GRANULARITY OF ASSET MANAGEMENT

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ABSTRACT

Under the current financial circumstances, many DNOs put unprecedented focus on opportunities for investment optimization. However, the traditional efforts to balance financial performance and operational performance tend to based on static data mining. In Shanghai Power, we piloted a project to improve the traditional return on investment method and push it a little bit further to granularity asset management. The method features an ROI perspective from both current capacity constraints of network and projected demand forecast, a granular way of dividing one city into over 300 small districts to put spotlights on the real "hot" areas, and a closed-loop monitoring system by feeding afterwards performance as a key input to influence next year's budget allocation. By using this method, we can make more accurate investment decisions and improve investment efficiency a lot.

The main topics are related to:
Combine current constraints and demand forecast
Granularly divide the city, spotlight real needs
Closed-loop monitoring system

BLOCK 1: DESIGN PRINCIPLES FROM ROI PERSPECTIVE

As a state-owned corporation, we have a duty to act in the best long-term interests of our country. In this fiduciary role, we believe there should be some guiding principles:

Granularity of Asset Management requires an Enterprise Culture

The first principle is to establish an enterprise-oriented asset management culture. Individuals must recognize that while they are acting to accomplish the mission of their sub-company, they are acting to accomplish the missions of other sub-companies and the organization as a whole. So we need to develop a system to help managers evaluate, coordinate each investment decision.

Combine current constraints and demand forecast

We introduce the future demand growth into our model to capture the economic potentials for a particular area. The future demand is measured by the collected customer requests, which ask for additional load in the year to come. These requests, which are tracked accurately by our customer management system and with a very high conversion rate (~70%) to become true load within the next year, serve as a perfect proxy for future increase in electricity sales volumes. By combining both the current capacity utilization of network with a quite precise future demand predict, we can tackle the "hot spots" around the city in a dynamic and forward-looking way.

Broaden the Definition of Control, making the best use of investment.

Granularity makes a share language between different areas, it significantly broaden the company's control scope, so that not only big project but also tiny ones can be identified, tracked and managed

Appropriate Definition of the Role of Information Technology (IT) Department

Inappropriately defining the IT role may drive a wedge between IT department and sub-companies. From granularity perspective, the IT department at some point becomes essential for micromanaging. So the guiding principle should be a balance between the usefulness of the information and the ability of the organization to maintain the information in a current state. It will be discussed in block 2, when dealing with the KPIs.

BLOCK 2: DIVISION OF FUNCTION BLOCK

Traditionally, Shanghai Power (SHP) allocated its investment from the perceptive of its whole operation without the consideration of the differences of foundation situation, the change of requirement, and various developing predictions. However, the proposed method based on investment optimization uses the function block as a fundamental unit, which can help to make the optimization more accurate. Based on such a reason, dividing SHP into plenty of function blocks seems to be an essential process.

So that the investment of SHP can be optimized by the proposed method, a granular way to divide over 300 areas for one city, with aim to put spotlights on the real needs is proposed. With the assistance of our IT platform, we divide the whole city of Shanghai into over 300 small districts, and then identify the areas of high priority. By micromanaging, we are now able to allocate investment budget in a more targeted way, while in traditional way, those needs may be buried under the average performance of each branch company.

After such a division, we use some indexes to define

these blocks as three different kinds of areas.
Class A: In such areas, the power grids are under a high level utilization and potential to develop in following years, which means the main district of grass-root investment.
Class B: In such areas, the power grids are not under a high level utilization as Class A, however, have high load needed funds to improve.
Class C: In such areas, the load of power grid is super-abounded which means it can run well without too much improvement during several investment periods.
After then, SHP is supposed to put spotlights on the real "hot" areas which are composed of several As, Bs, Cs, rather than allocate the investment as traditional situations of the branch companies.

BLOCK 3: CONFIRMATION OF "HOT" AREAS

The method proposed in this paper is used to help SHP to make its investment distribution more detailed managed, appropriate, efficient, and so on. As mentioned above, we determine to divide the whole city of Shanghai into more than 300 functional blocks in order to define them as different districts to help distribute the investment more accuracy. So how to make sure which area is hot and which block is the type of A is more important.

Index selection

As far as we are concerned, to measure the property of a power grid, we have plenty of indexes, and each one has it own especial emphasis and applications. Therefore, we need to select one or more indexes, which is suitable to the method proposed in the article, to make the analysis more convinced and precise.
After the sifting quantities of index of power grid, we believe that the following fours are up to the standard, which are tension of capacity of power grid, load coefficient of 10kv distribution grid, load coefficient of 10kv distribution transform, and prediction of electricity sales. For the further evaluation, we figure out the first and the third one are both lacking in data and we are supposed to collect the data during a period which can help to modify out model. While, the fourth one is a type of prediction, which mean it is ambiguous on a certain degree. Consequently, we decide to select the second index as the main of this method proposed in the paper.
Besides, we choose the 10kv grid as our model, under the consideration that 10kv is more representative in varies types of power grids, covered more extensively, and adequate of data. Based on such advantages, we make the deal.

Measurement of the load coefficient

As mentioned above, we determine to use the index of load coefficient as our main index.

Load coefficient (LC) is defined that the ratios of the load gross power and rated power of the power grid in one district during the period of 25 days.

$$LC=P_{load}/P_{rated}$$

Then, we need to know what the LC in one district is. As we know, the power grid is composed of lots of routines, and all the loads get the power from the routines. Then, we can believe that the LC of the routine can reflect the whole grid load of the district and we decide that the total sum load of the routines in the same district is just the load of the grid.
After such a definition, we find a problem that a routine can always not exist in one district, be through several block instead. Thus, we use the weighted decomposition to describe the whole routine.
For example, if a routine go through 3 districts A, B, and C and in different district its LC is not the same. Then we decompose it into three parts, and each part has it own weight. And the weight representatives the LC proportion in the corresponding block. Particularly, we assume the weight of A is 0.5, B is 0.3, C is 0.2, then the LC*0.5 of this routine belongs to the load of district A, and LC*0.3 belongs to district B, so is C.
After above, we can figure out the composition of the LC in one district which is the LC of the routines which totally exist in this district and the LC multiplies the weight of the routines which exist in such district partially. The table below express it detailed.

Table 1: Different weights of branches.

Name	Weight
Branch A	0.2
Branch B	1.0
Branch C	0.9
Branch D	0.5

So, we can conclude that the LC of this district is:

$$LC=Pa*0.2+Pb*1.0+Pc*0.9+Pd*0.5$$

(Weights come from the empirical analysis of the practical data by the experienced staff, and the 25days of a period is also experienced and common used in power area.)

Functional block

Finishing the discussion of the definition of LC, we have to make sure the types of functional blocks.
As we mentioned in part 3, we divide the whole city into more than 300 functional blocks, and further step, into 3 classes. Next we give the judgement of which block belongs to which class with the following table.

Table 2: Definitions of different classes.

Class	Definition	Investment
A	LC is above 60% or more, or LC is not above 60% but will increase rapidly and soon over 60% in the next	Main district and more investment

	period	
B	LC is not below 30% and above 60% and the increase not fast	Investment as traditional plan
C	LC is below 30% and does not increase in the following period	Reduce the investment proportion

Under this definition, combined with the situation of SHP, we set the ratio is 4:2:1 as the Class ratio A: B: C. and it will become the basement of the new investment model, and we will adjust the ratio according to the change in the practical operation.

BLOCK 4: SCHEME IMPLEMENT AND CLOSED-LOOP MONITORING

Scheme implement

Intending to scheme implement, we need to exact the blocks' class. First we set the current data and a period data as a index of current status of the power grid, and set the power acquirement and potential prediction as the growth. Then if the LC of a block is over 60% or will increase to more than 60%, it will be believed as a block of Class A, so is B, and C, meanwhile make sure the ratio of A, B, and C is 4:2:1. Besides, we construct a system of scoring, which means Class A gets 4 scores; Class B gets 2 scores, and Class C gets 1 score. Via such system, the branch company can compute its score by the sum of the blocks of its region. Finally, SHP will do the investment depending on the score ratio of the branch company. After all, based on such a distribution and actual situation, it will make mini trim in order to make the investment distribution more accurate.

Closed-loop monitoring

After set the plan into operation, we need a method or system to make it stable and more accurate; accordingly, we suggest closed-loop monitoring.

A common fallacy in investment management is that we often dedicate too much time and efforts in planning without linking it with the historical performance. To introduce a performance-oriented culture in all the branches, we grant them the autonomy to allocate resources at their owe will.

Under detailed consideration, we make the decision to use the KPI to measure change of investment. Especially for SHP, the method proposed uses the principle called duty-right-p2p (The Company which establishes the investment plan also has the right of assessment and evaluation.) focusing on the operating result and efficiency, to make the closed-loop monitoring. Because we believe that if the duty equates to the right, the branch company will run plans more efficient. When we assess the plan and investment, we focus on the efficiency and input-output ratio.

About the assessment, we set an example table following to help expression.

Table 3: The relation between evaluation and investment ratio.

Assessment and evaluation	investment ratio (nest period to last)
Finish all the 10kv investment KPI	1.0
Not finish all, and the difference is below 10%	0.9
Not finish all, and the difference is above 20%	0.8

Via such a system, SHP realize the duty-right-p2p, and this will help to make the investment management method proposed in the paper more utilized, efficient, and accuracy, and operate stable.

BLOCK 5– CONCLUSIONS

In closing, Granularity of Asset Management is a holistic, inclusive and coordinated approach to asset management. It promotes both a philosophy and a set of best practices intended to overcome limiting conditions by coordinating asset-related investment processes across different sectors, integrating asset-related information systems, and adopting closed-loop monitoring for future investment decisions.