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# LAMPIRAN

**Lampiran 1.** Harga Bahan Bakar Minyak (BBM) yang Dikeluarkan oleh PLN

PLN Energi Primer Indonesia

Nomor : 12134/EPI.01.03/PLNEPI0300/2023
Lampiran : 1 Set
Sifat : Segera
Hal : Harga Jual BBM PT Pertamina Patra Niaga untuk PLN Periode 01 s.d 31 Desember 2023

30 November 2023

Kepada

Yth. 1. EVP OKI PLN
2. DIRUT PT PLN INDONESIA POWER
3. DIRUT PT PLN NUSANTARA POWER
4. DIRUT PLN BATAM
5. DIRUT PT BAG PT PELAYARAN BAHTERA ADHIGUNA

Mengacu kepada rata-rata MOPS Gasoil Periode Tanggal 25 Oktober 2023 - 24 November 2023 yaitu 104,88 USD/Barrel, MOPS HSFO 180 cst pada 461,51 USD/MT dan MOPS MFO LSFO pada 648,57 USD/MT, sesuai Perjanjian Jual Beli BBM yang berlaku. Dengan ini disampaikan Harga Jual BBM PT Pertamina Patra Niaga untuk PLN Periode 01 s.d 31 Desember 2023 adalah sebagai berikut:

| JENIS BBM | Harga BBM tanpa PPn (Rp./Ltr.) |
|---|---|
| HSD/BIOSOLAR | 10,780.00 |
| MFO High Sulfur (HSFO) | 7,640.00 |
| MFO Low Sulfur (LSFO) | 10,568.00 |
| IDO | 10,623.00 |

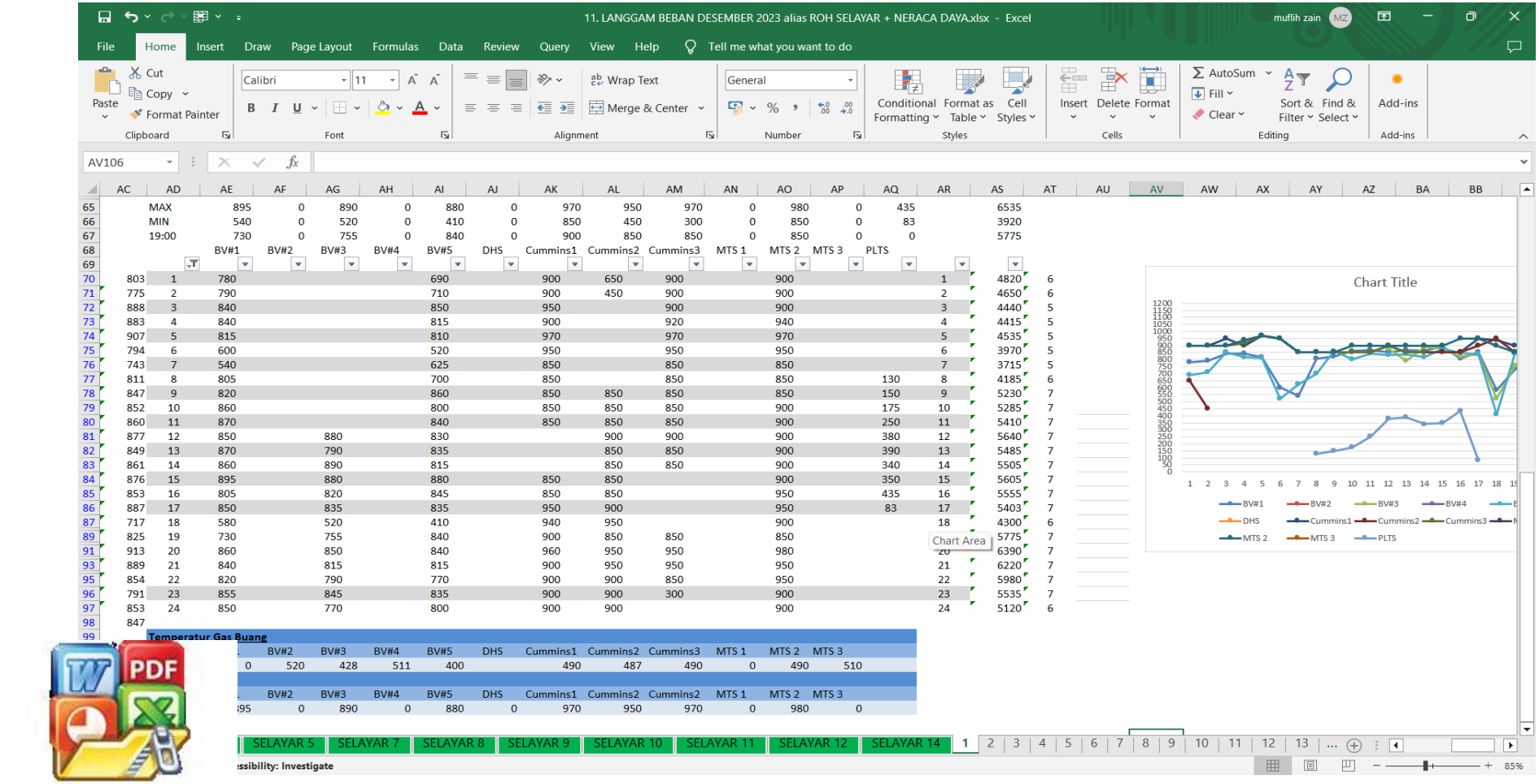
- *Catatan :*
  1. *Harga BBM diatas belum termasuk biaya Pajak Pertambahan Nilai (PPn) dan biaya transportasi dari Depo/TBBM PT Pertamina Patra Niaga, Mohon diperhatikan.*
  2. *Untuk Pembangkit yang menggunakan BBM jenis MFO, harga BBM mengacu kepada harga MFO High Sulfur (HSFO).*

Demikian kami sampaikan, atas perhatian dan kerjasama yang baik diucapkan terima kasih.

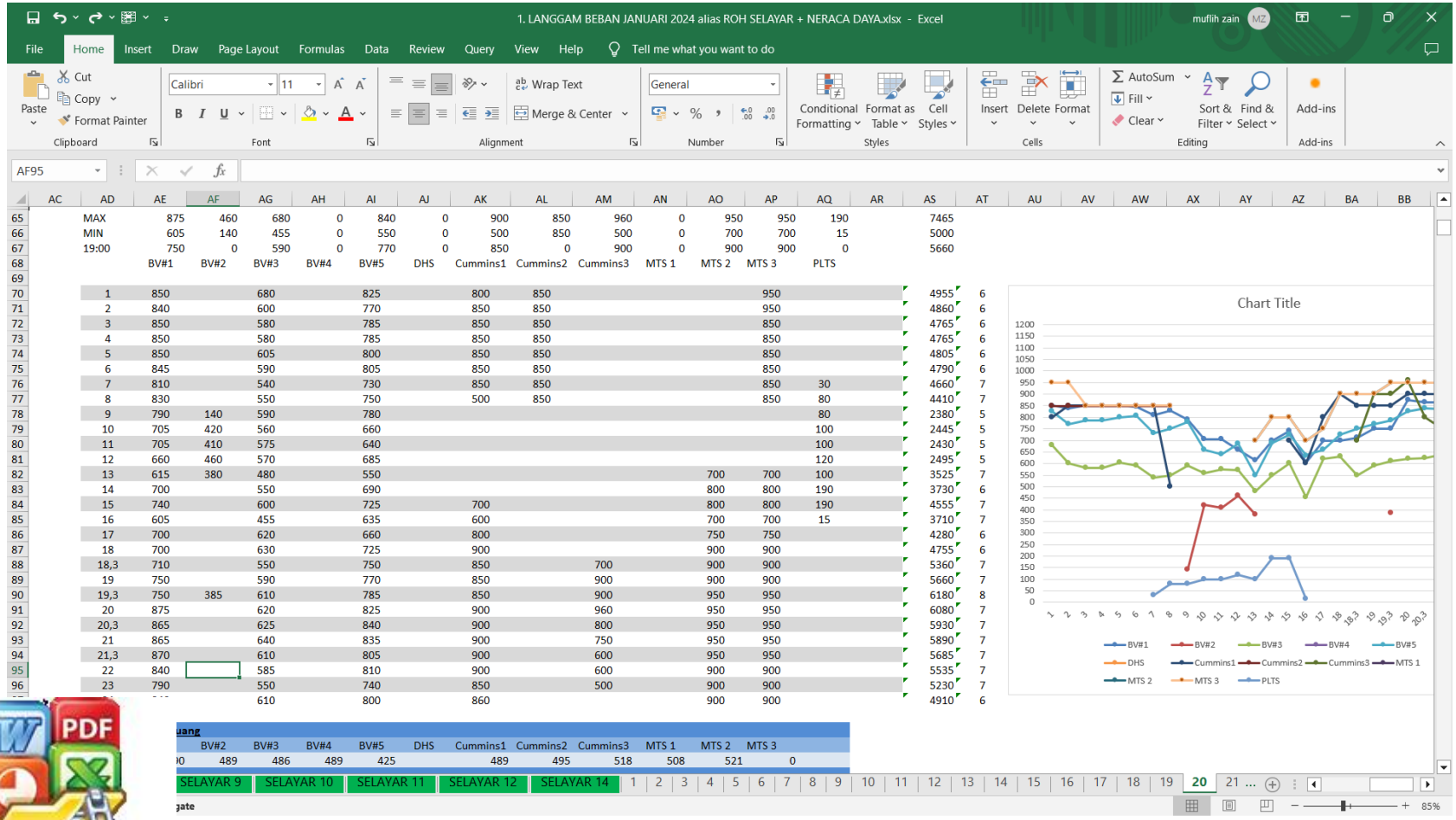
Ditandatangani secara elektronik oleh
DIREKTUR GAS DAN BBM,

PLN RAKHMAD DEWANTO

**Lampiran 2.** Data Operasional Beban Tiap Unit PT. PLN ULPLTD Selayar Desember 2023



**Lampiran 3.** Data Operasional Beban Tiap Unit PT. PLN ULPLTD Selayar Januari 2024



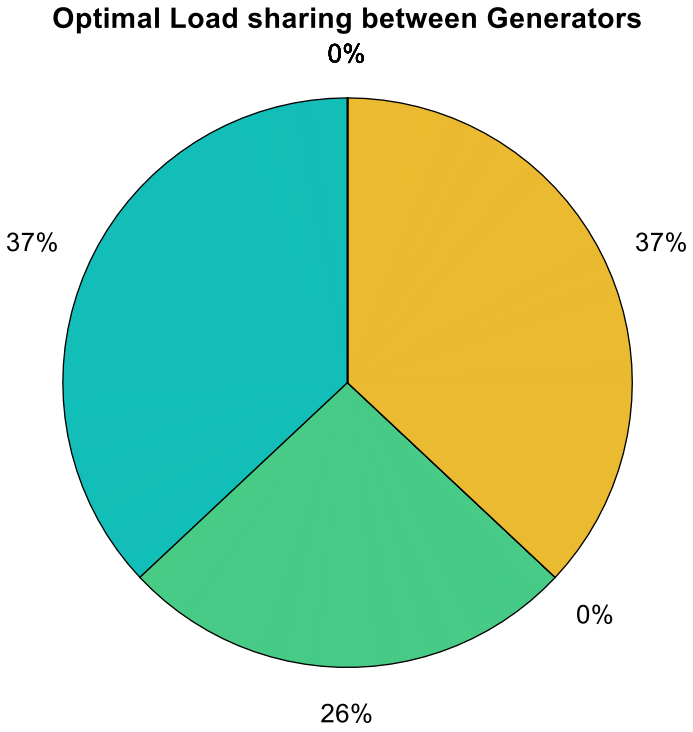
**Lampiran 4**. Data Produksi Daya PLTS Selayar Desember 2023

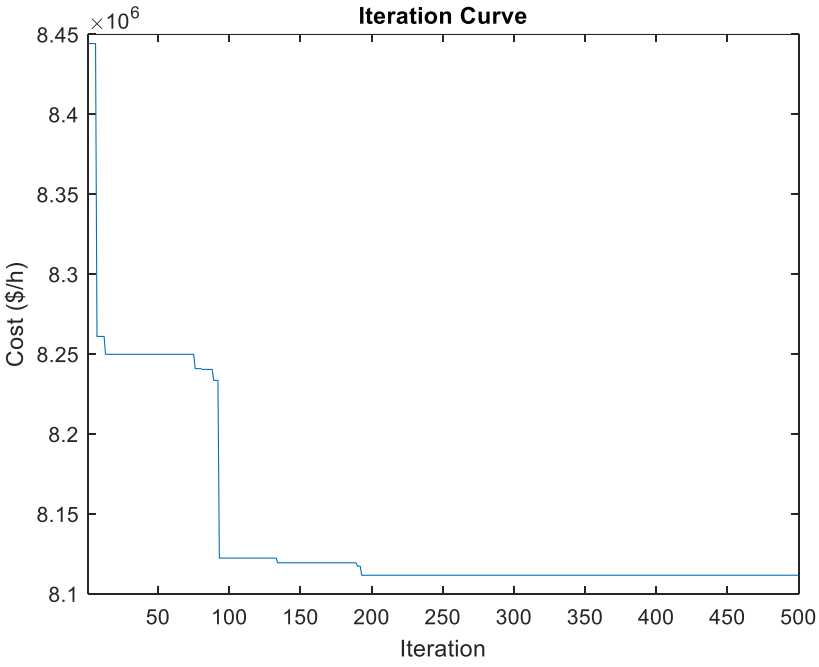
| Time | P Act (kW) | Irradiance (W/m2) | Frequency (Hz) |
|---|---|---|---|
| 20/01/2024 01:00:00.00 | 0,0005 | -1,164428246 | 50,02679321 |
| 20/01/2024 02:00:00.00 | 0,0005 | -1,412407407 | 50,03207345 |
| 20/01/2024 03:00:00.00 | 0,0005 | -1,336019132 | 50,00728228 |
| 20/01/2024 04:00:00.00 | 0,008049619 | -1,511156923 | 50,04981279 |
| 20/01/2024 05:00:00.00 | 0,036274457 | -1,35557313 | 50,01315776 |
| 20/01/2024 06:00:00.00 | 0,064499294 | 0,998093107 | 49,99870299 |
| 20/01/2024 07:00:00.00 | 52,506621 | 48,91761719 | 50,08316719 |
| 20/01/2024 08:00:00.00 | 70,18374331 | 62,87684609 | 50,09986459 |
| 20/01/2024 09:00:00.00 | 82,03713798 | 72,05373866 | 50,12843491 |
| 20/01/2024 10:00:00.00 | 119,7655679 | 164,9480038 | 50,15908055 |
| 20/01/2024 11:00:00.00 | 119,771187 | 191,599616 | 50,14483446 |
| 20/01/2024 12:00:00.00 | 119,7887253 | 233,2306757 | 50,03335434 |
| 20/01/2024 13:00:00.00 | 119,777971 | 161,1540586 | 50,25804646 |
| 20/01/2024 14:00:00.00 | 209,3219501 | 196,7317608 | 50,22995347 |
| 20/01/2024 15:00:00.00 | 209,3282233 | 193,0495226 | 50,07899834 |
| 20/01/2024 16:00:00.00 | 128,0562225 | 107,0302818 | 50,23253105 |
| 20/01/2024 17:00:00.00 | 107,8293808 | 94,28667276 | 50,06949976 |
| 20/01/2024 18:00:00.00 | 19,6781593 | 19,6306486 | 50,07430668 |
| 20/01/2024 19:00:00.00 | 0,003593597 | -1,122317647 | 50,08149303 |
| 20/01/2024 20:00:00.00 | 0,008852944 | -1,155141844 | 50,0262566 |
| 20/01/2024 21:00:00.00 | 0,01411229 | -1,219320475 | 50,00794293 |
| 20/01/2024 22:00:00.00 | 0,019371636 | -1,186857668 | 50,04768842 |
| 20/01/2024 23:00:00.00 | 0,024630983 | -1,440942876 | 50,07305017 |
| 28/01/2024 00:00:00.00 | 0,06927544 | -1,637360877 | 50,00890945 |
| 28/01/2024 01:00:00.00 | 0,081803908 | -1,495059568 | 49,96816148 |
| 28/01/2024 02:00:00.00 | 0,094332376 | -1,352298443 | 50,01611162 |
| 28/01/2024 03:00:00.00 | 0,106860843 | -1,711412616 | 50,08087089 |
| 28/01/2024 04:00:00.00 | 0,119389311 | -1,539925187 | 50,11705778 |
| 28/01/2024 05:00:00.00 | 0,131917778 | -1,570173666 | 50,0652213 |
| 28/01/2024 06:00:00.00 | 0,144446246 | 0,909845592 | 50,19231565 |
| 28/01/2024 07:00:00.00 | 92,7393204 | 85,49172433 | 50,06971431 |
| 28/01/2024 08:00:00.00 | 220,3704031 | 200,0368319 | 49,99314562 |
| 28/01/2024 09:00:00.00 | 325,4916583 | 292,8971321 | 50,01895819 |
| 28/01/2024 10:00:00.00 | 609,8195939 | 688,4137355 | 50,02314105 |
| 28/01/2024 11:00:00.00 | 490,9688759 | 439,8999979 | 50,0188185 |
| 2024 12:00:00.00 | 549,3367182 | 584,1740248 | 49,99481649 |
| 2024 13:00:00.00 | 549,3276619 | 707,842234 | 49,99469541 |
| 2024 14:00:00.00 | 549,3350189 | 666,7824459 | 50,00051779 |
| 2024 15:00:00.00 | 549,3619884 | 724,91388 | 50,04301553 |

**Lampiran 5.** Hasil Optimasi pada Software MATLAB

**P = 2,7 MW  PLTS = 0 MW**

**Differential evolution**



------- Input - Output Characteristic ----------

11×6 table

| Unit | a.(Rp/MW^2) | b.($/MW) | c.($) | P Lower | P Upper |
|---|---|---|---|---|---|
| 1 | 26.239 | 3.0492e+06 | 11912 | 0 | 0.9 |
| 2 | 173.15 | 3.1317e+06 | 55004 | 0 | 0.9 |
| 3 | 121.74 | 3.0524e+06 | 26400 | 0 | 0.9 |
| 5 | 19509 | 3.034e+06 | 26304 | 0 | 0.9 |
| 6 | 13199 | 6.5885e+06 | 5738.2 | 0 | 0.22 |
| 7 | 131.84 | 2.9428e+06 | 3.4496 | 0 | 1 |
| 8 | 23.5 | 2.9429e+06 | 2.5549 | 0 | 1 |
| 9 | 184.59 | 2.9639e+06 | 1.4661 | 0 | 1 |
| 10 | 504.5 | 2.9529e+06 | 344.96 | 0 | 1 |
| 11 | 3.234 | 2.9612e+06 | 2.156 | 0 | 1 |
| 12 | 33.418 | 2.959e+06 | 25.872 | 0 | 1 |

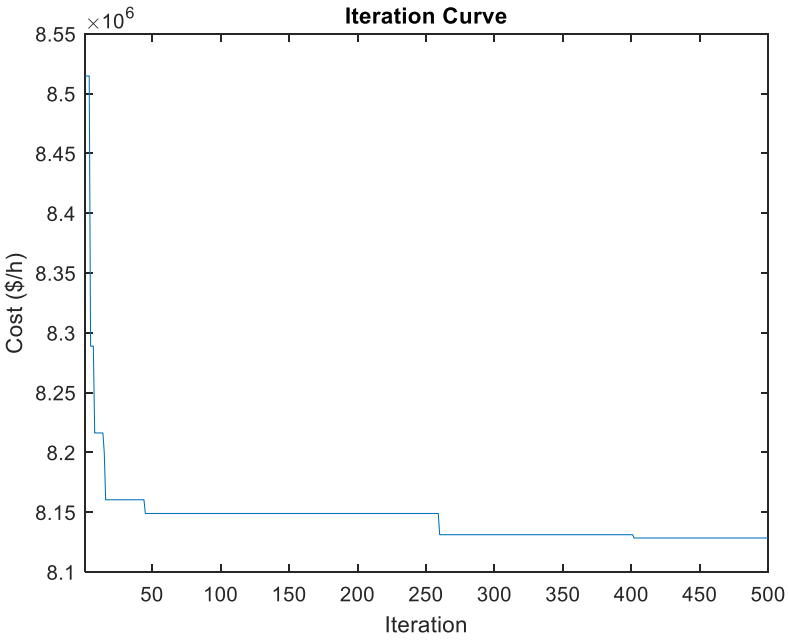
dataPLTDSelayar.m | maindePLTDSELAYAR.m

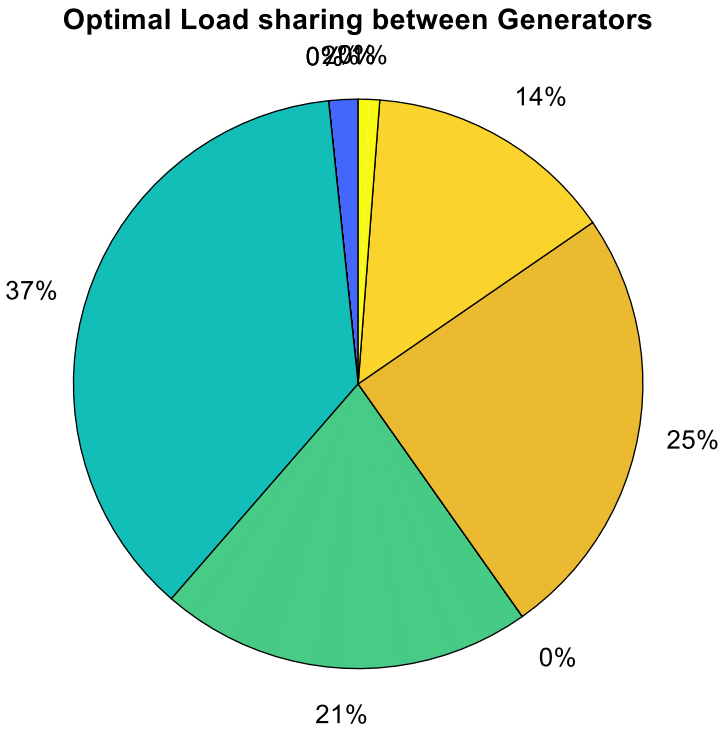
```
clc
clear
clear global
close gcf
close all


%% Input Plants Data

dataPLTDSelayar;

%% Control Parameters of algorithm
[rowdata, colomndata] = size(plants);
data        = plants(1:rowdata,2:colomndata);
lb          = data(:,4)';           % Get lower bounds matriks from data variable
ub          = data(:,5)';           % Get upper bounds matriks from data variable
nUnit       = length(data(:,1));    % Get data length from data variable
VarSize     = [1 nUnit];            % Decision Variables Matrix Size
unitCurrency= (' $/h');
unitPower   = (' MW/h');


%% Control Parameters Algorithm
Max_iter    = 500;          % The number of cycles for foraging {a stopping criteri
nPop        = 300;          % Total foods

%% Control Parameters of ABC algorithm
nOnlooker   = round(0.2*nPop);                    % Number of Onlooker Bees
L           = round(0.5*nPop);    % Abandonment Limit Parameter (Trial Limit)
a           = 0.9;                        % Acceleration Coefficient Upper Bound


%% Control Parameters of DE Algorithm
```

```
-------- Differential Evolution ------------
Total Iteration           = 500
Total Cost                = 8085033.5678 $/h
Total Beban               = 2.7 MW/h
Total Daya                = 2.701 $/h
-------------- Unit Power & Cost -----------------
Daya Unit1      = 0 MW/h
Daya Unit2      = 0 MW/h
Daya Unit3      = 0 MW/h
Daya Unit4      = 0 MW/h
Daya Unit5      = 0 MW/h
Daya Unit6      = 1 MW/h
Daya Unit7      = 0.70099 MW/h
Daya Unit8      = 0 MW/h
Daya Unit9      = 1 MW/h
Daya Unit10      = 0 MW/h
Daya Unit11      = 0 MW/h
Cost Unit1      = 11911.9 MW/h
Cost Unit2      = 55003.87 MW/h
Cost Unit3      = 26400.22 MW/h
Cost Unit4      = 26303.66 MW/h
Cost Unit5      = 5738.19 MW/h
Cost Unit6      = 2942945.282 MW/h
Cost Unit7      = 2062993.8878 MW/h
Cost Unit8      = 1.4661 MW/h
Cost Unit9      = 2953707.064 MW/h
Cost Unit10      = 2.156 MW/h
Cost Unit11      = 25.872 MW/h
---------------- Detail Power ------------------
Daya Beban                = 2.7 MW/h
Daya Loss                 = 0 MW/h
   Daya Loss + Beban      = 2.7 MW/h
   Terbangkitkan          = 2.701 MW/h
   Daya Tak Terpenuhi     = 0.00099403 MW/h
```

**Artificial Bee Colony**

```
--------- Artificial Bee Colony -----------
Total Iteration           = 500
Total Cost                = 8121760.4007 $/h
Total Beban               = 2.7 MW/h
Total Daya                = 2.703 $/h
-------------- Unit Power & Cost -----------------
Daya Unit1      = 0 MW/h
Daya Unit2      = 0.080116 MW/h
Daya Unit3      = 0.012965 MW/h
Daya Unit4      = 0 MW/h
Daya Unit5      = 0 MW/h
Daya Unit6      = 0.84931 MW/h
Daya Unit7      = 0.36627 MW/h
Daya Unit8      = 0.45973 MW/h
Daya Unit9      = 0.16295 MW/h
Daya Unit10      = 0.49396 MW/h
Daya Unit11      = 0.27768 MW/h
Cost Unit1      = 11911.9 MW/h
Cost Unit2      = 305905.6425 MW/h
Cost Unit3      = 65974.5091 MW/h
Cost Unit4      = 26303.66 MW/h
Cost Unit5      = 5738.19 MW/h
Cost Unit6      = 2499459.762 MW/h
Cost Unit7      = 1077916.1246 MW/h
Cost Unit8      = 1362630.7649 MW/h
Cost Unit9      = 481534.2309 MW/h
Cost Unit10      = 1462707.3526 MW/h
Cost Unit11      = 821678.2642 MW/h
---------------- Detail Power ------------------
Daya Beban                = 2.7 MW/h
Daya Loss                 = 0 MW/h
   Daya Loss + Beban      = 2.7 MW/h
   Terbangkitkan          = 2.703 MW/h
   Daya Tak Terpenuhi     = 0.0029825 MW/h
```



**Skenario 2**

| Unit | a.(Rp/MW^2) | b.($/MW) | c.($) | P Lower | P Upper |
|---|---|---|---|---|---|
| 1 | 26.239 | 3.0492e+06 | 11912 | 0 | 0.9 |
| 3 | 121.74 | 3.0524e+06 | 26400 | 0 | 0.9 |
| 5 | 19509 | 3.034e+06 | 26304 | 0 | 0.9 |
| 9 | 184.59 | 2.9639e+06 | 1.4661 | 0 | 1 |

```
---------- Result Calculation -------------
-------- Differential Evolution -------------
Total Iteration           = 500
Total Cost                = 8227067.4013 $/h
Total Beban               = 2.7 MW/h
Total Daya                = 2.7041 $/h
-------------- Unit Power & Cost -----------------
Daya Unit1      = 0.80413 MW/h
Daya Unit2      = 0 MW/h
Daya Unit3      = 0.9 MW/h
Daya Unit4      = 1 MW/h
Cost Unit1      = 2463892.2996 MW/h
Cost Unit2      = 26400.22 MW/h
Cost Unit3      = 2772671.6177 MW/h
Cost Unit4      = 2964103.264 MW/h
----------------- Detail Power -------------------
Daya Beban                = 2.7 MW/h
Daya Loss                 = 0 MW/h
Total Daya Loss + Beban   = 2.7 MW/h
Total Terbangkitkan       = 2.7041 MW/h
Total Daya Tak Terpenuhi  = 0.004126 MW/h
```

| Unit | a.(Rp/MW^2) | b.($/MW) | c.($) | P Lower | P Upper |
|---|---|---|---|---|---|
| 1 | 26.239 | 3.0492e+06 | 11912 | 0 | 0.9 |
| 3 | 121.74 | 3.0524e+06 | 26400 | 0 | 0.9 |
| 5 | 19509 | 3.034e+06 | 26304 | 0 | 0.9 |
| 9 | 184.59 | 2.9639e+06 | 1.4661 | 0 | 1 |

```
---------- Result Calculation -------------
--------- Artificial Bee Colony -----------
Total Iteration           = 500
Total Cost                = 8243551.4166 $/h
Total Beban               = 2.709 MW/h
Total Daya                = 2.7095 $/h
-------------- Unit Power & Cost -----------------
Daya Unit1      = 0.714 MW/h
Daya Unit2      = 0.67804 MW/h
Daya Unit3      = 0.35156 MW/h
Daya Unit4      = 0.96591 MW/h
Cost Unit1      = 2189069.7714 MW/h
Cost Unit2      = 2096115.2123 MW/h
Cost Unit3      = 1095321.0467 MW/h
Cost Unit4      = 2863045.3863 MW/h
----------------- Detail Power -------------------
Daya Beban                = 2.709 MW/h
Daya Loss                 = 0 MW/h
Total Daya Loss + Beban   = 2.709 MW/h
Total Terbangkitkan       = 2.7095 MW/h
Total Daya Tak Terpenuhi  = 0.00049872 MW/h
```

**OPTIMASI REALTIME 20 JANUARI (HARI KERJA)**

**01.00**

```
-------- Differential Evolution ------------
Total Iteration           = 500
Total Cost                = 14752194.4345 $/h
Total Beban               = 4.955 MW/h
Total Daya                = 4.955 $/h
-------------- Unit Power & Cost -----------------
Daya Unit1      = 0 MW/h
Daya Unit2      = 0 MW/h
Daya Unit3      = 0 MW/h
Daya Unit4      = 0 MW/h
Daya Unit5      = 0 MW/h
Daya Unit6      = 1 MW/h
Daya Unit7      = 0.99072 MW/h
Daya Unit8      = 0 MW/h
Daya Unit9      = 1 MW/h
Daya Unit10      = 1 MW/h
Daya Unit11      = 0.96429 MW/h
Cost Unit1      = 11911.9 MW/h
Cost Unit2      = 55003.87 MW/h
Cost Unit3      = 26400.22 MW/h
Cost Unit4      = 26303.66 MW/h
Cost Unit5      = 5738.19 MW/h
Cost Unit6      = 2942945.282 MW/h
Cost Unit7      = 2915637.5797 MW/h
Cost Unit8      = 1.4661 MW/h
Cost Unit9      = 2953707.064 MW/h
Cost Unit10      = 2961163.59 MW/h
Cost Unit11      = 2853381.6127 MW/h
---------------- Detail Power ------------------
Daya Beban                = 4.955 MW/h
Daya Loss                 = 0 MW/h
   Daya Loss + Beban      = 4.955 MW/h
   Terbangkitkan          = 4.955 MW/h
   Daya Tak Terpenuhi     = 1.8459e-06 MW/h
```