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Hanoi, November 18th 2015

CIRCULAR

STIPULATING THE ELECTRICAL DISTRIBUTION SYSTEM

Pursuant to Decree no. 95/2012/ND-CP dated November 12th 2012 of the Government stipulating functions, tasks, power and organizational structure of Ministry of Industry and Trade;

Pursuant to Electricity Law dated December 3rd 2004 and Law on revising, supplementing a number of articles of Electricity Law dated November 20th 2012;

Pursuant to Decree no. 137/2013/ND-CP dated October 21st 2013 of the Government providing detailed regulations on implementation of a number of articles of Electricity Law and Law on revising, supplementing a number of articles of Electricity Law;

At the request of Director of Electricity Regulatory Authority of Vietnam (ERAV),

Minister of Industry and Trade promulgates Circular stipulating the electrical distribution system.

Chapter I

GENERAL PROVISIONS

Article 1. Governing scope

This Circular stipulates for:

1. Requirements in operation of the electrical distribution system.
2. Load demand forecast.
3. Investment and development plan for the electrical distribution system.
4. Technical conditions, requirements and procedures for connection to the electrical distribution system.
5. Operation of the electrical distribution system.

Article 2. Subjects of application

This Circular is applied for the following subjects:

1. Power distributor.
2. Power retailer.
3. National Load Dispatch Center (NLDC).
4. Electrical transmission entity.
5. Customer of the distribution grid.
6. Vietnam Electricity (EVN).
7. Other relevant organizations, individuals.

Article 3. Interpretation of terms

In this Circular, the below terms are interpreted as follows:

1. *Voltage level* is one among values of nominal voltage used in the electrical system, including:
 - a) Low voltage refers to the nominal voltage up to 01 kV;
 - b) Medium voltage refers to the normal voltage from more than 01 kV up to 35 kV;
 - c) High voltage refers to the normal voltage from more than 35 kV up to 220 kV;
 - d) Extra high voltage refers to the normal voltage of more than 220 kV.

2. *Authorized dispatch level* refers to the dispatch level which is authorized to command, dispatch the electrical system according to the dispatch hierarchy.

3. *Available capacity of the generation unit* refers to the actual maximal generation capacity of the generation unit which operates stably and continuously in a certain time period.
4. *Voltage change* refers to the change in voltage range in relation to the normal voltage in the time period of more than 01 minute.
5. *Connection point* refers to the point at which equipment, grid and power plant of customer of the electrical distribution system or other electrical distributor is connected to the electrical distribution system.
6. *National Load Dispatch Center (NLDC)* refers to the entity which commands, controls the process of electrical generation, transmission, distribution in the national electrical system, including the following dispatch levels:
- a) National dispatch level;
 - b) Regional dispatch level.
7. *Power generator* refers to the power entity which owns one or numerous power plants connected to the distribution grid, receives operating licence for power generation.
8. *Power distributor* refers to the power entity which receives operating licence for distribution and sale of power, including:
- a) Power corporation;
 - b) Power company of province, city directly under Power corporation (hereinafter referred to as provincial power company).
9. *Power retailer* refers to the power entity which receives operating licence for distribution and retail of power, bulk purchase of power from the power distributor for further retail of power for customers.
10. *Power transmission entity* refers to the power entity which receives operating licence for transmission of power, takes responsibility for managing, operating the national transmission grid.
11. *Earth fault factor* refers to the ratio between the voltage value of the phase free from the earth fault and the voltage value of the same phase before the earth fault event (applied for the single-phase earth fault or two-phase earth fault).
12. *Electrical distribution system* refers to the electrical system which consists of distribution grids and power plants connected to the distribution grids.
13. *Measurement system* refers to the system which consists of measurement equipment and integrated circuits which measure and identify the amount of electricity transmitted through a measurement point.
14. *SCADA (Supervisory Control and Data Acquisition) system* refers to the system which collects data for purpose of monitoring, control and operation of the electrical system.
15. *Power customer* refers to organization, individual which purchases power from the distribution grid for their use, not for reselling for other organizations, individuals.
16. *Customer of the distribution grid* refers to organization, individual which has electrical device, grid connected to the distribution grid for use of electrical distribution service, including:
- a) Power generator;
 - b) Power retailer;
 - c) Power customer.
17. *Major customer of the distribution grid* refers to the customer who uses the distribution grid, including:
- a) Power generator which owns power plant with capacity of 03 MW or more;
 - b) Power customer who consumes electricity of 1,000,000 kWh/month or more.
18. *Power user of the distribution grid with their own power station* refers to the customer who owns substation, grid connected to the distribution grid at the level of medium voltage and 110 kV.
19. *Dispatch command* refers to real-time command, control of the operational mode of the electrical system.
20. *Distribution grid* refers to the grid consisting of lines and power stations with voltage of up to 110 kV.

21. *Transmission grid* refers to the grid consisting of lines and power stations with the voltage of more than 110 kV.
22. *Typical day* refers to the day on which load experiences typical consumption mode according to Regulation on contents, methods, sequence and procedures of load research promulgated by Ministry of Industry and Trade. The typical day consists of the typical day for working day, weekend day, holiday (if any) for year, month and week.
23. *Grid disconnection* refers to the disconnection between power plants, power stations, leading to partial or entire power outage for regional or national electrical system.
24. *Load shedding* refers to the process of disconnecting loads from the grid in case of faults of the electrical system or in case of short-term local overload with the aim to ensure safe operation of the electrical system. This is conducted through the automatic load shedding system or dispatch command.
25. *Harmonics* refers to a sine-shaped voltage or current at a multiple of the fundamental frequency of the system.
26. *Remote Terminal Unit (RTU) / Gateway* refers to the device installed at power station or power plant for purpose of collecting and transmitting data to the control center of the SCADA system.
27. *Connection separation* refers to separation of electrical grid or appliances of the distribution grid customer from the distribution grid at the relevant connection point.
28. *Connection agreement* refers to the agreement document between the power distributor and the customer of the distribution grid who has their own power station for connection of their electrical appliances to the distribution grid.
29. *IEC Standard* refers to electrotechnical standards promulgated by International Electrotechnical Commission.
30. *Power station* refers to substation, switchgear station or compensation station.
31. *Control center* refers to the center which is equipped with IT, telecommunications infrastructure for remote monitoring, control of a group of power plants, group of power stations or switchgear devices of the grid.

Chapter II

REQUIREMENTS ON OPERATION OF THE ELECTRICAL DISTRIBUTION SYSTEM

Item 1. TECHNICAL REQUIREMENTS

Article 4. Frequency

Rated frequency of the national electrical system is 50 Hz. Under normal condition, frequency of the electrical system has a change range of ± 0.2 Hz in relation to the rated frequency. In case the electrical system is unstable, the frequency of the electrical system has a change range of ± 0.5 Hz in relation to the rated frequency.

Article 5. Voltage

1. Levels of normal voltage in the electrical distribution system

Normal voltage levels in the electrical distribution system include 110 kV, 35 kV, 22 kV, 15 kV, 10 kV, 06 kV and 0.4 kV.

2. Under the normal operational mode, the permissible working voltage at the connection point is allowed to have change in relation to the normal voltage as follows:

- At the connection point with the power customer, the change is ± 05 %;
 - At the connection point with the power plant, the change is + 10% and - 05 %;
 - In the case that the power plant and power customer is connected to the same bus bar of the distribution grid, the voltage at the connection point is decided by the power distributor which operates and manages the regional grid in alignment with technical requirements on operation of the distribution grid and voltage quality requirements for the power customer.
3. Under the mode of single fault or post-fault service restoration, the voltage change at the connection point with the power customer who suffers direct impact from the fault is allowed at + 05 % and - 10 % in relation to the normal voltage.

4. Under the mode of serious fault of the electrical transmission system or service restoration, the voltage change is allowed at $\pm 10\%$ in relation to the normal voltage.

5. In the case that the customer of the distribution grid has demand on higher quality of the voltage in relation to the regulation at clause 2 of this Article, the customer can negotiate with the power distributor or the power retailer.

Article 6. Phase balance

Under the normal operational mode, negative sequence component of the phase voltage is no more than 03% of the normal voltage for the voltage of 110 kV or 05% of the normal voltage for medium and low voltage.

Article 7. Harmonics

1. Total harmonic distortion (THD) is the ration between RMS value of all the harmonics and RMS value of the fundamental component (by %), following the formula:

$$THD = \sqrt{\frac{\sum_{i=2}^N V_i^2}{V_1^2}} \times 100\%$$

Of which:

a) THD: Total harmonic distortion;

b) V_i : RMS value of the harmonics at level i and N refers to the highest level of the harmonics in question.

c) V_1 : RMS value of the voltage at the fundamental level (frequency of 50 Hz).

2. THD at all connection points should not exceed the limit stated in the below Table 1:

Table 1. THD

| Voltage level | THD | Individual distortions |
|------------------------|-------|------------------------|
| 110 kV | 3.0 % | 1.5 % |
| Medium and low voltage | 6.5 % | 3.0 % |

3. The unusual voltage peak on the distribution grid in the short time period is allowed to exceed the TDH stipulated at clause 2 of this Article but should not cause damages to equipment of the distribution grid.

Article 8. Flicker

1. Under the normal operational mode, flicker at all connection points should not exceed the limit stipulated in the below Table 2:

Table 2: Flicker

| Voltage | Permissible flicker |
|----------------|--|
| 110 kV | $P_{st95\%} = 0.80$ $P_{lt95\%} = 0.60$ |
| Medium voltage | $P_{st95\%} = 1.00$ $P_{lt95\%} = 0.80$ |
| Low voltage | $P_{st95\%} = 1.00$ $P_{lt95\%} = 0.80$ |

Of which:

a) Short-term flicker (P_{st}) refers to the value measured during 10 minutes with standardized measurement equipment according to IEC868. $P_{st95\%}$ refers to the value threshold of P_{st} in the way that during 95% of the measurement time (at least one week) and at 95% of measurement positions, P_{st} is not excessive to this value.

b) Long-term flicker (P_{lt}) is calculated from 12 continuous measurement results of P_{st} (during two hours) following the formula:

$$P_{lt} = \sqrt[3]{\frac{1}{12} * \sum_{j=1}^{12} P_{stj}^3}$$

$P_{lt95\%}$ refers to the value threshold of P_{lt} in the way that during 95% of the measurement time (at least one week) and at 95% of the measurement positions, P_{lt} is not excessive to this value.

2. At the connection points of medium and low voltage, short-term flicker (P_{st}) should not exceed 0.9 and the long-term flicker (P_{lt}) should not exceed 0.7 according to IEC1000-3-7 standard.

Article 9. Short-circuit current and fault correction time

1. The maximal permissible short-circuit current and the maximal fault correction time of the main protector is stipulated in the below Table 3:

Table 3. The maximal permissible short-circuit current and the maximal fault correction time

| Voltage | Maximal short-circuit current (kA) | Maximal fault correction time of the main protector (ms) | The minimal suffering time of equipment (s) | |
|----------------|------------------------------------|--|---|-------------------------|
| | | | Applied to 31/12/2017 | Applied from 01/01/2018 |
| Medium voltage | 25 | 500 | 03 | 01 |
| 110 kV | 31.5 | 150 | 03 | 01 |

2. For the medium-voltage grid which supplies power for urban area with dense population and fragmented line which makes difficult to protect switchgear equipment on the grid, it is allowed that the fault correction time of the main protector at some switchgear positions is more than the time stipulated at clause 1 of this Article but should be less than 01 second (s) and ensure safety for electrical equipment and grid.

3. The power distributor should notice the maximal permissible short-circuit current value at the connection point so that the major customer of the distribution grid coordinates in investment, installation of equipment.

Article 10. Earthing mode

1. Neutral earthing mode in the electrical distribution system is stipulated in the Table 4 as follows:

Table 4. Earthing mode

| Voltage | Neutral point |
|--------------|--|
| 110 kV | Direct earthing. |
| 35 kV | Isolated neutral or impedance-based earthing |
| 15 kV, 22 kV | Direct earthing (three phases three lines) or repeated earthing (three phase four lines) |
| 06 kV, 10 kV | Isolated neutral. |
| Under 1000 V | Direct earthing (neutral earthing, repeated earthing, combined neutral earthing) |

2. In the case that the neutral earthing mode in the electrical distribution system is conducted differently from the regulation at clause 1 of this Article, it should obtain written agreement of the NLDC.

Article 11. Earth fault factor

Earth fault factor of the electrical distribution grid should not exceed 1.4 for the grid with neutral, direct earthing and 1.7 for the grid with isolated neutral earthing or the grid with neutral, impedance-based earthing.

Item 2. RELIABILITY OF POWER SUPPLY AND POWER LOSS

Article 12. Indices of reliability of power supply of the distribution grid

1. Indices of reliability of power supply of the distribution grid include:

- System Average Interruption Duration Index - SAIDI
- System Average Interruption Frequency Index - SAIFI;

c) Momentary Average Interruption Frequency Index - MAIFI.

2. Indices of reliability of the distribution grid are calculated as follows:

a) SAIDI is calculated by taking the sum of interruption duration in more than 05 minutes of the power customer and the power retailer which purchases power of the power distributor divided by total number of power customers and power retailers which purchase power of the power distributor following the formula:

$$SAIDI_t = \frac{\sum_{i=1}^n T_i \times K_i}{K_t}$$

$$SAIDI_y = \sum_{t=1}^{12} SAIDI_t$$

Of which:

- T_i : Interruption duration of the time i in the month t (only consider interruption times with duration of more than 05 minutes);

- K_i : Total number of power customers and power retailers which purchase power from the power distributor, suffering impacts of the interruption time i in the month t ;

- n : Total number of interruption times in more than 05 minutes in the month t under the power supply scope of the power distributor;

- K_t : Total number of power customers and power retailers which purchase power from the power distributor in the month t ;

- $SAIDI_t$ (minute): Index of average interruption duration of the distribution grid in the month t ;

- $SAIDI_y$ (minute): Index of average interruption duration of the distribution grid in the year y .

b) SAIFI is calculated by taking the total number of power customers and power retailers which purchase power from the power distributor experiencing more than 05 minutes of power outage divided by total number of power customers and power retailers which purchase power from the power distributor following the formula:

$$SAIFI_t = \frac{\sum_{i=1}^n K_i}{K_t}$$

$$SAIFI_y = \sum_{t=1}^{12} SAIFI_t$$

Of which:

- n : Total number of interruption times in more than 05 minutes in the month t under the power supply scope of the power distributor;

- K_i : Total number of power customers and power retailers which purchase power from the power distributor, suffering impacts of the interruption time i in the month t ;

- K_t : Total number of power customers and power retailers which purchase power from the power distributor in the month t ;

- $SAIFI_t$: Index of average interruption frequency of the distribution grid in the month t ;

- $SAIFI_y$: Index of average interruption frequency of the distribution grid in the year y .

c) MAIFI is calculated by taking the total number of power customers and power retailers which purchase power from the power distributor experiencing momentary interruption (interruption duration of 05 minutes or less) divided by total number of power customers and power retailers which purchase power from the power distributor following the formula:

$$MAIFI_t = \frac{\sum_{i=1}^n K_i}{K_t}$$

$$MAIFI_y = \sum_{t=1}^{12} MAIFI_t$$

Of which:

- n: Total number of momentary interruption times in the month t under the power supply scope of the power distributor;
- K_i: Total number of power customers and power retailers which purchase power from the power distributor suffering impacts of the momentary interruption time i in the month t;
- K_t: Total number of power customers and power retailers which purchase power from the power distributor in the month t;
- MAIFI_t: Index of momentary average interruption frequency of the distribution grid in the month t;
- MAIFI_y: Index of momentary average interruption frequency of the distribution grid in the year y.

Article 13. Indices of reliability of power supply

1. Reliability of power supply is recorded and assessed through two sets of index namely "Reliability of overall power supply" and "Reliability of power supply of the distribution grid". Each of such sets of index consists of 03 indices of SAIDI, SAIFI and MAIFI which are identified according to regulation at Article 12 of this Circular.

2. The set of index "Reliability of overall power supply" is used to assess quality of power supply for power customers of the power distributor and calculated according to regulation at Article 12 of this Circular excepting for cases of interruption due to the following causes:

- a) The customer of the distribution grid requests for power outage;
- b) Equipment of the customer of the distributor grid fails to meet technical requirements on electrical safety for service restoration;
- c) Equipment of the customer of the distribution grid has faults;
- d) Due to force majeure events which are out of control of the power distributor or the customer of the distribution grid violates law regulations with regards to conditions, sequence of power supply stoppage, decrease promulgated by Ministry of Industry and Trade.

3. The set of index "Reliability of power supply of the distribution grid" is one among norms for assessing performance of the power distributor, calculated according to regulation at Article 12 of this Circular excepting for cases of interruption due to the following causes:

- a) Cases stated in clause 2 of this Article;
- b) Power interruption originated from the transmission grid;
- c) Load shedding according to dispatch command of the authorized dispatch level;
- d) Power cut if there is potential of serious unsafety for human and equipment during operation of the electrical system.

Article 14. Power loss of the distribution grid

Power loss of the distribution grid includes:

1. Technical power loss refers to the power loss caused by the physical nature of the electrical conductor wire, electrical equipment on the distribution grid.
2. Non-technical power loss refers to the power loss caused by impacts of factors of power business management rather than physical nature of the electrical conductor wire, electrical equipment on the distribution grid.

Article 15. Sequence for approving norms of reliability of annual power supply, power loss of the distribution grid

1. Before every November 15th, EVN is responsible for developing plan on reliability of power supply and power loss for the following year of power distributors to submit to ERAV for consideration, approval.

2. Before every December 15th, ERAV approves norms of reliability of power supply and power loss of individual power distributors, which form a basis for calculating costs of power distribution for power distributors.

Item 3. REQUIREMENTS ON CUSTOMER SERVICE QUALITY

Article 16. Norms of customer service quality

1. Duration for considering, signing connection agreements and conducting new connections or duration for adjusting connections for customers.

2. Duration for notifying stoppage, decrease of power supply.

3. Quality of written response to requests, complaints of customers is assessed for the following criteria:

a) Transparency of written response to requests, complaints of customers is assessed for the following factors:

- Response to complaint is accepted or not;

- Clear explanation on corrective solution if the complaint is accepted;

- In case rejection of complaint, the power distributor or power retailer should clearly state the reasons and instruct the customer case by case;

- Provide other necessary information for the customer to review the corrective solution.

b) Proportion of response to complaints of customer within the duration stipulated at point c of clause 2 of Article 17 of this Circular.

4. Quality of receiving customer's complaints via telephone is assessed for proportion of calls from customers to be received within the duration stipulated at point d of clause 2 of Article 17 of this Circular.

Article 17. Requirements on customer service quality

1. The power distributor, power retailer should organize, maintain and update the information system to record all requests, complaints of customers in written form or via telephone.

2. Requirements on customer service quality are as follows:

a) Duration for considering and signing the connection agreement from receiving the full and valid application file complies with regulation at Article 45 of this Circular;

b) Duration for notifying stoppage, decrease of power supply complies with regulation on conditions, sequence of stoppage, decrease of power supply promulgated by Ministry of Industry and Trade;

c) Quality of written response to customer's requests, complaints: more than 95% of written responses to complaints have clear contents and comply with law regulations within 05 working days;

d) Quality of receiving customer's complaints via telephone: more than 80% of calls from customers are received within 30 seconds.

Chapter III

LOAD DEMAND FORECAST OF THE ELECTRICAL DISTRIBUTION SYSTEM

Article 18. General provisions on load demand forecast of the electrical distribution system

1. Load demand forecast of the electrical distribution system refers to the forecast for the entire load supplied from the electrical distribution system excepting for loads which have separate source of power supply. Load demand forecast of the electrical distribution system forms a basis for developing the annual investment plan of the distribution grid, operational plan of the electrical distribution system, operational plan of the national electrical system and operational plan of electricity market.

2. Load demand forecast of the electrical distribution system includes yearly, monthly and weekly load demand forecasts.

3. Responsibility for load demand forecast of the electrical distribution system

a) Power retailers, major power customers of the distribution grid are responsible for providing the power distributor with their own data on load demand forecast, including summarized load demand forecast for the entire entity and load demand forecast for individual connection points;

b) Provincial power companies are responsible for load demand forecast of the electrical distribution system within their relevant management scope including load demand forecast at points of

connection to the transmission grid;

c) Power corporations are responsible for load demand forecast of the electrical distribution system within their relevant management scope including load demand forecast at all points of connection to the transmission grid on the basis of results of load demand forecast of subordinate national power companies and major customers of the electrical distribution system.

4. Power corporations are responsible for conducting load research for purpose of load demand forecast and calculating power retail price in accordance with the Regulation on contents, methods, sequence and procedures of load research promulgated by Ministry of Industry and Trade.

5. ERAV is responsible for organizing development and promulgation of the Procedure of load demand forecast of the national electrical system.

Article 19. Yearly load demand forecast

1. Information, data used for the yearly load demand forecast includes:

- a) Data on load demand forecast in the approved power development plans of provinces, cities directly under the Center;
- b) Power price, population growth rate, economic development trend of the locality in which the power distributor is located and other relevant socioeconomic factors;
- c) Load demand developments in the last five years;
- d) Forecast of power demand growth of existing loads in coming years;
- e) Power demand of new loads, projects, industrial parks, clusters which are already planned and scheduled for construction and operation;
- f) Programmes of energy saving, load demand management and solutions for reduced power loss;
- g) Capacity and amount of power traded at individual points of connection to the grid of other power distributors;
- h) Capacity and amount of imported, exported power (if any);
- i) Other social factors, events having impacts on load demand.

2. Results of yearly load demand forecast

a) For the first year

- Forecast data on monthly power, max capacity of the power distributor and at individual points of connection to the transmission grid;
- Load curve of typical day on monthly basis of the entire power distribution and at individual points of connection to the transmission grid.

b) For four next years

- Forecast data on yearly power, max capacity of the entire power distributor and at individual points of connection to the transmission grid;
- Load curve of typical day on yearly basis of the entire power distribution and at individual points of connection to the transmission grid.

3. Responsibility for providing information for purpose of load demand forecast

a) Power customer with average capacity of 1,000,000 kWh/month and more is responsible for providing the following information:

- Current load curve of typical day;
- Expected max capacity and power output registered for monthly use in the coming year; expected max capacity and power output registered for annual use in the next four years;
- Additional parameters on grid, circuit breaker and the protection layout for electrical equipment which is directly connected or has impacts on the distribution grid.

b) Major customers of the electrical distribution system who own generation units are responsible for providing the following information:

- Forecast of monthly output, capacity generated to the distribution grid;
- Technical specifications of new generation units and schedule of putting into operation in next five years.

c) Power retailers are responsible for providing the following information:

- Total number of customers, power by years for the last five years;
- Forecast of capacity and power demand by years for the next five years;
- Load curve of typical day on monthly basis at connection point for the following year;
- Additional parameters on grid, circuit breaker and the protection layout for electrical equipment which is directly connected or has impacts on the distribution grid.

d) The power distributor having connection to grid of other power distributor should provide information on max capacity and expected output delivered and received at connection point in individual months of the following year; max capacity and expected output delivered and received at connection point in individual years of the next four years.

4. Sequence of implementation

a) Before every July 1st, subjects stipulated at clause 3 of this Article should provide information for the power distributor to develop load demand forecast for the coming year and next four years;

b) Before every August 1st, power corporations should complete results of annual load demand forecast in accordance with regulation at clause 2 of this Article to provide for the NLDC.

Article 20. Monthly load demand forecast

1. Information, data used for monthly load demand forecast:

- a) Results of yearly load demand forecast;
- b) Statistical data on consumed power, day peak capacity and night peak capacity in the relevant month of the previous year;
- c) Other required information.

2. Results of monthly load demand forecast

- a) Max capacity, consumed power on weekly basis of the entire power distributor and at individual points of connection to the transmission grid;
- b) Max capacity, power delivered and received on weekly basis at points of power trading with foreign countries through the grid of the power distributor;
- c) Max capacity, power delivered and received on weekly basis of major customers of distribution grid;
- d) Typical load curve of working day, off day, holiday of the entire power distributor.

3. Major customers of the distribution grid are responsible for providing the power distributor with forecast of consumed power, max capacity in the coming month at connection points for the following cases:

- a) Difference of more than 02 MW between the actual consumed power and the data of relevant month in the yearly load demand forecast;
- b) Difference of more than 01 MW between actual generated power of the power distributor and expected generated power of the relevant month in the yearly load demand forecast.

4. Sequence of implementation

a) Before every 15th day, major customers of the distribution grid should provide the power distributor with information stipulated at clause 3 of this Article for purpose of load demand forecast of the coming month;

b) Before every 20th day, power corporations should complete load demand forecast of the coming month and notify the NLDC accordingly.

Article 21. Weekly load demand forecast

1. Results of weekly load demand forecast include the following parameters:

- a) Max capacity, consumed power on daily basis of the entire power distributor and at individual points of connection to the transmission grid;
- b) Max capacity, power delivered and received on daily basis at points of power trading with foreign countries through the grid of the power distributor;
- c) Load demand of week days of the entire power distributor.

2. Before 10AM of every Tuesday, power corporations are responsible for completing and providing the NLDC with load demand forecast of two coming weeks to develop operational plans for such two coming weeks.

Chapter IV

DEVELOPMENT AND INVESTMENT PLAN OF THE DISTRIBUTION GRID

Article 22. General provisions on the development and investment plan of the distribution grid

1. On annual basis, power corporations are responsible for preparing the development and investment plan of the distribution grid under their management scope for the coming year with a vision to next two years.

2. The annual development and investment plan of the distribution grid is prepared on the following bases:

a) Results of yearly load demand forecast;

b) Alignment with the approved power development plans of provinces, cities directly under the Center and signed connection agreements.

Article 23. Requirements for the annual development and investment plan of the distribution grid

1. Ensure power supply for load demand of existing customers and expected customers; connect new power sources to the distribution grid.

2. Satisfy operational requirements of the electrical distribution system as stipulated at Chapter II of this Circular.

3. Propose the detailed list and operational schedule of distribution grid works which are planned for investment in the coming year and total investment amount by work items for the next two years.

4. Propose the list of transmission grid works which require investment, upgrading to satisfy requirements on investment schedule of works under the development and investment plan of the distribution grid.

Article 24. Contents of the development and investment plan of the distribution grid

The development and investment plan of the distribution grid includes the following main contents:

1. Evaluation of current status of the distribution grid.

2. Load demand forecast of the coming year with a vision to the next four years as stipulated at Article 19 of this Circular.

3. Evaluation of the investment situation of distribution grid works already approved in the development and investment plan of the distribution grid in the following year.

4. The list of new connection points with major customers of the distribution grid, expected connection points.

5. Calculations, analyses, selection of the optimal grid connection layout, including:

a) Calculation of the operational mode of the distribution grid;

b) Calculation of short circuit to the medium voltage bus bar of stations 110 kV;

c) Calculation of voltage loss on the distribution grid;

d) Calculation of power loss on the distribution grid;

e) Calculation of reactive power compensation;

f) Implementation plan of reactive power compensation on the distribution grid.

6. The list of distribution lines and substations which are newly constructed or require upgrading for the coming year and total amount of new construction and upgrading of the distribution grid by voltage levels and work items for the next two years according to regulation at the attached Appendix 1 of this Circular.

7. Summarization of capital for new construction and upgrading of the distribution grid by voltage levels.

Article 25. Sequence of approving the development and investment plan of the distribution grid

1. Before every September 15th, power corporations are responsible for preparing the annual

development and investment plan of the distribution grid including contents regulated at Article 24 of this Circular and reporting to the EVN for adoption.

2. Before every October 1st, power corporation is responsible for submitting to the ERAV with the annual development and investment plan of the distribution grid which is already adopted by the EVN.

3. Before every October 15th, the ERAV is responsible for organizing appraisal and approval of the development and investment plan of the distribution grid of power corporation with the aim to ensure safe operation of the electrical distribution system, supply power for socioeconomic development and develop power selling price.

Chapter V

CONNECTION TO THE DISTRIBUTION GRID

Item 1. GENERAL PRINCIPLES

Article 26. Connection point

1. Connection point in the electrical distribution system includes:

- a) Connection point of equipment, grid, and power plant of the customer of the distribution grid to the distribution grid of the power distributor;
- b) Connection point of equipment, grid between two power distributors;
- c) Connection point of equipment, grid of the power customer to the distribution grid of the power retailer.

2. Connection point should be described in detail with relevant drawings, layouts, explanations in the connection agreement or power purchase agreement.

Article 27. Delimitation of assets and operational management

1. Delimitation boundary of assets between the power distributor or power retailer with the customer of the distribution grid is the connection point.
2. Assets of each party at the delimitation boundary should be listed in detail and attached to relevant drawings, layouts in the connection agreement or power purchase agreement.
3. Assets under ownership of one party should be subject to investment, construction and management, operation by such party according to standards and regulations of the law unless otherwise agreed.

Article 28. Compliance with the power development plan

1. The connection plan of new power stations, grids and plants to the distribution grid should be consistent with the power development plan which is approved by competent state agency.
2. In the case that the connection plan at the request of the customer is not consistent with the approved power development plan, the power distributor or power retailer is responsible for notifying the relevant customer for their knowledge and correction, supplementation according to the Regulation on content, sequence, procedure of appraising, approving and adjusting the power development plan promulgated by Ministry of Industry and Trade.

Article 29. Responsibility for compliance with requirements on connection and coordination in conducting connection

1. Power distributor and power customer are responsible for complying with requirements on connection of electrical equipment under their ownership in accordance with regulations at this Circular.
2. Power distributor is responsible for coordination in implementing the connection plan when the customer submits the valid application file. Connection and adjustment of connection should satisfy technical requirements for connected equipment as stipulated at Item 2 of this Chapter.
3. In the case that equipment at the connection point of the customer of the distribution grid fails to satisfy technical requirements and operational requirements of the distribution grid, the power distributor is responsible for notification and coordination with the customer in delivering corrective actions. The customer of the distribution grid should bear all costs of implementing corrective actions.
4. The power distributor is responsible for promulgating the internal procedure for task implementation, coordinating with the customer to shorten the implementation duration of the connection agreement, conduct connection for the customer.

Item 2. TECHNICAL REQUIREMENTS FOR CONNECTED EQUIPMENT

Article 30. Requirements for connected electrical equipment

1. The main connection layout should include all medium- and high-voltage equipment at connection positions, show the linkage, connection between the grid of the customer of the distribution grid and the distribution grid. Electrical equipment should be described by standard symbols, signs and named, numbered according to the Operating Procedure in the national electrical system promulgated by Ministry of Industry and Trade.
2. Circuit breaker which has direct relation to the connection point and systems of protection, control, measurement should be able to close / interrupt the maximal short-circuit current at the connection point in response to the grid development map for the next ten years.
3. Circuit breaker at the connection point between the power plant and the distribution grid should be equipped with a synchronous testing system.

Article 31. Requirements on phase balance

Under the normal working mode, the customer of the distribution grid should ensure that their equipment causes no negative sequence component of voltage at the connection point of more than 3% of the nominal voltage for the voltage 110 kV or 5% of the nominal voltage for the voltage under 110 kV.

Article 32. Requirements on current harmonics

1. The maximal permissible value of Total Harmonic Current Distortion (THDC) is stipulated as follows:
 - a) For the connection to medium and low-voltage level with capacity of less than 50 kW: current value of high-order harmonics is no more than 20% of the load current.
 - b) For the connection to high-voltage level or connections with capacity of 50 kW or more: current value of high-order harmonics is no more than 12% of the load current.
2. THDC measured by the power distributor at the connection point of the customer follows the standard IEC1000-4-7, in at least 24 hours with the interval of 10 minutes. No more than six months from the day when the customer's equipment is found as fail to meet the value stated at clause 1 of this Article, the customer should apply corrective actions to meet THDC value within the permissible limit.

Article 33. Requirements on flicker

The maximal permissible flicker at the connection point with the distribution grid should follow regulation at Article 8 of this Circular.

Article 34. Requirements on earthing mode

1. The customer of the distribution grid should apply neutral earthing modes for their grids according to regulation at Article 10 of this Circular, excepting for the cases otherwise agreed, and approved by the authorized dispatch level.
2. In the case that the customer is supplied power from multiple sources, the customer is responsible for installing suitable protective equipment with the aim to prevent and limit the current from going through the neutral point.

Article 35. Requirements on capacity factor

The customer who uses power for purpose of production, business, service with or without separate substations, with maximal consumption capacity of 40 kW or more is responsible for maintaining the capacity factor ($\cos\phi$) no less than 0.9 at the position of installing the power counter according to the power purchase agreement.

Article 36. Requirements on the protective system

1. The protective relay system of power stations, lines 110 kV and generation units of the power plant connected to the grid 110 kV should follow the regulation on technical requirements for the automated protective relay system in power plant and substation promulgated by the ERAV.
2. The power distributor and the customer of the distribution grid who has separate power station is responsible for designing, installing, calibrating, testing and operating the protective system on the grid within relevant management scope to satisfy standards and requirements on operating time, sensitiveness and selectiveness when correcting faults, to ensure safe and reliable operation of the electrical distribution system.
3. The power distributor and the customer of the distribution grid who has separate power station

should agree on requirements for the protective system in the relevant connection agreement. Coordination in installing protective relay equipment at the connection point should be agreed between the power distributor, power customer and authorized dispatch level in the process of connection negotiation.

4. The power distributor should provide the customer of the distribution grid who has separate power station with parameters of the protective relay system on the distribution grid which has direct relation to the protective system of the customer at the connection point in the process of connection negotiation. The authorized dispatch level is responsible for calculating, examining and promulgating protective relay calibration sheet or adopting calibrated values on the distribution grid under their authority following the national load dispatch procedure promulgated by Ministry of Industry and Trade.

5. The customer of the distribution grid who has separate power station should not install equipment for limiting short-circuit current at the bus bar connected to the distribution grid unless agreed with the power distributor and authorized dispatch level.

6. Besides requirements stated at clauses 1, 2, 3, 4 and 5 of this Article, the protective system of the power plant and the customer of the distribution grid who has separate power station connected to the voltage 110 kV should satisfy the following requirements:

a) The lines 110 kV which connect the power plant to the national electrical system should have two communication channels for purpose of transmitting protective relay signals between two ends of the line with interval of no more than 20 ms;

b) The customer of the distribution grid who has separate power station connected to the voltage 110 kV is responsible for investing, installing low-frequency relay for purpose of automatic load shedding according to calculations of the authorized dispatch level.

Article 37. Requirements on the information system

1. The power plant connected to the distribution grid with capacity of 10 MW or more or substation 110 kV should be equipped with the information system which is then connected to the information system of the authorized dispatch level for purpose of communication and data transmission during operation of the electrical system. Necessary communication means for purpose of load dispatch includes radio communication, telephone and facsimile which should well operates.

2. Requirements on other information system which is not covered in clause 1 of this Article are agreed upon by relevant parties and clearly stated in the connection agreement.

3. The power distributor and the customer of the distribution grid is responsible for investing, managing, operating the information system within their management scope to ensure continued, trusted communication, information transmitted to the authorized dispatch level for purpose of operating the electrical distribution system.

4. The authorized dispatch level and the power distributor is responsible for coordinating in notifying the customer of the distribution grid with requirements on information, data and coordinating with the customer in testing, checking and connecting the information, data system of the customer to the current information, data system under relevant management scope for purpose of operating the electrical distribution system.

Article 38. Requirements on connection to the SCADA system

1. The power plant connected to the distribution grid with capacity of 10 MW or more (regardless of connected voltage level) and substation 110 kV not connected to the control center should be equipped with Gateway or RTU which has two connection ports which are direct, simultaneous and physically independent of the SCADA system of the authorized dispatch level. In the case that the power plant, substation has multiple authorized dispatch levels, such levels are responsible for providing, sharing information for purpose of coordination in operating the electrical system.

2. The power plant connected to the distribution grid with capacity of 10 MW or more and connected to the control center should be equipped with Gateway or RTU which has one direct connection to the SCADA system of the authorized dispatch level and two direct connections to the control system at the control center. Substations 110 kV which are controlled and operated remotely from the control center should be equipped with Gateway or RTU which has two direct connections to the control system at the control center. SCADA connected information, data of power plant, substation should ensure real-time connection and transmission to the SCADA system of the authorized dispatch level for purpose of operation, dispatch of the electrical system.

3. Requirements on connection to the SCADA system of the authorized dispatch level which are not covered in clauses 1 and 2 of this Article should be agreed upon by relevant parties and clearly stated

in the connection agreement. Accordingly, the power distributor is responsible for coordinating with the authorized dispatch level to agree upon requirements for the SCADA system connection in the connection agreement.

4. RTU/Gateway equipment of the power distributor and the customer of the distribution grid has compatible specifications and ensures good connection to the SCADA system of the authorized dispatch level.

5. Owner of power plant, power station is responsible for investing, installing, managing, operating RTU/Gateway equipment within its management scope, data transmission line, or renting such items from relevant service provider to ensure continued, trusted data transmission, connection to the SCADA system of the authorized dispatch level.

6. The authorized dispatch level is responsible for integrating data according to the data list agreed upon with the power distributor, power customer into its SCADA system. The power distributor, power customer is responsible for configuring, establishing the database on their system to ensure compatibility with the SCADA system of the authorized dispatch level and coordinating with the authorized dispatch level in the implementation process.

7. In the case that the SCADA system of the authorized dispatch level has change in technologies and gets approval of the competent agency after signing the connection agreement which results in change or upgrading of the control system, RTU/Gateway equipment of the power distributor and power customer, then the authorized dispatch level, power distributor, power customer are responsible for coordinating in implementing necessary adjustments, corrections so that equipment of such parties is compatible with changes of the SCADA system. The power distributor and power customer are responsible for investing, upgrading the control system, RTU/Gateway equipment to ensure compatibility with the SCADA system of the authorized dispatch level.

8. The data list requirement, technical requirement of RTU/Gateway equipment is specified at the Regulation on technical requirement and operational management of the SCADA system promulgated by the ERAV.

9. The ERAV is responsible for organizing to develop and promulgate the regulation on technical requirement and operational management of the SCADA system.

Article 39. Requirements for generation units of hydro power plant and thermal power plant connected to the distribution grid

1. Requirements for generation units of power plant with total installed capacity of more than 30 MW connected to the distribution grid follow technical requirements at the Regulation on the electrical transmission system promulgated by Ministry of Industry and Trade.

2. Requirements for generation units of hydro and thermal power plants (including biomass, biofuel, solid waste-based power) with total installed capacity of 30 MW or less.

a) Be able to continuously generate normal active power in the frequency range of 49 Hz to 51 Hz. In the frequency range of 47.5 Hz to 49 Hz, power decrease should not exceed the value which is calculated by the required rate of frequency decrease of the electrical system, in alignment with relation characteristic between active power and frequency of the generation unit. The minimal time for maintaining power generation corresponding to frequency range of the system is summarized in Table 5 as follows:

Table 5. Minimal time for maintaining power generation corresponding to frequency ranges of the electrical system

| Frequency range of the electrical system | Minimal time for maintaining power generation |
|---|--|
| 47.5 HZ to 48.0 Hz | 10 minutes |
| 48 Hz to 49 Hz | 30 minutes |
| 49 Hz to 51 Hz | Continuous generation |
| 51Hz to 51.5 Hz | 30 minutes |
| 51.5 Hz to 52 Hz | 01 minute |

b) Generation unit connected to the distribution grid should be able to continuously generate and receive reactive power at the factor of 0.9 (corresponding to the generating mode of reactive power) to 0.95 (corresponding to receiving mode of reactive power) at the normal capacity and keep the voltage difference to fall within the range specified at Article 5 of this Circular.

c) Generation unit connected to distribution grid should be able to suffer voltage asymmetry in the

electrical system according to regulation at Article 6 of this Circular and suffer zero and negative sequence current components in the time period no less than the duration for eliminating phase-phase and phase-earth short circuit near the generator through backup protector with relation to the connection point.

d) In the case that the connection point is equipped with the automatic switchgear, the protective relay system of the power plant should ensure good coordination with the automatic switchgear of the power distributor and be designed in a way that the generation unit can be separated from the distribution grid right after the first-time open of circuit breaker, automatic switchgear of the distribution grid and maintain separation of generation unit from the distribution grid until the grid is fully restored.

e) Power plants with total installed capacity of 30 MW or less connected to the grid 110 kV should be equipped with governor and able to work with values of static coefficient of adjustable characteristic in the range of 03% to 05% and the dead band of the governor within the limit of ± 0.05 Hz.

Article 40. Requirements for wind power plant, solar power plant connected to the distribution grid from the medium voltage level or higher

1. Wind power plant, solar power plant should be able to generate active power in the frequency range from 49 Hz to 51 Hz under the following modes:

a) Free generation mode: generate as high capacity as possible according to change of primary energy sources (wind or sun);

b) Generation capacity control mode:

Wind power plant, solar power plant should be able to adjust generation of reactive power according to command of the authorized dispatch level in alignment with change of the primary energy source in no more than 30 seconds with an error of ± 0.1 % of the nominal capacity, specifically:

- Generate capacity according to dispatch command in the case that primary energy source is equal or higher than the forecasted value.

- Generate as high capacity as possible in the case that the primary energy source is lower than the forecasted value.

2. Wind power plant, solar power plant at all times of grid connection should be able to maintain power generation in the minimal duration corresponding to frequency ranges stipulated at Table 5 of point a of clause 2 of Article 39 of this Circular.

3. When frequency of the electrical system is more than 51 Hz, wind power plant, solar power plant should decrease active power at a speed no less than 01% of the nominal capacity per second. Power decrease corresponding to frequency is calculated by the following formula:

$$\Delta P = 20 \times P_m \times \left(\frac{51.0 - f_n}{50} \right)$$

Of which:

a) ΔP : Decrease of active power (MW);

b) P_m : Active power at the time before conducting power decrease (MW);

c) f_n : Frequency of the electrical system before conducting power decrease (Hz).

4. Wind power plant and solar power plant connected to the distribution grid should be able to adjust active power and voltage as follows:

a) In the case that the power plant generates an active power more than or equal to 20% of nominal active power and the voltage falls under the normal operational range, the power plant should be able to continuously adjust reactive power in the power factor range of 0.95 (corresponding to the mode of generating reactive power) to 0.95 (corresponding to the mode of receiving reactive power) at the connection point corresponding to the nominal capacity.

b) In the case that the power plant generates active power of less than 20% of the nominal capacity, the power plant can decrease capability of receiving or generating reactive power in alignment with characteristic of the generation unit.

c) In the case that voltage at the connection point falls within the range of ± 10 % of the nominal voltage, the power plant should be able to adjust the voltage at the connection point with an error of no more than ± 0.5 % of the nominal voltage in the permissible working band of generator and complete in no more than 02 minutes.

d) In the case that the voltage at the connection point falls out of the range of ± 10 % of the nominal

voltage, the power plant should be able to generate or receive reactive power (corresponding to the nominal reactive power) which is at least equal to two times of the voltage change rate at the connection point.

5. Wind power plant, solar power plant at all times of grid connection should be able to maintain power generation corresponding to the voltage band at the connection point in the following durations:

a) The voltage of less than 0.3 pu (pu refers to the relative unit system representing the ratio of actual voltage value and nominal voltage value), the minimal maintenance time is 0.15 seconds.

b) The voltage from 0.3 pu to less than 0.9 pu, the minimal maintenance time is calculated as follows:

$$T_{\min} = 4 \times U - 0,6$$

Of which:

- T_{\min} (second): minimal maintenance time of power generation;

- U (pu): actual voltage at the connection point by the unit of pu.

c) The voltage of 0.9 pu to less than 1.1 pu, wind power plant and solar power plant should continuously maintain power generation;

d) The voltage of 1.1 pu to less than 1.15 pu, wind power plant and solar power plant should maintenance power generation within 03 seconds;

e) The voltage of 1.15 pu to less than 1.2 pu, wind power plant and solar power plant should maintain power generation within 0.5 second.

6. Wind power plant, solar power plant should cause no negative sequence component of the phase voltage at the connection point of more than 01% of the nominal voltage. Wind power plant, solar power plant should be able to suffer negative sequence component of the phase voltage at the connection point up to 03% of the nominal voltage for the voltage level 110 kV or up to 05% of the nominal voltage for the voltage level less than 110 kV.

7. Total harmonic distortion caused by wind power plant, solar power plant at the connection point should not be more than 03%.

8. Flicker caused by wind power plant, solar power plant at the connection point should not be more than the value specified at Article 8 of this Circular.

Article 41. Requirements for the solar power system connected to the distribution grid at low-voltage level

The solar power system connected to the low-voltage grid should satisfy the following requirements:

1. Connection capacity

a) Total installed capacity of the solar power system connected to the low-voltage level of the low-voltage substation should not be more than 30% of installed capacity of the substation.

b) The solar power system with capacity of less than 03 kVA is connected to the single-phase or three-phase low-voltage grid.

c) The solar power system with capacity of 03 kVA to 100 kVA (but no more than 30% of installed capacity of the connected low-voltage substation) is connected to three-phase low-voltage grid.

2. The solar power system should be able to continuously maintain power generation in the frequency band of 49 Hz to 51 Hz. When frequency of the electrical system falls out of the band from 49 Hz to 51 Hz, then the solar power system should be able to maintain power generation in the minimal time of 0.2 second.

3. The solar power system should be able to continuously maintain power generation when the voltage at the connection point falls within the band of 85% to 110% of the nominal voltage. When the voltage at the connection point falls out of the band of 85% to 110% of the nominal voltage, the solar power system should be able to maintain power generation in the minimal time of 02 seconds.

4. The solar power system should cause no penetration of direct current into the distribution grid of more than 0.5% of the nominal current at the connection point.

5. The solar power system should be equipped with protective equipment with the aim to eliminate faults and ensure safe operation of the solar power system. For the solar power system with capacity of 10 kVA or more, the customer who has request for connection should agree with the power distributor upon requirements for the protective system.

6. The solar power system connected to the low-voltage grid should comply with regulations on

voltage, phase balance, harmonics, flicker and earthing mode as regulated at Articles 5, 6, 7, 8 and 10 of this Circular.

Article 42. Technical requirements of the control system

1. General technical requirements

- a) The monitoring, control system and the information and communications system at the control center should be equipped with equipment to ensure safe and reliable operation of power plants, power stations implemented by the control center;
- b) The monitoring, control system of the control center should have compatible technical characteristics and ensure stable, trusted and continued connection, data transmission from power plants, power stations to the SCADA system of the authorized dispatch level;
- c) The control system should have backup power source to ensure normal operation in case of power interruption from the national grid.

2. Connection requirements of the control system

a) Requirement for connection of the information system

- There are two independent data transmission lines connected to the information system of the authorized dispatch level. In case there are multiple authorized dispatch levels, such dispatch levels should be responsible for agreeing upon the method of information sharing.
- There are two data transmission lines connected to the control and information system of power plants, power stations under remote control of the center.
- Means of communication for dispatch work including telephone, facsimile, and computer network should be well operated.

b) Requirements for connection to the SCADA system

- There are two connection ports which are direct, simultaneous and physically independent of the SCADA system of the authorized dispatch level. In the case that there are multiple authorized dispatch levels, such dispatch levels should be responsible for sharing information.
- There are two ports connected to RTU/Gateway equipment, control system of power plant, power station, circuit breaker under remote control by the center.

- c) The control center should be equipped with monitors and connected to the camera system of power plant and power station and transmitted to the control center.

3. Power plant and power station subject to remote control by the control center should be equipped with the monitoring, control, camera and telecommunication system for purpose of stable, reliable and continuous data transmission, connection to the control center according to requirements at clauses 1 and 2 of this Article.

Item 3. SEQUENCE, PROCEDURES OF CONNECTION AGREEMENT

Article 43. Application file for connection

- 1. In case connection to the three-phase low-voltage grid, when there is need for new connection to the distribution grid or change of the existing connection, the customer of the distribution grid should send to the power distributor with documents stated at Appendix 2A attached to this Circular.
- 2. In case connection at the low-voltage level and 110 kV, when there is need for new connection or change of the existing connection, the relevant customer should send to the power distributor with the following documents:
 - a) Connection registration information corresponding to the connection demand regulated at Appendices 2B, 2C, 2D of this Circular.
 - b) Layout of main electrical equipment behind the connection point.
 - c) Technical document with regards to equipment expected for connection and expected changes at the connection point, expected completion time, technical data of the new connection or change of the existing connection.

Article 44. Sequence of connection agreement for low-voltage level and 110 kV

- 1. Upon receiving the application file for connection, the power distributor is responsible for examining and giving written notification regarding sufficiency and validity of the file.
- 2. After receiving the sufficient and valid application file for connection, the power distributor is

responsible for conducting the following tasks:

- a) Review requirements related to expected electrical equipment at the connection point;
 - b) Assume prime responsibility for assessing impacts of connection of electrical equipment, grid, power plant of the customer on the distribution grid with regards to load bearing capacity of existing lines, substations; impacts on short-circuit current, impacts on power quality of the distribution grid after the connection; coordination of protective systems.
 - c) Collect feedbacks of authorized dispatch level with regards to impacts of the connection on the electrical system, requirement for connection to the information system and SCADA system of the authorized dispatch level, requirements for protective relay, automation, and contents related to technical requirements for equipment at the connection point.
 - d) Develop and agree on single-line diagram with technical specifications of equipment and layout of connection points of customers to the distribution grid, which will be the official layout in the connection agreement.
 - e) The draft connection agreement according to contents stated in the Appendix 03 of this Circular and send this draft to the customer applying for connection.
3. The customer applying for connection is responsible for providing the power distributor with necessary information for purpose of review, implementation organization of the connection plan and signing of the connection agreement with the power distributor.
4. The connection agreement is made in 05 copies, each party keeps 02 copies and 01 copy is sent to the authorized dispatch level.
5. In the case that the connection plan cannot be agreed upon, the power distributor is responsible for giving written notification to the customer and reporting to the ERAV on the reason for such failure to reach agreement on the connection plan.

Article 45. Term for review and signing of the connection agreement

1. The term for review and signing of the connection agreement with the customer of the distribution grid who has request for connection at the voltage level 110 kV and the customer who owns generation unit and has request for connection to the medium-voltage grid is regulated in the below Table 6:

Table 6. The term for review and signing of the connection agreement

| Implementation items | Implementation duration | PIC |
|---|--------------------------------|--|
| Submit the application file for connection | | Customer applying for connection |
| Review the application file for connection | No more than 15 working days | Power distributor, authorized dispatch level |
| Prepare the draft connection agreement | No more than 03 working days | Power distributor |
| Conduct negotiation and sign the connection agreement | No more than 07 working days | Power distributor and customer applying for connection |

2. For the customer who has separate power station connected to the medium-voltage grid: Within 04 working days from receiving the full valid application file, the power distributor or power retailer is responsible for reviewing, negotiating, and signing the connection agreement with the power customer who has separate power station connected to the medium-voltage grid.

Item 4. CONNECTION FOR THE CUSTOMER OF THE DISTRIBUTION GRID

Article 46. Right to access to equipment at the connection point

1. The power distributor is entitled to access to equipment which is managed by the customer at the connection point during the process of constructing, installing, removing, testing, checking, maintaining and operating such equipment.
2. The power customer is entitled to access to equipment which is managed by the power distributor at the connection point during the process of constructing, installing, removing, testing, checking, maintaining and operating such equipment.
3. The power distributor, customer of the distribution grid is responsible for facilitating for relevant parties to perform rights stipulated at clauses 1 and 2 of this Article.

Article 47. Provide the examination file for energization condition of the connection point for the customer of the distribution grid at the voltage level 110 kV and the customer having generation unit connected to the medium-voltage grid

1. Before the expected day when the connection point is energized, the customer applying for connection should provide the power distributor with 01 application file and the authorized dispatch level with 01 application file for purpose of overall review of energization conditions for the connection point (technical documents with confirmation of the customer applying for connection and notarized copies of legal documents), including:

a) Partial and full acceptance minutes for connected equipment of power plant, line and substation connected to the distribution grid comply with national and international standards, regulations and satisfy technical requirements of connected equipment as stipulated at Item 2 of this Chapter;

b) Technical design document which is approved, revised, supplemented in relation to the original design includes the following document:

- General description, layout of electrical equipment;

- Main connection layout, single line diagram;

- Schematic diagram, design of the protective and control system showing circuit breaker, current transformer, voltage transformer, lightning protection, disconnector, logical circuit with interlocked switch according to status of circuit breaker;

- Other relevant diagrams (if any).

c) Documents on technical specification and operational management include the following documents:

- Technical specification of installed equipment including specification of the connection line;

- Technical documents of exciter, governor system;

- Manual on calibration of protective and automated relay, specialized software for communication and calibration of relay, calibration values of protective relay from the connection point to the customer's premises.

- Manufacturer's manual on operation of equipment and other relevant technical documents.

d) Schedule of commissioning, energization and operation.

2. Unless agreed otherwise, the customer applying for connection is responsible for providing sufficient documents as regulated at clause 1 of this Article in the following term:

a) No later than two months before the expected date of the first commissioning of the power plant;

b) No later than 01 month before the expected date of the first commissioning of line, substation (excepting for full acceptance minutes for line and substation).

3. No later than 20 working days from the date receiving sufficient documents of the energization file of the generation unit or no later than 15 working days from the date receiving sufficient documents of the energization file of line, substation, the power distributor and authorized dispatch level is responsible for sending to the customer applying for connection with the following documents:

a) Equipment numbering layout:

b) Requirements for calibration of protective relay of the customer from the connection point to the customer; relay calibration form and relevant calibration values for relay protection equipment of the customer applying for connection which are promulgated or adopted by the authorized dispatch level.

c) Requirements for testing, calibration of equipment;

d) Requirements for methods of receiving dispatch commands;

e) Requirements for establishing the communication system for purpose of dispatch work;

f) Requirements for collecting and transmitting data to the SCADA system (if any);

g) Automatic control method (if any);

h) Expected energization method;

i) The list of procedures related to operation, dispatch of the national electrical system, electrical distribution system and coordinated operation process;

k) The list of relevant staff and operators with their phone number and facsimile number.

4. No later than 10 working days before the expected date of energization of the connection point, the customer applying for connection should provide the power distributor and authorized dispatch level with the following contents:

- a) Commissioning schedule (for power plant) and energization schedule for electrical equipment;
- b) Agreement on assigning responsibilities for involved parties in management and operation of connected equipment;
- c) Internal regulations on safe operation of connected equipment;
- d) The list of operators in charge of customers, including their full name, job position, responsibility, phone number and facsimile number.

Article 48. Provide the examination file for energization condition of the connection point to the power customer who has separate power station connected to the medium-voltage grid

1. Before the expected date for energizing the connection point, the customer applying for connection should provide the power distributor with one file for purpose of conducting examination of energization conditions of the connection point (technical documents with confirmation of the customer applying for connection and notarized copies of legal documents), including:

- a) Technical design document which is approved, revised and supplemented (if any) in relation to the original design including general description, main connection layout, layout of electrical equipment, schematic diagram of the protective and control system, other relevant diagrams and technical specifications of main electrical device;
- b) Manufacture's manual on operation and management of equipment;
- c) Partial and full acceptance minutes of connected equipment of line and substation to the distribution grid comply with national and international standards, regulations and satisfy technical requirements of connected equipment as stipulated at Item 2 of this Chapter;
- d) Schedule of commissioning and operation.

2. After receiving sufficient documents, the power distributor is responsible for sending to the customer applying for connection with the following documents:

- a) Equipment numbering layout;
- b) Requirements for calibration of protective relay of the customer from the connection point to the customer: relay calibration form and relevant calibration values for relay protection equipment of the customer applying for connection which is promulgated and adopted by the authorized dispatch level;
- c) Requirements for testing, calibration of equipment;
- d) Requirements for methods of receiving dispatch commands;
- e) Requirements for establishing the communication system for purpose of dispatch work;
- f) Requirements for collecting and transmitting data to the SCADA system (if any);
- g) Automatic control method (if any);
- h) Expected energization method;
- i) The list of procedures related to operation, dispatch of the national electrical system, electrical distribution system and coordinated operation process.
- k) The list of relevant staff and operators with their phone number and facsimile number.

3. Before the date of first energization and commissioning, the customer applying for connection should provide the power distributor with the following contents:

- a) Schedule of commissioning and energization of electrical equipment;
- b) Agreement on assigning responsibilities for involved parties in management and operation of connected equipment;
- c) Internal regulations on safe operation of connected equipment;
- d) The list of operators in charge of customers including their full name, job position, responsibilities and phone number, facsimile number.

Article 49. Examination of energization conditions of connection point

1. The customer applying for connection is responsible for agreeing with the power distributor on the

date of field visit to the connection point.

2. In the case that the power distributor notifies that the connection point or relevant equipment at the connection point of the customer fails to satisfy energization conditions, then the customer should correct, supplement or replace equipment according to requirements and agree with the power distributor on the date of the next field visit.

3. The power distributor is responsible for assuming prime responsibility, coordinating with the authorized dispatch level in agreeing with the customer on the procedure of examining energization conditions of the connection point.

4. The power distributor and authorized dispatch level (if any) should sign the examination minutes of energization conditions of connection point with the customer applying for connection.

Article 50. Energization of the connection point

1. Upon having the examination minutes of energization conditions of the connection point, the customer applying for connection is responsible for sending to the power distributor and authorized dispatch level with the energization registration form of the connection point in attachment with the following documents:

a) Documents confirming that the work is legally and technically eligible:

- Equipment subject to energization is already tested and examined according to operational and technical requirements at the connection point;
- Metering system is fully completed, meter reading is finalized.
- Power purchase agreement (if any) is signed;
- Work acceptance file according to law regulations on construction.

b) Documents confirming that the work is eligible in terms of dispatch, operation:

- The first equipment is numbered in accordance with primary circuit diagram promulgated by the authorized dispatch level;
- Relay protection system which is calibrated in accordance with requirements of the authorized dispatch level;
- Operator is trained, tested, granted with operational certificate and recognized of job title according to the Procedure of national electrical system dispatch promulgated by Ministry of Industry and Trade;
- Dispatch communication means (radio communication, telephone, facsimile) are well operated.
- Improve information connection, sufficient signals to the SCADA system, information system of the authorized dispatch level (if any).

2. Within 03 working days from the date receiving the energization registration form, the authorized dispatch level should assume prime responsibility, coordinate with the power distributor to notify the customer applying for connection with regards to time and method of energization of the connection point.

3. The power distributor and power customer is responsible for energization of the connection point according to the method notified by the authorized dispatch level.

Article 51. Sequence of testing, acceptance before putting the equipment behind the connection point into operation

1. For the customer of the distribution grid connected at the voltage level of 110 kV and the power generator which has generation unit connected to the medium-voltage level:

a) During the time of testing before putting equipment behind the connection point into operation, the customer applying for connection should assign staff on duty and notify the list of staff on duty, their phone number, facsimile number to the power distributor and authorized dispatch level for coordinated operation if necessary;

b) During the time of commissioning and acceptance, the customer applying for connection is responsible for coordinating with the power distributor and authorized dispatch level to ensure that operational parameters satisfy technical requirements at the connection point in the permissible limit as stipulated at Item 2 of this Chapter.

c) Upon completion of commissioning, acceptance, the customer applying for connection should confirm the actual operational parameters at the connection point of electrical equipment, line, substation and generation unit. In the case that operational parameters at the connection point fail to

satisfy technical requirements stipulated at Item 2 of this Chapter due to the customer's electrical equipment or grid, the power distributor is entitled to disconnect the power plant or grid of the customer from the distribution system and request the customer to take corrective actions.

d) Grid, power plant and electrical equipment behind the connection point of the customer applying for connection is only allowed to put into official operation after completing partial, full commissioning, acceptance and satisfying technical requirements at the connection point as stipulated at Item 2 of this Chapter and law regulations on construction with regards to work acceptance. During the process of commissioning, acceptance and official operation, the customer of the distribution grid should comply with the Procedure of national electrical system dispatch promulgated by Ministry of Industry and Trade and other relevant regulations.

2. For the customer who has separate power station connected to the medium-voltage grid: within 06 working days from the date receiving the full and valid energization file for the connection point of the customer as regulated at Article 48 of this Circular, the power distributor is responsible for coordinating with the customer in completing energization for commissioning, acceptance and energization for official operation for the customer applying for connection.

Article 52. Operational examination and monitoring of connected equipment

1. The customer of the distribution grid is responsible for operation of equipment in accordance with operational and technical requirements at the connection point in the permissible limit regulated at this Circular. In the case that operational parameters of electrical equipment fails to satisfy technical and operational requirements at the connection point, the power distributor is entitled to request the customer to re-test equipment managed by themselves to identify reasons and take corrective actions.

2. In the case that two parties cannot reach an agreement on examination result and cause of failure, the two parties should agree on the examination scope so that the customer hires an independent testing organization to conduct examination, testing. In the case that examination results of the independent testing organization reveal faults caused by the customer's equipment but the customer refuses to accept corrective actions, the power distributor is entitled to disconnect the customer's equipment from the distribution grid.

3. The customer of the distribution grid should bear costs of additional testing, examination if examination results indicate that the customer's equipment violates technical and operational requirements at the connection point. The power distributor should bear costs of additional testing, examination if examination results indicate that the customer's equipment complies with technical and operational requirements at the connection point.

4. Before examining connected equipment to identify violations of technical requirements at the connection point, the power distributor should notify in advance the customer of the distribution grid and authorized dispatch level with regards to the time of field visit, the list of people conducting field visit. In the case that it can cause power interruption for the customer, the power distributor should notify in advance at least 05 days for the customer of the distribution grid and authorized dispatch level. The customer of the distribution grid who has separate power station should coordinate and create favourable conditions for conducting the field visit.

5. During the field visit, the power distributor is allowed to install power metering equipment and examine at connected equipment but should not cause impacts on safe operation of power plant, grid and electrical equipment of the customer of the distribution grid.

6. During the operational process, if the connection point is found with risks of unsafe operation for the electrical system which are caused by equipment owned by the customer, the power distributor should immediately notify the authorized dispatch level and the customer of the distribution grid who has separate power station and state a deadline for corrective action to prevent risks of unsafe operation for the electrical system. If after the deadline is expired, technical causes are not addressed, the power distributor is entitled to disconnect the connection point and notify the customer. The customer should conduct further test to put the equipment behind the connection point into operation according to regulations at Article 51 of this Circular.

Article 53. Replacement, installation of equipment at the connection point

1. In the case that the customer of the distribution grid has separate power station which is expected for replacement, upgrading of connected equipment, further installation of new electrical device with potential impacts on safe, trusted and continued service of the distribution grid, the customer should notify, agree with the power distributor on such changes and supplement to the connection agreement.

2. In the case that proposal of the customer of the distribution grid who has separate power station is

not accepted, the power distributor should give written notification to the customer with regards to other necessary requirements for such new equipment.

3. All replaced equipment at the connection point should be subject to examination, testing and acceptance in accordance with regulations of Articles 47 – 51 of this Circular.

Article 54. Connection to the low-voltage grid for the power customer

1. In the case of power use for purpose of living activities

Within 07 working days from the date receiving the full and valid file of the customer, the power distributor or power retailer is responsible for signing relevant contract and supplying power for the customer.

2. In the case of power use for non-living activities

a) Within 03 working days from the date receiving the full and valid file of the customer, the power distributor or power retailer is responsible for examining, conducting field visit and developing plan of power supply for the customer.

b) Within 05 working days from the date conducting field visit and developing plan of power supply, the power distributor or power retailer is responsible for signing relevant contract and supplying power for the customer.

3. In case it fails to supply power for the customer, the power distributor or power retailer should give written notification to the customer and clearly state reasons, with confirmation of local Department of Industry and Trade.

Item 5. PREPARATION OF ENERGIZATION OF THE CONNECTION POINT FOR ELECTRICAL EQUIPMENT OF THE POWER DISTRIBUTOR

Article 55. Provide files for purpose of examining energization conditions of the connection point for electrical equipment of the power distributor

1. Before the expected date of energization of the connection point, the power distributor is responsible for providing the authorized dispatch level with 01 file for purpose of examining energization conditions of the connection point (technical documents with confirmation of the power distributor and notarized copies of legal documents), including:

a) Main connection layout, primary single-line diagram, electrical equipment layout;

b) Schematic diagram, design diagram of the protective and control system which shows circuit breaker, current transformer, voltage transformer, lightning protection, disconnector, logical circuit with interlocked switch according to status of circuit breaker;

c) Other relevant diagrams (if any);

d) Manual on calibration of protective and automatic relay, specialized software for communication and calibration of relay;

e) Technical documents, specifications of installed equipment including specifications of the connection line;

f) Schedule of commissioning, energization and operation.

2. No later than 01 month before the expected date of commissioning of power line, station, the power distributor is responsible for providing all documents regulated at clause 1 of this Article, unless otherwise agreed.

3. No later than 15 working days from the date receiving sufficient documents, the authorized dispatch level is responsible for sending to the power distributor with the following documents:

a) Equipment numbering layout;

b) Requirements for method of receiving dispatch commands;

c) Issue relay calibration form or adopt relay calibration values according to the Procedure of national electrical system dispatch promulgated by Ministry of Industry and Trade;

d) Requirements for testing, calibration of equipment;

e) Requirements for establishing the communication system for purpose of dispatch work;

f) Requirements for connection and operation for the SCADA system;

g) Expected method of energization;

h) The list of relevant staff and operators with their phone number and facsimile number.

4. No later than 07 working days before the date energizing the connection point, the power distributor should agree with the authorized dispatch level on the schedule of commissioning and operation of electrical equipment.

Article 56. Energization of the connection point for electrical equipment of the power distributor

1. The power distributor is responsible for sending to the authorized dispatch level with the energization registration form for the connection point in attachment with the following documents:

a) Documents confirming that the work has sufficiently legal and technical procedures

- Equipment subject to energization is already tested, examined and satisfies technical and operational requirements at the connection point;

- Metering system is fully completed, meter reading is finalized;

- Work acceptance file according to law regulations on construction.

b) Documents confirming that the work is eligible in terms of dispatch, operation

- Primary equipment is numbered in accordance with the primary circuit diagram promulgated by the authorized dispatch level;

- Protective and automatic relay system is calibrated in accordance with relay calibration forms promulgated or adopted by the authorized dispatch level;

- Operators are trained, tested, granted with operational certificate and recognized of job title according to the Procedure of national electrical system dispatch promulgated by Ministry of Industry and Trade;

- Dispatch communication means (radio communication, telephone, facsimile) are well operated.

- Improve information connection, sufficient signals to the SCADA system, information system of the authorized dispatch level.

2. Within 03 working days from the date receiving the energization registration form, the authorized dispatch level is responsible for notifying the power distributor with regards to the time and method of energization for the connection point.

3. The power distributor is responsible for coordinating with the authorized dispatch level and other relevant entities in conducting energization for the connection point according to the method notified by the authorized dispatch level.

Article 57. Replacement, installation of equipment on the distribution grid

1. In the case that the power distributor has a desire for replacement, upgrading, installation of electrical equipment on the distribution grid which has potential impacts on safe, trusted and continued power supply of the distribution grid, the power distributor should get written agreement with the authorized dispatch level and notify relevant entities with regards to such changes.

2. In the case that proposal of the power distributor is not accepted, the authorized dispatch level is responsible for notifying the power distributor regarding additional requirements for such new equipment.

3. All equipment subject to replacement, installation should follow regulation at Articles 55 and 56 of this Circular.

Item 6. DISCONNECTION AND RESTORATION OF CONNECTION

Article 58. General regulation on disconnection and restoration of connection

1. Cases of disconnection include:

a) Voluntary disconnection refers to disconnection at the request of the customer of the distribution grid, including permanent and temporary disconnection;

b) Compulsory disconnection refers to disconnection in cases that the customer of the distribution grid violates the connection agreement, power purchase agreement, violate regulations on operational examination and monitoring for connected equipment or at the request of competent agency when the relevant customer violates law regulations.

2. The customer of the distribution grid should bear all costs of disconnection and restoration of connection.

Article 59. Voluntary disconnection

1. Permanent disconnection

a) Cases of disconnection of the customer of the distribution grid from the electrical distribution system and responsibilities of relevant parties should be specified in the connection agreement and power purchase agreement.

b) Upon having a desire for permanent disconnection from the electrical distribution system, the customer of the distribution grid should give written notification to the power distributor and authorized dispatch level at least 01 month before the expected date of permanent disconnection. In the case that the customer of the distribution grid owns generation units connected to the distribution grid, it requires to give written notification to the power distributor and authorized dispatch level at least 03 months before the expected date of permanent connection.

2. Temporary connection

The customer of the distribution grid is responsible for notifying and agreeing with the power distributor and authorized dispatch level regarding the time of temporary disconnection from the electrical distribution system.

Article 60. Compulsory disconnection

The power distributor is entitled to disconnect the customer of the distribution grid from the electrical distribution system in the following cases:

1. At the request for disconnection of the competent state agency.
2. Cases of compulsory disconnection as stipulated in the power purchase agreement or connection agreement.
3. Cases stipulated at clauses 2 and 6 of Article 52 of this Circular.

Article 61. Restoration of connection

The power distributor is responsible for restoring connection for the customer of the distribution grid in the following cases:

1. At the request for connection restoration of the competent state agency or when causes of disconnection are eliminated, consequences are addressed and relevant costs are settled by the customer.
2. At the request for connection restoration of the customer of the distribution grid and relevant costs are settled by the customer in case of temporary disconnection.

Chapter VI

OPERATION OF THE ELECTRICAL DISTRIBUTION SYSTEM

Item 1. RESPONSIBILITY FOR OPERATION

Article 62. Responsibilities of the power distributor

1. Manage, operate, maintain, repair electrical equipment and grid under relevant management scope.
2. Develop annual, monthly, weekly and daily plans of operation, maintenance, repair of electrical equipment and distribution grid as stipulated at Items 2 and 3 of this Chapter.
3. Manage, operate the distribution grid to ensure safe, stable, reliable power supply for customers, satisfy technical and operational requirements as stipulated at Chapter II of this Circular.
4. Invest, install, maintain, manage and operate the protective relay system in relevant management scope to ensure stability, reliability and selectivity. Develop methods, calculations, examine the protective relay system for the protective system of the customer of the distribution grid at the point of connection to the distribution grid in the case the protective diagram has impact on the distribution grid protection system to ensure selectivity, sensibility and ability to eliminate faults.
5. Invest, install, maintain, manage and operate the distributed control system, RTU/Gateway equipment, SCADA system, information system under relevant management scope and information, data transmission line to ensure reliable and continuous data, information transmission to the SCADA system, information system, control system of the authorized dispatch level.
6. Comply with dispatch commands of the authorized dispatch level excepting for those causing risk to people's life, equipment or those violating regulations already promulgated.
7. Operate the electrical distribution system in accordance with the regulation on the electrical

transmission system, the procedure of national electrical system dispatch, the operational procedure in the national electrical system, the fault correction procedure in the electrical system promulgated by Ministry of Industry and Trade and regulations at this Circular.

8. Coordinate with other power distributor and customers of the distribution grid who have separate power station in the process of operating equipment at the connection point to its grid.

9. Coordinate with the authorized dispatch level in developing the operational plan of the electrical distribution system, establishing protective diagram, communication system, transmission of SCADA data and control signals for purpose of operation of the electrical distribution system.

10. Comply with regulations on electrical safety, protect safe corridor of electrical grids, works according to law regulations.

Article 63. Responsibilities of the NLDC, authorized dispatch level

1. Develop plan, method of operation for purpose of dispatch, operation of the electrical distribution system under relevant authority for coming year, month, week and day.

2. Command, dispatch the electrical distribution system under relevant authority in accordance with the regulation on the electrical transmission system, the procedure of national electrical system dispatch, the operational procedure in the national electrical system, the fault correction procedure in the electrical system promulgated by Ministry of Industry and Trade and regulations at this Circular to ensure safe, stable and reliable operation of the electrical distribution system.

3. Coordinate with the power distributor, customer of the distribution grid in agreeing on the equipment maintenance, repair plan; establish the communication system, SCADA data transmission and remote control for purpose of operation work; examine and adopt protective diagram in the electrical system under relevant authority to ensure selectivity, sensibility and ability to eliminate faults.

4. Perform other responsibilities as regulated by laws.

Article 64. Responsibilities of the customer of the distribution grid

1. Power customer connected to the low-voltage level is responsible for:

a) Developing the procedure of operational management, testing, maintenance, repair of electrical equipment and grid under relevant management scope in alignment with current law regulations and manufacturer's regulations.

b) Managing operation, maintenance, repair of electrical equipment and grid under relevant management scope in response to technical requirements at Item 2 of Chapter V of this Circular, commitments in the connection agreement, power purchase agreement and other current law regulations.

c) Complying with dispatch commands of the authorized dispatch level according to the Procedure of national electrical system dispatch, the operational procedure in the national electrical system, the fault correction procedure in the national electrical system promulgated by Ministry of Industry and Trade.

d) Providing accurate, timely information for the power distributor to develop operational plan, maintenance, repair plan of the electrical distribution system;

e) Coordinating with the power distributor to maintain power quality and ensure economic operation of the electrical distribution system according to the agreement with the power distributor.

2. Power distributor and power customer connected to the voltage level 110 kV are responsible for:

a) Performing regulations at clause 1 of this Article;

b) Investing, installing, maintaining, managing and operating the protective relay system under relevant management scope to ensure stability and reliability;

c) Investing, installing, maintaining, managing and operating distributed control system, RTU/Gateway equipment, information system under relevant management scope and information, data transmission line to ensure reliable and continuous data, information transmission to the SCADA system, information system, control system of the authorized dispatch level. Do not disconnect relevant equipment from operation without approval of the authorized dispatch level, which causes interruption of SCADA signals, information and control signals.

3. The power customer connected to the low-voltage level is responsible for operating its own electrical equipment and grid in alignment with technical requirements stipulated at Item 2 of Chapter V of this Circular.

Item 2. PLAN OF MAINTENANCE, REPAIR OF THE ELECTRICAL DISTRIBUTION SYSTEM

Article 65. General regulation on maintenance, repair of the electrical distribution system

1. The power distributor is responsible for developing yearly, monthly, daily plans of maintenance, repair of the electrical distribution system for purpose of developing the operational plan of the electrical distribution system under relevant management scope.

2. Plan of maintenance, repair of the electrical distribution system is developed with consideration of maintenance, repair plan of grid, power station of the customer using the distribution grid and should satisfy the following requirements:

- a) Mitigate impacts on safe, stable, reliable and continuous power supply;
- b) Optimize coordination in maintenance, repair and power source and grid.

3. During developing the maintenance, repair plan of the electrical distribution system under relevant management scope, the power distributor is responsible for coordination with authorized dispatch levels, power transmission entities, and other power distributors with the aim to mitigate impacts on power supply security for the electrical system.

4. In the case it fails to implement the maintenance, repair plan of the electrical distribution system as published, the customer of the distribution grid who has separate power station, power retailer should notify accordingly and coordinate with the power distributor for further adjustments.

Article 66. Annual maintenance, repair plan

1. Before every June 1st, the customer of the distribution grid who has separate power station and the power retailer is responsible for providing the power distributor with information on the maintenance, repair plan for the next two years for the grid 110 kV and the next year for the medium-voltage grid, including:

- a) The list of electrical lines, equipment connected to the grid of the power distributor which are expected for maintenance, repairs;
- b) Reasons for maintenance, repair;
- c) Scope of power supply interruption due to maintenance, repair;
- d) Estimated power, capacity of loads subject to power supply interruption;
- e) Estimated power, capacity of power plant not generated to the distribution grid.

2. Before every July 1st, the power distributor should complete the draft maintenance, repair plan for the next two years for the grid 110 kV and for the next year for the medium-voltage grid with consideration of the following factors:

- a) Results of load demand forecast;
- b) Maintenance, repair plans of the customer of the distribution grid who has separate power station, the power retailer and requirements for change of maintenance, repair plans (if any);
- c) Requirements for maintenance, repair of the electrical transmission grid;
- d) Coordination of maintenance, repair plans of the customer of the distribution grid who has separate power station, power retailer, in line with actual operational conditions with the aim to optimize economic – technical operation of the electrical distribution system;
- e) Other requirements related to maintenance, repair.

3. In the case that it fails to reach agreement on the maintenance, repair plan of the power distributor, before every July 10th, the customer of the distribution grid who has separate power station, power retailer is entitled to send written request to the power distributor for adjusting the annual maintenance, repair plan. The power distributor is responsible for considering, adjusting the annual maintenance, repair plan in alignment with the customer's request. In the case the annual maintenance, repair plan cannot be adjusted according the customer's request, the power distributor should give written notification to the customer and clearly state reasons.

4. Before every December 1st, the power distributor should complete and publish the maintenance, repair plan for the next two years for the grid 110 kV and for the next year for the medium-voltage grid on its website, including the following contents:

- a) The list of electrical equipment, lines subject to maintenance, repair;
- b) Reasons for maintenance, repair of such electrical equipment, lines;

- c) Main task contents;
- d) Expected maintenance, repair schedule;
- e) Other requirements related to maintenance, repair work.

Article 67. Monthly maintenance, repair plan

1. In the case that the monthly maintenance, repair plan has changes in relation to the published annual maintenance, repair plan, the customer of the distribution grid who has separate power station, power retailer should provide the power distributor with the information as stipulated at clause 1 of Article 66 of this Circular before every 10th date.

2. Before every 15th date, the power distributor should complete the draft monthly maintenance, repair plan with consideration of the following factors:

- a) The published annual maintenance, repair plan;
- b) Results of load demand forecast of the next month;
- c) Request for adjusting the maintenance, repair plan of the customer of the distribution grid who has separate power station and of the power retailer;
- d) Requirements for maintenance, repair on the electrical transmission grid.

3. Before every 25th date, the power distributor should complete and publish the maintenance, repair plan of the next month on its website, including the following contents:

- a) Name of electrical equipment, lines subject to maintenance, repair;
- b) Reasons for maintenance, repair of such electrical equipment, lines;
- c) Main task contents;
- d) Expected time of starting and finishing the maintenance, repair work;
- e) Other requirements related to the maintenance, repair work;
- f) Estimated power, capacity which cannot be supplied due to maintenance, repair.

Article 68. Weekly maintenance, repair plan

1. On weekly basis, the power distributor is responsible for developing the maintenance, repair plan for the next two weeks with consideration of the following factors:

- a) The approved monthly operational plan;
- b) Load demand results of the next two weeks;
- c) Updated plan of maintenance, repair of power sources, grids;
- d) Request for adjusting the maintenance, repair plans of the customer of the distribution grid who has separate power station and of the power retailer.

2. In the case there is change in relation to the monthly maintenance, repair plan, before 10AM of every Monday, the customer of the distribution grid who has separate power station, the power retailer should provide the power distributor with the information as stipulated at clause 1 of Article 66 of this Circular.

3. Before 4PM of every Thursday, on the basis of the monthly maintenance, repair plan and the information provided by the customer of the distribution grid and the power retailer, the power distributor should complete and publish the maintenance, repair plan for the next two weeks on its website, including the following contents:

- a) Name of electrical equipment, lines subject to maintenance, repair;
- b) Reasons for maintenance, repair of such electrical equipment, lines;
- c) Main task contents;
- d) Expected time of starting and finishing the maintenance, repair work;
- e) Other requirements related to the maintenance, repair work;
- f) Scope of power supply interruption due to the maintenance, repair work;
- g) Estimated power and capacity which cannot be supplied due to the maintenance, repair work.

4. Before 4PM of every Friday, on the basis of the weekly maintenance, repair plan published by the

power distributor, power retailers are responsible for developing maintenance, repair plans for distribution grids under their management scope and notify impacted customers according to the Regulation on conditions, sequence of stoppage, decrease of power supply promulgated by Ministry of Industry and Trade.

Item 3. OPERATIONAL PLAN

Article 69. Annual operational plan

1. The power distributor is responsible for developing the operational plan of the electrical distribution system for the next year, with the following main contents:

- a) Load demand forecast of the next year;
- b) Maintenance, repair plan of the next year;
- c) Estimated power generation output in the next year of power plants which have installed capacity of 30 MW or less connected to the distribution grid.

2. Before every December 1st, the power distributor is responsible for completing the operational plan of the next year and publish the plan on its website, at the same time notify the customer of the distribution grid who has separate power station, power retailer and other relevant entities with regards to the operational plan of the next year for the grid 110 kV, generation units connected to the distribution grid for their implementation coordination.

Article 70. Monthly operational plan

1. The power distributor is responsible for developing the operational plan of the electrical distribution system for the next month on the basis of the annual operational plan of the electrical distribution system already published, including the following contents:

- a) Load demand forecast of the next month;
- b) Maintenance, repair plan of the next month;
- c) Expected power output in the next month of individual power plants with installed capacity of 30 MW or less connected the distribution grid.

2. Before every 25th date, the power distributor is responsible for completing the operational plan of the next month and publish on its website, at the same time notify the customer of the distribution grid who has separate power station, the power retailer and relevant entities with regards to the operational plan in the next month of the medium-voltage grid and the grid 110 kV, generation units connected to the distribution grid for their implementation coordination.

Article 71. Weekly operational plan

1. The power distributor is responsible for developing the operational plan of the electrical distribution system for the next two weeks on the basis of the monthly operational plan already published, including the following contents:

- a) Load demand forecast of the next two weeks;
- b) Maintenance, repair plan of the next two weeks;
- c) Expected time and scope of power supply interruption in the next two weeks;
- d) Expected power output and generation capacity in the next two months of individual power plants with installed capacity of 30 MW or less connected to the distribution grid.

2. Before 4PM of every Thursday, the power distributor is responsible for completing the operational plan of the next two weeks and publish on its website, at the same time notify the customer of the distribution grid who has separate power station, the power retailer and relevant entities with regards to the operational plan of the next two weeks of the medium-voltage grid and the grid 110 kV, generation units connected to the distribution grid for their implementation coordination.

3. Before 4PM of every Friday, on the basis of the weekly operational plan already published, the power distributor and the power retailer are responsible for completing the weekly operational plan of the low-voltage grid and notify the impacted customers under relevant management scope.

Article 72. Method of daily operation

1. On daily basis, upon the weekly operational plan already published, the power distributor is responsible for developing the operational method of the next day, including the following contents:

- a) The list of power sources and grids subject to maintenance, repair;

- b) Expected time and scope of power supply interruption of the next day;
 - c) Expected power output and generation capacity per hour of the next day of individual power plants with installed capacity of 30 MW or less connected to the distribution grid.
2. Before every 4PM, the power distributor is responsible for completing and publishing the operational method of the next day on its website.

Article 73. Operation of the electrical distribution system

1. The power distributor is responsible for operating the electrical distribution system according to the daily operational method and mobilization schedule of the next hour already published, in compliance with the Procedure of the national electrical system dispatch promulgated by Ministry of Industry and Trade and other relevant regulations.
2. The customer of the distribution grid is responsible for complying with dispatch command of the authorized dispatch level, coordinate and provide information for the power distributor for purpose of operating the electrical distribution system.

Item 4. OPERATION IN URGENT CASES

Article 74. Urgent cases

1. Urgent cases on the electrical distribution system refers to cases of entire and partial power interruption of the electrical transmission system or electrical distribution system, causing impacts on the normal operational mode or large-scale power outage in the electrical distribution system.
2. Urgent cases include:
 - a) Fault or entire or partial grid disconnection of the electrical transmission system, causing impacts on the normal operational mode of the electrical distribution system;
 - b) Fault on the electrical transmission system, causing a part of the electrical distribution system to operate under the islanding mode.
 - c) Fault of line or substation 110 kV, causing large-scale power outage in the electrical distribution system.

Article 75. Operating the electrical distribution system in case of breakdown or disconnection of all or part of the electrical transmission system

1. In case of the electrical transmission system breakdown affecting normal operating mode or causing power failure on the distribution grid, the power distributor is responsible for:
 - a) Immediately contacting the authorized dispatch level and the power transmission unit for information on expected time of power supply cut-off and scope of impact on load of the electrical distribution system due to this breakdown;
 - b) Applying load control measures and other operation measures to minimize scope of impact caused by the electrical transmission system breakdown.
2. In case of disconnection of all or part of the electrical transmission system affecting the normal operating mode or causing power failure on the electrical distribution system, the power distributor is responsible for:
 - a) Complying with the regulation on black start and restoration of the national power system and the regulation on electrical transmission system promulgated by Ministry of Industry and Trade;
 - b) Separating the distribution grid under the distributor's management into separate load areas in accordance with the national power system dispatch process promulgated by Ministry of Industry and Trade;
 - c) Restoring the load in preferential order of priority in accordance with the mode approved by the authorized dispatch level within its management;
 - d) Ensuring smooth communication for the electrical distribution system operation dispatch until the electrical system is completely restored.
3. The power distributor and the major customer using the distribution grid shall ensure smooth communication, assign operators and announce the list (full name, position, authority) of these operators for relevant parties to coordinate operations during emergency settlement and recovery.

Article 76. Operating the electrical distribution system in case of island mode

1. In case a part of the electrical distribution system is islanded, the authorized dispatch level shall consider and decide the operation of power plants connected to this distribution grid. The authorized

dispatch level shall direct the dispatch of power plants operating in island mode and ensure the readiness to synchronize with the electrical system when there is an order from the higher dispatch level.

2. In cases a power plant is designed to operate in island mode and has been agreed with the authorized dispatch level, the power generation unit may use the self-use system to supply power for load or other equipment of the customer with following conditions:

- a) The plant is fully equipped with protective relay system and has control methods for assemblies in both island mode and operating mode connected to the electrical distribution system;
- b) Ensuring the ability to identify and interrupt breakdowns during operation in island mode to protect assemblies and grids of the customers who use other distribution grids in the islanded part of the distribution grid;
- c) Ensuring the neutral grounding requirements of the islanded part of the distribution grid.

3. In case the islanded part of the distribution grid is unable to synchronize with the restored part of the electrical system, the authorized dispatch level shall separate the power plants connected to the islanded part of the distribution grid to restore the power supply to the islanded area from the restored electrical system, and then restore the operation of the islanded power plants.

Article 77. Operating the electrical distribution system in case of serious breakdown on the distribution grid of 110 kV voltage level

In case of breakdown on 110 kV line or distribution substation causing widespread power failure in the electrical distribution system, the power distributor is responsible for:

1. Urgently isolating and handling the breakdown in compliance with the national electrical system breakdown handling process promulgated by Ministry of Industry and Trade.
2. Notifying the breakdown to the authorized dispatch level, the electrical transmission unit and the customers using the distribution grid with their own power stations affected by the breakdown.
3. Changing the connection method, ensuring the power supply capacity to a maximum level for the electrical distribution system load during the breakdown.

Article 78. Restoring the electrical distribution system

1. In case the electrical distribution system breaks up and operates in island mode or in case a major breakdown occurs on the distribution grid, the power distributor shall be responsible for coordinating with the authorized dispatch level, the power transmission unit, the customers using the distribution grid with their own power stations and the related units to return the electrical distribution system to the normal operating mode as soon as possible.
2. The power distributor shall be responsible for zoning the load with a scale suitable to the black start capacity of the power plants and notifying the authorized dispatch level to ensure quick restoration of the electrical distribution system
3. The power plants connected to the distribution grid in island operating and synchronous mode shall comply with the dispatch order of the authorized dispatch level.
4. In case the distribution grid does not have the power plants which are able to automatically start to operate in island mode, the distribution grid is only restored from the electrical transmission system, the power distributor shall restore the electrical distribution system under the order of the authorized dispatch level. The power distributor shall restore the load in preferential order and in accordance with the approved plan.
5. The power distributor is responsible for notifying the customers using the distribution grid with their own power stations for coordination in the course of handling breakdown of the electrical distribution system.

Section 5. LOAD AND VOLTAGE CONTROL

Article 79. Load control

1. Load control consists of following measures:
 - a) Stoppage of or reduction in power supply level;
 - b) Load shedding;
 - c) Reduction in load capacity of the power customers who participate in power demand management programs.

2. Regulations on reduction in load capacity of power customers when they participate in power demand management programs in compliance with the regulation on content and order of load program implementation issued by Ministry of Industry and Trade.

Article 80. Stoppage of and reduction in power supply level

1. The power distributor is responsible for stopping and reducing power supply level as planned in accordance with the announced weekly operation plan specified in Article 71 of this Circular.

2. The power distributor may stop or reduce unplanned power supply level in following cases:

- a) Due to a breakdown of the grid supplying power to customers; a breakdown in the electrical system causing power failure which cannot be controlled by the power seller.
- b) At the request of the national electrical system dispatch unit when the electrical system has insufficient capacity, thus threatening the power supply security of the national electrical system;
- c) There is a risk of breakdown, serious unsafety to people, equipment and electrical systems;
- d) In case of force majeure.

3. When stopping or reducing the power supply level, the power distributor or the power retailer shall notify the affected power customers in accordance with the regulations on conditions, sequences of stopping and reducing power supply level issued by Ministry of Industry and Trade.

Article 81. Making load shedding plans

1. The power distributor is responsible for making load shedding plan within its management based on:

- a) Requirements for safe, reliable and stable operation of the electrical system;
 - b) Plans for load shedding, regulation, load reduction due to the threat to power supply security of the national electrical system dispatch unit;
 - c) Preferential order of loads;
 - d) Mitigation measures affecting power customers with the same preferential order of power supply.
2. Load shedding plans must include capacity levels, implementation order, and load shedding time.
3. Before 16:00 every Thursday, the power distributor is responsible for announcing the load shedding plan for the next 02 weeks on its website.

Article 82. Load shedding measures

- 1. Automatic load shedding means shedding affected by frequency relay for selective load cut in order to keep the frequency within permissible limit, and to avoid widespread power failure.
- 2. Ordered load shedding means shedding requested by the authorized dispatch level in case of lack of power or breakdown of the electrical system in order to ensure the power supply security.

Article 83. Load shedding performance

- 1. The power distributor must perform load shedding in accordance with the load shedding plan made and announced.
- 2. In case of load shedding ordered by the authorized dispatch level or to protect the distribution grid, the power distributor and the power retailer shall notify the power customers in accordance with the regulation on conditions, order of stopping and reducing power supply promulgated by Ministry of Industry and Trade.
- 3. After automatic load shedding or load shedding ordered by the authorized dispatching level, the power distributor is responsible for:
 - a) Notifying the authorized dispatch level of capacity, time, load shedding area and load shedding levels in accordance with the active setting value of frequency relay;
 - b) Restoring the load shedding when ordered by the authorized dispatch level.
- 4. In case the load is under the management scope of the customers subject to automatic load shedding or load shedding ordered by the authorized dispatch level, the customers using the distribution grid is responsible for:
 - a) Notifying the authorized dispatch level and the power distributor of capacity, time, load shedding and load shedding levels in accordance with the active setting value of frequency relay;

- b) Restore the fired load when ordered by the dispatch level.
- b) Restoring the load shedding when ordered by the authorized dispatch level.

Article 84. Making voltage adjustments

1. The authorized dispatching level is entitled to control and the power distributor is responsible for calculating and adjusting voltage at the nodes on the distribution grid in accordance with the regulation on national electrical system dispatch process issued by Ministry of Industry and Trade.
2. The customers using the distribution grid are responsible for coordinating with the authorized dispatch level and the power distributor to maintain voltage on the electrical distribution system through measures to control reactive power and to adjust transformer voltage division steps.

Article 85. Monitoring and remote control

1. The control and remote manipulation of equipment at power stations and power plants shall comply with the national electrical system dispatch process, the operation process in the national electrical system promulgated by Ministry of Industry and Trade and this Circular provisions.
2. In case the power distributor or the authorized dispatch level request for monitoring, control and remote manipulation of power stations or power plants of the customers using the distribution grid with their own power stations, the power distributor or the authorized dispatch level shall agree with the customers using the distribution grid with their own power stations on mode of customers' equipment monitoring and control. The power distributor or the authorized dispatch level is responsible for equipping control system and integrated equipment required for collecting information, monitoring and controlling the grid system of the customers using the distribution grid with their own power stations when both parties have reached an agreement, including control of circuit breaker in accordance with decentralized control of circuit breaker system within the customer's grid.
3. The customers using the distribution grid with their own power stations are responsible for coordinating with the power distributor and the authorized dispatch level in installing, operating the remote control and monitoring systems under their management.

Section 6. INFORMATION EXCHANGE IN OPERATION AND REPORTING REGULATION

Article 86. Forms of information exchange

1. The power distributor, the major customers using the distribution grids and the power retailer shall agree on a form of information exchange to ensure uninterrupted and 24/24 hours contact for operation.
2. The power distributor, the major customers using the distribution grid and the power retailer shall appoint an officer in charge of contact for operation and exchanging the list of officers in charge of contact and operators.
3. The forms of information exchange between the power distributor, the major customers using the distribution grid and the power retailer with the authorized dispatch level shall comply with the national electrical system dispatch process issued by Ministry of Industry and Trade.

Article 87. Information exchanging in operation

1. The power distributor and the authorized dispatch level are responsible for notifying the major customers using the distribution grid when the distribution grid operating mode may affect the grid operating mode or the customer's generator assembly, including following information:
 - a) The electrical distribution system operating mode and possible impacts on the customer's grid or generator assembly;
 - b) The cause of impacts on the customers' grid or generator assembly and necessary remedial measures.
2. The major customers using the distribution grid is responsible for immediately notifying the power distributor and the authorized dispatch level when they realize that their grid operating mode or generator assemblies may affect the distribution grid, including following information:
 - a) The cause of changes to the grid operating mode or the customer's generator assembly;
 - b) Possible impacts on the distribution grid.

Article 88. Notification of abnormal situations

1. Abnormal situation means a situation where the electrical distribution system is malfunctioning, threatening to malfunction or operating parameters are out of permissible range.

2. When an abnormal situation arises on the electrical distribution system, the power distributor is responsible for:

- a) Immediately notifying the major customers using the distribution grid that may be affected;
- b) Supplementing and clarifying information provided to the major customers using the distribution grid and owning the power plant if requested.

3. The major customers using the distribution grid shall immediately notify the power distributor when there is abnormal situation on the grid under their management, affecting the electrical distribution system.

Article 89. Notification of serious breakdowns

1. Serious breakdowns are those causing 110 kV lines or distribution substations to be separated from operation, causing widespread power failure in the electrical distribution system.

2. The power distributor, the major customers using the distribution grid are responsible for notifying breakdowns on their grids when serious breakdowns occur on the grids in accordance with the national electrical system troubleshooting process issued by Ministry of Industry and Trade.

3. The notice of a serious breakdown contains following main contents:

- a) Date and time of the breakdown;
- b) Duration of the breakdown;
- c) Location of the breakdown and the affected area;
- d) Faulty equipment;
- e) Brief description of the breakdown;
- f) Causes of the breakdown (if any);
- g) Estimated time for troubleshooting;
- h) Load shedding measures that have been implemented (if any).

4. The power distributor or the major customers using the distribution grids is responsible for supplementing and clarifying the contents in notices of serious breakdowns if requested.

Section 7. COORDINATION IN OPERATION

Article 90. General responsibilities for operation coordination

1. The power distributor and the customers using the distribution grid shall agree on responsibilities and scope of operation control for equipment on the related distribution grid between both parties; appoint people in charge of coordinating safe operation of the grid and equipment.

2. The power distributor and the customers using the distribution grid shall coordinate, establish and maintain the implementation of required safety measures upon implementation or testing under their management.

3. The power distributor and the customers using the distribution grid shall develop a process of operation coordination to ensure safety for people and equipment in operation and testing activities, including following contents:

- a) Principles and procedures of operation coordination;
- b) Responsibilities for and rights to control, operation and testing on the distribution grid under their management.

4. The power distributor and the customers using the distribution grid are responsible for agreeing on coordination of operation, storage, management, update and exchange of relevant documents.

Article 91. Coordination in operation performance

1. When performing work and operating on the grid, the power distributor and the customer using the distribution grid shall comply with the regulations on coordination of safe operation and other relevant regulations on dispatch, safe operation.

2. The power distributor and the customer using the distribution grid are responsible for coordination in installing signs, warning devices and safety instructions, providing appropriate facilities in working position to ensure safe work.

3. The inspection, monitoring and control of connected equipment at property delimit boundary shall

be conducted by the people appointed by the power distributor and the customer using the distribution grid.

Section 8. TESTING ON THE ELECTRICAL DISTRIBUTION SYSTEM

Article 92. General requirements for testing on the electrical distribution systems

1. Testing on the electrical distribution systems includes testing on the grids of the power distributor and the grids, power plants or electrical equipment of the customers using the distribution grids.
2. The testing can only be conducted within working capacity of the electrical equipment or the generator assembly and during the testing period as notified, witnessed by the representatives of relevant parties and shall comply with applicable processes and regulations. The testing shall ensure no danger to people and equipment on the electrical distribution system during the testing.
3. The power distributor and the customer using the distribution grid are responsible for periodically testing equipment under their ownership and management in order to ensure safe operation of equipment and compliance with the technical requirements for operation and the technical requirements at connection points.
4. The testing of electrical equipment at connection points with transmission grids shall comply with the regulation on electrical transmission systems promulgated by Ministry of Industry and Trade.
5. The cost of periodical testing shall be paid by equipment owners.
6. The cost of unscheduled testing shall be paid by the testing requester if the testing results show that the grid or the generator assembly meet the technical requirements for operation and the technical requirements at connection points prescribed in this Circular or the parameters stated in the Connection Agreement; in case the testing results show that the grid or the generator assembly does not meet the technical requirements for operation and the technical requirements at connection points prescribed in this Circular or are inconsistent with the parameters stated in the Connection Agreement, the owner and the operating manager of the grid or the generator assembly, not meeting the technical requirements for operation and the technical requirements at connection points shall bear the testing costs.

Article 93. Cases of experimenting equipment on distribution grids

1. Periodical testing of equipment on the distribution grid.

The duration of periodic testing is stipulated or directed by the equipment manufacturer. In the absence of the manufacturer's regulations or instructions, the duration of periodic testing shall be decided by the equipment owner but shall not exceed 03 years.

The content of periodic testing is stipulated or directed by the equipment manufacturer. In the absence of the manufacturer's instructions, full contents of periodic inspection provided in the regulation on national electrical engineering issued by Ministry of Industry and Trade shall be performed.

2. Unscheduled testing of equipment on the distribution grid in following cases:

- a) To ensure safe, reliable and stable operation of the electrical distribution system;
- b) At the request of the customers using the distribution grid when there is doubt that the quality of power supply on the distribution grid violates the regulations in Chapter II of this Circular or the commitment in the Connection Agreement;
- c) At the request of the power distributor when there is doubt that the equipment of the customers uses the distribution grid has adverse impacts on the distribution grid.

Article 94. Cases of testing generator assembly

1. The power distributor is entitled to test each generator assembly connected to the distribution grid no more than 02 (two) times a year, except for following cases:

- a) The testing results specify that one or more operating characteristics of the generator assembly are not consistent with the characteristics recorded in the Connection Agreement;
- b) When the power distributor and the generation unit do not agree on the parameters and the operating characteristics of the generator assembly in the testing results;
- c) At the request of the generation unit;
- d) Testing fuel conversion.

2. The generation unit is entitled to request testing in following cases:

- a) To re-check the operating characteristics of the calibrated generator assembly after each failure

related to the generator assembly;

b) To test the generator assembly after installation, overhaul, replacement, improvement or re-assembly.

Article 95. Responsibilities for testing equipment on the distribution grid

1. The power distributor are responsible for:

a) Organizing periodic testing of equipment on the distribution grid under its ownership and management;

b) Organizing unscheduled testing of the distribution grid if required to ensure the distribution grid operates safely, stably, reliably and satisfies the technical requirements for operation and the technical requirements at connection points prescribed in this Circular;

c) Organizing and performing testing of the grid of the customers using the distribution grid if requested;

d) Coordinating with the electrical transmission unit and other power distributors when testing the equipment at boundary connection points;

e) Notifying in writing the customers using the distribution grid and relevant units of the testing plan for implementation coordination.

2. The customers using the distribution grids are responsible for:

a) Organizing periodic testing of the grids, electrical equipment, and generator assemblies under their ownership and operation management;

b) Coordinating with the power distributor in testing the electrical equipment at connection points to the distribution grid;

c) Notifying in writing the power distributor of the testing plan for implementation coordination;

d) Organizing periodic maintenance of electrical equipment and equipment connected to the distribution grid;

e) After the testing is completed, sending a copy of the testing minutes to the power distributor for monitoring.

Article 96. Testing order as requested by the power distributor

1. At the request for testing of electrical equipment, generator assembly of the customer using the distribution grid as prescribed in Point c, Clause 2, Article 93 of this Circular, the power distributor is responsible for notifying in writing the customer at least 15 days before the expected date of testing. The notice shall include following contents:

a) Purpose of and reason for the requested testing;

b) Location of the testing;

c) Estimated time of the testing;

d) Expected item and sequence of the testing;

e) Plan for power supply stoppage or reduction as required by the testing (if any).

2. In case the customer using the distribution grid disagrees with the testing plan notified by the power distributor, within 7 days of the notice receipt, the customer shall re-notify and propose solutions in order to reach an agree with the power distributor on how to carry out the testing.

3. The power distributor is responsible for coordinating with the customer using the distribution grid to organize the testing as planned.

4. The testing results are sent by the testing organizer to the other party.

Article 97. Testing sequence as requested by the customer using the distribution grid

1. Testing the distribution grid as prescribed in Point b, Clause 2, Article 93 of this Circular

a) The customer using the distribution grid shall send a written request for testing to the power distributor, including following contents:

- Purpose of and reason for the testing request

- Item and sequence of the testing.

b) Within 07 days of receiving the testing request from the customer using the distribution grid, the power distributor is responsible for replying to the customer's request for testing;

c) The customer using the distribution grid and the power distributor are responsible for reaching an agreement on how to conduct the required testing before organizing the testing;

d) The testing results are sent by the testing organizer to the other party.

2. Testing the grids, electrical equipment, generator assembly owned and operated by the customer using the distribution grid as requested by the customer

a) The customer using the distribution grid is responsible for sending a written request for testing to the power distributor, including following contents:

- Purpose of and reason for the requested testing;
- Location of the testing;
- Estimated time of the testing;
- Expected item and sequence of the testing;
- Plan for power supply stoppage or reduction as required by the testing (if any).

b) In case of testing the generator assembly, in addition to the contents specified in Point a of this Clause, the generation unit shall supplement following information:

- Profile of the generator assembly;
- Characteristics of the generator assembly;
- Expected operating mode of the generator assembly during the testing.

c) Within 07 days of receiving the testing request from the customer using the distribution grid, the power distributor is responsible for checking and requesting the customer to supplement necessary information;

d) Within 14 days of receiving full information on the testing request from the customer using the distribution grid, the power distributor is responsible for notifying in writing the customer requesting the testing and relevant units of the planned testing;

e) The customers using the distribution grid are responsible for conducting the testing and sending the testing results to the power distributor.

Article 98. Responsibilities for post-testing performance

1. The power distributor shall adjust, invest in, upgrade and replace the equipment on the distribution grid in case the testing results show that the equipment on the distribution grid under its ownership and management does not meet the technical requirements for and the technical requirements at connection points as specified in this Circular or the requirements in the Connection Agreements.

2. The customers using the distribution grid shall adjust, invest in, upgrade and replace the equipment within the duration agreed with the power distributor in case the testing results show that the equipment owned and managed by the does not meet the technical requirements for and the technical requirements at connection points as specified in this Circular or the requirements in the Connection Agreements.

Section 9. REPORT ON RESULTS OF THE ELECTRICAL DISTRIBUTION SYSTEM OPERATION

Article 99. Regulations on report

1. Monthly report

Before the 10th day of a month, Vietnam Electricity is responsible for reporting to Electricity Regulatory Authority on the implementation situation, the results of the electrical distribution system operation in the previous month, including following contents:

a) The implementation of requirements for the electrical distribution system operation prescribed in Chapter II of this Circular includes:

- Technical requirements;
- Reliability of power supply;
- Power loss;
- Customer service quality.

- b) The operation of the distribution grid under its management: Growth, developments, load forecast; overload situation, equipment breakdown and cause of breakdown; the situation of SCADA signal connection, outstanding issues arising in the process of the distribution grid operation;
- c) The proposed operation and management measures to ensure safe and reliable operation of the electrical distribution grid, to improve power supply quality and customer service quality.

2. Annual report

Before January 31st of a year, Vietnam Electricity is responsible for reporting to Electricity Regulatory Authority on the implementation situation, the results of the electrical distribution system operation in the previous month, including following contents:

- a) The implementation situation, the results of the electrical distribution system operation in the previous year including the contents specified in Clause 1 of this Article;
- b) The plans and solutions regarding investment, management and operation in order to ensure safe and reliable operation of the grid and improve power supply quality and customer service quality.

3. Unexpected report

- a) The power distributor is responsible for reporting in writing on serious breakdowns and impacts due to the stoppage of and reduction in power supply to power customers and power retailers purchasing power from the power distributor to Electricity Regulatory Authority, Department of Industry and Trade in accordance with the regulation on conditions for order of power supply stoppage and reduction issued by Ministry of Industry and Trade;
- b) The power distributor is responsible for making irregular report on the electrical distribution system operation at the request of Electricity Regulatory Authority, Department of Industry and Trade, Vietnam Electricity, the national electrical system dispatch unit.

Chapter VII

IMPLEMENTATION ORGANIZATION

Article 100. Implementation organization

- 1. Electricity Regulatory Authority is responsible for disseminating, guiding and inspecting the implementation of this Circular.
- 2. Where necessary, Electricity Regulatory Authority is responsible for organizing the development and promulgation of the detailed guidance on technical requirements for solar power systems and wind power systems connected to the distribution grid in accordance with the provisions of this Circular.
- 3. Vietnam Electricity is responsible for directing its member units to implement this Circular.
- 4. The power distributor and the customers using the electrical distribution grids are responsible for making plans for investing, upgrading and renovating grids and electric equipment under their management to ensure that the technical requirements stipulated in this Circular are met.
- 5. During the implementation, if a dispute arises between the units related to this Circular implementation, the units may refer the case to Electricity Regulatory Authority for settlement in accordance with the order and procedures for dispute settlement in power activities issued by Ministry of Industry and Trade.

Article 101. Amendment of a number of Articles of Circular No. 12/2010/TT-BCT dated April 15th 2010 of Minister of Industry and Trade regulating the electrical transmission system and Circular No. 40/2014/TT-BCT dated November 5th 2014 by Minister of Industry and Trade regulating the national electrical system dispatch process

- 1. Amending Clause 2, Article 3 of Circular No. 12/2010/TT-BCT as follows:
 - "2. The *voltage level* is one of the nominal voltage values used in the electrical system, including:
 - a) Low voltage is the nominal voltage level of up to 1000 V;
 - b) Medium voltage is the nominal voltage level above 1000 V to 35 kV;
 - c) High voltage is the nominal voltage level above 35 kV to 220 kV;
 - d) Super high voltage is the nominal voltage level above 220 kV."
- 2. Amending Clause 33, Article 3 of Circular No. 12/2010/TT-BCT as follows:
 - "33. A *distribution grid* is a part of the grid consisting of lines and substations up to 110 kV."

3. Amending Clause 34, Article 3 of Circular No. 12/2010/TT-BCT as follows:

"34. A *transmission grid* is part of the grid consisting of lines and power stations with a voltage of over 110 kV."

4. Amending Clause 35, Article 3 of Circular No. 40/2014/TT-BCT as follows:

"35. A *medium voltage grid* is a distribution grid with a nominal voltage level of over 1000 V to 35 kV."

Article 102. Effectiveness

1. This Circular takes effect from January 18th 2016. Circular No. 32/2010/TT-BCT dated July 30th 2010 of Minister of Industry and Trade stipulates that the electrical distribution system expires from the date when this Circular takes effect.

2. In case a contract on equipment procurement and installation was signed before September 15th 2010, with contents different from those of this Circular, the power distributor and the customer using the grid can be continued under the signed contract.

3. During the implementation of this Circular, if any problem arises, the concerned units are required to directly report to Electricity Regulatory Authority for consideration and settlement in accordance with its competence or to report to Ministry of Public for settlement./.

Recipients:

- Office of General Secretary;
- Prime Minister, Deputy Ministers of the Government;
- Ministries, Ministerial Ministries, Government Agencies;
- People's Committee, Department of Industry and Trade of provinces and cities directly under the Central Government;
- People's Supreme Procuracy; People's Supreme Court;
- Minister, Deputy Ministers of Industry and Trade;
- Department of Normative Act Inspection (Ministry of Justice)
- Official Gazette;
- State Audit Office of Vietnam;
- Website: Government, Ministry of Industry and Trade;
- Vietnam Electricity;
- National Power Transmission Corporation;
- Power Corporations;
- Power Companies;
- National Load Dispatch Center;
- Archive: Secretariat, Legal Affairs, ERAV .

**FOR MINISTER
DEPUTY MINISTER**

Hoang Quoc Vuong

APPENDIX 1

LIST OF NEWLY CONSTRUCTED/RE-CONSTRUCTED LINES AND SUBSTATIONS FOR THE FOLLOWING YEAR AND 02 FOLLOWING YEARS
(Attached to Circular No. 39/2015/TT-BCT dated November 18th 2015 by Minister of Industry and Trade stipulating the electrical distribution system)

Table 1.1. List of newly constructed and re-constructed lines

| No. | List of lines | Cross-section | | Scale | | Operating time | Remarks |
|------------|---------------------------------------|---------------|-------------------------------------|--------------------|-------------|----------------|---------|
| | | Existing | Newly constructed or re-constructed | Number of circuits | Length (km) | | |
| I | Voltage level 110kV | | | | | | |
| 1 | Newly constructed line | | | | | | |
| | | | | | | | |
| 2 | Re-constructed line | | | | | | |
| | | | | | | | |
| II | Voltage level 35kV | | | | | | |
| 1 | Newly constructed line | | | | | | |
| | | | | | | | |
| 2 | Re-constructed line | | | | | | |
| | | | | | | | |
| III | Voltage level 22kV | | | | | | |
| 1 | Newly constructed line | | | | | | |
| | | | | | | | |
| 2 | Re-constructed line | | | | | | |
| | | | | | | | |
| IV | Voltage levels 15kV, 10kV, 6kV | | | | | | |
| 1 | Newly constructed line | | | | | | |
| | | | | | | | |
| 2 | Re-constructed line | | | | | | |
| | | | | | | | |

Table 1.2. List of newly constructed and re-constructed substations

| No. | List of substations | Transformer | Existing | | Following year | | Remarks |
|-----------|-------------------------------------|-------------|-------------|--------------|----------------|--------------|---------|
| | | | Scale (MVA) | Voltage (kV) | Scale (MVA) | Voltage (kV) | |
| I | Voltage level 110kV | | | | | | |
| 1 | Newly constructed substation | | | | | | |
| | | | | | | | |
| 2 | Upgraded, re-constructed substation | | | | | | |
| | | | | | | | |
| II | Voltage level 35kV | | | | | | |
| 1 | Newly constructed | | | | | | |

| | | | | | | | |
|--|-------------------------------------|--|--|--|--|--|--|
| | substation | | | | | | |
| 2 | Upgraded, re-constructed substation | | | | | | |
| III Voltage level 22kV | | | | | | | |
| 1 | Newly constructed substation | | | | | | |
| 2 | Upgraded, re-constructed substation | | | | | | |
| IV Voltage levels 15kV, 10kV, 6kV | | | | | | | |
| 1 | Newly constructed substation | | | | | | |
| 2 | Upgraded, re-constructed substation | | | | | | |

Table 1.3. List of newly constructed and re-constructed low voltage works

| No. | Items | Existing | Following year | | Remarks |
|-----|-----------------------|----------|-----------------|----------------|---------|
| | | | Newly installed | Re-constructed | |
| I | Line (km) | | | | |
| II | 1 phase meter (piece) | | | | |
| III | 3 phase meter (piece) | | | | |

APPENDIX 2A

INFORMATION ON REGISTRATION FOR CONNECTION TO 03 PHASE LOW VOLTAGE GRID

(Attached to Circular No. 39/2015/TT-BCT dated November 18th 2015 by Minister of Industry and Trade stipulating the electrical distribution system)

I. INFORMATION ON CUSTOMER

1. Customer/attorney's name:
2. Identity card/passport number:
3. Permanent residence:
4. Address of electricity use:
5. Contact: Phone number....., Fax....., Email.....

II. INFORMATION ON REQUEST FOR CONNECTION

1. Type of required connection (new connection/connection change):
2. Registration for electricity use in the current year and 03 following years:

| Registration for electricity use | Current year | 1 st year | 2 nd year | 3 rd year | Remarks |
|---|--------------|----------------------|----------------------|----------------------|---------|
| Maximum capacity (kW) | | | | | |
| Average annual electricity output (kWh) | | | | | |

3. Main types of load (welder, grinder, lighting...):
4. Expected power factor:
5. Purpose of electricity use (domestic use, production, business...):
6. Special requirements for equipment (if any):
7. Time of electricity use:

APPENDIX 2B

INFORMATION ON REGISTRATION FOR CONNECTION FOR CUSTOMERS USING ELECTRICITY CONNECTED TO MEDIUM VOLTAGE GRID

(Attached to Circular No. 39/2015/TT-BCT dated November 18th 2015 by Minister of Industry and Trade stipulating the electrical distribution system)

I. GENERAL INFORMATION

1. Information on customers in need of connection

- a) Full name of customer in need of connection:
- b) Registered head office address:
- c) Representative/Attorney:
- d) Title:
- e) Identity card/passport number:
- f) Contact: Phone number....., Fax....., Email.....

2. Legal records

Documents on corporate capacity in accordance with laws.

3. Project description

- a) Request for connection: (describe demand for connection)
- b) Project name:
- c) Construction site:
- d) Fields of operation/types of production:
- e) Expected date of connection point energization:
- f) Expected voltage level for connection:

II. INFORMATION ON DEMAND FOR ELECTRICITY USE

1. Data on electric power and rated capacity

Maximum use capacity: (kW)

Electric consumption/day/month/year: (kWh)

2. Forecast of electric demand at connection point

| Registration for electricity use | Current year | 2 nd year | 3 rd year | 4 th year | 5 th year |
|---|--------------|----------------------|----------------------|----------------------|----------------------|
| Maximum capacity (kW) | | | | | |
| Average annual electricity output (kWh) | | | | | |

- Customers have to provide information on total installed capacity of electrical equipment, mode of electric consumption (shifts, working days and holidays).

- Customers using electricity for production, business and service with a maximum capacity of 40 kW or higher have to provide information on load diagram of a typical day of a year in operation (or expected year of changes to existing connection) and 04 following years.

3. Requirements for backup level

Customers who use and receive electricity directly from distribution grid and are important customers in accordance with the list approved by Provincial People's Committee, and need to receive electricity from two or more sources should specify backup source and required backup capacity.

4. Load characteristics and other requirements (if any)

Details about technological line characteristics and load components of customers using electricity and receiving electricity directly from distribution grid, with particular attention to providing information on loads that may cause fluctuations of more than 5% of total capacity of customers using electricity and receiving electricity directly from distribution grid at connection point and flickering voltage level of such loads.

APPENDIX 2C

INFORMATION ON REGISTRATION FOR CONNECTION FOR CUSTOMERS USING ELECTRICITY CONNECTED TO 110KV GRID

(Attached to Circular No. 39/2015/TT-BCT dated November 18th 2015 by Minister of Industry and Trade stipulating the electrical distribution system)

I. GENERAL INFORMATION

1. Information on customers in need of connection

- a) Full name of customer in need of connection:
- b) Registered head office address:
- c) Representative:
- d) Title:
- e) Identity card/passport number:
- f) Contact: Phone number....., Fax....., Email.....

2. Legal records

Documents on corporate capacity in accordance with laws.

3. Project description

- a) Request for connection: (describe demand for connection)
- b) Project name:
- c) Construction site:
- d) Fields of operation/types of production:
- e) Expected date of connection point energization:
- f) Expected voltage level for connection:

II. INFORMATION ON DEMAND FOR ELECTRICITY USE

1. Data on electric power and rated capacity

Maximum active power: (MW) Reactive power: (MVA_r) Electric consumption/day/month/year: (kWh)

2. Forecast of electric demand at connection point

- Customers have to provide information on demand for electric load at connection points including maximum capacity, electric power and load diagram of a typical day of a year in operation (or expected year of changes to existing connection) and 04 following years, including following data:

- + Active power and reactive power received from distribution grid;
- + Active power and spontaneous reactive power (if any).

- Customers have to provide information on their electricity consumption characteristics, including data related to electric consumption such as product output, power specific consumption for a product unit, mode of electric consumption (shifts, working days and holidays), total installed capacity of electrical equipment and maximum capacity, power factor...

3. Technical data on electrical equipment and grids of electric load at connection point

a) Electric diagram

- Plan of equipment layout;
- Diagram of main electric connection, showing:

- + Main bar layout;
- + Electric circuits (overhead lines, underground cables, transformers...);
- + Phase layout;
- + Grounding layout;
- + Switchgears;
- + Operating voltage;
- + Protection method;
- + Connection location;
- + Reactive power complementer layout.

This diagram is limited to substations connected to connection points and other electrical equipment of the customers requesting connection that could affect the electrical distribution system, stating the parts expected to be expanded or changed (if any) in the future.

b) Electrical equipment

- Switchgears (circuit breaker, isolator...) of electric circuits related to connection points:
 - + Rated operating voltage;
 - + Rated current (A);
 - + Rated 03-phase short-circuit breaking current (kA);
 - + Rated 01-phase short-circuit breaking current (kA);
 - + Rated 03-phase load cut current (kA);
 - + Rated 01-phase load cut current (kA);
 - + Rated heaviest 03-phase short-circuit current (kA);
 - + Rated heaviest 01-phase short-circuit current (kA);
 - + Basic insulation level - BIL (kV).
- Transformer:
 - + Rated voltage and coil layout;
 - + Rated capacity MVA of each coil;
 - + Voltage division coil, pressurization type (underload or no-load), voltage division area (number of outputs and size of voltage division pitch);
 - + Pressurization period cycle;
 - + Grounding layout (Direct grounding, no grounding and grounding through reactor);
 - + Saturation curve;
 - + Positive sequence electric resistance and reactance of transformer at nominal, minimum, maximum voltage division step per rated capacity percentage MVA of transformer. For 03-coil transformer, with 03 externally connected coils, electric resistance and reactance between each pair of coil must be calculated with the 3rd coil being an open circuit;
 - + Zero sequence electric resistance and reactance of transformer at nominal, minimum, maximum voltage division step (Ω);
 - + Basic insulation level (kV).
- Reactive power complementers (capacitor/induction coil):
 - + Type of capacitance equipment (fixed or variable) and/or inductance rate or operating area MVA_r;
 - + Electric resistance and reactance, charge/discharge current;
 - + For controllable capacitor/induction coil, details of the control principle, control data such as voltage, load, switch or automation, operating time and other settings must be provided. .
- Voltage transformer (VT)/transformer instrument (TI):
 - + Transformation ratio;

- + Certificate of compliance with technical requirements in accordance with law on measurement.
- Protection and control system:
 - + Protection system configuration;
 - + Recommended installation value;
 - + Time to eliminate incidents of main and backup protection systems;
 - + Automatic closing cycle (if any);
 - + Control management and data communication.
- Overhead lines and power cables related to connection points:
 - + Electric resistance/reactance/capacitance;
 - + Rated load current and maximum load current.

c) Short circuit related parameters

- 03-phase short-circuit current (immediately appearing at fault point and after fugitive fault) from the customer's electrical system using the distribution grid to the electrical distribution system at connection point;
- Zero sequence electric resistance and reactance value of the customer's electricity system using the distribution grid from connection point;
- Voltage value before fault in compliance with maximum fault current;
- Negative sequence electric resistance and reactance value of the customer's electrical system using the distribution grid from connection point;
- Zero sequence electric resistance and reactance value of circuit is equivalent to P_i of the electric system using the distribution grid.

d) Requirements for backup level

Customers using and receiving electricity directly from the distribution grid who wish to receive electricity from two or more sources, required backup source and capacity (MW and MVar) must be specified.

4. Load characteristics and other requirements related to power load.

Customers who use and receive electricity directly from the distribution grid are required to provide following information:

- Details of load components of customers using and receiving electricity directly from the distribution grid, with particular attention to information on loads that may cause fluctuations of over 05% of the total capacity of customers using and receiving electricity directly from the distribution grid at connection point and voltage flicker level of such loads.
- Details of load characteristics at each connection point:

| Parameters | Unit |
|---|-----------------|
| Power factor in reactive power receive mode | |
| Load sensitivity to voltage | MW/kV, MVar/kV |
| Load sensitivity to frequency | MW/Hz, MVar/Hz |
| Expected maximum and medium phase imbalance | % |
| Expected maximum harmonic curve | |
| Expected short-term and long-term voltage flicker | |
| Load variation rate including up and down | kW/s and kVar/s |
| Shortest repeated time step of load variation | second (s) |
| Magnitude of maximum variable pitch in electricity demand | kW and kVar |
| - Other requirements related to power load. | |

INFORMATION ON POWER PLANTS AND GENERATOR ASSEMBLIES OF CUSTOMERS
REQUESTING CONNECTION (CONNECTION TO MEDIUM OR MORE VOLTAGE GRID)

(Attached to Circular No. 39/2015/TT-BCT dated November 18th 2015 by Minister of Industry and Trade stipulating the electrical distribution system)

Information applicable to power plants, generator assemblies of large customers using the distribution grid and requesting connection requires:

1. Description of power plant

- Plant name;
- Location;
- Type of plant (hydroelectricity, coal, gas thermoelectricity...);
- Assembly number, rated capacity;
- Expected electricity output;
- Expected capacity to be generated to the grid;
- Expected operating time;
- Recommended voltage level at connection point.

2. Circuit

- a) Plan of equipment layout;
- b) Diagram of main current connection, specifying:
 - Plan of equipment layout;
 - Diagram of main electric connection, showing:
 - + Main bar layout;
 - + Electric circuits (overhead lines, underground cables, transformers...);
 - + Phase layout;
 - + Grounding layout;
 - + Switchgears;
 - + Operating voltage;
 - + Protection method;
 - + Connection location;
 - + Reactive power complement layout.

This diagram is limited to substations connected to connection points and other electrical equipment of the customers requesting connection that could affect the electrical distribution system, stating the parts expected to be expanded or changed (*if any*) in the future.

3. Generator operation characteristics

For each type of generator assembly, following information must be provided:

- Generator assembly number;
- Rated generating capacity MW;
- Rated assembly generating capacity MVA;
- Self-use load active capacity MW;
- Self-use load reactive capacity MVAR;
- Terminal voltage kV;
- Active capacity band MW-MW;
- Reactive capacity generated at rated active capacity MVAR;
- Reactive capacity received at rated active capacity MVAR;
- Short-circuit factor;

- Rated stator current (A);
- Rated stator current at rated output current (rated active capacity, rated load-bearing factor, rated terminal voltage) and rated rotor velocity (A);
- Rated rotor voltage (kV);
- Operating band of generator assembly including thermal limit and excitation;
- Open circuit magnetization graph;
- Short-circuit characteristics;
- No-load active component graph;
- Voltage graph;
- Time for synchronization from warm status (hours);
- Time for synchronization from cool status (hours);
- Minimum operating time;
- Minimum stoppage time;
- Rated normal load (MW/minute);
- Rated normal load separation (MW/minute);
- Type of starting fuel;
- On-load fuel variation possibility;
- Ready modes;
- Time for change to load mode;
- Control range for operation of secondary frequency regulating system (SFRS) (MW);
- Other related operating characteristics;
- Provide detailed information on backup capacity of generators in different operating modes.

For thermal power plants, in addition to above required parameters, functional block diagram of the plant main components, boilers, alternating current generators, and heat or steam sources must be provided.

4. Technical description of each generator assembly

Following parameters and values:

- Axial synchronous reactance X_d ;
- Axial transient reactance X'_d ;
- Axial unsaturated pre-transient reactance X''_d ;
- Horizontal synchronous reactance X_q ;
- Horizontal unsaturated pre-transient reactance X'_q ;
- Horizontal pre-transient reactance X''_q ;
- Negative reactance X_2 ;
- Zero-sequence reactance X_0 ;
- Stator resistance R_a ;
- Stator opening reactance X_L ;
- Point reactance X_p ;
- Electric machine time constant symbol and value;
- Transient circuit opening positive axis $T_{do'}$ (s);
- Pre-transient circuit opening positive axis $T_{do''}$ (s);
- Transient circuit opening right angle axis $T_{qo'}$ (s);
- Pre-transient circuit opening right angle axis $T_{qo''}$ (s);

- Transient short circuit positive axis T_d' (s);
- Pre-transient short circuit positive axis T_d'' (s);
- Transient short circuit right angle axis T_q' (s);
- Pre-transient short circuit right angle axis T_q'' (s);
- Inertia constant of generator turbine for entire dialing unit (MWsec/MVA);

5. Excitation system

Expected type of excitation and electrical system stabilization device (PSS) *(if any)*, Laplace block diagram in accordance with IEEE standard (or allowed applicable equivalent standards) and associated parameters and transmission function.

6. Velocity regulating and stabilizing system

Expected type of velocity regulation, Laplace block diagram in accordance with IEEE standard (or allowed applicable equivalent standards) and associated parameters and transmission function.

7. Protection and control system

- Provide information on the generator relay protection system of.
- Provide information on the plant automatic control system and expected method of pairing with SCADA system, the plant telecommunication terminal and substation of the Customers who request connection.

8. Black start

Information about black start system is required.

9. Environmental impacts

Information related to greenhouse gas emission is required, including:

a) For thermal power plants

- CO₂;
- CO₂ ton/fuel ton;
- CO₂ reduction performance;
- SO₂;
- TSO₂ ton/fuel ton;
- SO₂ reduction performance;
- NO_x;
- NO_x ton/power output curve MWh.

b) Charge power plants

- Standby power (MWH pump);
- Maximum pump power (MW);
- Minimum pump power (MW);
- Maximum output power (MW);
- Minimum output power (MW);
- Performance (output/pump percentage %).

c) Wind power station

- Type of turbine (fixed or variable speed);
- Manufacturer's details of technical and operational characteristics with separate reference for flicker and harmonic presentation;
- Mode of seasonal operation of generator: seasonal or continuous;
- List of expected maximum output level generated to the distribution grid of the electricity distributor for each month of operation (MW);
- Power generation graph on typical day of a month with maximum generation amount;

- Expected details of frequent or rapid output variation, including magnitude, maximum rate of variation, frequency and duration.

10. Forecast availability

- Expected maintenance requirements: ...week/year;
- Availability (taken from expected requirements for scheduled maintenance);
- Availability of seasonally generated capacity rate MW;
- Absolute availability;
- Partial availability;
- Forced outage probability;
- Power limit;
- Daily power generation (GWh);
- Weekly power generation (GWh);
- Monthly power generation (GWh);
- Annual power generation (GWh).

For hydropower plants, data on generating capacity and expected power for each month of a year and information related to hydrology and hydropower must be provided, specifically as follows:

| | | |
|---|---------------------------------|--|
| A. PRIMARY POWER - HYDROPOWER: | | |
| A.1. Parameters on reservoir and reservoir regulation: | | |
| 1. Data on reservoir: | | |
| Useful capacity: | billion m ³ | |
| Entire reservoir capacity: | billion m ³ | |
| Flood control capacity: | billion m ³ | |
| Retention level: | m | |
| Dead level: | m | |
| Reinforced level: | M | |
| Regulation capacity for numerous years (if any): | billion m ³ | |
| Reservoir foundation area: | km ² | |
| Reservoir length at retention level: | km | |
| Average reservoir width: | km | |
| Average reservoir depth: | m | |
| Reservoir characteristic: | $V = f(h)$ | |
| 2. Reservoir regulation: | | |
| Type of regulation: | One year, several years, mixed | |
| Brief reservoir regulation process: | (put in a text file) | |
| Full reservoir regulation process: | (put in a text file) | |
| Reservoir regulation chart: | By month or week | |
| A.2. Parameters on dam | | |
| 1. Main dam structure (flood discharge): | | |
| Type of dam: | (stone and concrete...) | |
| Type of flood discharge: | (natural, using discharge gate) | |
| Dam peak altitude: | m | |
| Dam surface height: | m | |
| Dam surface length: | m | |

| | | |
|---|-------------------------|--|
| Dam bottom length: | m | |
| Upper altitude of flood discharge stop plank: | m | |
| (Dam structure diagram) | (a photo file) | |
| 2. Power generation dam structure: | | |
| Type of dam: | (stone and concrete...) | |
| Dam peak altitude: | m | |
| Dam surface height: | m | |
| Dam surface length: | m | |
| Dam bottom length: | m | |
| Upper altitude of intake gate: | m | |
| Lower altitude of intake gate: | m | |
| (Dam structure diagram) | (a photo file) | |
| 3. Upstream side: | | |
| Retention level: | m | |
| Dead level: | m | |
| Reinforced level: | m | |
| Regulation capacity for numerous years (if any): | m | |
| 4. Downstream side: | | |
| Water level when stopping the whole plant: | m | |
| Water level when running minimum capacity: | m | |
| Water level when running rated capacity: | m | |
| Water level when discharging capacity at a frequency of 0.01% | m | |
| A.3. Main data on weather and hydrology: | | |
| 1. Climate and weather characteristics | (a text file) | |
| 2. Data on hydrological characteristics | | |
| River basin area: | km ² | |
| Average total flow of numerous years | m ³ | |
| Average annual return water flow: | m ³ /s | |
| Summary table of average monthly return water flow: | (a text file) | |
| Average annual rainfall: | mm | |
| Flood flow: | | |

| Frequency | Maximum flood flow (m ³ /s) | Average day and night flow (m ³ /s) |
|-----------|---|--|
| 10.00% | | |
| 1.00% | | |
| 0.10% | | |
| 0.01% | | |
| | | |

Table of return water frequency and designed energy

| Frequency | Flow | Energy |
|--|--------------------------|--------|
| 25 % | | |
| 50 % | | |
| 65 % | | |
| 75 % | | |
| 90 % | | |
| Average for numerous years | | |
| A.4. Special notes: | | |
| (a text file) | | |
| B. HYDRAULIC MECHANICS | | |
| B.1. Types of stop planks (valves) used for works | | |
| 1. Water intake system: | (a text file) | |
| 2. Water discharge system: | (a text file) | |
| B.2 Water turbine | | |
| 1. Technical parameters | | |
| Type | (francis, pelton, mixed) | |
| Country of manufacture | | |
| Code | | |
| Capacity | MW | |
| Available power range corresponding to design head | fromMW to...MW | |
| Design head | m | |
| Maximum head | m | |
| Minimum head | m | |
| Water flow through turbine when rated load | m ³ /s | |
| Rated rotation speed | round/minute | |
| Interleaving rotation speed | round/minute | |
| Suction height (HS) | m | |
| Specific consumption at rated head | m ³ /kWh | |
| 2. Turbine structure (this section is put in a text file with following structure: | | |
| Stator turbine | | |
| Compression ring | | |
| - bearing | | |
| - direction socket | | |
| Volute chamber | | |
| Impeller | | |
| Turbine shaft | | |
| Guide vane | | |
| Servomotor | | |
| Turbine speed regulator | | |
| 3. Turbine operation | | |
| Explain turbine operation (starting, normal, turbine stop, normal stop, fault stop, compensating switch, etc.) | (a text file) | |

| | | |
|--|-------------------|--|
| Turbine characteristics | $P = f(\Delta h)$ | |
| Specific consumption characteristics by head | | |
| 3. Enclosed auxiliary systems and devices | (a text file) | |
| (Given in writing, including: high pressure - low pressure pneumatic system, oil system, fire hydrant system, cooling water system...) | | |

11. Technical data of electrical equipment at connection points

a) Switchgears: circuit breakers, isolators of connection circuits related to connection points

- Rated operating voltage;
- Rated current (A);
- Rated 03-phase short circuit cutoff (kA);
- Rated 01-phase short circuit cutoff (kA);
- Rated 03-phase load cutoff (kA);
- Rated 01-phase load cutoff (kA);
- Rated heaviest 03-phase short circuit current;
- Rated heaviest 01-phase short circuit current;
- Basic isolation level (kV).

b) Transformer

- Rated voltage and coil layout;
- Rated capacity MVA of each coil;
- Voltage division coil, pressurization type (underload or no-load), voltage division area (number of outputs and size of voltage division pitch);
- Pressurization period cycle;
- Grounding layout (direct grounding, no grounding and grounding through reactor);
- Saturation curve;
- Positive sequence electric resistance and reactance of transformer at nominal, minimum, maximum voltage division step per rated capacity percentage MVA of transformer. For 03-coil transformer, with 03 externally connected coils, electric resistance and reactance between each pair of coil must be calculated with the 3rd coil being an open circuit;
- Zero sequence electric resistance and reactance of transformer at nominal, minimum, maximum voltage division step (Ω);
- Basic isolation level (kV).

c) Reactive power complementers (capacitor/induction coil):

- Type of capacitance equipment (fixed or variable) and/or inductance rate or operating area MVar;
- Electric resistance and reactance, charge/discharge current;
- For controllable capacitor/induction coil, details of the control principle, control data such as voltage, load, switch or automation, operating time and other settings must be provided. .

d) Voltage transformer (VT)/transformer instrument (TI):

- Transformation ratio;
- Certificate of compliance with technical requirements in accordance with law on measurement.

e) Protection and control system:

- Protection system configuration;
- Recommended installation value;
- Time to eliminate incidents of main and backup protection systems;
- Automatic closing cycle (if any);

- Control management and data communication.

f) Overhead lines and power cables related to connection points:

- Electric resistance/reactance/capacitance;
- Rated load current and maximum load current.

12. Generator owned by the customers who request connection

For generators owned by customers, following information on load forecast must be provided:

- Forecast of maximum and minimum power load demands;
- Power requirements.

APPENDIX 3

SAMPLE CONNECTION AGREEMENT

(Attached to Circular No. 39/2015/TT-BCT dated November 18th 2015 by Minister of Industry and Trade stipulating the electrical distribution system)

SOCIALIST REPUBLIC OF VIETNAM

Independence – Freedom – Happiness

CONNECTION AGREEMENT

BY AND BETWEEN (POWER DISTRIBUTOR) AND ... (NAME OF CUSTOMER REQUESTING CONNECTION)

Number:

- Pursuant to Circular No. / / TT-BCT dated ... / ... / ... of Minister of Industry and Trade enacting the Regulation on the electrical distribution system;
- Pursuant to the request for connection dated ... / ... / ... of *[name of the customer requesting connection]* to *[the power distributor]*;
- Pursuant to the request for connection documents *[name of the customer requesting connection]* to *[the power distributor]* dated ... / ... / ...;
- Pursuant to the working records and preliminary agreement on connection plan ...;
- Pursuant to the request and capacity of electrical distribution service supply,

Today, dated ... / ... / ... at ..., we are:

Party A: [Power distributor]

Represented by: ... Position: Address:

Phone number:; Fax:

Account number: ...

Tax code: ...

Party B: [Name of the customer requesting connection]

Represented by: ...

Title: ...

Address: ...

Phone number:; Fax:

Account number:

Tax code: ...

Both parties agree to sign the connection agreement with following contents:

Article 1. *[Name of the power distributor]* agree on the power plant connection *[Name of the plant]* of

[name of the customer requesting connection] to the distribution grid, specifically as follows:

1. Project scale

- a) Start point: ...
- b) End point: ...
- c) Line:
 - Connection voltage level: ...
 - Conduct: ...
 - Number of circuits: ...
 - Route length: ...
 - Structure: ...
 - Operating mode: ...
- e) Substation:
 - Type of substation:
 - Substation capacity:

2. Power measurement

.....
(In compliance with the Regulation on power measurement in the electrical system enacted by Ministry of Industry and Trade)

3. Investment boundary

.....

4. Requirements for technical solutions

5. Attached documents

- Attachment No. 1:
- Attachment No. 2:
- Attachment No. 3:
- Attachment No. 4:
- Attachment No. 5:

(The attached documents are part of the Connection Agreement, both parties negotiate and agree in detail on how and when to provide the attached documents).

Article 2. Responsibilities of both parties

1. Responsibilities of Party A

[Name of the power distributor] is responsible for investing in the distribution grid construction for connection to the grid of [Name of the customer requesting connection] in accordance with the construction investment boundary prescribed in Clause 3 Article 1 of this connection agreement.

2. Responsibilities of Party B

- a) [Name of the customer requesting connection] is responsible for investing in the construction of its distribution grid for connection to the grid of [Name of the power distributor] in accordance with the construction investment boundary prescribed in Clause 3 Article 1 of this connection agreement.
- b) [Name of the customer requesting connection] commits to manage and operate its electrical system/power plant in compliance with Circular No .../.../TT-BCT dated ... /... /2015 of Minister of Industry and Trade enacting Regulations on the electrical distribution system and other relevant regulations.

.....

Article 3. Date of connection

Expected date of energization is (.../.../...).

Article 4. Cost of additional inspection and testing

Cost of additional inspection and testing in the case specified in Clause ... Article ... Circular No. ... /.../TT-BCT dated ... / ... /2015 of Minister of Industry and Trade enacting Regulations on the electrical distribution system is agreed by both parties as follows:

1.
2.

Article 5. Other agreements

1. During the operation, in case of change or repair related to connection point or connection device, the party making changes shall notify in writing and send relevant technical documents to the other party; Draft the Connection Agreement Appendix for both parties to sign as a document attached to this Connection Agreement.

2.
3.

Article 6. Disconnection

1. Party B has the right to request voluntary disconnection in the specific cases specified in Attachment No. 5 and shall comply with relevant provisions of Regulation on the electrical distribution system enacted by Ministry of Industry and Trade.

2. Party A has the right to compulsory disconnection in the cases specified in Clauses 2 and 6, Article 53 of Circular No/2015/TT-BCT dated .../.../2015 enacted by Ministry of Industry and Trade in Regulation on the electrical distribution system.

3. Other cases: ... *(as agreed by both parties)*

Article 7. Enforcement validity

1. This connection agreement takes effect from the date of signing.
2. The effective period of the connection agreement:
3. This connection agreement is made into 05 originals of the same validity, each party keeps 2 originals and 01 original is sent to the authorized dispatch level./.

Representative of Party B

Representative of Party A

(Name, title)

(Name, title)

[Attachment No. 1] Diagram of equipment layout at connection point

(Attached to Connection Agreement No.)

[Attachment No. 2] Documents specifying fixed boundaries

(Attached to Connection Agreement No.)

Dated/...../.....

Name of substation or connection road:

Location:

Address:

Phone number:

The grid operator of the power distributor (Name, phone number):

The grid operator of the customer requesting connection (Name, phone number): Connection points:

Property boundary:

**Authorized representative of the customer
requesting connection**

**Authorized representative of the power
distributor**

(Signed, full name, sealed)

(Signed, full name, sealed)

[Attachment No. 3]: List of equipment under fixed ownership at connection point

I. Main equipment (including distribution road and substation)

1. Equipment name, number:
2. Main technical description:
3. Investor/owner:
4. Other information:
5. Comments:

II. Secondary equipment

1. Equipment name, number:
2. Main technical description:
3. Investor/owner:
4. Other information:
5. Comments:

III. Measurement system

1. Equipment name, number:
2. Main technical description:
3. Investor/owner:
4. Other information:
5. Comments:

IV. Other equipment

1. Equipment name, number:
2. Main technical description:
3. Investor/owner:
4. Other information:
5. Comments:

[Attachment No. 4] Technical description of electrical equipment related to connection points of the customers in need connection

(Attached to Connection Agreement No.)

[Attachment No. 5] Request for temporary or permanent disconnection of the customers using the distribution grid

(Attached to Connection Agreement No.)

Describe the cases where the customer using the distribution grid and proposing temporary or permanent disconnection (for a limited time) to the power distributor and the responsibilities of the customer using the distribution grid from case to case./.