The Distribution Planning Information System Combined with Feeder GIS

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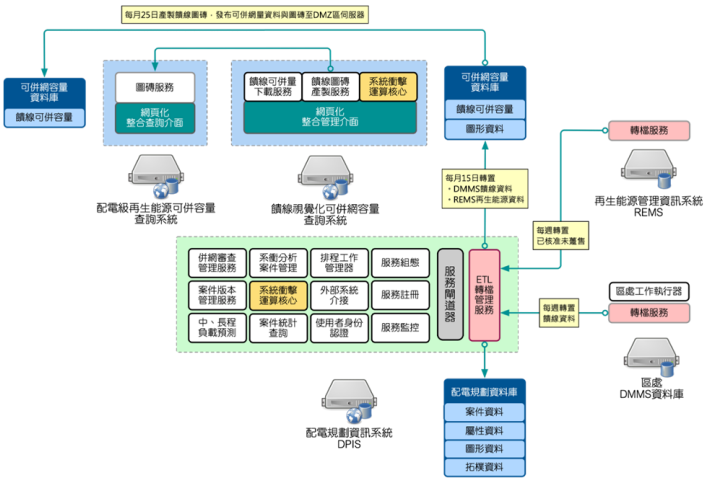
1. Background

To accommodate the increasing adoption of renewable energy sources, this research analyzes all renewable energy from approved applications to distributed ones for each feeder. The system utilizes distributed computing to quickly calculate the grid connection capacity information of feeders all over Taiwan. It can allow users to evaluate new application cases through grid impact analysis by calculating the impact of grid connection on transformers, conductors, and other equipment. This will enable them to review whether the new application cases meet Taipower's regulations and calculate recommended feasible solutions. This can significantly reduce the time required for review and improve efficiency.

This research utilizes ETL (Extract Transform Load) data transformation management services to periodically transform data used by the Network Distribution Planning Information System (NDPIS) systems, reducing the need for manual data transformation. It integrates the substations' power distribution equipment topology information, simplifies the data structure required for calculating grid connection capacity, and aggregates it to the central server as the operational data for conducting multi-stage system impact performance analysis. Each section's maximum grid connection capacity is quickly calculated, and the calculation results are integrated with geographic information system (GIS) technology. The data processing flow is shown in Figure 1.

2. System Framework

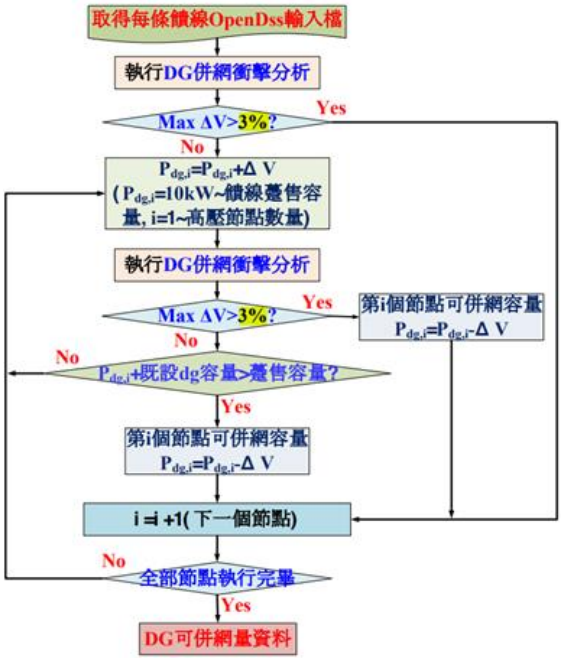


Source: [1]

Figure 1 System Data Flow

3. System Analysis and Computing Kernel

OpenDSS is the computational engine in this study, which calculates the voltage at each node in the electrical network. The impact of renewable energy equipment in the same substation, transformer, or feeder is considered, while other system background values, such as load and energy storage systems, are ignored. According to Taipower's regulations[2], the voltage should be within a range of plus or minus 3%. The system judgment rules and processing steps are illustrated in Figure 2.



Source: [2]

Figure 2 Calculation Processing Flow

4. System Applications

This research has conducted system impact analyses on renewable energy resources, including energy storage systems, light storage, and photovoltaics. The web version of the Network Distribution Planning Information System (NDPIS) provides users with methods to handle grid-connection applications. These include improving transformer capacity, changing wire specifications, setting up new feeders or branch feeders, installing new transformers, and reducing the requested capacity. (Figure 3) This process provides suggestions on feasible solutions, significantly reducing the time needed for data collation and repeated calculations, thus speeding up the process and reducing Taipower's burden.

Source: Taipower NDPIS website

Figure 3 Suggestions For Improving System According to Impact Analysis

5. References

[1]「配電規劃資訊系統結合配電級再生能源可併容量查詢系統暨網頁化 完成報告」，台灣電力股份有限公司，民國 112 年 9 月。

[2] 台灣電力公司再生能源發電系統併聯技術要點，台灣電力公司，民國 112 年 8 月。