Table 3.2: Generating stations available units capabilirty

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stations | No of unit Installed | Available Units | Generation Installed Capacity (MW) | Generation  Available Capability (MW) | Remarks of Generators |
| Kanji (Hydro) | 8 |  | 760 | 327 | IG9-out due to burnt 7.5MVA 33/0.415Kv and 183.6MVA 16/330Kv station service transformer and generator transformer. IG10- Shutdown due to thrust bearing temperature problem |
| Jebba (Hydro) | 6 |  | 578.4 | 351 | 2G5-out due to guide bearing problem. 2G6-out due to burn generator winding and AVR |
| Shiroro (Hydro) | 4 |  | 600 | 600 | 411G3- out on fault |
| Egbin (Steam) | 6 | ST1,3,4&5 6 | 1320 | 1100 | ST2 out on major overhaul |
| Sapele (Steam) | 6 |  | 720 | 120 | ST4- Out on fault, ST5- Awaiting major overhead,  ST6- tripped in gas control value not following reference point |
| Delta (Gas) | 18 |  | 900 | 604 | GT3&5- out on generator winding fault, GT4-out on liss of excitation, GT8&14 out on major overhaul, GT18-out due to generator lookout problem. GT2- tripped on transformer differentiate lockout. |
| Afam IV&V (Gas) | 8 |  | 351 | 120 | GT11-12 – DE-commissioned and scrapped- GT13,14,&16-out on blade failure |
| Afam VI | 4 |  | 650 | 576 | Generator are always limited by gas constraint |
| Sapele NIPP | 4 | 1 | 500 | 112 | GT2 and 3-Out due to gas constraint, GT4- out due to high air filter differentiate pressure |
| Geregu NIPP | 3 |  | 450 | 435 | Generate output are majorly limited by gas constant |
| Geregu Gas | 3 |  | 450 | 435 | Generate output are majorly limited by gas constant |
| Omotosho (Gas) | 8 |  | 335 | 304 | Generation limited due to gas constant and low had demand by the Discos |
| Omotosho NIPP (Gas) | 4 |  | 500 | 360 | GT1-out due to bulging on combustion can |
| Alaoji NIPP  (Gas) | 4 |  | 500 | 360 | GT3-shutdown due to power part |
| Olorunsogo (Gas) | 8 |  | 335 | 240 | Generation limited due to gas constant and low had demand by the Discos |
| Olorunsogo NIPP | 6 |  | 750 | 300 | Generation limited due to gas constant and low had demand by the Discos |
| Azura IPP (Gas) | 3 |  | 461 | 450 |  |
| Okpai  Gas/Steam | 3 |  | 480 | 300 | Generation limited due to available gas |
| Ihovbor | 4 |  | 500 | 270 | Generation limited due to gas constant |

Table 3.1: Nigeria Electricity Distribution Companies Operating Structure (a Population of states in Nigeria, National Bureau of Statistics, 2018).

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| S/N | Name of DISCO | Areas of Operation | Number of Feeders | Area a  Population | Percentage Load Allocation (%) |
| **1** | Abuja Distribution Company | FCT, Kogi, and Niger Sate | 92 | 13593863 | 11.5 |
| 2 | Benin Distribution Company | Edo, Delta, Ekiti and Ondo State | 69 | 17841450 | 9.0 |
| 3 | Eko Distribution Company | Lagos (Lekki to Epe, Island and Victoria Island) | 87 | 4800239 | 11.0 |
| 4 | Enugu Distribution Company | Abia, Enugu Anambra, Ebonyi, and Imo State | 75 | 21955414 | 9.0 |
| 5 | Ibadan Distribution Company | Kwara, Oyo, Osun and Ogun State | 119 | 20957062 | 13.0 |
| 6 | Ikeja Distribution Company | Lagos (All of the mainland, Ikeja to Badagry) | 86 | 7200359 | 15.0 |
| 7 | Jos Distribution Company | Bauchi, Benue, Gombe, Nassarawa and Plateau | 45 | 22259928 | 5.5 |
| 8 | Kaduna Distribution Company | Kaduna, Kebbi, Sokoto and Zamfara | 64 | 22205933 | 8.0 |
| 9 | Kano Distribution Company | Jigawa, Kano and Kastina | 63 | 28736374 | 8.0 |
| 10 | PortHarcourt | Akwa Ibom, Bayelsa, Cross River, and Rivers | 70 | 18930331 | 6.5 |
| 11 | Yola Distribution Company | Adamawa, Borno, Taraba and Yobe | 44 | 16469590 | 3.5 |

Table 4.1: Existing Nigeria power grid system bus voltage and power performance value

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bus Name** | **Bus Volatge (kV)** | **Bus Per Unit Voltage** | **Active Power Flow at the bus (MW)** | **Reactive Power Flow at the bus (MVAR)** | **Bus Volatge Angle (deg)** |
| Afam | 327.7 | 0.99 | 638.0 | 263.36 | -7.8 |
| Aja | 303.3 | 0.92 | 334.48 | 155.70 | -30.2 |
| Ajaokuta | 330.4 | 1.00 | 869.80 | 83.12 | -1.0 |
| Akangba | 292.7 | 0.89 | 118.77 | 73.61 | -22.9 |
| Aladja | 328.7 | 1.00 | 160.15 | 61.07 | -1.8 |
| Alagbon | 300.9 | 0.91 | 148.54 | 72.20 | -30.9 |
| Alaoji GS | 326.3 | 0.99 | 339.00 | 103.01 | -8.3 |
| Alaoji TS | 324.8 | 0.98 | 842.45 | 289.01 | -8.9 |
| Aliade | 323.8 | 0.98 | 454.94 | 107.61 | -19.6 |
| Asaba | 321.3 | 0.97 | 65.33 | 26.85 | -7.8 |
| Ayede | 323.9 | 0.98 | 170.55 | 105.70 | -14.4 |
| Benin | 329.5 | 1.00 | 1229.14 | 115.85 | -3.7 |
| Benin Kebbi | 325.9 | 0.99 | 94.71 | 58.69 | -13.6 |
| Damaturu | 339.1 | 1.03 | 133.41 | 99.57 | -47.9 |
| Delta | 329.8 | 1.00 | 604.00 | 52.42 | -1.0 |
| Egbin | 325.9 | 0.99 | 1675.74 | 598.34 | -24.2 |
| Ganmo | 327.5 | 0.99 | 131.13 | 37.63 | -12,5 |
| Geregu | 330.4 | 1.00 | 870 | 45.15 | -0.9 |
| Gombe | 332.2 | 1.01 | 326.4 | 112.82 | -44.1 |
| Gwagwalada | 322.1 | 0.98 | 572.92 | 98.98 | -12.5 |
| Ihovbor | 330.4 | 1.00 | 720.20 | 66.98 | -2.2 |
| Ikeja West | 306.4 | 0.93 | 1175.11 | 405.41 | -19.8 |
| Ikot Ekpene | 323.7 | 0.98 | 374.67 | 8.67 | -10.8 |
| Jebba GS | 331.4 | 1.00 | 35.00 | 104.26 | -10.0 |
| Jebba TS | 331.5 | 1.00 | 581.44 | 109.81 | -10.1 |
| Jos | 327.8 | 0.99 | 451.22 | 97.93 | -28.3 |
| Kaduna | 321.5 | 0.97 | 706.02 | 146.25 | -21.6 |
| Kanji GS | 331.1 | 1.00 | 327.00 | 111.87 | -8.4 |
| Kanji TS | 331.2 | 1.00 | 326.99 | 111.59 | -8.4 |
| Kano | 308.5 | 0.93 | 287.21 | 20.76 | -35.6 |
| Katampe | 315.1 | 0.95 | 329.71 | 155.79 | -16.7 |
| Lekki | 300.7 | 0.91 | 99.62 | 49.81 | -31.0 |
| Lokoja | 328.1 | 0.99 | 652.18 | 42.40 | -3.7 |
| Maiduguri | 350.5 | 1.06 | 24.78 | 6.19 | -49.2 |
| Makurdi | 325.0 | 0.98 | 364.21 | 139.66 | -21.2 |
| New Haven | 321.2 | 0.97 | 308.71 | 101.84 | -12.8 |
| Oke-Aro | 312.4 | 0.95 | 117.61 | 96.72 | -23.2 |
| Okpai | 327.5 | 0.99 | 297.0 | 120.25 | -5.9 |
| Olorunsogo | 328.4 | 1.00 | 540.00 | 291.69 | -13.6 |
| Omotosho | 329.6 | 1.00 | 664 | 133.45 | -2.2 |
| Onitsha | 322.6 | 0.98 | 595.77 | 326.89 | -7.3 |
| Osogbo | 326.6 | 0.99 | 434.86 | 139.97 | -12.5 |
| Sakete | 298.7 | 0.91 | 245.73 | 82.44 | -23.0 |
| Sapele | 330.1 | 1.00 | 293.47 | 20.08 | -2.8 |
| Shiroro | 329.1 | 1.00 | 949.96 | 167.58 | -15.5 |
| Ugwuaji | 321.5 | 0.97 | 549.62 | 152.29 | -12.9 |
| Yola | 325.9 | 0.99 | 91.51 | 56.72 | -47.9 |

Table 4.6: Lines Simulation Profile of the Existing 330kV Grid System

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Line Name** | **Length (Km)** | **% Loading** | **Sending - Bus** | **I.s** | **Ps – Flow** | **Qs Flow** | **Receiving Bus** | **I-r** | **Pr - Flow** | **Qr – Flow** |
| **Afam – Alaoji 1** | 28.8 | 30.6 | Afam IV | 0.410 | 222.4 | 71.2 | Alaoji | 0.416 | -220.8 | -77 |
| **Afam – Alaoji 2** | 28.8 | 30.6 | Afam IV | 0.410 | 222.4 | 71.2 | Alaoji | 0.416 | -220.8 | -77 |
| **Afam – Ikot Ekpeme 1** | OUT OF SERVICE | | | | | | | | | |
| **Afam – Ikot Ekpeme 2** | OUT OF SERVICE | | | | | | | | | |
| **Aja – Alagbon** | 26 | 21.2 | Ajah | 0.310 | 148.8 | 66.5 | Alagbon | 0.317 | -149.5 | -72.2 |
| **Aja – Lekki** | 7 | 11.9 | Aja | 0.178 | 84.3 | 40.4 | Lekki | 0.178 | -84.1 | -38.9 |
| **Ajaokuta – Geregu 1** | 1.5 | 50.9 | Geregu | 0.761 | 435.0 | -22.6 | Ajaokuta | 0.761 | -434.9 | 22.9 |
| **Ajaokuta – Geregu 2** | 1.5 | 50.9 | Geregu | 0.761 | 435.0 | -22.6 | Ajaokuta | 0.761 | -434.9 | 22.9 |
| **Ajaokuta – Lokoja 1** | 47.39 | 38.4 | Ajaokuta | 0.573 | 327.9 | 8.7 | Lokoja Ts | 0.574 | -326.1 | -11.1 |
| **Ajaokuta – Lokoja 2** | 47.39 | 38.4 | Ajaokuta | 0.573 | 327.9 | 8.7 | Lokoja Ts | 0.574 | -326.1 | -11.1 |
| **Akangba – Ikeja West 1** | 17 | 9.2 | Ikeja West | 0.137 | 60.0 | 41.5 | Akangba | 0.138 | -59.4 | -36.8 |
| **Akangba – Ikeja West 2** | 17 | 9.2 | Ikeja West | 0.137 | 60.0 | 41.5 | Akangba | 0.138 | -59.4 | -36.8 |
| **Aladja – Delta** | 30 | 20.9 | Delta Gs | 0.282 | 160.4 | 12.5 | Aladja Ts | 0.284 | -160.2 | -21.5 |
| **Alaoji L7A** | 20 | 23.3 | Alaoji Gs | 0.313 | 169.5 | 51.5 | Alaoji Ts | 0.317 | -169.3 | -56.9 |
| **Alaoji L8A** | 20 | 23.3 | Alaoji Gs | 0.313 | 169.5 | 51.5 | Alaoji Ts | 0.317 | -169.3 | -56.9 |
| **Asaba – Onitsha** | 47.95 | 9.3 | Onitsha | 0.118 | 65.4 | 10.2 | Asaba Ts | 0.127 | -65.3 | -26.8 |
| **Ayede – Olorunsogo** | 60 | 13.3 | Olorunsogo | 0.175 | 84.0 | 53.1 | Ayede | 0.198 | -83.8 | -73.3 |
| **Ayede – Osogbo** | 119 | 11.0 | Osogbo | 0.155 | 87.1 | -8.7 | Ayede | 0.165 | -86.8 | -32.4 |
| **B Kebbi – Kainji** | 310 | 13.2 | Kainji | 0.188 | 95.7 | -49.4 | BeninKebbi | 0.197 | -94.7 | -58.7 |
| **Benin – Ajaokuta 1** | 120 | 9.9 | Ajaokuta | 0.148 | 73.9 | -41.6 | Benin | 0.141 | -73.5 | -33.0 |
| **Benin – Ajaokuta 2** | 120 | 9.9 | Ajaokuta | 0.148 | 73.9 | -41.6 | Benin | 0.141 | -73.5 | -33.0 |
| **Benin – Egbin** | 218 | 61.8 | Benin | 0.924 | 527.3 | 3.3 | Egbin | 0.910 | -505.3 | -93.9 |
| **Benin – Omotosho** | 120 | 8.8 | Omotosho | 0.131 | 68.5 | -30.5 | Benin | 0.124 | -68.3 | -17.4 |
| **Damaturu – Maiduguri** | 260 | 11.7 | Damaturu | 0.175 | 25.0 | -99.6 | Maiduguri | 0.042 | -24.8 | -6.2 |
| **Delta – Benin** | 50 | 34.6 | Delta | 0.517 | 293.8 | -31.5 | Benin | 0.514 | -292.2 | 25.4 |
| **Egbin – Aja N3J** | 14 | 23.5 | Egbin | 0.351 | 170.1 | 101.6 | Aja | 0.351 | -167.2 | -77.8 |
| **Egbin – Aja N4J** | 14 | 23.5 | Egbin | 0.351 | 170.1 | 101.6 | Aja | 0.351 | -167.2 | -77.8 |
| **Egbin – Ikeja West** | 18 | 11.1 | Ikeja West | 0.166 | 64.0 | -60.9 | Egbin | 0.166 | -62.9 | 69.4 |
| **Egbin – Oke-Aro 1** | 15.2 | 6.2 | Oke Aro | 0.093 | 14.0 | -48.4 | Egbin | 0.093 | -13.7 | 50.4 |
| **Egbin – Oke-Aro 2** | 15.2 | 6.2 | Oke Aro | 0.093 | 14.0 | -48.7 | Egbin | 0.093 | -13.7 | 50.4 |
| **Ganmo – Osogbo** | 47 | 3.4 | Ganmo | 0.027 | 12.8 | 8.5 | Osogbo | 0.051 | -12.8 | -26.0 |
| **Gombe - Damaturu** | 160 | 18.5 | Gombe | 0.277 | 134.6 | -85.2 | Damaturu | 0.234 | -133.4 | 32.4 |
| **Gombe – Jos** | 265 | 40.3 | Jos | 0.603 | 337.4 | -58.9 | Gombe | 0.574 | -326.4 | 51.1 |
| **Gombe – Yola** | 240 | 12.7 | Gombe | 0.167 | 92.3 | -27.6 | Yola | 0.191 | -91.5 | -56.7 |
| **Gwagwalada – Lokoja 1** | 174.6 | 34.4 | Lokoja | 0.514 | 291.9 | -10.1 | Gwagwalada | 0.514 | -286.5 | -8.3 |
| **Gwagwalada – Lokoja 2** | 174.6 | 34.4 | Lokoja | 0.514 | 291.9 | -10.1 | Gwagwalada | 0.514 | -286.5 | -8.3 |
| **Ihoubor – Benin** | 20 | 50.2 | Ihoubor | 0.777 | 443.8 | -32 | Benin | 0.751 | -428.7 | 3.8 |
| **Ikeja West – Osogbo** | 256.7 | 22.2 | Osogbo | 0.278 | 155.8 | 21.0 | Ikeja West | 0.333 | -153.1 | -87.8 |
| **Ikeja West- Sakete** | 70 | 33.5 | Ikeja West | 0.487 | 247.7 | 73.6 | Sakete | 0.501 | -245.7 | -82.4 |
| **Ikot Ekpeme- Alaoji 1** | 55 | 24.6 | Alaoji | 0.335 | 188.1 | -9.7 | Ikot-Ekpeme | 0.334 | -187.3 | -4.3 |
| **Ikot Ekpeme- Alaoji 2** | 55 | 24.6 | Alaoji | 0.335 | 188.1 | -9.7 | Ikot-Ekpeme | 0.334 | -187.3 | -4.3 |
| **Jebba- Ganmo** | 110 | 16.1 | Jebba | 0.230 | 131.8 | 1.9 | Ganmo | 0.240 | -131.1 | -37.6 |
| **Jebba Gs-Jebba Ts 1** | 8 | 4.8 | Jebba Gs | 0.072 | 39.0 | -12.9 | Jebba TS | 0.07 | -39 | 10.7 |
| **Jebba Gs-Jebba Ts 2** | 8 | 37.9 | Jebba Gs | 0.566 | 312.0 | -91.3 | Jebba Ts | 0.566 | -312.0 | 91.3 |
| **Jebba- Shiroro 1** | 244 | 15.9 | Jebba TS. | 0.238 | 128.8 | -46.3 | Shiroro | 0.231 | -127.4 | -34.4 |
| **Jebba- Shiroro 2** | 244 | 15.9 | Jebba TS | 0.238 | 128.8 | -46.3 | Shiroro | 0.231 | -127.4 | -34.4 |
| **Jos- Makurdi 1** | 286 | 20.1 | Makurdi | 0.273 | 136.7 | -69.8 | Jos TS | 0.240 | -134.7 | -19.5 |
| **Jos- Makurdi 2** | 286 | 20.1 | Makurdi | 0.273 | 136.7 | -69.8 | Jos TS | 0.240 | -134.7 | -19.5 |
| **Kaduna- Kano** | 250 | 39.6 | Kaduna | 0.532 | 296.3 | 6.3 | Kano | 0.539 | -287.2 | -20.8 |
| **Kaduna- Shiroro 1** | 96 | 42.6 | Shiroro | 0.631 | 357.5 | 37.4 | Kaduna | 0.637 | -353.0 | -34.5 |
| **Kaduna- Shiroro 2** | 96 | 42.6 | Shiroro | 0.631 | 357.5 | 37.4 | Kaduna | 0.637 | -353.0 | -34.5 |
| **Kaduna-Jos M2S** | 197 | 24.0 | Kaduna | 0.359 | 184.5 | -77.3 | Jos | 0.324 | -181.8 | -27.4 |
| **Kainji- Jebba 1** | 81 | 14.1 | Kainji Ts | 0.209 | 115.6 | -31.1 | Jebba | 0.201 | -115.2 | 3.4 |
| **Kainji- Jebba 2** | 81 | 14.1 | Kainji Ts | 0.209 | 115.6 | -31.1 | Jebba | 0.201 | -115.2 | 3.4 |
| **Kanji Gs- Kanji Ts 1** | 0.47 | 20.1 | Kainji Gs | 0.301 | 163.5 | -55.9 | Kanji Ts | 0.301 | -163.5 | 55.8 |
| **Kanji Gs- Kanji Ts 2** | 0.47 | 20.2 | Kainji Gs | 0.301 | 163.5 | -55.9 | Kanji Ts | 0.301 | -163.5 | 55.8 |
| **Katampe- Gwagwalada** | 72.01 | 36.7 | Gwagwalada | 0.540 | 295.6 | 56.8 | Katampe | 0.549 | -293.1 | -61.1 |
| **Lekki- Alagbon BIE** | 16.61 | 2.4 | Alagbon | 0.032 | 15.6 | 5.7 | Lekki | 0.036 | 15.5 | -10.9 |
| **Makurdi- Aliade 1** | 47.39 | 25.0 | Aliade | 0.340 | 182.7 | -53.8 | Makurdi | 0.332 | -182.1 | 41.7 |
| **Makurdi- Aliade 2** | 47.39 | 25.0 | Aliade | 0.340 | 182.7 | -53.8 | Makurdi | 0.332 | -182.1 | 41.7 |
| **N/Haven- Ugwuaji 1** | 6.5 | 13.5 | N/Haven | 0.183 | 88.3 | -50.9 | Ugwauaji | 0.181 | -88.3 | 48.8 |
| **N/Haven- Ugwuaji 2** | 6.5 | 13.5 | N/Haven | 0.183 | 88.3 | -50.9 | Ugwauaji | 0.181 | -88.3 | 48.8 |
| **Oke-aro-Ikj West 1** | 15.2 | 8.1 | Ikeja-West Ts | 0.122 | 59.3 | -25.6 | Oke-Aro | 0.121 | -58.8 | 29.3 |
| **Oke-aro-Ikj West 2** | 15.2 | 8.1 | Ikeja-West Ts | 0.122 | 59.3 | -25.6 | Oke-Aro | 0.121 | -58.8 | 29.3 |
| **Okpai-Onitsha 1** | 56 | 21.9 | Okpai | 0.282 | 148.5 | 60.1 | Onitsha Ts | 0.298 | 147.9 | -76.1 |
| **Okpai-Onitsha 2** | 56 | 21.9 | Okpai | 0.282 | 148.5 | 60.1 | Onitsha Ts | 0.298 | -147.9 | -76.1 |
| **Olorun- Ikeja West** | 7.7 | 61.9 | Olorunsogo | 0.905 | 456.0 | 238.6 | Ikeja west | 0.926 | -448.4 | -201.4 |
| **Omotosho-Ikj West** | 160 | 72.3 | Omotosho | 1.069 | 595.5 | 133.4 | IkJ West | 1.081 | -573.6 | -4.1 |
| **Onitsha-Alaoji** | 138 | 10.3 | Onitsha | 0.140 | 62.5 | -46.9 | Alaoji | 0.111 | -62.3 | -1.7 |
| **Onitsha-Benin 1** | 137 | 19.0 | Benin | 0.265 | 151.1 | 10.7 | Onitsha | 0.284 | -149.9 | -51.4 |
| **Onitsha-Benin 2** | 137 | 19.0 | Benin | 0.265 | 151.1 | 10.7 | Onitsha | 0.284 | -149.9 | -51.4 |
| **Onitsha-N/Haven** | 96 | 41.2 | Onitsha | 0.561 | 312.2 | -24.9 | N/Haven | 0.556 | -308.7 | 20.0 |
| **Osogbo-Ihovbor** | 251 | 28.0 | Ihovbor | 0.418 | 236.2 | -39.1 | Osogbo | 0.409 | -231.2 | -13.0 |
| **Osogbo-Jebba 1** | 157 | 12.5 | Jebba | 0.168 | 96.0 | -8.6 | Osogbo | 0.187 | -95.5 | -46.2 |
| **Osogbo-Jebba 2** | 157 | 12.5 | Jebba | 0.168 | 96.0 | -8.6 | Osogbo | 0.187 | -95.5 | -46.2 |
| **Sapele-Aladja** | 93 | 9.5 | Aladja | 0.129 | 61.6 | -39.6 | Sapele | 0.108 | -61.5 | 5.6 |
| **Sapele-Benin 1** | 50 | 11.5 | Sapele | 0.141 | 80.4 | -10.0 | Benin | 0.172 | -97.7 | -10.8 |
| **Sapele-Benin 2** | 50 | 12.7 | Sapele | 0.171 | 97.8 | -6.7 | Benin | 0.172 | -97.7 | -10.8 |
| **Sapele-Benin 3** | 50 | 12.7 | Sapele | 0.171 | 97.8 | -6.7 | Benin | 0.172 | -97.7 | -10.8 |
| **Shiroro-Gwagwalada** | 146 | 15.2 | Gwagwalada | 0.227 | 95.9 | -82.4 | Shiroro | 0.177 | -95.2 | 34.1 |
| **Shiroro-Katampe** | 218 | 12.4 | Shiroro | 0.073 | 37.0 | 19.0 | Katampe | 0.186 | -36.6 | -94.7 |
| **Ugwuaji- Aliade 1** | 157 | 31.3 | Ugwuaji | 0.426 | 230.7 | -56.0 | Aliade | 0.408 | -227.5 | 26.1 |
| **Ugwuaji- Aliade 2** | 157 | 31.3 | Ugwuaji | 0.426 | 230.7 | -56.0 | Aliade | 0.408 | -227.5 | 26.1 |
| **Ugwuaji-Ikot Ekpeme 1** | OUT OF SERVICE | | | | | | | | | |
| **Ugwuaji-Ikot Ekpeme 2** | OUT OF SERVICE | | | | | | | | | |
| **Ugwuaji-Ikot Ekpeme 3** | 63 | 24.8 | Ikot Ekpene | 0.334 | 187.3 | 4.3 | Ugwuaji | 0.337 | -186.5 | -20.2 |
| **Ugwuaji-Ikot Ekpeme 4** | 63 | 24.8 | Ikot Ekpene | 0.334 | 187.3 | 4.3 | Ugwuaji | 0.337 | -186.5 | -20.2 |

Table 4.7: Lines Simulation Profile of the Power Grid when 200MW of Solar Photovoltaic System was Integrated into the Grid System

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Line Name** | **Length (km)** | **%loading** | **Sending Bus** | **I.s (kA)** | **Ps flow (MW)** | **Qs flow (MW)** | **Receiving Bus** | **I.s (kA)** | **Pr Flow (MW)** | **Qr Flow (MW)** |
|
|
| Afam-Alaoji 1 | 28.8 | 65.4 | Afam | 0.886 | 497.9 | 81 | Alaoji | 0.889 | -495.2 | -69.1 |
| Afam-Alaoji 2 | 28.8 | 65.4 | Afam | 0.886 | 497.9 | 81 | Alaoji | 0.889 | -495.2 | -69.1 |
| Afam-Ikot Ekpene 1 | OUT OF SERVICE | | | | | | | | | |
| Afam-IkotEkpene 2 | OUT OF SERVICE | | | | | | | | | |
| Aja – Alagbon | 26 | 21.2 | Ajah | 0.311 | 149.6 | 66.8 | Alagbon | 0.318 | -149.3 | -72.6 |
| Ajah – Lekki | 7 | 11.9 | Ajah | 0.178 | 84.7 | 40.6 | Lekki | 0.178 | -84.5 | -39.1 |
| Ajaokuta – Geregu 1 | 1.5 | 20.8 | Geregu | 0.311 | 176.5 | -22.8 | Ajaokuta | 0.311 | -176.5 | 22.4 |
| Ajaokuta – Geregu 2 | 1.5 | 20.8 | Geregu | 0.311 | 176.5 | -22.8 | Ajaokuta | 0.311 | -176.5 | 22.4 |
| Ajaokuta – Lokoja 1 | 47.39 | 27.1 | Ajaokuta | 0.406 | 232.4 | -8.2 | Lokoja | 0.406 | -231.5 | -2 |
| Ajaokuta – Lokoja 2 | 47.39 | 27.1 | Ajaokuta | 0.406 | 232.4 | -8.2 | Lokoja | 0.406 | -231.5 | -2 |
| Akangba – Ikj West 1 | 17 | 9.3 | Ikj West | 0.138 | 60.8 | 42 | Akangba | 0.139 | -60.2 | -37.3 |
| Akangba – Ikj West 2 | 17 | 9.3 | Ikj West | 0.138 | 60.8 | 42 | Akangba | 0.139 | -60.2 | -37.3 |
| Aladja – Delta | 30 | 29.5 | Delta | 0.401 | 229 | 4.8 | Aladja | 0.401 | -228.4 | -11.4 |
| Alaoji L7A | 20 | 9.6 | Alaoji Gs | 0.123 | 54 | 43.3 | Alaoji Ts | 0.131 | -54 | -50.3 |
| Alaoji L8A | 20 | 9.6 | Alaoji Gs | 0.123 | 54 | 43.3 | Alaoji Ts | 0.131 | -54 | -50.3 |
| Asaba – Onitsha | 47.95 | 9.3 | Onitsha | 0.119 | 65.6 | 10.2 | Asaba | 0.127 | -65.5 | -26.9 |
| Ayede – Olorunsogo | 60 | 14.4 | Olorunsogo | 0.195 | 99.9 | 48.7 | Ayede | 0.215 | -99.7 | -68.5 |
| Ayede – osogbo | 119 | 9.6 | Osogbo | 0.126 | 71.4 | -4.7 | Ayede | 0.143 | -71.2 | -37.4 |
| B.Kebbi-Kainji | 310 | 13.2 | Kainji | 0.188 | 95.7 | -49.4 | B.Kebbi | 0.197 | -94.7 | -58.7 |
| Benin – Ajaokuta 1 | 120 | 11.9 | Benin | 0.178 | 89.7 | -48.7 | Ajaokuta | 0.161 | -89.1 | -24.2 |
| Benin – Ajaokuta 2 | 120 | 11.9 | Benin | 0.178 | 89.7 | -48.7 | Ajaokuta | 0.161 | -89.1 | -24.2 |
| Benin – Egbin | 218 | 40.6 | Benin | 0.608 | 346.2 | -30.1 | Egbin | 0.596 | -336.9 | 19.9 |
| Benin – Omotosho | 120 | 5.3 | Benin | 0.079 | 37.8 | -25.2 | Omotosho | 0.078 | -37.8 | -24.1 |
| Damaturu – Maiduguri | 260 | 11.8 | Damaturu | 0.176 | 25.4 | -101.2 | Maiduguri | 0.042 | -25.2 | -6.3 |
| Delta Gs – Benin | 52.65 | 34.1 | Delta | 0.511 | 288.7 | -43 | Benin | 0.506 | -287.1 | -36.5 |
| Egbin – Ajah N3J | 14 | 23.5 | Egbin | 0.352 | 170.9 | 102.1 | Ajah | 0.352 | -168.1 | -78.2 |
| Egbin – Ajah N4J | 14 | 23.5 | Egbin | 0.352 | 170.9 | 102.1 | Ajah | 0.352 | -168.1 | -78.2 |
| Egbin – Ikeja West | 18 | 6.7 | Egbin | 0.1 | 17.7 | 53.6 | Ikeja West | 0.1 | -17.3 | -50.8 |
| Egbin – Oke-aro 1 | 15.2 | 6.4 | Egbin | 0.095 | 33.8 | 42.2 | Oke-Aro | 0.096 | -33.5 | -40 |
| Egbin – Oke-aro 2 | 15.2 | 6.4 | Egbin | 0.095 | 33.8 | 42.2 | Oke-Aro | 0.096 | -33.5 | -40 |
| Ganmo – Osogbo | 47 | 3.1 | Ganmo | 0.023 | 11.8 | 5.7 | Osogbo | 0.046 | -11.8 | -23.3 |
| Gombe – Damaturu | 160 | 18.7 | Gombe | 0.279 | 136.7 | -86.6 | Damaturu | 0.236 | -135.5 | 32.9 |
| Gombe – Jos | 265 | 40.6 | Jos | 0.608 | 342.7 | -59.8 | Gombe | 0.579 | -331.6 | 51.9 |
| Gombe – Yola | 240 | 12.9 | Gombe | 0.169 | 93.7 | -28.1 | Yola | 0.192 | -93 | -57.6 |
| Gwagwalada – Lokoja 1 | 174.6 | 23.3 | Lokoja | 0.347 | 197 | -19.3 | Gwagwalada | 0.349 | -194.5 | -25.1 |
| Gwagwalada – Lokoja 2 | 174.6 | 23.3 | Lokoja | 0.347 | 197 | -19.3 | Gwagwalada | 0.349 | -194.5 | -25.1 |
| Ihovbor – Benin | 20 | 53.6 | Ihoubor | 0.801 | 458.5 | -26.6 | Benin | 0.801 | -457 | 31.8 |
| Ikj West – Osogbo | 256.7 | 20.5 | Osogbo | 0.25 | 140.8 | 15.5 | Ikeja West | 0.306 | -138.6 | -87.2 |
| Ikj West – Sakete | 70 | 33.7 | Ikeja West | 0.49 | 251.1 | 74.5 | Sakete | 0.504 | -249 | -83.5 |
| Ikot Ekpeme – Alaoji 1 | 55 | 35.1 | Alaoji | 0.478 | 268.5 | -12.8 | Ikot Ekpeme | 0.477 | -267 | 5.1 |
| Ikot Ekpeme – Alaoji 2 | 55 | 35.1 | Alaoji | 0.478 | 268.5 | -12.8 | Ikot Ekpeme | 0.477 | -267 | 5.1 |
| Jebba – Shiroro 1 | 244 | 16.2 | Jebba | 0.242 | 129.8 | -49.8 | Shiroro | 0.231 | -128 | -31 |
| Jebba – Shiroro 2 | 244 | 16.2 | Jebba | 0.242 | 129.8 | -49.8 | Shiroro | 0.231 | -128.4 | -31 |
| Jebba Gs – Jebba Ts 1 | 8 | 4.8 | Jebba Gs | 0.072 | 39 | -14.3 | Jebba Ts | 0.071 | -39 | 11.3 |
| Jebba Gs – Jebba Ts 2 | 8 | 38.2 | Jebba Gs | 0.572 | 312 | -102.3 | Jebba Ts | 0.572 | -312 | 102.2 |
| Jebba-Ganmo | 110 | 15.9 | Jebba | 0.228 | 131.2 | -1 | Ganmo | 0.238 | -130.5 | -34.9 |
| Jos – Makurdi 1 | 286 | 22.5 | Makurdi | 0.306 | 154.4 | -77.2 | Jos | 0.266 | -151.8 | -8.4 |
| Jos – Makurdi 2 | 286 | 22.5 | Makurdi | 0.306 | 154.4 | -77.2 | Jos | 0.266 | -151.8 | -8.4 |
| Kaduna – Jos M2S | 197 | 19.9 | Kaduna | 0.298 | 156.6 | -63.8 | Jos | 0.271 | -154.8 | 4.9 |
| Kaduna – Kano | 250 | 18.8 | Kaduna | 0.256 | 129.6 | -65.1 | Kano | 0.226 | -128.1 | -15.7 |
| Kaduna – Shiroro 1 | 96 | 30.7 | Shiroro | 0.459 | 262.4 | -8.1 | Kaduna | 0.459 | -260.1 | -8 |
| Kaduna – Shiroro 2 | 96 | 30.7 | Shiroro | 0.459 | 262.4 | -8.1 | Kaduna | 0.459 | -260.1 | -8 |
| Kainji Gs – Kainji Ts 1 | 0.47 | 20.2 | Kainji Ts | 0.302 | 163.5 | -57.7 | Kainji Gs | 0.302 | -163.5 | 57.5 |
| Kainji Gs – Kainji Ts 2 | 0.47 | 20.2 | Kainji Ts | 0.302 | 163.5 | -57.7 | Kainji Gs | 0.302 | -163.5 | 57.5 |
| Kainji Jebba 1 | 81 | 14 | Kainji Ts | 0.21 | 115.6 | -32.8 | Jebba Ts | 0.201 | -115.2 | 5.1 |
| Kainji-Jebba 2 | 81 | 14 | Kaiji Ts | 0.21 | 115.6 | -32.8 | Jebba Ts | 0.201 | -115.2 | 5.1 |
| Katampe-Gwagwalada | 72.01 | 30.1 | Gwagwalada | 0.437 | 236.6 | 66.4 | Katampe | 0.45 | -234.9 | -78.2 |
| Lekki-Alagbon BIE | 16.61 | 2.4 | Alagbon | 0.032 | 15.6 | 5.7 | Lekki | 0.037 | -15.6 | -11 |
| Makurdi-Aliade 1 | 47.39 | 27.4 | Aliade | 0.373 | 200.6 | -60 | Makurdi | 0.365 | -199.9 | 49 |
| Makurdi-Aliade 2 | 47.39 | 27.4 | Aliade | 0.373 | 200.6 | -60 | Makurdi | 0.365 | -199.9 | 49 |
| N/Haven-Ugwuaji 1 | 6.5 | 6 | N/Haven | 0.082 | 28 | -36.1 | Ugwuayi | 0.079 | -28 | 33.8 |
| N/Haven-Ugwuaji 2 | 6.5 | 6 | N/Haven | 0.082 | 28 | -36.1 | Ugwuayi | 0.079 | -28 | 33.8 |
| Okearo-Ikj West 1 | 15.2 | 3 | Ikeja West | 0.044 | 11.8 | -20.5 | Oke Aro | 0.044 | -11.8 | 20.8 |
| Okearo-Ikj West 1 | 15.2 | 3 | Ikeja West | 0.044 | 11.8 | -20.5 | Oke Aro | 0.044 | -11.8 | 20.8 |
| Okpai-Onitsha 1 | 56 | 21.6 | Okpai | 0.279 | 148.5 | 55.1 | Onitsha | 0.293 | -148 | -71.3 |
| Okpai-Onitsha 1 | 56 | 21.6 | Okpai | 0.279 | 148.5 | 55.1 | Onitsha | 0.293 | -148 | -71.3 |
| Olorunsogo-Ikj West | 77 | 58.9 | Olorunsogo | 0.86 | 440 | 214.5 | Ikeja West | 0.881 | -433.1 | -183.7 |
| Omotosho-Ikj west | 160 | 55.5 | Omotosho | 0.813 | 453.4 | 99.5 | Ikeja West | 0.83 | -440.6 | -48.1 |
| Onitsha-Alaiji | 138 | 12.9 | Alaoji | 0.175 | 95.5 | -24.2 | Onitsha | 0.174 | -95.1 | -22.4 |
| Onitsha-Benin 1 | 137 | 9 | Benin | 0.046 | 10.2 | 24.3 | Onitsha | 0.134 | -10 | -74.3 |
| Onitsha-Benin 1 | 137 | 8.9 | Benin | 0.046 | 10.2 | 24.3 | Onitsha | 0.134 | -10 | -74.3 |
| Onitsha-N/Haven | 96 | 24.9 | Onitsha | 0.339 | 189.3 | -14.3 | N/Haven | 0.336 | -188 | -9.6 |
| Osogbo-Ihovbor | 251 | 24.7 | Ihorbor | 0.369 | 207.6 | -42.2 | Osogbo | 0.361 | -203.7 | -19.9 |
| Osogbo-Jebba 1 | 157 | 12.3 | Jebba | 0.169 | 95.3 | -11.5 | Osogbo | 0.184 | -94.8 | -43.5 |
| Osogbo-Jebba 2 | 157 | 12.3 | Jebba | 0.169 | 95.3 | -11.5 | Osogbo | 0.184 | -94.8 | -43.5 |
| Sapele-Aladja | 93 | 10.2 | Aladja | 0.139 | 66.4 | -43.4 | Sapele | 0.117 | -66.3 | 9.6 |
| Sapele-Benin 1 | 50 | 9.4 | Sapele | 0.141 | 80.4 | -9.4 | Benin | 0.141 | -80.3 | -8.7 |
| Sapele-Benin 2 | 50 | 10.4 | Sapele | 0.141 | 80.4 | -9.4 | Benin | 0.141 | -80.3 | -8.7 |
| Sapele-Benin 3 | 50 | 10.4 | Sapele | 0.141 | 80.4 | -9.4 | Benin | 0.141 | -80.3 | -8.7 |
| Shiroro-Gwagwalada | 146 | 8 | Shiroro | 0.057 | 32.1 | 5.3 | Gwagwalada | 0.119 | -32 | -59 |
| Shiroro-Katampe | 218 | 15.5 | Shiroro | 0.177 | 100.6 | 8.4 | Katampe | 0.232 | -99.6 | -79.9 |
| Ugwuaji-Aliade 1 | 157 | 33.8 | Ugwuaji | 0.459 | 249.2 | -57.6 | Aliade | 0.441 | -245.4 | -32.2 |
| Ugwuaji-Aliade 2 | 157 | 33.8 | Ugwuaji | 0.459 | 249.2 | -57.6 | Aliade | 0.441 | -245.4 | -32.2 |
| Ugwuaji-Ikot Ekpene 1 | OUT OF SERVICE | | | | | | | | | |
| Ugwuaji-Ikot Ekpene 2 | OUT OF SERVICE | | | | | | | | | |
| Ugwuaji-Ikot Ekpene 3 | 63 | 35.1 | Ikot Ekpene | 0.477 | 267 | -5.1 | Ugwuaji | 0.477 | -265.3 | -3.5 |
| Ugwuaji-Ikot Ekpene 4 | 63 | 35.1 | Ikot Ekpene | 0.477 | 267 | -5.1 | Ugwuaji | 0.477 | -265.3 | -3.5 |