

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(12), 2014 [5844-5850]

Analysis on green supply chain optimization theoretical of Grid enterprise material in China

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ABSTRACT

Under the pressure from government's increasingly stringent environmental policies and the driving force of internal interests, the implementation of green supply chain management is the only way for enterprise sustainable development. In the grid enterprise, assets structure and operating cost is closely related to materials, effect of material management plays a larger impact on corporate profits. Grid supplies has these features of big demand, strong compatibility, high requirements of time limit, which determines enterprise material management must establish material supply chain system. As the core enterprise supply chain of grid companies, they can play an important role on integration of upstream and downstream resources, and implementation of green supply chain on the overall efficiency. This paper combines the actual conditions of grid material supply chain management, for grid enterprises provide certain reference materials of green supply chain optimization from theoretical perspective to explore its goal, contents and system architecture of green optimization of grid material supply chain.

KEYWORDS

Grid enterprise; Material management; Supply chain; Green optimization; Theory system.



THE CONTENT AND CHARACTERISTIC OF GRID MATERIAL SUPPLY CHAIN^[1]

Electricity production is composed of deliver, transport, transfer, match, use link and so on. Grid supply chain takes grid enterprises as the core, with the power generation companies and terminal power users composed of power supply and demand network^[2](see Figure 1). The power grid enterprises provide electricity from power generation enterprises to the ultimate user through transmission, distribution and retail of the electricity. That forms the grid subject supply chain that includes power transition and delivery^[3]. The other part that provides product and service for production infrastructure, maintenance and first-aid repair of power grid enterprises is the grid material supply chain. It is the supplementary supply chain of entity flow of grid material includes various suppliers and manufacturer (see Figure 2).

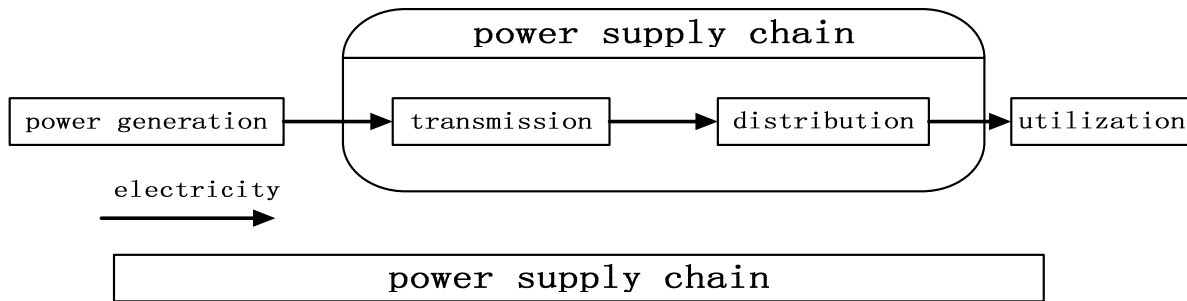


Figure 1 : Architecture of grid supply chain

Grid material supply chain also can be described as: Starting from equipment suppliers of power supplies or raw material suppliers, through agents and distributors, the enterprise needed supplies after inventory, distribution and other activities until the user of a whole chain network, with grid enterprises as the core enterprise and the guide of demand information.

It can be learnt from the definition of supply chain of grid material that its principle members are grid material manufacturer, grid material agent, grid material retailer, power grid enterprise and so on. The running of this supply chain is driven by the project construction requirements of power grid enterprises or project department, causing material purchase and following logistics activity.

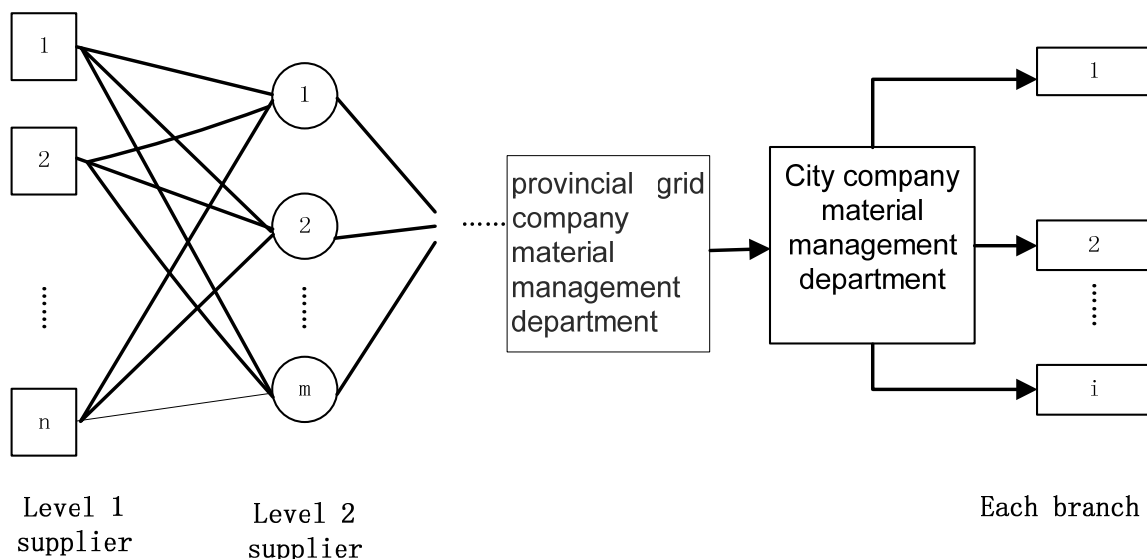


Figure 2 : Diagram of supply chain of grid material

Unlike other supply chains, supply chain of grid material has distinct characters of its industry as follows:

(1) Taking demand as a drive: Grid material supply chain is the equipment supply chain based on power grid construction and operation management demand. It is ultimately affected by supply and demand in electric power market.

(2) Taking supply logistics as objective: Grid materials are highly exclusive. The price of the raw materials is closely related to the demand and supply condition. Companies often reduce the supply chain in the form of scale custom to inhibit the bullwhip effect.

(3) To satisfy the internal customers as the leading factor: The primary task of grid material management is to meet the production and operation demand. So the supply chain of power grid is of efficient kind rather than benefit kind.

THE BACKGROUND ON GREEN SUPPLY CHAIN OPTIMIZATION OF GRID MATERIALS

(1) Applications and development of supply chain management thinking

Since the 1980s, supply chain management as a kind of new thought, which had been attracting great attention by scholars and business. In essence, supply chain management represents a kind of integrated point of view^[4]. With the method of system, for from raw material suppliers to end users of the whole logistics, information flow and work flow to plan, control and management. The traditional sense of the supply chain management was often at the expense of the environment for the pursuit of better customer satisfaction, greater market share and higher profit growth, which contributed to the environmental pollution, accelerated the depletion of natural resources. How to build a "resource friendly and environmental saving" society so as to realize sustainable economic development has become a problem that must be concerned about. So in the entire process of supply chain management into the concept of "ecological consciousness" makes the supply chain of resource consumption and the harm to the ecological environment minimal. At the same time, it can make supply chain environmental benefits, social benefits and ecological benefits harmonious. Contributing economic optimization of supply chain members has become the inevitable choice of realizing the sustainable development of enterprises^[5].

(2) Reform and development of our power industry puts forward new challenges for grid material management

The electric power system reform since 2002 in our country, vertical integration of power industry after the reorganization, formed by five major power generation groups and two grid companies and two electric power construction company as the main body of the power planning and construction and the production operation pattern; In addition some provincial and industry, there is also sizeable power production enterprises. It can be said at present power generation has initially formed a variety of energy coexist, a number of companies competition situation. While the grid enterprises within the designated area are still in a monopoly position exclusive business. Power industry is an important basic energy industry in our country and an important driver of national economy. More than thirty years with the rapid development of market economy in the incremental demand for energy production, at the same time the electric power enterprise is faced with "environmentally friendly" and "sustainable development" urgent requirement. To Change the single epitaxial growth mode and transform enterprise management mode becomes a practical problem facing the electric power enterprises.

(3) Grid materials management directly affects the economic benefit of enterprises

Power grid enterprise of fixed assets in its own assets structure proportion is big. As 2010-2014 state grid investment in fixed assets and the power grid an example, it can be seen (see TABLE 1) in

power grid enterprise's investment in fixed assets, grid investment accounted for more than 90%. While the grid investment in equipment procurement cost accounts for more than 70%, the purchasing cost is directly and closely related to the enterprise profits.

TABLE 1 : 2010-2014 national grid investment in fixed assets and grid investment; Units: one hundred million yuan

	2010	2011	2012	2013	2014
fixed-asset investment	2905	3220	3307	3605	4035
grid investment	2644	2924	3054	3379	3815
proportion	91.02%	90.81%	92.35%	93.73%	94.55%

Note: Data from China statistics yearbook database.

For grid enterprises, to ensure equipment safety, reliable, stable operation and to reduce maintenance costs and improve maintenance quality is the core of the grid enterprise competitiveness. In the power grid enterprise, 50-80% of fixed assets are power equipment, the cost of power grid operation and assets are highly correlated. The operating expenses of the power grid enterprise fixed assets including fixed assets depreciation costs, repair costs, material costs etc. is an important component of the grid enterprise cost^[6]. TABLE 2 shows the main business cost structure of grid enterprises (by state grid company financial statements consolidation in 2013).

TABLE 2 : 2013 power grid enterprise main business cost structure table

Project	composition
power purchase cost	75%
depreciation cost	11%
artificial cost	5%
materials cost	2%
repair charge	2%
other costs (controlled)	4%
other costs (uncontrolled)	1%
total	100%

Note: Data from China statistics yearbook database.

It can be seen from TABLE 2, depreciation cost, material costs and repairs three is 62.5% of the cost of control. And these three are closely related to the enterprise fixed assets, the depreciation charge accounts for the largest project of grid enterprise cost in addition to the electricity purchasing cost. The above features of grid enterprise's assets and cost structure are closely related to the equipment material, which directly influences the economic benefits for enterprises.

(4)Grid green logistics supply chain will become the trend of grid logistics management development

With environmental protection and sustainable development problems are more and more attention, low carbon economy and the strategy of "smart grid" is put forward, which inevitably affects the power grid equipment procurement plan, inventory distribution and emergency logistics management. Besides large scale power grid enterprises in our country, the number of every scrap of power equipment is amazing. The scrapped equipment which loss of the use functional still has itself material properties and the value is still high. It provides a huge space for development for the reverse

logistics and remanufacturing logistics. Based on reverse logistics and the remanufacturing logistics system, the equipment has the advantage of the higher material value scrap can be put back into the production manufacturing to play its the second and third economic value. Grid enterprises face the dual drive of the government environmental protection pressure and its economic power^[7]. To carry out the concept of green supply chain as the core of grid material supply chain management become inevitable.

GRID MATERIAL SUPPLY CHAIN THEORETICAL SYSTEM OF THE GREEN OPTIMIZATION

The green optimization of grid material supply chain is green supply chain management for grid supplies. It is the basic starting point for enterprise sustainable development, which using the optimization theory, combining with actual grid material management, integrating of material supply chain resources, in order to realize the enterprise economic benefit and social environmental benefits of coordinated development.

(1) The goal of the green optimization of grid material supply chain

Grid material supply chain after the optimization into environmental factor is a very complicated problem, the establishment of its target directly affects the establishment of the optimization model and the integration of resources. Strategic development, the foundation of the information and trust each other of supply chain members become the important factors that affect supply chain to their advantage. Therefore should be combined with strategic needs of grid enterprise to carry out the green optimization work in stages and layers. The goal can be decomposed as follows:

1) General objective: to reduce the cost of power supply, raise the level of service and quality, save resources and protect the environment, realize the coordinated development of economic and environmental benefits.

2) Secondary goal: grid enterprises as the core, from the internal integration, external coordination, overall operation and environmental benefits of four angles as a whole for studying the phase:

a. Internal integration: to improve the procurement strategy, ensure material supply ability; to promote efficiency of storage and distribution, optimize the operation and management process; to standard waste materials disposal system, strengthen the waste materials recycling; set up information platform to improve the work efficiency and cooperation consciousness.

b. External coordination: to establish strategic cooperative relations, technical support and the joint development of the deep cooperation; to share Enterprise external information and resources to improve the ability of power grid companies cope with external market risk.

c. Environmental benefits: in the guarantee under the premise of power supply, integrating supply chain each link of environmental constraints to make the whole supply chain resources use and environmental impact is minimal.

d. Overall operation: to perfect the uncertainty forecast of market supply and demand, to make the interests of the whole supply chain optimal.

(2) Grid material supply chain theoretical system of the green optimization

Grid material supply chain the oretical system of the green optimization contains two parts: the basic theory and optimizing content. The basic theory mainly includes the theories and methods of green optimization; optimizing content includes grid material internal supply chain management (purchasing management, warehouse management, waste materials management, emergency supplies management and so on), the external supply chain optimization and the whole supply chain optimization. In addition, for ease of tuning parameters Settings, it needs to analysis the influence factors of affect the green

optimization and evaluates the green optimization results. The results of the evaluation can play feedback guidance for further optimization.

The theoretical system framework of grid supplies green optimization is shown in Figure 3.

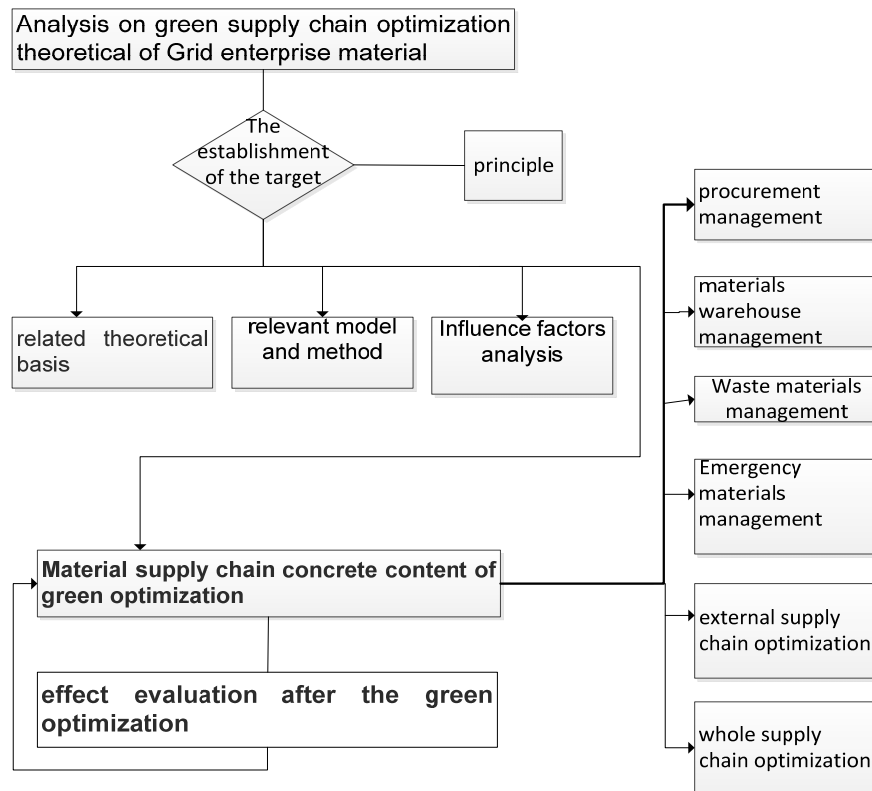


Figure 3 : Grid material supply chain theoretical system of the green optimization

SUMMARY

Power supplies as a strategic resource is the important cornerstone of enterprise development, its establishment of the supply chain system to enhance the level of power grid material management can play an important support. The green optimization of grid material supply chain considers from the enterprise economic benefit and environmental benefit two angles. Realize enterprise management costs reduced, at the same time it can promote environmental benefits, for the sustainable development of the power grid enterprise has important practical significance. The research on grid material supply chain is less, and the research for green optimization of grid material supply chains is less people involved. This paper has carried on the preliminary study for grid materials of green supply chain optimization problem from the theoretical point of view, and how to solve optimization problems to be further research.

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