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Calculation of Electricity Generation Price Range for Solar and Wind Power Plants under Circular 19/2023

1. Calculation of maximum EGP of a solar power plant

1.1. The maximum EGP of a solar power plant (**Maximum Solar EGP**) is calculated (in VND/kWh) based on the following formula:[1]

Maximum Solar EGP = Fixed Average Price + Fixed O&M Price

Of which:

1.1.1. **Fixed Average Price** is the fixed average price of the standard solar power plant. Fixed Average Price is a fixed number, but it is said to be intended to recover investment cost of the investor.[2] Fixed Average Price is calculated (in VND/kWh) based on the following formula:[3]

Fixed Average Price = Annual ICC ÷ Average Energy Delivered

Of which:

(a) **Annual ICC** is the annually converted investment capital cost to build the standard solar power plant (excluding VAT) (calculated in VND), which is calculated using a formula that takes into account the following elements:[4]

[1] Article 4 of Circular 19/2023.

[2] Article 5.1 of Circular 19/2023.

[3] Article 5.1 of Circular 19/2023.

[4] Article 5.2 of Circular 19/2023.

(i) **Investment Unit Cost** of the standard solar power plant (calculated in VND/kWp). The Investment Unit Cost is the investment cost for 1 kWp of the installed capacity of the standard solar power plant (excluding investment cost for transmission lines and transformer stations leading up to the connection point, and energy storage systems) and is determined based on the applicable total investment cost, updated in accordance with the foreign exchange rate at the time of calculating the EGP bracket, with reference to the data provided by consultants if necessary;[5]

(ii) **Installed Capacity** of the standard solar power plant (kWp);

(iii) the economic life of the standard solar power plant (fixed at 20 years);[6] and

(iv) the **Financial Discount Rate** of the standard solar power plant (calculated in %). Such financial discount rate is the before-tax weighted average nominal cost of capital of the standard solar power plant, calculated using a formula which takes into account the following elements (some of which are fixed by Circular 19/2023):[7]

- the ratio of debt in the total investment of the standard solar power plant (calculated in %) (fixed at 70%);[8]
- the ratio of equity in the total investment of the standard solar power plant (calculated in %) (fixed at 30%);[9]
- the economic life of the standard solar power plant (fixed at 20 years);[10]

[5] Articles 5.2 and 5.3 of Circular 19/2023.

[6] Item I.1 of Table I under the Schedule of Circular 19/2023.

[7] Article 5.4 of Circular 19/2023.

[8] Item III.1 of Table I under the Schedule of Circular 19/2023.

[9] Item III.2 of Table I under the Schedule of Circular 19/2023.

[10] Item I.1 of Table I under the Schedule of Circular 19/2023.

- the average time to repay debt of the investor (fixed at 10 years);[11]
- the **Debt Interest Rate** which is calculated (in %) by the weighted average of the interest rates of different loan capital sources of domestic currency and foreign currency in accordance with the formula that takes into account the following elements:[12]
    - the **Foreign Debt Ratio** which is the ratio of foreign currency loan in the total loan capital, fixed at 80%;[13]
    - the **Foreign Debt Interest Rate** which is the interest rate of the foreign currency loan determined by the average of the 180-Day Average Secured Overnight Financing Rates over the course of 36 [consecutive] months immediately preceding the time of building the [EGP] bracket as announced by the Fed (www.newyorkfed.org) plus the average annual rate of bank loan arrangement fee at 3% per annum;
    - the **Domestic Debt Ratio**, which is the ratio of domestic currency loan in the total loan capital, fixed at 20%;[14] and
    - the **Domestic Debt Interest Rate** which is the interest rate of the domestic currency loan determined by the average of the interest rates for 12-month post-paid deposits in Vietnamese Dong for individual customers of 5 [consecutive] years immediately preceding the year of building the [EGP] bracket, determined on September 30th each year of four commercial banks (i.e., Vietcombank Vietinbank,

[11] Item IV of Table I under the Schedule of Circular 19/2023.

[12] Article 5.4(a) of Circular 19/2023.

[13] Item III.3 of Table I under the Schedule of Circular 19/2023.

[14] Item III.4 of Table I under the Schedule of Circular 19/2023.

BIDV, Agribank or the legal successor units of these banks) plus the average annual service fee rate of the banks at 3.5% per annum.

- the **Profit/Equity Rate** which is the before-tax rate of return over equity, calculated (in %) in accordance with the formula that takes into account the following elements:[15]
  - the after-tax rate of return over equity, fixed at 12%; and
  - the average CIT rate (in %) during the economic life of the solar power plant under the applicable regulations.

(b) **Average Energy Delivered** is the annual average of energy delivered over the years of the standard solar power plant (calculated in kWh), which is calculated based on the following formula:[16]

Average Energy Delivered = Total Installed Area × Panel Efficiency Rate × Average Annual Radiation × Power Plant Efficiency

Of which:

(i) **Total Installed Area** is the total solar panel installation area (calculated in m2) corresponding to the Installed Capacity of the standard solar power plant.

(ii) **Panel Efficiency Rate** is the efficiency of the solar panel (calculated in %);

(iii) **Average Annual Radiation** is the average annual radiation intensity in three regions (northern, middle, and southern) of Vietnam corresponding to the standard solar power plant (calculated in kWh/m2/year);[17] and

[15] Article 5.4(b) of Circular 19/2023.

[16] Article 5.5 of Circular 19/2023.

[17] **VNLaw Notes:** This is the original ambiguous wording under Circular 19/2023, which we think should meant to say that the Average Annual Radiation is the average annual intensity in the *relevant region*

(iv) **Power Plant Efficiency** is the efficiency of the standard solar power plant (calculated in %).

These four factors are determined based on either (a) the power plant's approved technical design or feasibility study, or (b) the data from consultants.[18]

1.1.2. **Fixed O&M Price** is the fixed price for operation and maintenance of the standard solar power plant. Fixed O&M Price is a fixed number, but it is said to be intended to recover the cost for major repair, labour, and other annual costs.[19] Fixed O&M Price is calculated based on the following formula:[20]

Fixed O&M Price = Total Fixed O&M Cost ÷ Average Energy Delivered

Of which:

(a) **Average Energy Delivered** is mentioned in paragraph 1.1.1(b)); and

(b) **Total Fixed O&M Cost** is the total cost for operation and maintenance of the standard solar power plant (calculated in VND). Total Fixed O&M Cost is calculated based on the following formula:[21]

Total Fixed O&M Cost = Investment Unit Cost × Installed Capacity × Fixed O&M Cost Ratio

Of which:

(i) See paragraph 1.1.1(a)(i) for **Investment Unit Cost** and paragraph 1.1.1(a)(ii) for **Installed Capacity**; and

where such standard solar power plant would be located.

[18] Article 5.6 of Circular 19/2023.

[19] Article 6.1 of Circular 19/2023.

[20] Article 6.1 of Circular 19/2023.

[21] Article 6.2 of Circular 19/2023.

(ii) **Fixed O&M Cost Ratio** is the ratio of O&M costs in the Investment Unit Cost of the standard solar power plant (calculated in %) determined with reference to the data provided by consultants.

2. Calculation of maximum EGP of a wind power plant

2.1. The maximum EGP of a wind power plant (**Maximum Wind EGP**) is calculated (in VND/kWh) based on the following formula:[22]

Maximum Wind EGP = Fixed Average Price + Fixed O&M Price

Of which:

2.1.1. **Fixed Average Price** is the fixed average price of the standard wind power plant. Fixed Average Price is a fixed number, but it is said to be intended to recover investment cost of the investor.[23] Fixed Average Price is calculated (in VND/kWh) based on the following formula:[24]

Fixed Average Price = Annual ICC ÷ Average Energy Delivered

Of which:

(a) **Annual ICC** is the annually converted investment capital cost to build the standard wind power plant (excluding VAT) (calculated in VND), which is calculated using a formula that takes into account the following elements:[25]

(i) **Investment Unit Cost**, which is the investment cost for 1 kW of the installed capacity of the standard wind power plant (excluding investment cost for transmission lines and transformer stations leading up to the connection point, and energy storage systems), calculated in VND/kW, and determined based on the

[22] Article 7 of Circular 19/2023.

[23] Article 8.1 of Circular 19/2023.

[24] Article 8.1 of Circular 19/2023.

[25] Article 8.2 of Circular 19/2023.

applicable total investment cost, updated in accordance with the foreign exchange rate at the time of calculating the EGP bracket, with reference to the data provided by consultants if necessary;[26]

(ii) **Installed Capacity** of the standard wind power plant;

(iii) the economic life of the standard wind power plant (fixed at 20 years);[27] and

(iv) the **Financial Discount Rate** of the standard wind power plant (calculated in %). Such financial discount rate is the before-tax weighted average nominal cost of capital of the standard wind power plant, calculated using a formula which taking into account the following elements:[28]

- the ratio of debt in the total investment of the standard wind power plant (calculated in %), which is fixed at 70%;[29]
- the ratio of equity in the total investment of the standard wind power plant (calculated in %), which is fixed at 30%;[30]
- the economic life of the standard wind power plant, which is fixed at 20 years;[31]
- the average time to repay debt of the investor, which is fixed at 10 years;[32]

[26] Articles 8.2 and 8.3 of Circular 19/2023.

[27] Item I.2 of Table I under the Schedule of Circular 19/2023.

[28] Article 8.4 of Circular 19/2023.

[29] Item III.1 of Table I under the Schedule of Circular 19/2023.

[30] Item III.2 of Table I under the Schedule of Circular 19/2023.

[31] Item I.2 of Table I under the Schedule of Circular 19/2023.

[32] Item VI of Table I under the Schedule of Circular 19/2023.

- the **Debt Interest Rate** which is calculated (in %) by the weighted average of the interest rates of different loan capital sources of domestic currency and foreign currency in accordance with the formula that takes into account the following elements:[33]
    - the **Foreign Debt Ratio**, which is the ratio of foreign currency loan in the total loan capital, fixed at 80%;[34]
    - the **Foreign Debt Interest Rate**, which is the interest rate of the foreign currency loan determined by the average of the 180-Day Average Secured Overnight Financing Rates over the course of 36 [consecutive] months [immediately preceding] the year of building the [EGP] bracket as announced by the Fed (www.newyorkfed.org) plus the average annual rate of bank loan arrangement fee at 3% per annum;
    - the **Domestic Debt Ratio**, which is the ratio of domestic currency loan in the total loan capital, fixed at 20%;[35] and
    - the **Domestic Debt Interest Rate** which is the interest rate of the domestic currency loan determined by the average of the interest rates for 12-month post-paid deposits in Vietnamese Dong for individual customers of 5 [consecutive] years immediately preceding the year of building the [EGP] bracket, determined on September 30th each year of four commercial banks (i.e., Vietcombank Vietinbank, BIDV, Agribank or the legal successor units of these banks) plus the average annual service fee rate of the banks at 3.5% per annum.

[33] Article 8.4(a) of Circular 19/2023.

[34] Item III.3 of Table I under the Schedule of Circular 19/2023.

[35] Item III.4 of Table I under the Schedule of Circular 19/2023.

- the **Profit/Equity Rate** which is the before-tax rate of return over equity, calculated (in %) in accordance with the formula that takes into account the following elements:[36]
    - the after-tax rate of return over equity, fixed at 12%; and
    - the average CIT rate (in %) during the economic life of the solar power plant under the applicable regulations.

(b) **Average Energy Delivered** is the annual average of energy delivered over the years of the standard wind power plant (calculated in kWh), which is calculated based on the following formula:[37]

Average Energy Delivered = P50 Average Energy Delivered – P50 Average Energy Delivered x Total Variability x P75 Normal Distribution Factor

Of which:

(i) **P50 Average Energy Delivered** is the average energy over the years with the probability at 50% of the standard wind power plant (calculated at kWh). P50 Average Energy Delivered is calculated based on the following formula:[38]

P50 Average Energy Delivered = 8760 x Installed Capacity x Capacity Factor

Of which:

- **Installed Capacity** is mentioned in paragraph 2.1.1(a)(ii); and

[36] Article 8.4(b) of Circular 19/2023.

[37] Article 8.5 of Circular 19/2023.

[38] Article 8.6 of Circular 19/2023.

- **Capacity Factor** (calculated in %) is the capacity factor of the standard wind power plant determined based on either (a) the power plant's approved technical design or feasibility study, or (b) the data from consultants.[39]

(ii) **Total Variability** is the total variability of the standard wind power plant (calculated at %). Total Variability is determined based on the determined based on either (a) the power plant's approved technical design or feasibility study, or (b) the data from consultants;[40] and

(iii) **P75 Normal Distribution Factor** is the normal distribution factor equivalent to the average energy over the years with the probability at 75% of the standard wind power plant (fixed at 0.674).[41]

2.1.2. **Fixed O&M Price** is the fixed price for operation and maintenance of the standard wind power plant. Fixed O&M Price is a fixed number, but it is said to be intended to recover the cost for major repair, labour and other annual costs.[42] Fixed O&M Price is calculated (in VND/kWh) based on the following formula:[43]

Fixed O&M Price = Total Fixed O&M Cost ÷ Average Energy Delivered

Of which:

(a) **Average Energy Delivered** is mentioned in paragraph 2.1.1(b); and

[39] Article 8.7 of Circular 19/2023.

[40] Article 8.7 of Circular 19/2023.

[41] Item II.1 of Table I under the Schedule of Circular 19/2023.

[42] Article 9.1 of Circular 19/2023.

[43] Article 9.1 of Circular 19/2023.

(b) **Total Fixed O&M Cost** is the total cost for operation and maintenance of the standard wind power plant (calculated in VND). Total Fixed O&M Cost is calculated based on the following formula:[44]

Total Fixed O&M Cost = Investment Unit Cost x Installed Capacity x Fixed O&M Cost Ratio

Of which:

(i) See paragraph 2.1.1(a)(i) for **Investment Unit Cost** and paragraph 2.1.1(a)(ii) for **Installed Capacity**; and

(ii) **Fixed O&M Cost Ratio** is the ratio of O&M costs in the Investment Unit Cost of the standard wind power plant (calculated in %) determined with reference to the data provided by consultants.

[44] Article 9.2 of Circular 19/2023.