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## Low Carbon Development of Hainan

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### Abstract

With the construction of Hainan international tourism island rising to a national strategy level, the green growth pattern based on low carbon objectives will become a significant part in the development of Hainan's economy. In this paper, low carbon electric power system and differentiation service will be discussed, and some opinions were brought up to have a good impact on Hainan's low carbon development.

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Keywords: International tourism island; Low carbon; Energy saving; Differentiation service; Market-oriented

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### 1. Introduction

<Several Opinions of the State Council on Promoting the Construction and Development of the Hainan International Tourism Island> was printed and distributed officially on December 2009, which means the construction of Hainan international tourism island has risen to a national strategy level. Hainan is facing a new historical opportunity.

Mandatory administrative orders were recently made in many regions of China to complete the “11<sup>th</sup> five-year plan” energy conservation and emission reduction targets. Unpleasant signs can be seen. Hard measures, like cut out electricity, have been made to restrict high energy-consuming firms; In some places, even residents had to take compulsory blackout. Administrative orders only will certainly has their effects in short-term, however, it won't have a positive incentive on those enterprises to initiate the emission reduction. Cutting emission should be more relied on market. Establishing a market-oriented mechanism is gradually being a consensus.

Many researches has been done on this subject. There are literatures about building electric multilateral trading market to optimize industrial structure <sup>[1]</sup>; Generation rights transactions are also proposed in some papers so as to conserve energy and reduce emission <sup>[2]</sup>. This paper discussed the construction of Hainan low carbon power system, and then put forward a differentiation service strategy which is based on the effect of energy conservation and emission reduction.

## 2. Low carbon power system of hainan

Building Hainan's low carbon power system means there will be transitions in all parts from power generation to customer side in Hainan. Such transition won't carry out without the construction of intelligent power grid [3]. The intelligent power grid has the following functions [4]. 1. Meet the target of the rapid development of Hainan's clean energy; 2. Realize the energy optimized allocation in Hainan; 3. Guarantee the operation of Hainan power grid; 4. Enhance the electricity conservation level on customer side.

### 2.1. The Generation Part of Low Carbon Power System

Hainan has rich solar energy resources which in theory is measured up to 4760 million reserves GWh/year. According to the calculation, land wind energy in Hainan can be developed to installed capacity of more than a million kilowatts, while sea wind energy can reach to 5 million kilowatts around. Developing new energy resources, including nuclear power, wind power and solar energy and biomass energy, is a key to construct Hainan's low carbon power system.

At present, Hainan's non-fossil energy industry is moving into the period of high-speed development, and Hainan's energy structure will be gradually optimized by accelerating the construction of hydropower, nuclear power project, and promoting the transformation and utilization of renewable energy resources such as wind, solar and biomass energy.

The < Development Planning Outline of Hainan International Tourism Island > promulgated in 2010 explicitly pointed out that a great many new energy projects will be launched in the near future. By 2020, the proportion of clean energy will rise from current 30.6% to 57.6%. Only with the nuclear power units going into operation, 260 tons of standard coal will be saved, and the reduction of the carbon dioxide emission will be 780 tons annually.

### 2.2. The Transmission Part of Low Carbon Power System

In the long run, the intelligent power grid also has a positive impact on clean energy's combination to the grid. The dispatching technology of intelligent grid can comprehensively improve the controllability of Hainan grid system and the market allocation ability, thus there will be solutions to debottleneck the grid constraint to clean energy [5].

Another front technology in intelligent grid is FACTS, it can improve the flexibility and the transmission capacity in the operation of the grid. Combined with the application of advanced automation technology, clean energy power will be integrated into the electric distribution network, and transmission losses will be dramatically reduced.

With the development of intelligent grid, some measures can be taken to encourage customers (residents or firms) to install small-scale efficient clean energy power equipment, and support customers to buy or sell green electric power at a certain stage.

### 2.3. The Customer Side of Low Carbon Power System

Optimizing the electricity utilization structure and realizing energy saving and emission reduction on terminal customer side will provide a big boost for Hainan international tourism island. The intelligent power grid's effects on electricity utilization part can be classified into the following points. 1. Long-term energy saving effect based on information feedback technique and demand side response technique [6]; 2. The application of electric vehicle;

The application of electric vehicle and the construction of the charging station has been put on the agenda. The station can provide a good effect of peak clipping and valley filling, while it can also serve as energy storage. When connected into the grid, the charging station can be seen as distributed generation which will operate well with renewable energy power generation.

### 2.4. Relevant Mechanism and Policy

During the transformation of power system, reasonable policy and mechanism was needed to ensure its success. According to the "long-term price protection policy" promulgated recently to facilitate the development of new energy power, it is strict for Hainan to ensure the full indemnificatory purchase of electric power generated from

renewable energy like wind and solar power, and transmission enterprises of Hainan should also cooperate with government to guarantee the imposition, utilization and supervision of renewable energy funds.

One of the challenges confronted by the Hainan's transmission enterprises is the network integration of renewable energy. Reform measures should be taken, and the most pivotal step is the drawn of the technical norms. As the reserve capacity is very important to the whole system, the low carbon generation capacity of Hainan should be considered at the design of integration regulation.

At every process of low carbon generation project, efficient scheme and mechanism can help investors anticipate investment return precisely, thereby, investment on low carbon generation will be attracted and new energy industry will enjoy a healthy development.

### 3. Differentiation service strategy

For the past few years, the government had paid profound attention to energy saving and emission reduction, however, the achievement was not satisfying mainly because local governments' performance evaluation criterion was overreliant on the GDP growth. In the later half of 2010, Some places were left vulnerable to power cut since local governments have no other options to complete the "11th five-year plan" energy conservation and emission reduction targets. But it did not have expected effect, on the contrary, the issue has aroused general social concern and the realistic situation had been reported repeatedly.

This section proposed a differentiation dispatch on generation side and a differentiation service strategy on power market [7]. All this methods are fundamental studies on Hainan's low carbon development.

#### 3.1. Energy-saving Dispatch on Generation-side

Transmission enterprises in Hainan can implement energy-saving dispatch (differentiation dispatch) on different power plants and different generator units according to their contribution degree on energy conservation and emission reduction. One principle in practical operation is "no water discarded due to dispatch". In this way, renewable energy power should be considered in priority when establishing annual scheduling plan.; For conventional power generation, in premises of safe operation and adequate power supply, large-scale coal-fired power units with desulfuration techniques should be arranged for dispatching planning. For now, Hainan has been well prepared for low carbon dispatching.

Many specific measures has been studied in practical.

- Ensure full acquisition of renewable energy like hydropower , wind and solar power generation; assign high-level use of hours for nuclear power generation to take full advantage of its generating capability.
- In consideration of coal-fired power units, arrange radix power generation in the principle of "fairly use of hours for same types of units"; arrange more hours for high-capacity, energy-economic and low-emission units in the principle of "biased quantity".

#### 3.2. Differentiation Service Strategy Based on the Effect of Energy Conservation and Emission Reduction

Energy-saving and emission reduction of large customer is of vital importance to the construction of Hainan international tourism island. This paper discussed a differentiation service strategy. It presents a new way to carry out energy conservation and emission reduction on marketing service [8].

Transmission enterprises of Hainan may consider establishing a year-end evaluation mechanism to analyze the energy consumption and emission of large customers. Then according to the statistics, classify large customers. This paper provide a reference for market segment which subdivide large customers into advancing type and lagging type.

Table 1 subdivision standard based on energy consumption and emission of large customers

Subdivision	Subdivision standard
Advancing customers	Energy consumption and carbon emission is apparently less than other enterprises in its industry; comprehensive energy consumption for unit output value and total emission reduced more than 3%.
Lagging customers	Energy consumption and carbon emission exceed state or local standards; comprehensive energy consumption for unit output value and total emission goes up instead down.

The main purpose is to encourage energy saving and emission reduction behavior of large customer, thus provide a health and low carbon circumstance of the construction of international tourism island. Strategy can be carried out in many aspects like electricity expanded procedure, meter reading, technique service, electricity price and tax revenue.

According to the <Demand side management measures> promulgated recently, Hainan government can make proper index system for electric power saving, and bring it into Hainan's energy and economy development scheme.

With the market reform is already under way, transmission enterprises in Hainan can put forward differentiation electric price strategy which is suitable for large customers when the time is right. For lagging customers, electricity price can be raised by certain percent so that technique innovation will be promoted in this mechanism.

Appropriate tax revenue policy is also helpful to reach perfect market mechanism and to form a fine circumstance where backward production can be eliminated [9]. To establish a good tax revenue mechanism, on the one hand Hainan government needs to release some incentive tax polices like financial subsidies or tax preference; on the other hand Government should strengthen mandatory taxation like imposing corresponding effluent charge and pollution tax on lagging customers.

#### 4. Conclusions

Low carbon development is the subject of the construction of Hainan international tourism island. From the hardware perspective, low carbon electric power system greatly promoted Hainan's low carbon development, while from the software perspective, the low carbon development also requires the market-oriented methods and marketing differentiation service. With the safeguard of technique and service, Hainan's low carbon development will sure achieve great success.

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