects, establish a set of alternative projects, and improve all aspects of the project data through good project generation mechanisms. There are three sources of project in new energy enterprises. They are projects derived from corporate strategy, projects generated from business operations process and staff proposed projects. Therefore, in this stage, we must first ensure that the new energy companies have established clear strategic goals and vision; Secondly, we must establish a good project generation mechanism, through which we can get a large number of projects with great value not only from corporate strategy, but also from business operations and staff suggestion. In addition, the optimal assessment of the project portfolio is conducted on the basis of a complete project data, therefore, when we establish a set of projects, we must collect and collate all aspects of data of new energy power projects, so that be prepared for the evaluation, optimization and combination of projects in the next phase. The new energy power project data to be collected includes the goal benefits, overhead costs, human resource needs and risk factors of the project[5]. The project data can be presented on the form of project application report, the project feasibility report and so on.

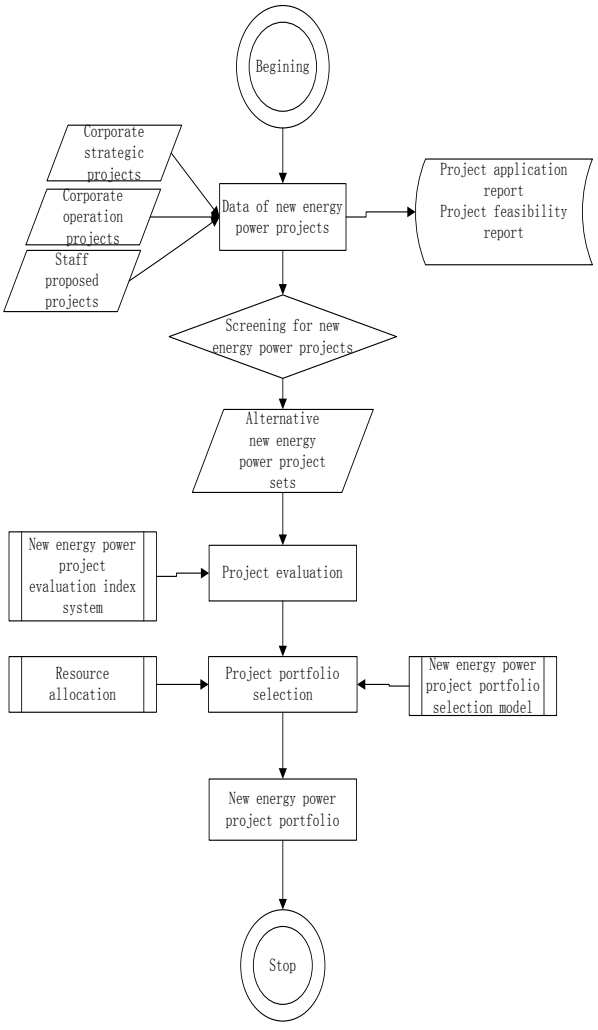

Fig. 1 A New Energy Power Project Portfolio Selection Process

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Second stage: evaluation of single-project

Through the collation and analysis of all aspects of project data collected in the first stage, we should build a project evaluation system from the perspective of individual projects, and select the appropriate project evaluation method to evaluate and screen the project, then eliminate the project that does not meet the basic measures. For example, we can establish the evaluation index system from the perspective of organizational strategy. The indicator system can reflect the coincidence degree between project goals and strategy goals, and the contribution degree for realizing corporate strategy objectives. And then we should evaluate and screen the projects with some evaluation methods, and terminate the projects which are inconsistent with the corporate strategy. Another example is to establish the evaluation index system of projects to evaluate and screen projects from financial benefits, technical feasibility and risks, such as what is shown in Figure 2.

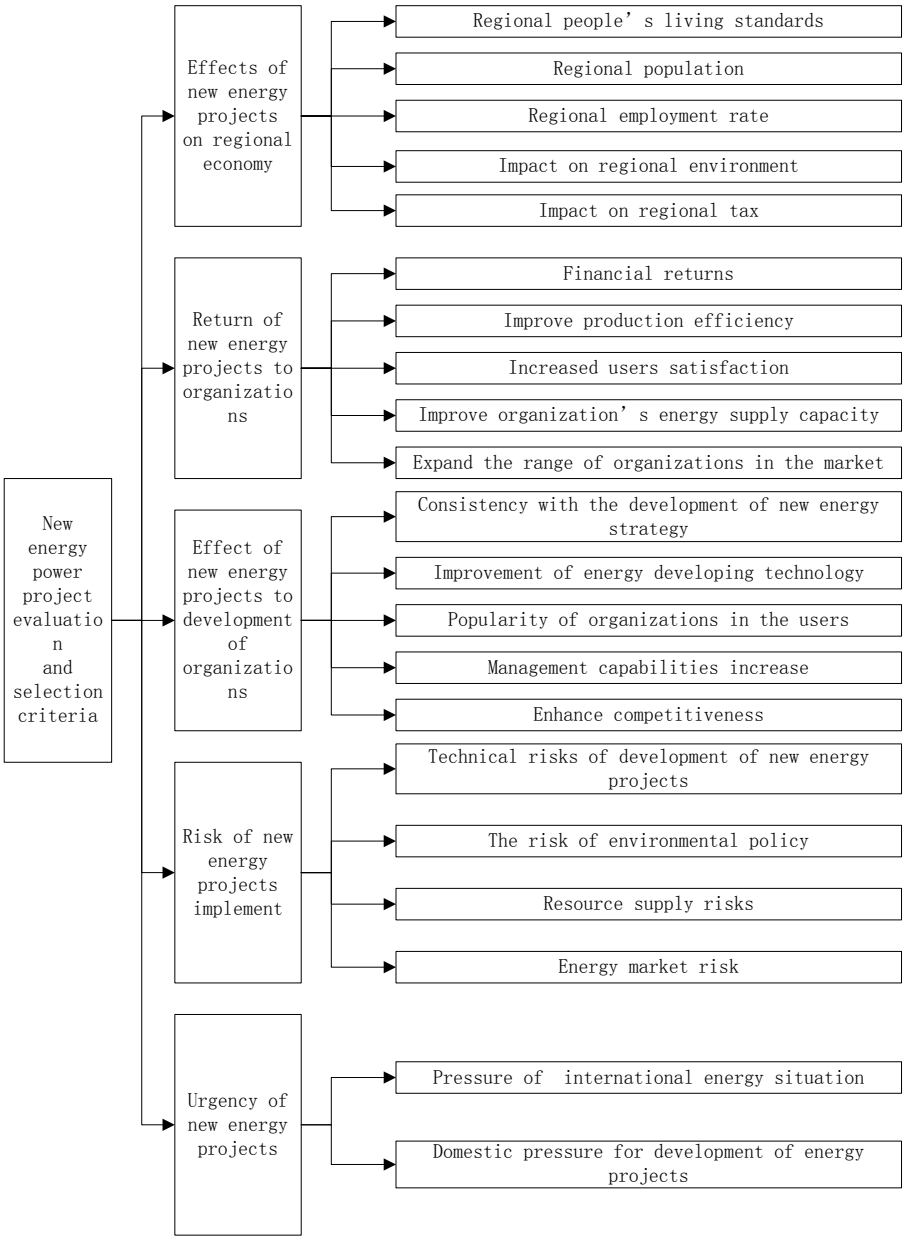

Fig. 2 Comprehensive Evaluation Index Systems Of New Energy Power Projects

Third stage: evaluation and selection of projects

New energy power project portfolio management not just manages projects, but also is the key to

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choose new energy power projects. Optimizing, selecting, and evaluating for numerous new energy projects, and determining the priority of the projects is not only the key work of project portfolio management, but also the basis of portfolio management. After the assessment on single new energy project, we need to select the qualified projects, combine them with the portfolio of projects in the previous cycle, and enter into the phase of project portfolio management. Combine and classify for the project, project sets, and project portfolio entering into project portfolio management, according to the allocation of resources, types of new energy projects and new energy organizations strategic objectives and detailed objectives. Optimization and sorting for the new energy project portfolio is not sorting for the priority of single project, but sorting for project groups and grouped projects that have already been divided into groups, so that to determine which projects to do first, which to do later[6].

3. PROJECT SELECTION MODEL

There are many optimizations and sorting methods for projects in portfolio, we illustrate as the following two methods:

(1) The simple sorting and optimization model based on ECV

Projects' simple sort and optimization models involve expected commercial value method and dynamic custom level listing method, and so on, among which expected commercial value method is relatively mature. ECV is a method that can maximize the portfolio's commercial value under some budget constraints, which is established on the basis of decision tree analysis. It defines the probability of project success and business success, calculates each project's commercial value to the company, that is expected commercial value, in order to carry out the sorting of the projects, and eventually pick out the projects with the largest expected commercial value[7]. It divides a project into several decision-making stages, such as development phase and commercialization phase and so on. It takes a project's future revenue streams, the probability of success in technology and business, and costs of development and commercialization into account. The general model of a project's expected commercial value is as follows:

ECV= [(NPV*SI*Pcs-C)*Pts-D]

Among the formula:

Pts is the probability of technical success

Pcs is the probability of commercial success

D is the development expenses of the project

C is the costs of commercialization

NPV is the net present value of the future earnings of the project

SI is strategic importance index, with three levels: high = 3, middle= 2, low = 1

Sorting according to ECV can not necessarily maximize the value of the portfolio. So, in order to maximize the value of the portfolio, we must take resource constraints into account.

(2) Scoring model

Scoring model method is another quantitative portfolio selection method which takes a number of evaluation scales into account. For a project, give scores in the range of l ~ 5 or 1~10 for each of its rating scale, and then make them respectively multiplied by respective weights, finally sum and aggregate into the score of the project.

Hoechst scoring model is one of the best scoring models currently used. The scoring model takes five main rating scales into account: the return to the enterprise; business strategy matches; strategic leverage; the possibility of commercial success; the likelihood of technological success. Each main rating scale is subdivided into a total of 19 sub-scales. The specific rating scale for the model is shown in Table 1.

Evaluating and sorting for new energy power projects will make sure that the new energy projects implemented and corporate strategy are closely linked, and the optimization order of the project will directly affect the development of enterprises, therefore, scientific and practical portfolio optimization evaluation system is the key link to ensure the success of portfolio management, the main role is as follows:

It can ensure that projects and strategic objectives are consistent. During project selection process, the strategic objectives of the new energy companies determine which projects will be included in the portfolio of projects, and which projects will be excluded. Only those which are consistent with the enterprise development strategy, and adapt to the long-term goals of the corporate can be included in the portfolio[8]. Those only belonging to the work scope of a department of the enterprise, and can't bring benefits to long-term development of the enterprise will be deleted.

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Table 1 Specific Rating Scale Of Scoring Model

1．1.The return to the enterprise	4．the possibility of commercial success
1 ） profit contribution to the enterprise	1）market demands
2 ） technological return	2）market maturity
3 ） time for commercial launch	3）the degree of competition
2 ． Business strategy matches	4 ） present development of commercial applications
1 ） consistency with the strategic objectives of enterprise	5）business outlook
2 ）the impact on corporate finance and strategy	6）impact from society and laws
3 ． strategic leverage	5 ． the likelihood of technological success
1 ）the quality of the project owner	1）technology gap
2 ） project development platform	2 ） the complexity of the program
3）project duration	3）the technical basis of existing skills
4 ） synergies with enterprise resources and skills	4）availability of personnel and facilities

It can ensure the optimal allocation of resources. Enterprise is a collection of a set of resources. Competitions among enterprises carry out around the competition and utilization for resources. For new energy enterprises, its position in the market depends not only on the quantity and quality of its own resources, but also on the efficiency of its use of resources. The former is a necessary condition for production and operation, while the latter is the key to maintain sustainable competitive advantage, is the real cause of David and Goliath, but also a concentrated expression of the efficiency of enterprise management[9]. In most cases, the new energy power projects also need to use a variety of resources, preparation of resource plans and arrangements for progress becomes more complex Therefore excluding those non-critical projects occupying key resources through project selection and prioritization in the project implementation process can ensure the optimal allocation of resources.

4. METHOD OF OPTIMAL ALLOCATION OF RECOURSES

Enterprise resource allocation refers to allocating the variety of resources owned in the past and at present among various production activities during business process. Whether the allocation of resources is optimized or does not determine whether the resources can fully or reasonably play their effectiveness. A corporate fundamental goal of the allocation of resources expresses as the corporate making sure that all the business activities can be carried out smoothly with the lowest resource costs, so that maximize efficiency, and realize the maximization of corporate profits. Appropriate resource is a prerequisite for the

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success of the project. For the single-project management, it is easier to realize the rational allocation of resources through the adjustment of tasks and duration. But in the modern enterprise level, the appropriate allocation of resources among projects has become a complex but important work when multiple projects are carried out simultaneously. In new energy enterprises, because resources are limited, projects competed for resources are often the direct cause of conflicts among projects. At the same time, enterprises have to ensure the largest input return of resources, and need to devote resources to the areas that have the greatest demands. Therefore, we can say that resource management is the fundamental of the new energy power project portfolio management[10].

The start of the new energy power projects will need the preparation of a lot of resources, such as human resources, material resources, equipment resources, and information resources. In single-project level, the resources involved in the project must be integrally managed, but for enterprises, the most effective method is to integrally manage the core resources impacting the success of the project firstly in order to avoid competition for resources. Therefore, the new energy companies need to establish a unified management system for core resources, recourse library is a better way, mainly including records of capacity and training of recourses, maintenance for recourses working conditions and resource selection and allocation system. The recourse library is in fact a database, and a shared library within the company. The definition of resources is not confined to the objects, but also includes a software module, a document, hardware facilities, environmental and personnel resources in the project.

There are two categories of recourse optimal allocation based on the network planning of portfolio: First, for a certain planed network, when the total cycle is limited, how to make time schedule of activity process, so that the resources needed by the whole scheme are more balanced, or the average requirement of resources is less. Problems of this kind are called resource leveling; Second, for a certain planed network, arrange the time for activities when the resources available are limited, so that the cycle of the whole project are shortest. Problems of this kind are called the allocation of limited resources[11]. Achieving the optimization objectives of above two types of problems can be solved by mathematical programming methods in theory. But with the increase in the number of projects, it is difficult for the traditional mathematical programming methods to find the optimal solution. So, approximate optimization methods are used more frequently in practical work. Heuristic methods are often used to solve the optimization problems of resource-balance for some larger projects.

The basic idea to solve the first kind of resource allocation problems with heuristic method is that: firstly, target the approximate optimal or approximation to the optimal, each step of computing must be better than the results of the previous step; secondly, according to the specific characteristics of the planed network and projects, determine some guided principles as the criterion during the procedures for selecting the best; lastly, the searching process divides the whole planning period into some time periods, and arrange the activities and recourses period by period from the beginning point of the network to the end (or from the endpoint to the starting point) to achieve the balance of resources.

The basic idea of solving the second kind of recourse allocation problems with heuristic method is that: firstly, divide the network planning into certain periods, and list the activity tasks that have already begun and may begin in a period; secondly, sort the activities in the period in accordance with the following principles. Firstly, arrange the key activities that have begun. If interruption is allowed, then the priorities of other activities should be sequentially arranged as: the key activities that have started, the remaining key activities, the non-critical activities that have started, and the remaining non-critical activities; secondly, in accordance with the resources needed (or the size of occupation), rank the key activities whose time differences are zero successively from more to less after the key activities that have begun; thirdly, rank the remaining non-critical activities sequentially after the former type of activities from small to large in accordance with the size of activity time differences; then according to the above sequence, introduce the activities within this period successively[12]. At the same time, calculate the requirements of the resources until they reach the limited number of resources. Subsequent activities should be postponed to the next period to retake the ranking; At last, recalculate the time differences of the activities after the postponing, and repeat the second step until all activities have been discharged within the time schedule. The modeling and algorithm procedures of the allocation of limited resources are summarized as follows:

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Now we need to distribute a kind of resource whose total number is A to some projects whose number is i, (i=l, 2, ...), set each project contain the same amount of work packages whose number is j (j = 1,2, ...), set Tij to be the lasting time of the whole project when the ongoing j work package within the i project has finished, and set Aij to be the demand for resources of the j work package within the i project, then solve the problem of how to allocate resources so as to make resource consumption time the shortest when implementing projects according to priority level.

1) Determine the decomposing work packages and project resource planning of each project according to project application

2) Solve t = min {Tij}, i = l, 2, ...

3) The project will enter into the implementation phase when allocating resources for the project according to the priority of the project within the time of t until $\Sigma Aij \geq A$

4) There will be a work package of a project the first to complete and free up resources at the time of t, redistribute resources according to the priority of the project until $\Sigma Aij \geq A$

5) Re-determine t = min {Tij}, that is the earliest ending time of all the ongoing work packages of each project from the time of re-allocating the resources

6) The cycle comes to step 4 until all the projects are completed and there will be no need to resources.

We can achieve resource optimization of the portfolio and maximize the use of enterprise resource by the above heuristic algorithms. However, the method has some shortcomings. Therefore, during the practical optimization process of new energy power portfolio, we should use different methods of portfolio resources optimal allocation in conjunction with specific conditions of portfolio.

5.CONCLUSIONS

As China's economy is developing, and infrastructure investment is increasing, project portfolio management becomes the inevitable trend of development of the energy enterprise project management.

The project portfolio management is an important means of combining corporate strategy with project management, playing the advantages of enterprise groups and improving economic efficiency. It is also an important and indispensable part of internal management. Through the integration of projects and corporate resources, enterprise project portfolio management achieves organization's strategic objectives, and ultimately gets maximize returns. To successfully implement enterprise project portfolio management, leaders must plan a method for project portfolio management to make the organization's resources being used fully and efficiently. Enterprise project portfolio management must have right tools, and choice of project priority is conducive to realize the connection of organizational strategy and project objectives, however, the optimal allocation and sharing of resources between multiple projects is the key factor that makes project portfolio management synergistic effect exist. From the perspective of project selection and resource allocation of portfolio management, the article explores and discusses the pre-portfolio decisions of new energy investment projects, based on the strategic objectives of the energy enterprises.

The article mainly introduces the methods and models of project selection and resource allocation, however, there are many other theories and methods involved in project portfolio management, which we business managers and related experts and scholars need to further explore and research, and constantly apply the new research results to practice, contributing to the development and construction of new energy projects in China.

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