MODEL BUILDING -- LINEAR REGRESSION

SPLIT THE TRAIN AND TEST DATASET

In [10]:
```
# !pip install pandas
import pandas as pd
# !pip install numpy
import numpy as np
# !pip install seaborn
import seaborn as sns
# !pip install matplotlib
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings("ignore")
# !pip install ipywidgets
import ipywidgets as widgets
```

READ THE CLEANED DATASET

In [11]:
```
df = pd.read_csv('Cleaned_df.csv')
df = df.drop(['Unnamed: 0'],axis = 1)
```

SPLIT THE DATASET INTO X AND Y

In [12]:
```
x = df.iloc[:,2:]
y = df.iloc[:,1]
```

SPLIT THE DATASET INTO TRAIN AND TEST OF X AND Y

In [13]:
```
# !pip install sklearn
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x,y,train_size = 0.8, random_state = 42)
```

CHECK FOR SHAPE OF TRAIN AND TEST SETS

In [14]:
```
print('Shape of x_train: ',x_train.shape)
print('Shape of x_test: ',x_test.shape)
print('Shape of y_train: ',y_train.shape)
print('Shape of y_test: ',y_test.shape)
```

```
Shape of x_train:  (196159, 19)
Shape of x_test:  (49040, 19)
Shape of y_train:  (196159,)
Shape of y_test:  (49040,)
```

FIT THE MODELS

In [15]:
```
from sklearn.linear_model import LinearRegression
lr = LinearRegression()
lr = lr.fit(x_train,y_train)
```

PREDICT THE MODEL

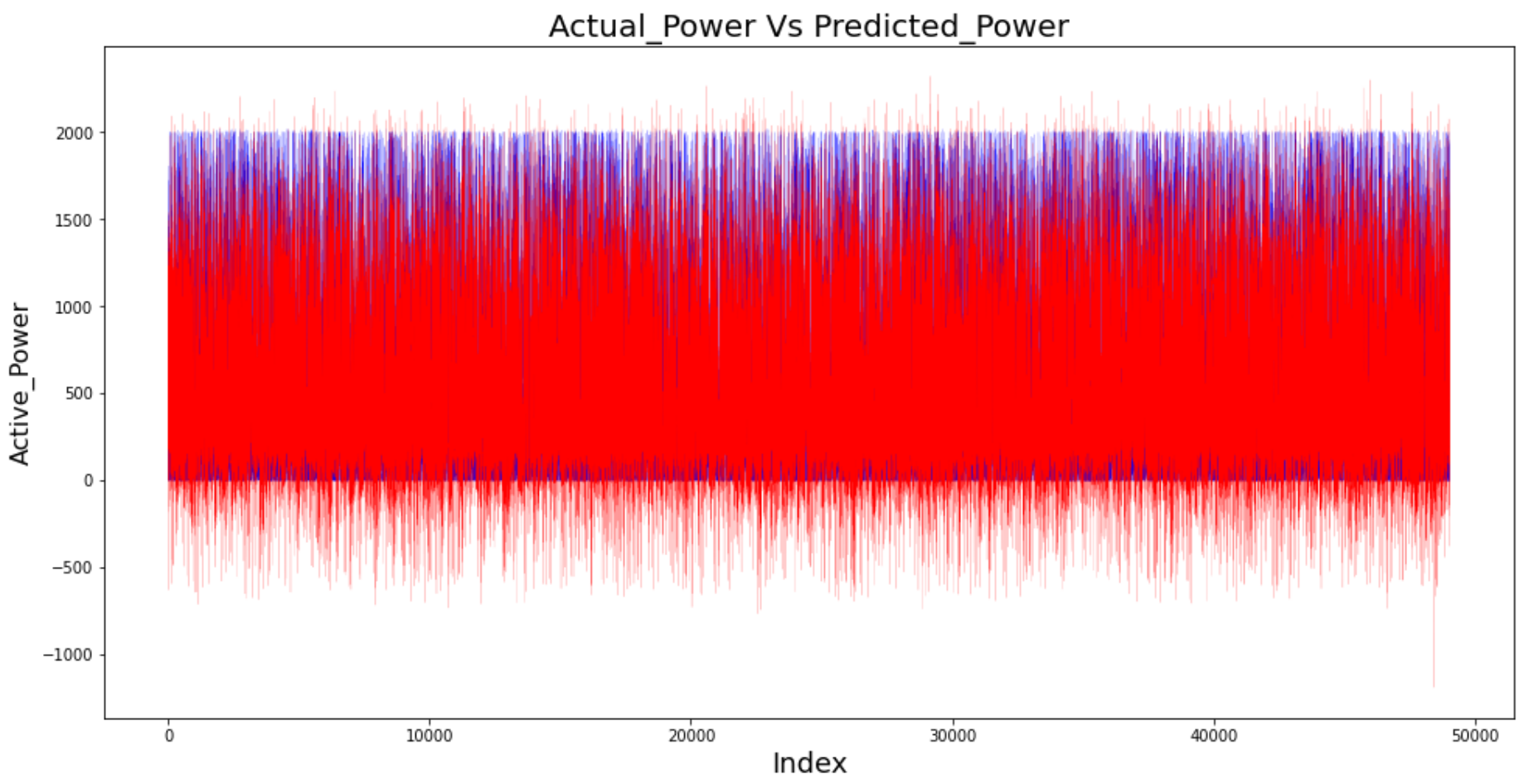
In [16]:
```
y_pred = lr.predict(x_test)
```

MODEL-1

In [17]:
```
# !pip install statmodels
import statsmodels.api as sm
x_train_sm = x_train

x_train_sm = sm.add_constant(x_train_sm)

mlm = sm.OLS(y_train,x_train_sm).fit()

mlm.params
print(mlm.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.938
Model:                            OLS   Adj. R-squared:                  0.938
Method:                 Least Squares   F-statistic:                 1.552e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:40:34   Log-Likelihood:            -1.2446e+06
No. Observations:              196159   AIC:                         2.489e+06
Df Residuals:                  196139   BIC:                         2.489e+06
Df Model:                          19
Covariance Type:            nonrobust
=====================================================================================================
                                        coef    std err          t      P>|t|      [0.025      0.975]
-----------------------------------------------------------------------------------------------------
const                             -3124.6801      9.735   -320.962      0.000   -3143.761   -3105.599
Avg_Ambient_Temp                     -4.8097      0.095    -50.819      0.000      -4.995      -4.624
Avg_Generator_Speed                  -0.0036      0.077     -0.047      0.963      -0.154       0.146
Avg_Nacelle_Pos                   5.365e-05      0.003      0.016      0.987      -0.006       0.006
Avg_Pitch_Angle                      12.3866      0.045    275.231      0.000      12.298      12.475
Avg_Rotor_Speed                     116.5211      8.183     14.239      0.000     100.483     132.560
Avg_Wind_Speed                       32.1814      0.325     99.074      0.000      31.545      32.818
Bearing_DE_Temp                      -9.4580      0.153    -61.715      0.000      -9.758      -9.158
Bearing_NDE_Temp                     -8.7528      0.158    -55.406      0.000      -9.062      -8.443
Gearbox_bearing_Temp                  2.9521      0.256     11.512      0.000       2.449       3.455
Gearbox_oil_Temp                     26.9376      0.341     78.954      0.000      26.269      27.606
Generator_wind_Temp_1               116.9005      2.156     54.210      0.000     112.674     121.127
Generator_wind_Temp_2              -144.2204      2.128    -67.784      0.000    -148.391    -140.050
Generator_wind_Temp_3                34.7784      0.289    120.193      0.000      34.211      35.345
Generators_sliprings_Temp            14.6944      0.154     95.160      0.000      14.392      14.997
Hidraulic_group_pressure              0.2188      0.014     15.428      0.000       0.191       0.247
Nacelle_Misalignment_Avg_Wind_Dir     0.0027      0.002      1.479      0.139      -0.001       0.006
Trafo_1_wind_Temp                    -1.9114      0.084    -22.684      0.000      -2.077      -1.746
Trafo_2_wind_Temp                     0.4971      0.071      7.003      0.000       0.358       0.636
Trafo_3_wind_Temp                     3.8216      0.074     51.661      0.000       3.677       3.967
==============================================================================
Omnibus:                    34340.376   Durbin-Watson:                   1.998
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           263120.746
Skew:                           0.636   Prob(JB):                         0.00
Kurtosis:                       8.530   Cond. No.                     3.86e+04
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 3.86e+04. This might indicate that there are
strong multicollinearity or other numerical problems.
```

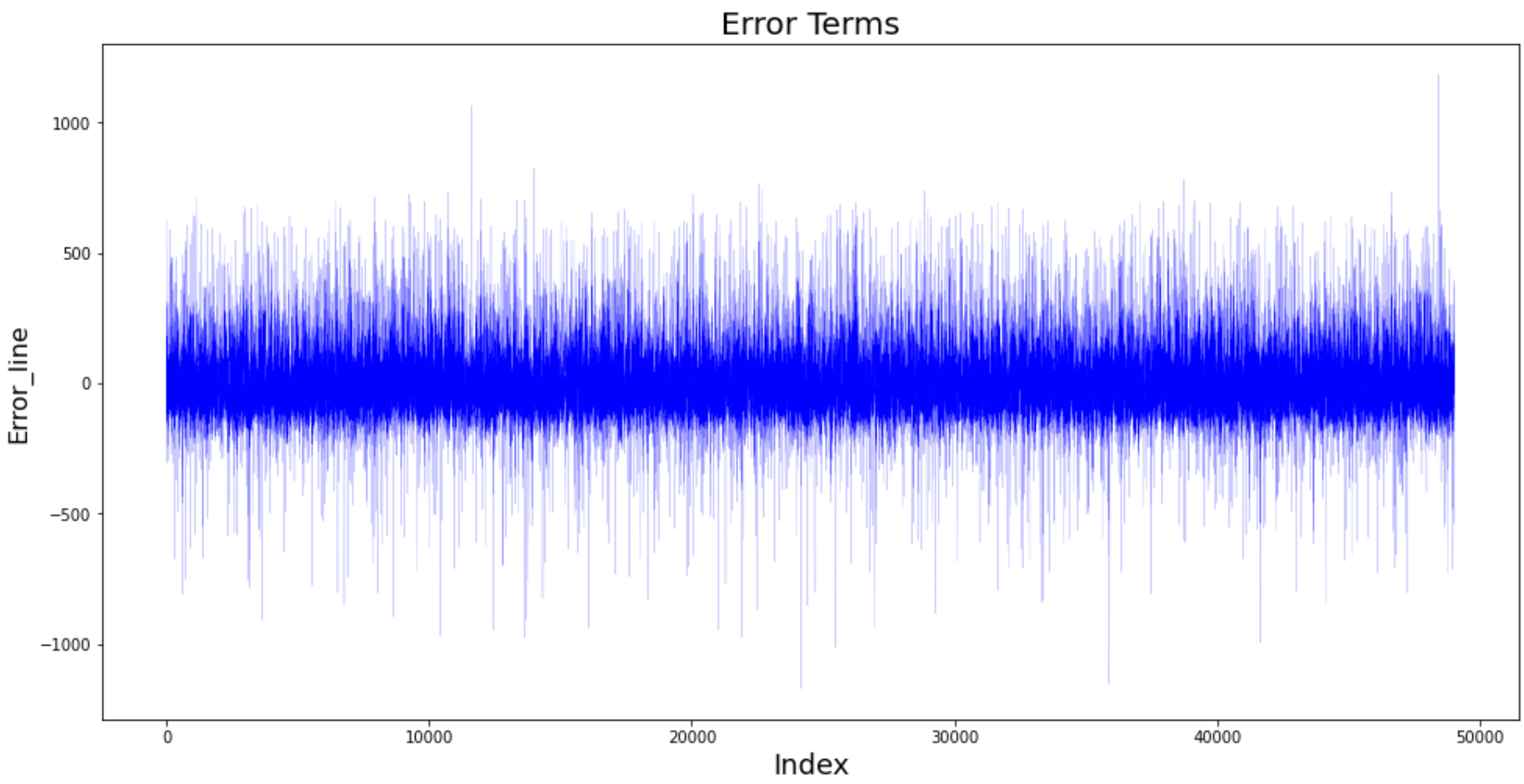
In [18]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [19]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x_train.values, i)
                          for i in range(len(x_train.columns))]

print(vif_data)
```

	feature	VIF
0	Avg_Ambient_Temp	70.956154
1	Avg_Generator_Speed	83644.989518
2	Avg_Nacelle_Pos	3.898009
3	Avg_Pitch_Angle	13.630874
4	Avg_Rotor_Speed	84271.377809
5	Avg_Wind_Speed	44.248870
6	Bearing_DE_Temp	615.214488
7	Bearing_NDE_Temp	669.374913
8	Gearbox_bearing_Temp	2756.496545
9	Gearbox_oil_Temp	2659.267301
10	Generator_wind_Temp_1	231529.737063
11	Generator_wind_Temp_2	232227.893434
12	Generator_wind_Temp_3	4572.275104
13	Generators_sliprings_Temp	450.132150
14	Hidraulic_group_pressure	81.460160
15	Nacelle_Misalignment_Avg_Wind_Dir	1.930151
16	Trafo_1_wind_Temp	311.304992
17	Trafo_2_wind_Temp	273.175199
18	Trafo_3_wind_Temp	285.184301

In [20]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)               # Plot heading
plt.xlabel('Index', fontsize=18)                       # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [21]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred)
r_squared = r2_score(y_test, y_pred)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 18890.960947349187
r_square_value : 0.938 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-2

In [22]:
```
x1_train = x_train[['Avg_Ambient_Temp', 'Avg_Generator_Speed', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed',
                    'Avg_Wind_Speed', 'Bearing_DE_Temp', 'Bearing_NDE_Temp', 'Gearbox_bearing_Temp', 'Gearbox_oil_Temp',
                    'Generator_wind_Temp_1', 'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Tem
                    'Hidraulic_group_pressure', 'Nacelle_Misalignment_Avg_Wind_Dir', 'Trafo_1_wind_Temp', 'Trafo_2_wind_
                    'Trafo_3_wind_Temp']]
x1_test = x_test[['Avg_Ambient_Temp', 'Avg_Generator_Speed', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed',
                    'Avg_Wind_Speed', 'Bearing_DE_Temp', 'Bearing_NDE_Temp', 'Gearbox_bearing_Temp', 'Gearbox_oil_Temp',
                    'Generator_wind_Temp_1', 'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Tem
                    'Hidraulic_group_pressure', 'Nacelle_Misalignment_Avg_Wind_Dir', 'Trafo_1_wind_Temp', 'Trafo_2_wind_
                    'Trafo_3_wind_Temp']]
```

Avg_Nacelle_Pos -- varible is removed because of its significant value is more than 0.05.

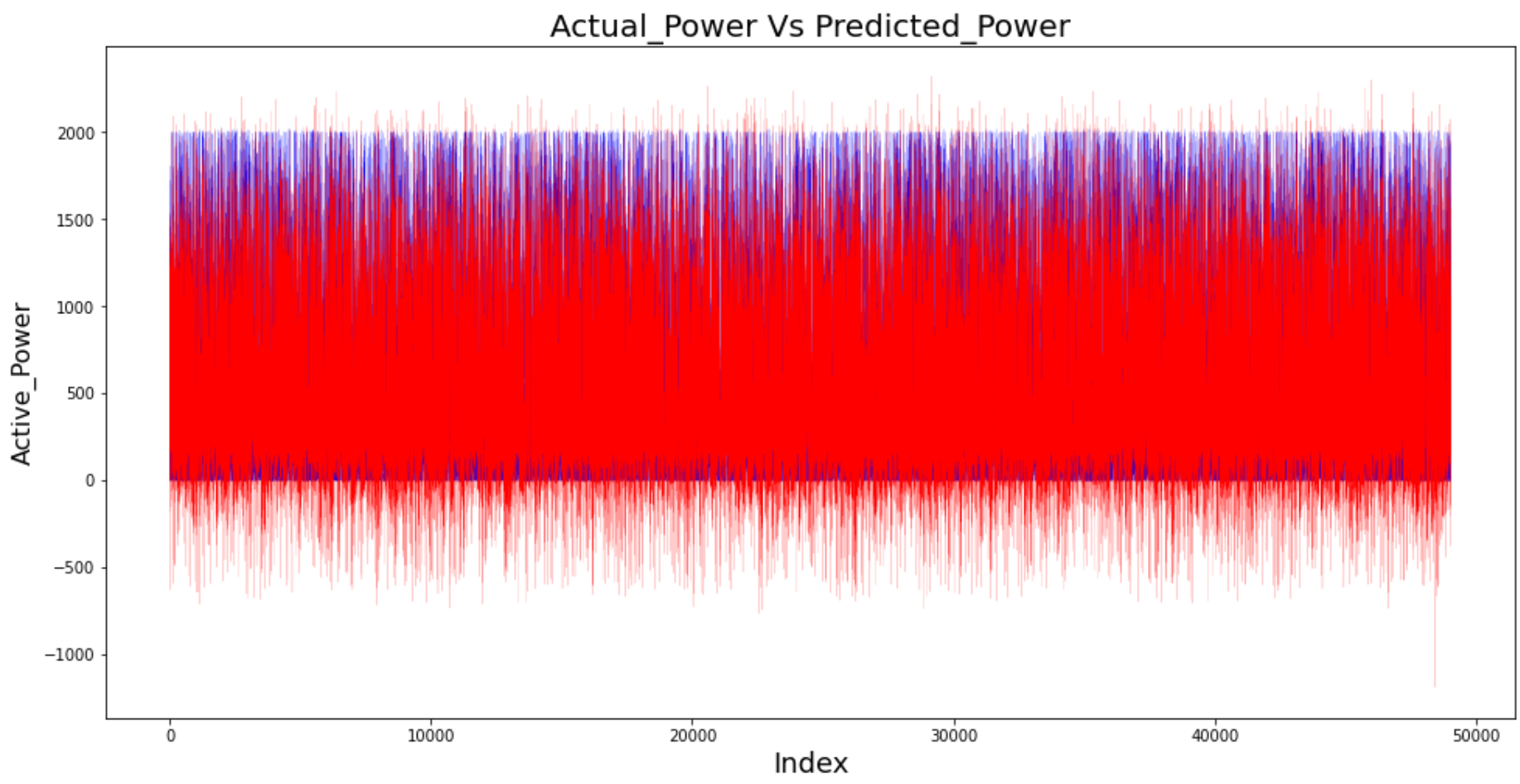
In [23]:
```
lr1 = lr.fit(x1_train,y_train)
```

In [24]:
```
y_pred1 = lr1.predict(x1_test)
```

In [25]:
```
import statsmodels.api as sm
x1_train_sm = x1_train

x1_train_sm = sm.add_constant(x1_train_sm)

mlm1 = sm.OLS(y_train,x1_train_sm).fit()


mlm1.params
print(mlm1.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.938
Model:                            OLS   Adj. R-squared:                  0.938
Method:                 Least Squares   F-statistic:                 1.639e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:40:49   Log-Likelihood:            -1.2446e+06
No. Observations:              196159   AIC:                         2.489e+06
Df Residuals:                  196140   BIC:                         2.489e+06
Df Model:                          18
Covariance Type:            nonrobust
=================================================================================================
                                    coef    std err          t      P>|t|      [0.025      0.975]
-------------------------------------------------------------------------------------------------
const                         -3124.6778      9.734   -320.999      0.000   -3143.757   -3105.599
Avg_Ambient_Temp                 -4.8097      0.095    -50.888      0.000      -4.995      -4.624
Avg_Generator_Speed              -0.0036      0.077     -0.047      0.963      -0.154       0.146
Avg_Pitch_Angle                  12.3866      0.045    275.319      0.000      12.298      12.475
Avg_Rotor_Speed                 116.5212      8.183     14.239      0.000     100.483     132.560
Avg_Wind_Speed                   32.1813      0.325     99.090      0.000      31.545      32.818
Bearing_DE_Temp                  -9.4580      0.153    -61.722      0.000      -9.758      -9.158
Bearing_NDE_Temp                 -8.7529      0.158    -55.415      0.000      -9.062      -8.443
Gearbox_bearing_Temp              2.9522      0.256     11.512      0.000       2.450       3.455
Gearbox_oil_Temp                 26.9375      0.341     78.975      0.000      26.269      27.606
Generator_wind_Temp_1           116.8993      2.155     54.242      0.000     112.675     121.123
Generator_wind_Temp_2          -144.2192      2.126    -67.825      0.000    -148.387    -140.052
Generator_wind_Temp_3            34.7784      0.289    120.207      0.000      34.211      35.345
Generators_sliprings_Temp        14.6946      0.154     95.511      0.000      14.393      14.996
Hidraulic_group_pressure          0.2188      0.014     15.428      0.000       0.191       0.247
Nacelle_Misalignment_Avg_Wind_Dir 0.0027      0.002      1.479      0.139      -0.001       0.006
Trafo_1_wind_Temp                -1.9114      0.084    -22.687      0.000      -2.077      -1.746
Trafo_2_wind_Temp                 0.4971      0.071      7.003      0.000       0.358       0.636
Trafo_3_wind_Temp                 3.8216      0.074     51.661      0.000       3.677       3.967
==============================================================================
Omnibus:                    34340.705   Durbin-Watson:                   1.998
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           263122.547
Skew:                           0.636   Prob(JB):                         0.00
Kurtosis:                       8.530   Cond. No.                     3.83e+04
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 3.83e+04. This might indicate that there are
strong multicollinearity or other numerical problems.
```

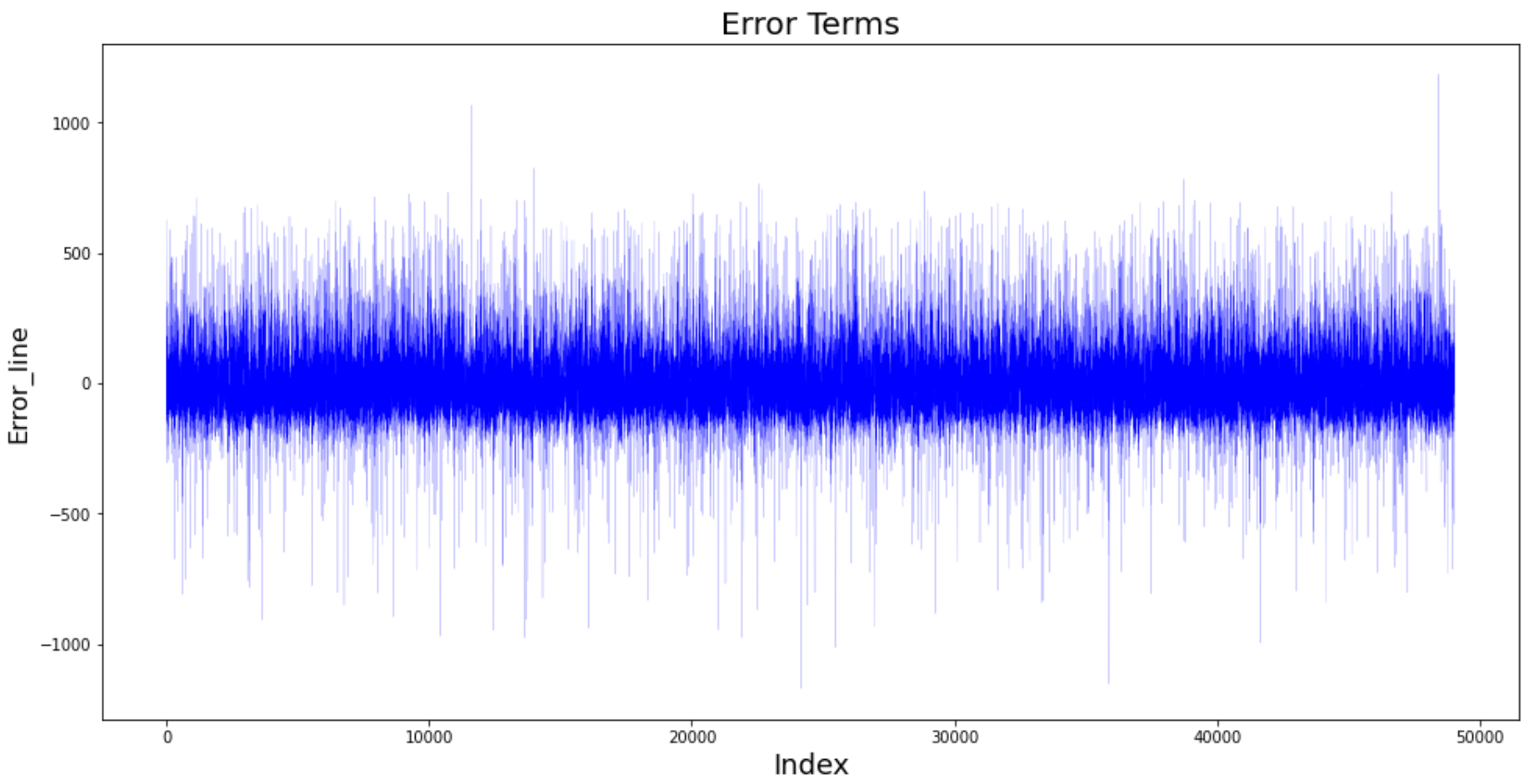
In [26]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred1, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [27]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x1_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x1_train.values, i)
                          for i in range(len(x1_train.columns))]

print(vif_data)
```

	feature	VIF
0	Avg_Ambient_Temp	70.755721
1	Avg_Generator_Speed	83644.968373
2	Avg_Pitch_Angle	13.620940
3	Avg_Rotor_Speed	84271.360161
4	Avg_Wind_Speed	44.235271
5	Bearing_DE_Temp	615.113078
6	Bearing_NDE_Temp	669.097227
7	Gearbox_bearing_Temp	2756.379755
8	Gearbox_oil_Temp	2658.394396
9	Generator_wind_Temp_1	231153.373715
10	Generator_wind_Temp_2	231860.090841
11	Generator_wind_Temp_3	4571.090312
12	Generators_sliprings_Temp	446.646861
13	Hidraulic_group_pressure	81.459161
14	Nacelle_Misalignment_Avg_Wind_Dir	1.930145
15	Trafo_1_wind_Temp	311.207540
16	Trafo_2_wind_Temp	273.126137
17	Trafo_3_wind_Temp	285.184025

In [28]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [29]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred1)
r_squared = r2_score(y_test, y_pred1)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 18890.96745365323
r_square_value : 0.938 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-3

In [30]:
```
x2_train = x_train[['Avg_Ambient_Temp', 'Avg_Generator_Speed', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed',
                    'Avg_Wind_Speed', 'Bearing_DE_Temp', 'Bearing_NDE_Temp', 'Gearbox_bearing_Temp', 'Gearbox_oil_Temp',
                    'Generator_wind_Temp_1', 'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Tem
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp',
                    'Trafo_3_wind_Temp']]
x2_test = x_test[['Avg_Ambient_Temp', 'Avg_Generator_Speed', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed',
                    'Avg_Wind_Speed', 'Bearing_DE_Temp', 'Bearing_NDE_Temp', 'Gearbox_bearing_Temp', 'Gearbox_oil_Temp',
                    'Generator_wind_Temp_1', 'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Tem
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp',
                    'Trafo_3_wind_Temp']]
```

Nacelle_Misalignment_Avg_Wind_Dir varible is removed because of its significant value is more than 0.05.

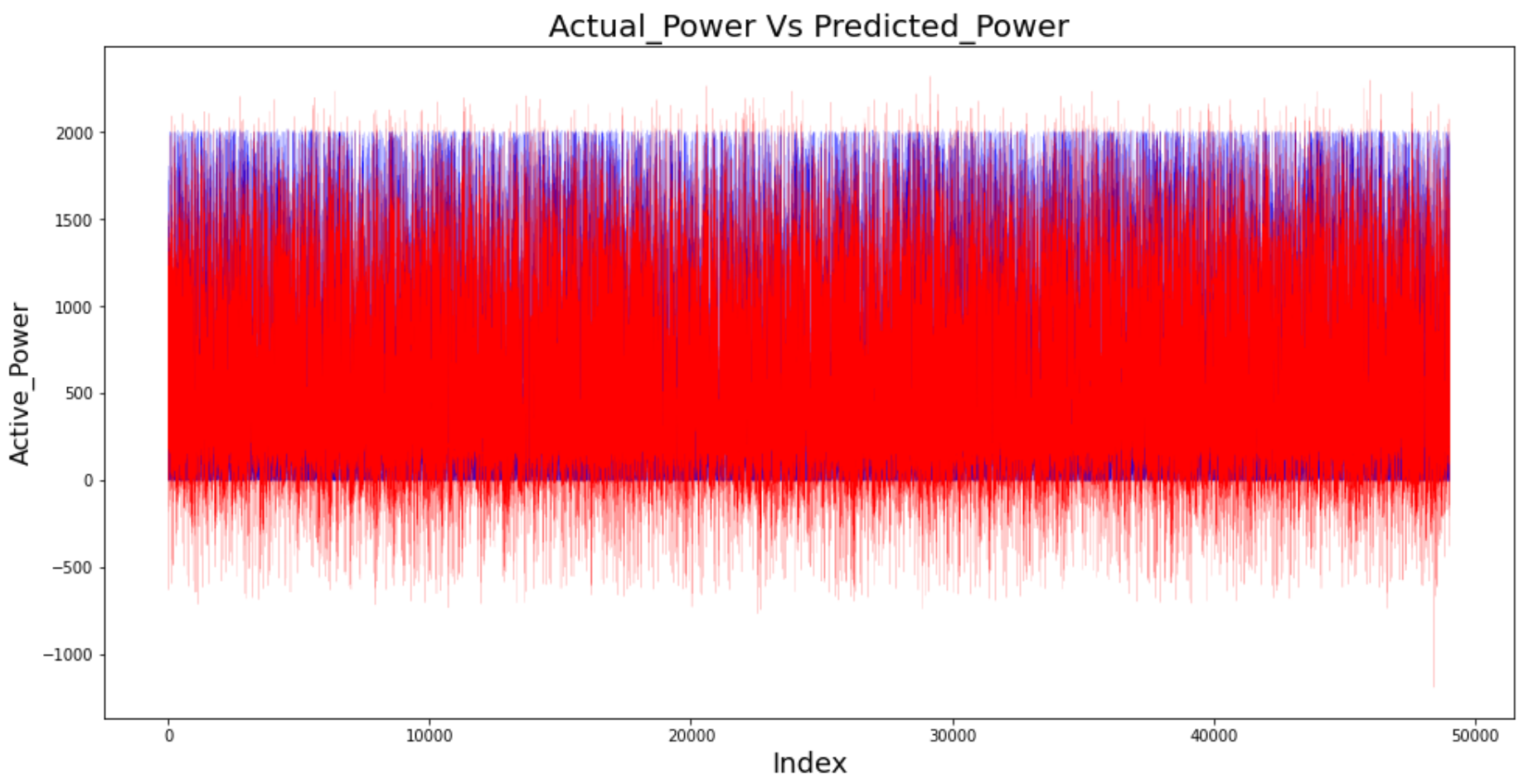
In [31]:
```
lr2 = lr.fit(x2_train,y_train)
```

In [32]:
```
y_pred2 = lr2.predict(x2_test)
```

In [33]:
```
import statsmodels.api as sm
x2_train_sm = x2_train

x2_train_sm = sm.add_constant(x2_train_sm)

mlm2 = sm.OLS(y_train,x2_train_sm).fit()

mlm2.params
print(mlm2.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.938
Model:                            OLS   Adj. R-squared:                  0.938
Method:                 Least Squares   F-statistic:                 1.735e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:03   Log-Likelihood:            -1.2446e+06
No. Observations:              196159   AIC:                         2.489e+06
Df Residuals:                  196141   BIC:                         2.489e+06
Df Model:                          17
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3124.4585      9.733   -321.013      0.000   -3143.535   -3105.382
Avg_Ambient_Temp                -4.7949      0.094    -51.016      0.000      -4.979      -4.611
Avg_Generator_Speed              0.0012      0.076      0.015      0.988      -0.149       0.151
Avg_Pitch_Angle                 12.3884      0.045    275.462      0.000      12.300      12.477
Avg_Rotor_Speed                116.0305      8.176     14.191      0.000     100.005     132.056
Avg_Wind_Speed                  32.1640      0.325     99.101      0.000      31.528      32.800
Bearing_DE_Temp                 -9.4560      0.153    -61.711      0.000      -9.756      -9.156
Bearing_NDE_Temp                -8.7499      0.158    -55.401      0.000      -9.060      -8.440
Gearbox_bearing_Temp             2.9580      0.256     11.536      0.000       2.455       3.461
Gearbox_oil_Temp                26.9373      0.341     78.975      0.000      26.269      27.606
Generator_wind_Temp_1          116.9224      2.155     54.254      0.000     112.699     121.146
Generator_wind_Temp_2         -144.2520      2.126    -67.844      0.000    -148.419    -140.085
Generator_wind_Temp_3           34.7897      0.289    120.287      0.000      34.223      35.357
Generators_sliprings_Temp       14.6734      0.153     95.790      0.000      14.373      14.974
Hidraulic_group_pressure         0.2189      0.014     15.435      0.000       0.191       0.247
Trafo_1_wind_Temp               -1.9121      0.084    -22.696      0.000      -2.077      -1.747
Trafo_2_wind_Temp                0.4958      0.071      6.986      0.000       0.357       0.635
Trafo_3_wind_Temp                3.8223      0.074     51.673      0.000       3.677       3.967
==============================================================================
Omnibus:                    34340.512   Durbin-Watson:                   1.998
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           263101.815
Skew:                           0.636   Prob(JB):                         0.00
Kurtosis:                       8.529   Cond. No.                     3.80e+04
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 3.8e+04. This might indicate that there are
strong multicollinearity or other numerical problems.
```

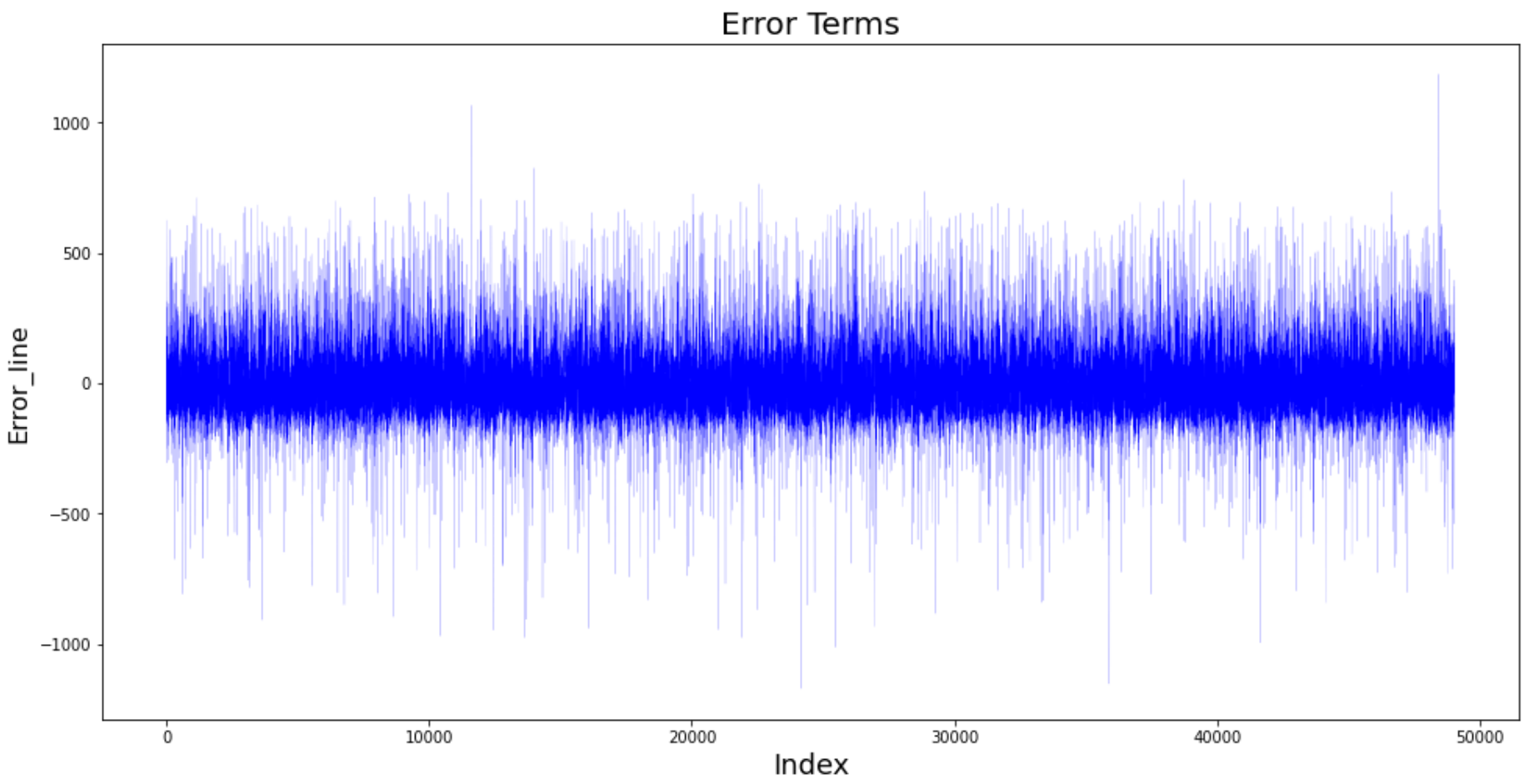
In [34]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred2, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [35]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x2_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x2_train.values, i)
                          for i in range(len(x2_train.columns))]

print(vif_data)
```

	feature	VIF
0	Avg_Ambient_Temp	69.958895
1	Avg_Generator_Speed	83497.589288
2	Avg_Pitch_Angle	13.609280
3	Avg_Rotor_Speed	84131.728964
4	Avg_Wind_Speed	44.178478
5	Bearing_DE_Temp	615.044433
6	Bearing_NDE_Temp	669.020778
7	Gearbox_bearing_Temp	2755.936095
8	Gearbox_oil_Temp	2657.976214
9	Generator_wind_Temp_1	231150.900292
10	Generator_wind_Temp_2	231849.033783
11	Generator_wind_Temp_3	4567.485073
12	Generators_sliprings_Temp	442.858267
13	Hidraulic_group_pressure	81.452678
14	Trafo_1_wind_Temp	311.202159
15	Trafo_2_wind_Temp	273.080192
16	Trafo_3_wind_Temp	285.172116

In [36]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred2, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [37]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred2)
r_squared = r2_score(y_test, y_pred2)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 18889.494881377803
r_square_value : 0.938 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-4

In [38]:
```
x3_train = x_train[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed',
                    'Avg_Wind_Speed', 'Bearing_DE_Temp', 'Bearing_NDE_Temp', 'Gearbox_bearing_Temp', 'Gearbox_oil_Temp',
                    'Generator_wind_Temp_1', 'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Tem
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp',
                    'Trafo_3_wind_Temp']]
x3_test = x_test[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed',
                    'Avg_Wind_Speed', 'Bearing_DE_Temp', 'Bearing_NDE_Temp', 'Gearbox_bearing_Temp', 'Gearbox_oil_Temp',
                    'Generator_wind_Temp_1', 'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Tem
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp',
                    'Trafo_3_wind_Temp']]
```

'Avg_Generator_Speed' varible is removed because of its significant value is more than 0.05.

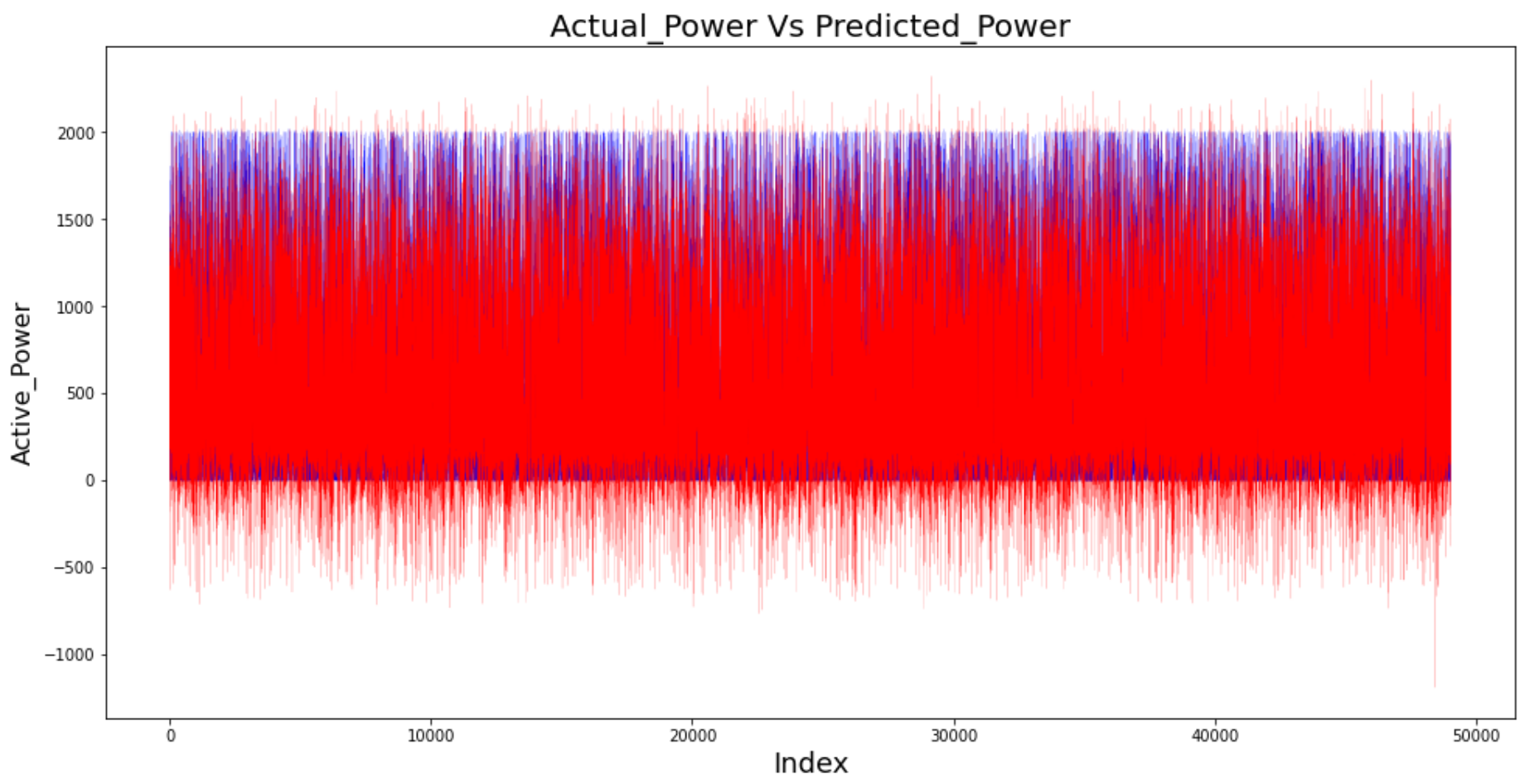
In [39]:
```
lr3 = lr.fit(x3_train,y_train)
```

In [40]:
```
y_pred3 = lr3.predict(x3_test)
```

In [41]:
```
import statsmodels.api as sm
x3_train_sm = x3_train

x3_train_sm = sm.add_constant(x3_train_sm)

mlm3 = sm.OLS(y_train,x3_train_sm).fit()

mlm3.params
print(mlm3.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.938
Model:                            OLS   Adj. R-squared:                  0.938
Method:                 Least Squares   F-statistic:                 1.844e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:14   Log-Likelihood:            -1.2446e+06
No. Observations:              196159   AIC:                         2.489e+06
Df Residuals:                  196142   BIC:                         2.489e+06
Df Model:                          16
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3124.4575      9.733   -321.021      0.000   -3143.534   -3105.381
Avg_Ambient_Temp                -4.7949      0.094    -51.025      0.000      -4.979      -4.611
Avg_Pitch_Angle                 12.3884      0.045    275.466      0.000      12.300      12.477
Avg_Rotor_Speed                116.1561      0.332    349.570      0.000     115.505     116.807
Avg_Wind_Speed                  32.1635      0.323     99.522      0.000      31.530      32.797
Bearing_DE_Temp                 -9.4560      0.153    -61.714      0.000      -9.756      -9.156
Bearing_NDE_Temp                -8.7500      0.158    -55.406      0.000      -9.060      -8.440
Gearbox_bearing_Temp             2.9578      0.256     11.550      0.000       2.456       3.460
Gearbox_oil_Temp                26.9375      0.341     79.005      0.000      26.269      27.606
Generator_wind_Temp_1          116.9223      2.155     54.255      0.000     112.698     121.146
Generator_wind_Temp_2         -144.2517      2.126    -67.845      0.000    -148.419    -140.084
Generator_wind_Temp_3           34.7897      0.289    120.288      0.000      34.223      35.357
Generators_sliprings_Temp       14.6733      0.153     95.838      0.000      14.373      14.973
Hidraulic_group_pressure         0.2189      0.014     15.436      0.000       0.191       0.247
Trafo_1_wind_Temp               -1.9121      0.084    -22.696      0.000      -2.077      -1.747
Trafo_2_wind_Temp                0.4958      0.071      6.989      0.000       0.357       0.635
Trafo_3_wind_Temp                3.8223      0.074     51.687      0.000       3.677       3.967
==============================================================================
Omnibus:                    34340.835   Durbin-Watson:                   1.998
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           263102.847
Skew:                           0.636   Prob(JB):                         0.00
Kurtosis:                       8.529   Cond. No.                     9.34e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 9.34e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

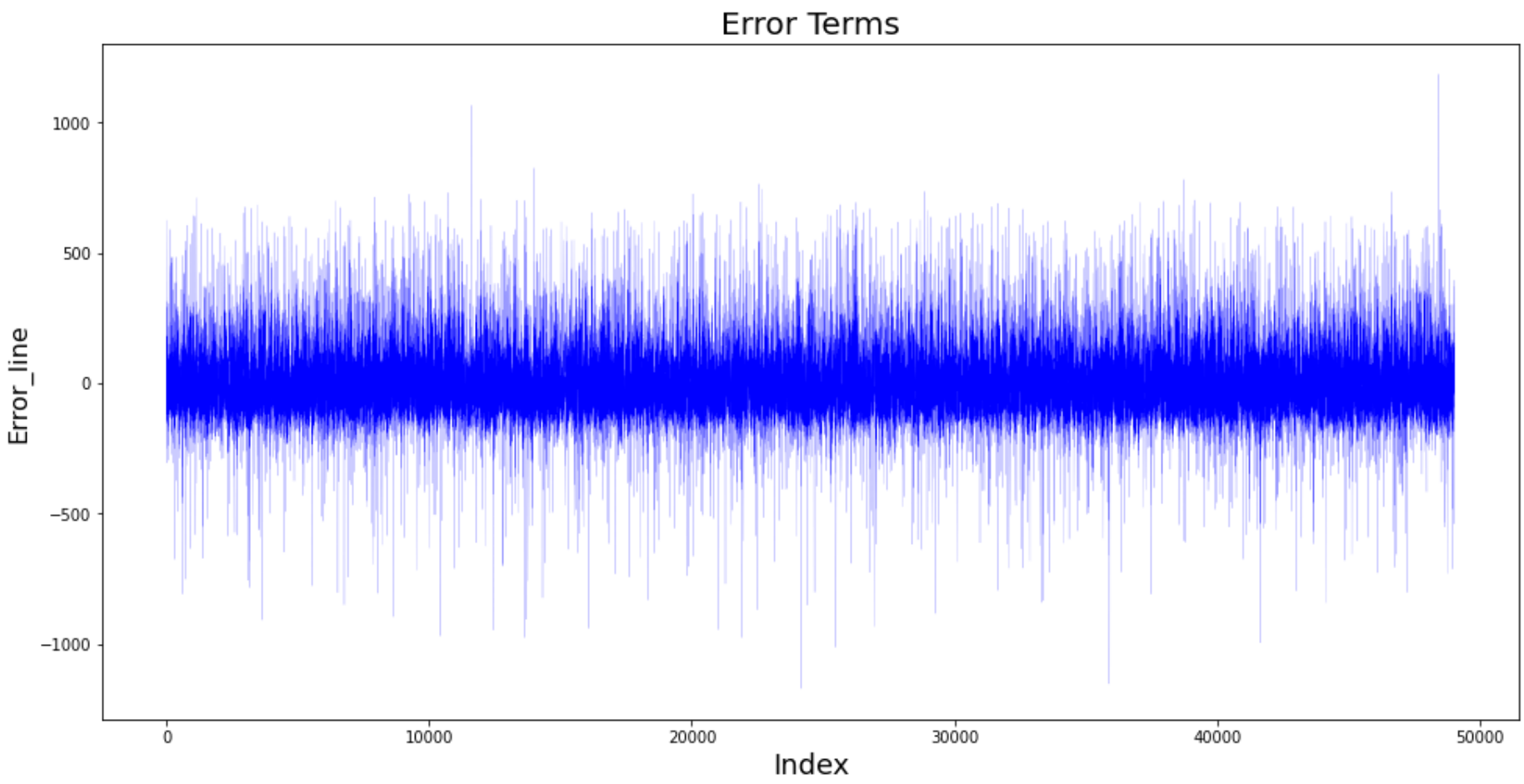
In [42]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred3, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [43]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x3_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x3_train.values, i)
                          for i in range(len(x3_train.columns))]

print(vif_data)
```

```
                     feature           VIF
0            Avg_Ambient_Temp     69.934265
1             Avg_Pitch_Angle     13.608803
2             Avg_Rotor_Speed    137.958877
3              Avg_Wind_Speed     43.805196
4             Bearing_DE_Temp    614.971703
5            Bearing_NDE_Temp    668.889859
6        Gearbox_bearing_Temp   2748.459206
7            Gearbox_oil_Temp   2653.258020
8       Generator_wind_Temp_1  231139.296838
9       Generator_wind_Temp_2  231830.976611
10      Generator_wind_Temp_3    4567.470518
11  Generators_sliprings_Temp     442.432227
12   Hidraulic_group_pressure      81.429600
13          Trafo_1_wind_Temp     311.197941
14          Trafo_2_wind_Temp     272.863521
15          Trafo_3_wind_Temp     285.012433
```

In [44]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred3, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [45]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred3)
r_squared = r2_score(y_test, y_pred3)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 18889.474403181845
r_square_value : 0.938 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-5

In [46]:
```
x4_train = x_train[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1',
                    'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp',
                    'Trafo_3_wind_Temp']]
x4_test = x_test[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1',
                    'Generator_wind_Temp_2', 'Generator_wind_Temp_3', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp',
                    'Trafo_3_wind_Temp']]
```

'Bearing_NDE_Temp' & 'Bearing_DE_Temp' These varibles are Auto Correlated each other. So, i removed one variable ('Bearing_NDE_Temp')

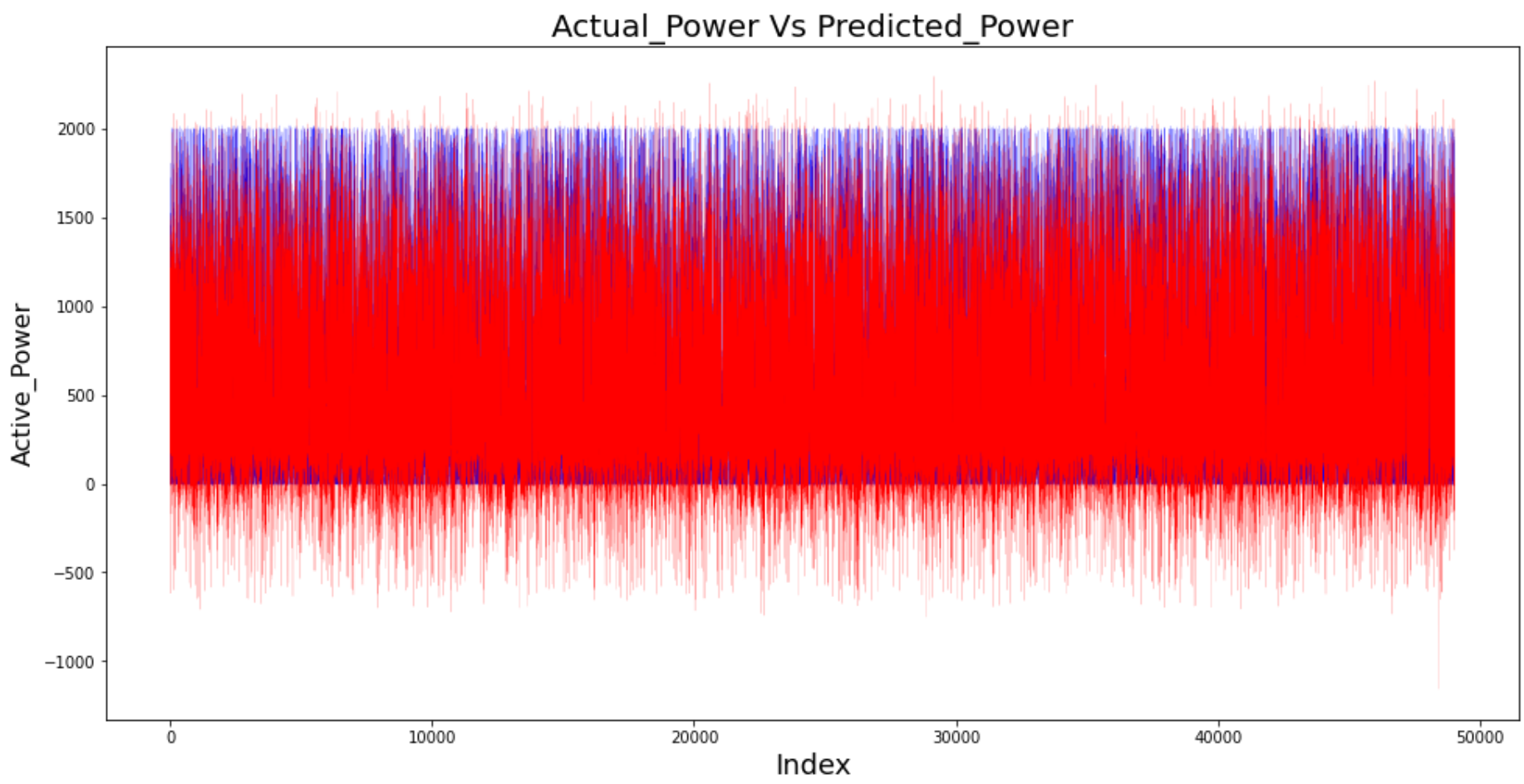
In [47]:
```
lr4 = lr.fit(x4_train,y_train)
```

In [48]:
```
y_pred4 = lr4.predict(x4_test)
```

In [49]:
```
import statsmodels.api as sm
x4_train_sm = x4_train

x4_train_sm = sm.add_constant(x4_train_sm)

mlm4 = sm.OLS(y_train,x4_train_sm).fit()

mlm4.params
print(mlm4.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.937
Model:                            OLS   Adj. R-squared:                  0.937
Method:                 Least Squares   F-statistic:                 1.934e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:23   Log-Likelihood:            -1.2461e+06
No. Observations:              196159   AIC:                         2.492e+06
Df Residuals:                  196143   BIC:                         2.492e+06
Df Model:                          15
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3052.2801      9.720   -314.006      0.000   -3071.332   -3033.228
Avg_Ambient_Temp                -4.7923      0.095    -50.603      0.000      -4.978      -4.607
Avg_Pitch_Angle                 12.3403      0.045    272.326      0.000      12.252      12.429
Avg_Rotor_Speed                116.4816      0.335    347.893      0.000     115.825     117.138
Avg_Wind_Speed                  32.7520      0.326    100.614      0.000      32.114      33.390
Bearing_DE_Temp                -14.3852      0.126   -114.421      0.000     -14.632     -14.139
Gearbox_bearing_Temp             2.7047      0.258     10.482      0.000       2.199       3.211
Gearbox_oil_Temp                25.0503      0.342     73.269      0.000      24.380      25.720
Generator_wind_Temp_1          117.0581      2.172     53.898      0.000     112.801     121.315
Generator_wind_Temp_2         -144.9050      2.143    -67.627      0.000    -149.105    -140.705
Generator_wind_Temp_3           34.3993      0.291    118.053      0.000      33.828      34.970
Generators_sliprings_Temp       12.7109      0.150     84.675      0.000      12.417      13.005
Hidraulic_group_pressure         0.2117      0.014     14.814      0.000       0.184       0.240
Trafo_1_wind_Temp               -1.3993      0.084    -16.582      0.000      -1.565      -1.234
Trafo_2_wind_Temp                0.5641      0.071      7.891      0.000       0.424       0.704
Trafo_3_wind_Temp                3.3687      0.074     45.481      0.000       3.224       3.514
==============================================================================
Omnibus:                    32465.610   Durbin-Watson:                   1.998
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           253064.039
Skew:                           0.582   Prob(JB):                         0.00
Kurtosis:                       8.441   Cond. No.                     9.11e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 9.11e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

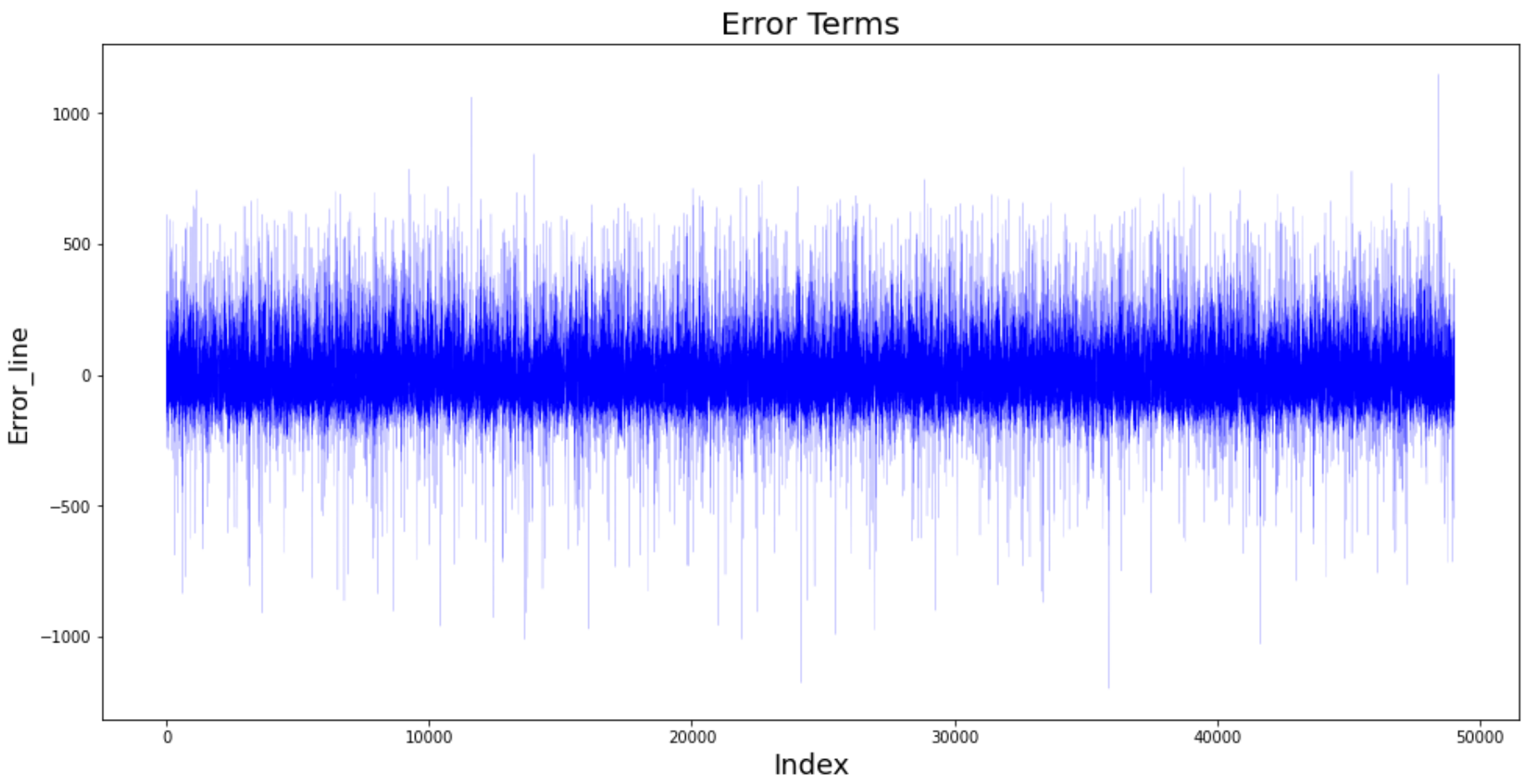
In [50]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred4, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [51]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x4_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x4_train.values, i)
                           for i in range(len(x4_train.columns))]

print(vif_data)
```

	feature	VIF
0	Avg_Ambient_Temp	69.931381
1	Avg_Pitch_Angle	13.608564
2	Avg_Rotor_Speed	137.953312
3	Avg_Wind_Speed	43.748536
4	Bearing_DE_Temp	411.876170
5	Gearbox_bearing_Temp	2742.710813
6	Gearbox_oil_Temp	2652.418117
7	Generator_wind_Temp_1	230826.581554
8	Generator_wind_Temp_2	231643.128321
9	Generator_wind_Temp_3	4566.958546
10	Generators_sliprings_Temp	421.338858
11	Hidraulic_group_pressure	81.347775
12	Trafo_1_wind_Temp	306.452596
13	Trafo_2_wind_Temp	272.843233
14	Trafo_3_wind_Temp	281.161026

In [52]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred4, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [53]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred4)
r_squared = r2_score(y_test, y_pred4)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 19200.959868118574
r_square_value : 0.937 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-6

In [54]:
```
x5_train = x_train[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1',
                    'Generator_wind_Temp_3', 'Generators_sliprings_Temp', 'Hidraulic_group_pressure', 'Trafo_1_wind_Temp
                    'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
x5_test = x_test[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1',
                    'Generator_wind_Temp_3', 'Generators_sliprings_Temp', 'Hidraulic_group_pressure', 'Trafo_1_wind_Temp
                    'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
```

'Generator_wind_Temp_1', 'Generator_wind_Temp_2' These varibles are Auto Correlated each other. So, i removed one variable ('Generator_wind_Temp_2')

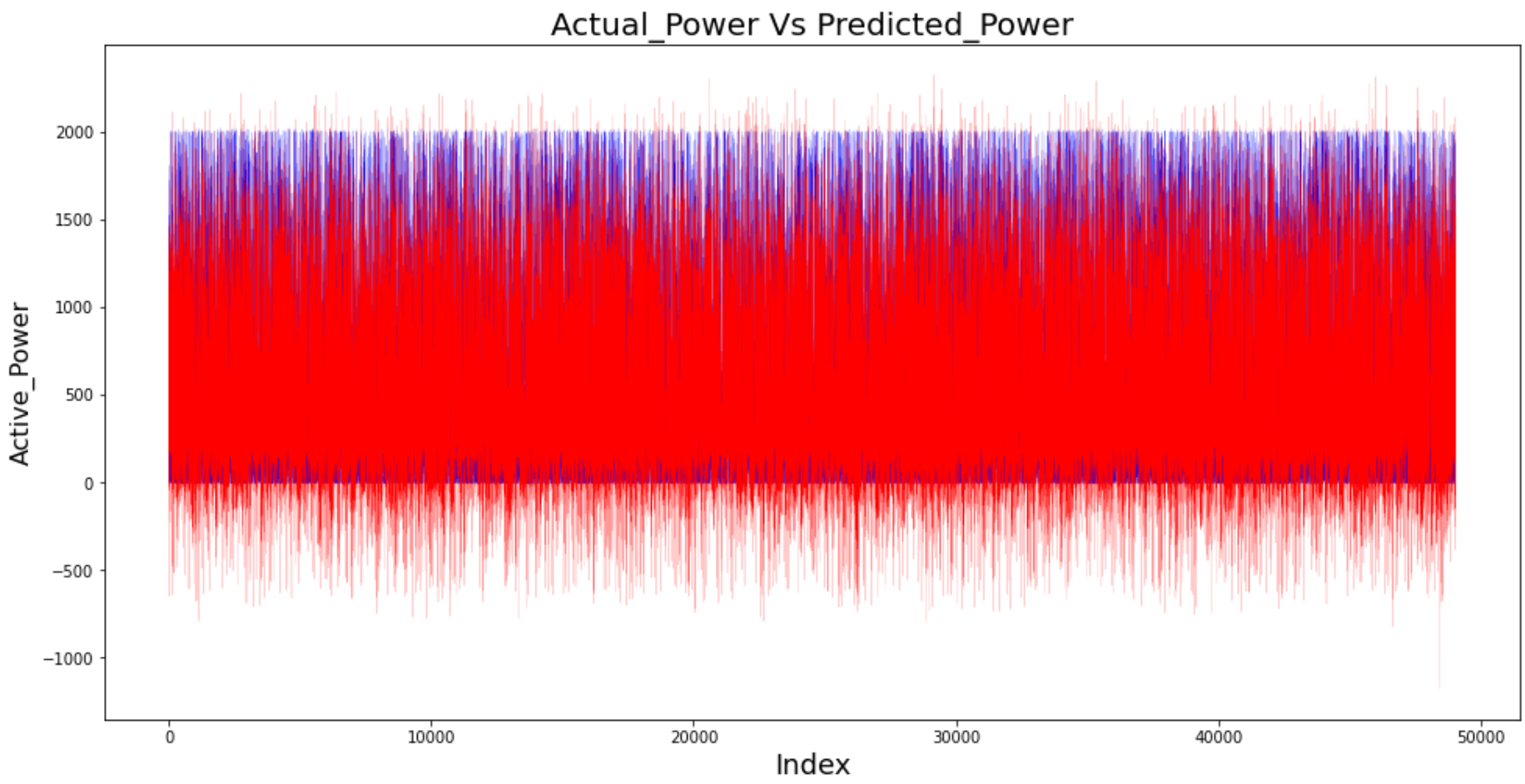
In [55]:
```
lr5 = lr.fit(x5_train,y_train)
```

In [56]:
```
y_pred5 = lr5.predict(x5_test)
```

In [57]:
```
import statsmodels.api as sm
x5_train_sm = x5_train

x5_train_sm = sm.add_constant(x5_train_sm)

mlm5 = sm.OLS(y_train,x5_train_sm).fit()

mlm5.params
print(mlm5.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.935
Model:                            OLS   Adj. R-squared:                  0.935
Method:                 Least Squares   F-statistic:                 2.022e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:31   Log-Likelihood:            -1.2484e+06
No. Observations:              196159   AIC:                         2.497e+06
Df Residuals:                  196144   BIC:                         2.497e+06
Df Model:                          14
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3214.7902      9.528   -337.409      0.000   -3233.465   -3196.116
Avg_Ambient_Temp                -5.2072      0.096    -54.469      0.000      -5.395      -5.020
Avg_Pitch_Angle                 13.5097      0.042    318.841      0.000      13.427      13.593
Avg_Rotor_Speed                116.8875      0.339    345.162      0.000     116.224     117.551
Avg_Wind_Speed                  38.0114      0.320    118.876      0.000      37.385      38.638
Bearing_DE_Temp                -13.9962      0.127   -110.167      0.000     -14.245     -13.747
Gearbox_bearing_Temp             1.1050      0.260      4.251      0.000       0.596       1.614
Gearbox_oil_Temp                26.3377      0.345     76.270      0.000      25.661      27.014
Generator_wind_Temp_1          -28.4262      0.302    -94.229      0.000     -29.017     -27.835
Generator_wind_Temp_3           34.8105      0.295    118.121      0.000      34.233      35.388
Generators_sliprings_Temp       13.4166      0.151     88.567      0.000      13.120      13.714
Hidraulic_group_pressure         0.2348      0.014     16.246      0.000       0.206       0.263
Trafo_1_wind_Temp               -2.0116      0.085    -23.700      0.000      -2.178      -1.845
Trafo_2_wind_Temp                0.9973      0.072     13.847      0.000       0.856       1.139
Trafo_3_wind_Temp                3.7910      0.075     50.777      0.000       3.645       3.937
==============================================================================
Omnibus:                    38016.002   Durbin-Watson:                   2.000
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           287712.537
Skew:                           0.732   Prob(JB):                         0.00
Kurtosis:                       8.750   Cond. No.                     8.53e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 8.53e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

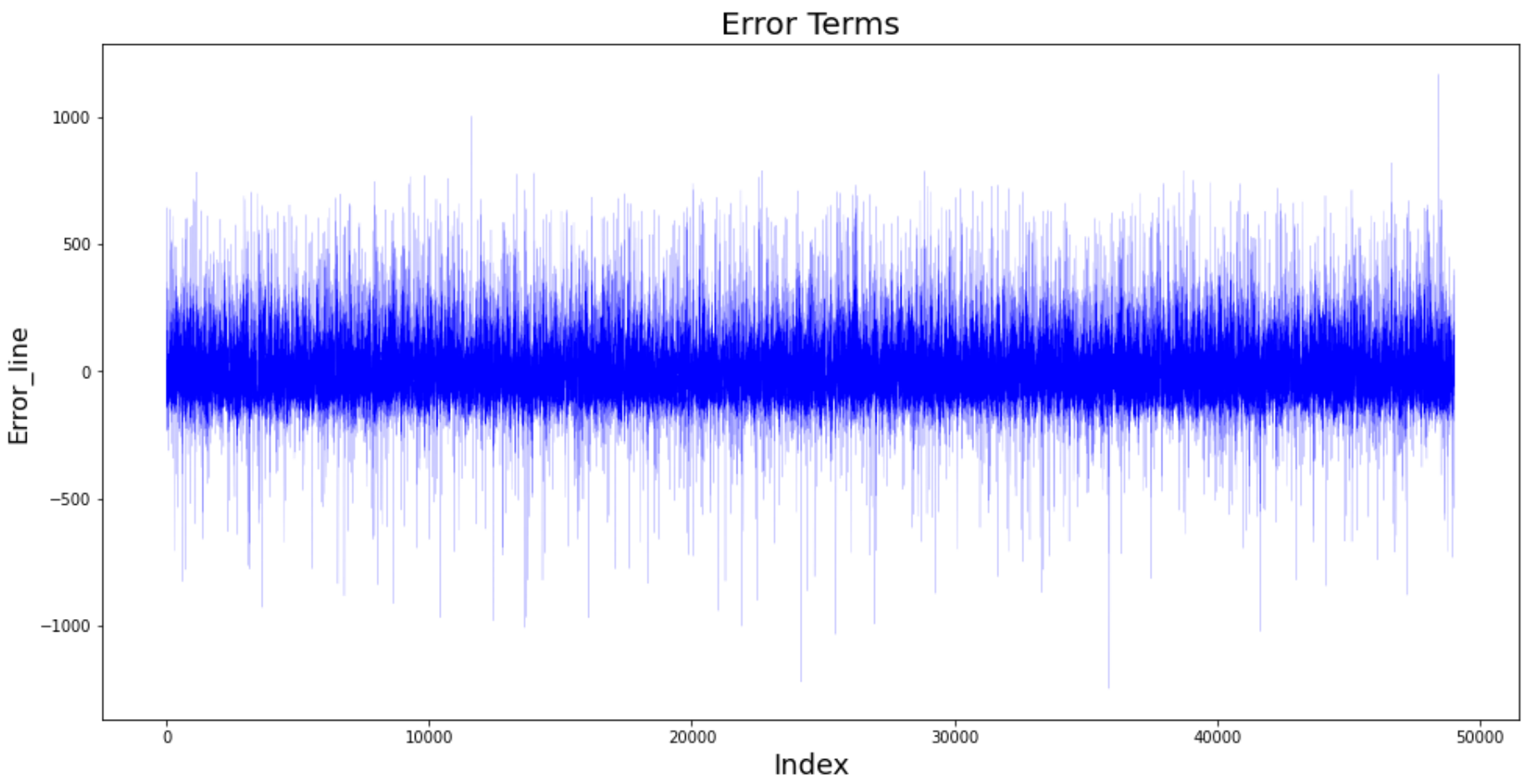
In [58]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred5, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [59]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x5_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x5_train.values, i)
                           for i in range(len(x5_train.columns))]

print(vif_data)
```

```
                     feature         VIF
0            Avg_Ambient_Temp   69.503414
1             Avg_Pitch_Angle   11.769708
2             Avg_Rotor_Speed  137.732875
3              Avg_Wind_Speed   41.224769
4             Bearing_DE_Temp  411.291111
5        Gearbox_bearing_Temp  2737.457889
6            Gearbox_oil_Temp  2601.629653
7       Generator_wind_Temp_1  4492.552730
8       Generator_wind_Temp_3  4566.868338
9   Generators_sliprings_Temp   420.397298
10  Hidraulic_group_pressure    81.121386
11         Trafo_1_wind_Temp  300.566284
12         Trafo_2_wind_Temp  269.594255
13         Trafo_3_wind_Temp  278.373809
```

In [60]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred5, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [61]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred5)
r_squared = r2_score(y_test, y_pred5)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 19596.03455227658
r_square_value : 0.935 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-7

In [62]:
```
x6_train = x_train[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
x6_test = x_test[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
```

'Generator_wind_Temp_1', 'Generator_wind_Temp_3' These varibles are Auto Correlated each other. So, i removed one variable ('Generator_wind_Temp_3')

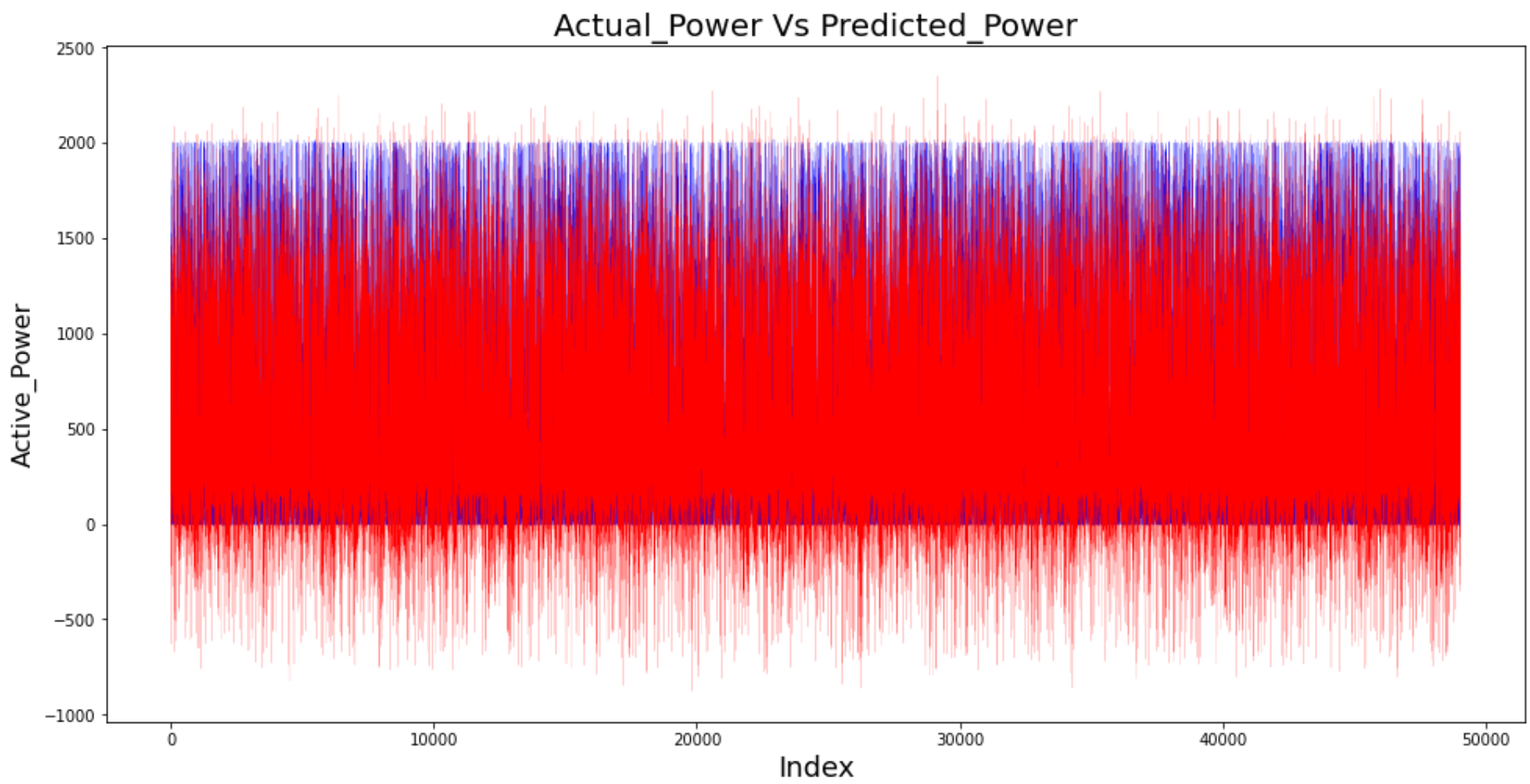
In [63]:
```
lr6 = lr.fit(x6_train,y_train)
```

In [64]:
```
y_pred6 = lr6.predict(x6_test)
```

In [65]:
```
import statsmodels.api as sm
x6_train_sm = x6_train

x6_train_sm = sm.add_constant(x6_train_sm)

mlm6 = sm.OLS(y_train,x6_train_sm).fit()

mlm6.params
print(mlm6.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.931
Model:                            OLS   Adj. R-squared:                  0.931
Method:                 Least Squares   F-statistic:                 2.023e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:37   Log-Likelihood:            -1.2551e+06
No. Observations:              196159   AIC:                         2.510e+06
Df Residuals:                  196145   BIC:                         2.510e+06
Df Model:                          13
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3102.5963      9.812   -316.211      0.000   -3121.827   -3083.365
Avg_Ambient_Temp                -6.5052      0.098    -66.187      0.000      -6.698      -6.313
Avg_Pitch_Angle                 14.1497      0.043    325.337      0.000      14.064      14.235
Avg_Rotor_Speed                120.3763      0.349    344.772      0.000     119.692     121.061
Avg_Wind_Speed                  36.8071      0.331    111.278      0.000      36.159      37.455
Bearing_DE_Temp                -14.6500      0.131   -111.524      0.000     -14.907     -14.393
Gearbox_bearing_Temp            -2.0452      0.268     -7.643      0.000      -2.570      -1.521
Gearbox_oil_Temp                27.2033      0.357     76.133      0.000      26.503      27.904
Generator_wind_Temp_1            5.8439      0.086     68.316      0.000       5.676       6.012
Generators_sliprings_Temp       16.2227      0.155    104.770      0.000      15.919      16.526
Hidraulic_group_pressure         0.2097      0.015     14.018      0.000       0.180       0.239
Trafo_1_wind_Temp               -2.4433      0.088    -27.840      0.000      -2.615      -2.271
Trafo_2_wind_Temp                1.2977      0.074     17.420      0.000       1.152       1.444
Trafo_3_wind_Temp                4.3404      0.077     56.280      0.000       4.189       4.492
==============================================================================
Omnibus:                    44311.715   Durbin-Watson:                   2.000
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           302008.341
Skew:                           0.917   Prob(JB):                         0.00
Kurtosis:                       8.795   Cond. No.                     8.21e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 8.21e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

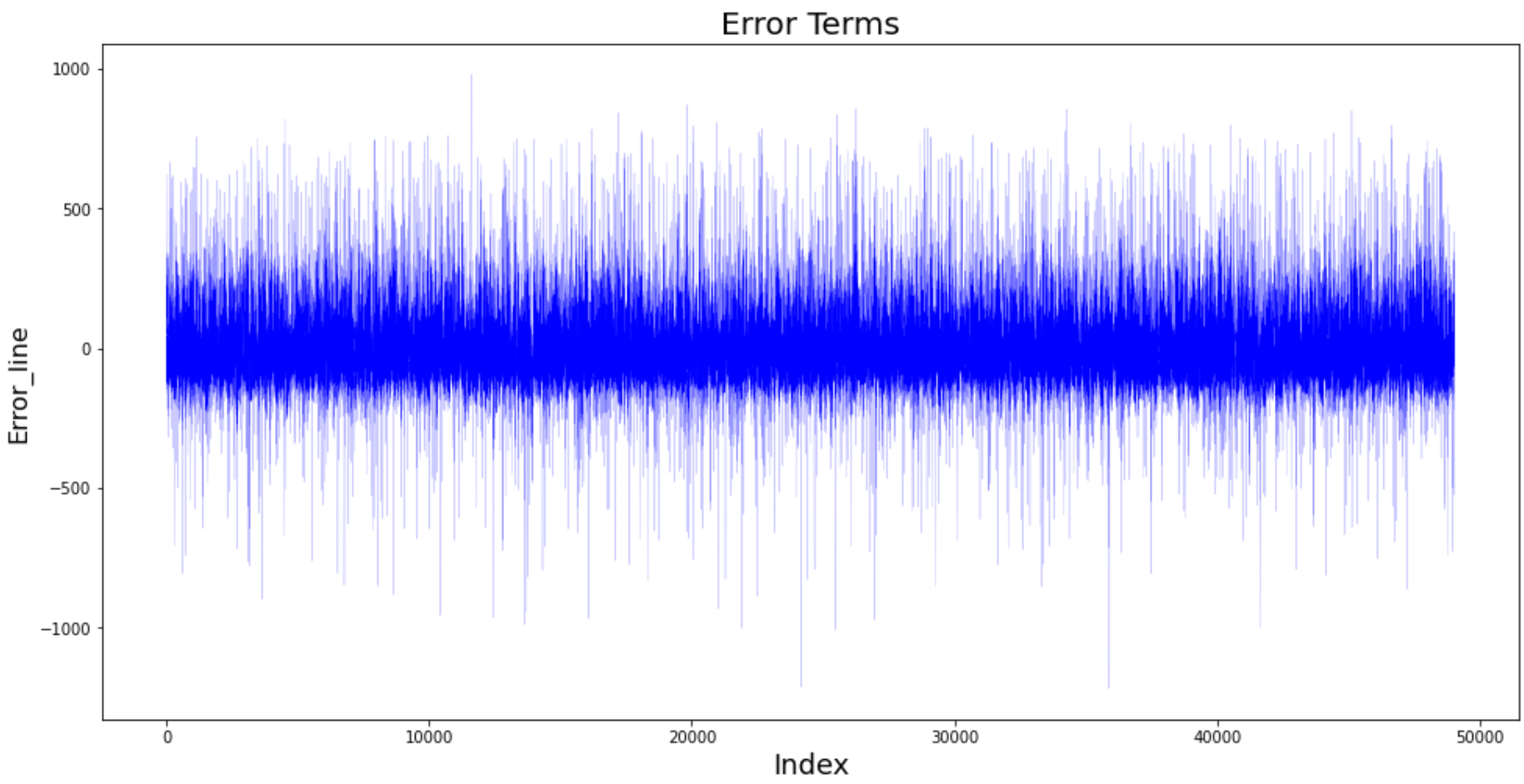
In [66]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred6, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [67]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x6_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x6_train.values, i)
                          for i in range(len(x6_train.columns))]

print(vif_data)
```

```
                     feature         VIF
0           Avg_Ambient_Temp    68.670256
1            Avg_Pitch_Angle    11.569321
2            Avg_Rotor_Speed   136.876007
3             Avg_Wind_Speed    41.172345
4            Bearing_DE_Temp   410.596555
5       Gearbox_bearing_Temp  2695.365135
6           Gearbox_oil_Temp  2568.161972
7      Generator_wind_Temp_1   289.828345
8  Generators_sliprings_Temp   408.753682
9   Hidraulic_group_pressure    81.101311
10         Trafo_1_wind_Temp   300.300197
11         Trafo_2_wind_Temp   269.403294
12         Trafo_3_wind_Temp   277.515705
```

In [68]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred6, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [69]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred6)
r_squared = r2_score(y_test, y_pred6)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 20977.0031614993
r_square_value : 0.931 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-8

In [70]:
```
x7_train = x_train[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
x7_test = x_test[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_bearing_Temp', 'Gearbox_oil_Temp', 'Generator_wind_Temp_1', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
```

'Trafo_1_wind_Temp', 'Trafo_2_wind_Temp' These varibles are Auto Correlated each other. So, i removed one variable ('Trafo_1_wind_Temp')

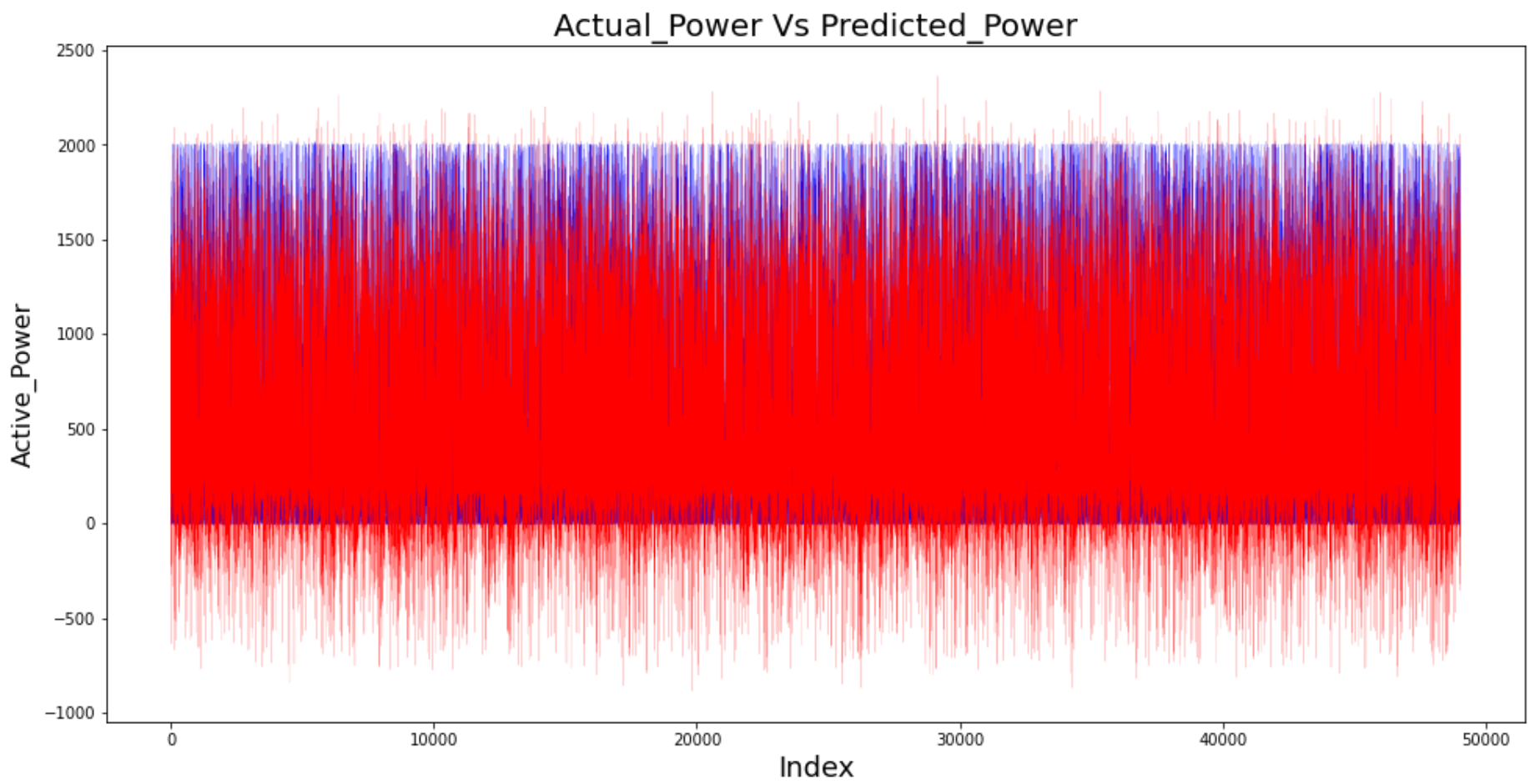
In [71]:
```
lr7 = lr.fit(x7_train,y_train)
```

In [72]:
```
y_pred7 = lr7.predict(x7_test)
```

In [73]:
```
import statsmodels.api as sm
x7_train_sm = x7_train

x7_train_sm = sm.add_constant(x7_train_sm)

mlm7 = sm.OLS(y_train,x7_train_sm).fit()

mlm7.params
print(mlm7.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.930
Model:                            OLS   Adj. R-squared:                  0.930
Method:                 Least Squares   F-statistic:                 2.182e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:44   Log-Likelihood:            -1.2555e+06
No. Observations:              196159   AIC:                         2.511e+06
Df Residuals:                  196146   BIC:                         2.511e+06
Df Model:                          12
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3139.2723      9.742   -322.237      0.000   -3158.367   -3120.178
Avg_Ambient_Temp                -6.8940      0.097    -70.721      0.000      -7.085      -6.703
Avg_Pitch_Angle                 14.3159      0.043    331.652      0.000      14.231      14.400
Avg_Rotor_Speed                121.1415      0.349    347.360      0.000     120.458     121.825
Avg_Wind_Speed                  36.6781      0.331    110.681      0.000      36.029      37.328
Bearing_DE_Temp                -14.3146      0.131   -109.217      0.000     -14.571     -14.058
Gearbox_bearing_Temp            -1.6877      0.268     -6.302      0.000      -2.213      -1.163
Gearbox_oil_Temp                27.1097      0.358     75.726      0.000      26.408      27.811
Generator_wind_Temp_1            6.0710      0.085     71.155      0.000       5.904       6.238
Generators_sliprings_Temp       16.4537      0.155    106.206      0.000      16.150      16.757
Hidraulic_group_pressure         0.2275      0.015     15.196      0.000       0.198       0.257
Trafo_2_wind_Temp               -0.2415      0.050     -4.828      0.000      -0.340      -0.143
Trafo_3_wind_Temp                3.3085      0.068     48.824      0.000       3.176       3.441
==============================================================================
Omnibus:                    45147.168   Durbin-Watson:                   1.999
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           312774.572
Skew:                           0.932   Prob(JB):                         0.00
Kurtosis:                       8.898   Cond. No.                     7.91e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 7.91e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

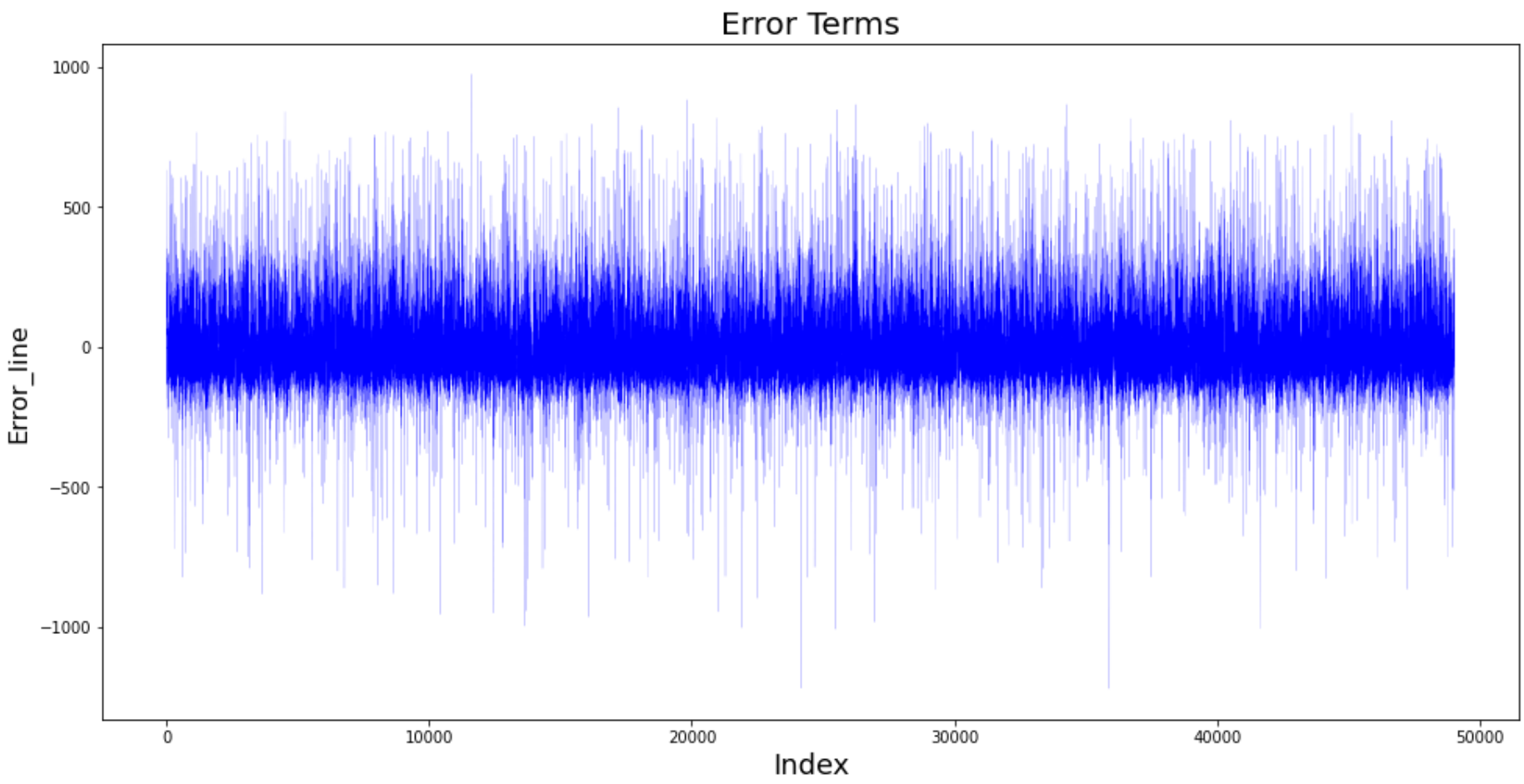
In [74]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred7, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [75]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x7_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x7_train.values, i)
                          for i in range(len(x7_train.columns))]

print(vif_data)
```

```
                      feature         VIF
0            Avg_Ambient_Temp    67.113971
1             Avg_Pitch_Angle    11.360998
2             Avg_Rotor_Speed   135.742639
3              Avg_Wind_Speed    41.169139
4             Bearing_DE_Temp   407.308201
5        Gearbox_bearing_Temp  2679.419095
6            Gearbox_oil_Temp  2524.926123
7       Generator_wind_Temp_1   281.508267
8   Generators_sliprings_Temp   408.074206
9    Hidraulic_group_pressure    81.100535
10          Trafo_2_wind_Temp   121.867959
11          Trafo_3_wind_Temp   214.358740
```

In [76]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred7, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [77]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred7)
r_squared = r2_score(y_test, y_pred7)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 21034.474288578378
r_square_value : 0.93 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-9

In [78]:
```
x8_train = x_train[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_oil_Temp', 'Generator_wind_Temp_1', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
x8_test = x_test[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Gearbox_oil_Temp', 'Generator_wind_Temp_1', 'Generators_sliprings_Temp',
                    'Hidraulic_group_pressure', 'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp']]
```

'Gearbox_bearing_Temp', 'Gearbox_oil_Temp' These varibles are Auto Correlated each other. So, i removed one variable ('Gearbox_bearing_Temp')

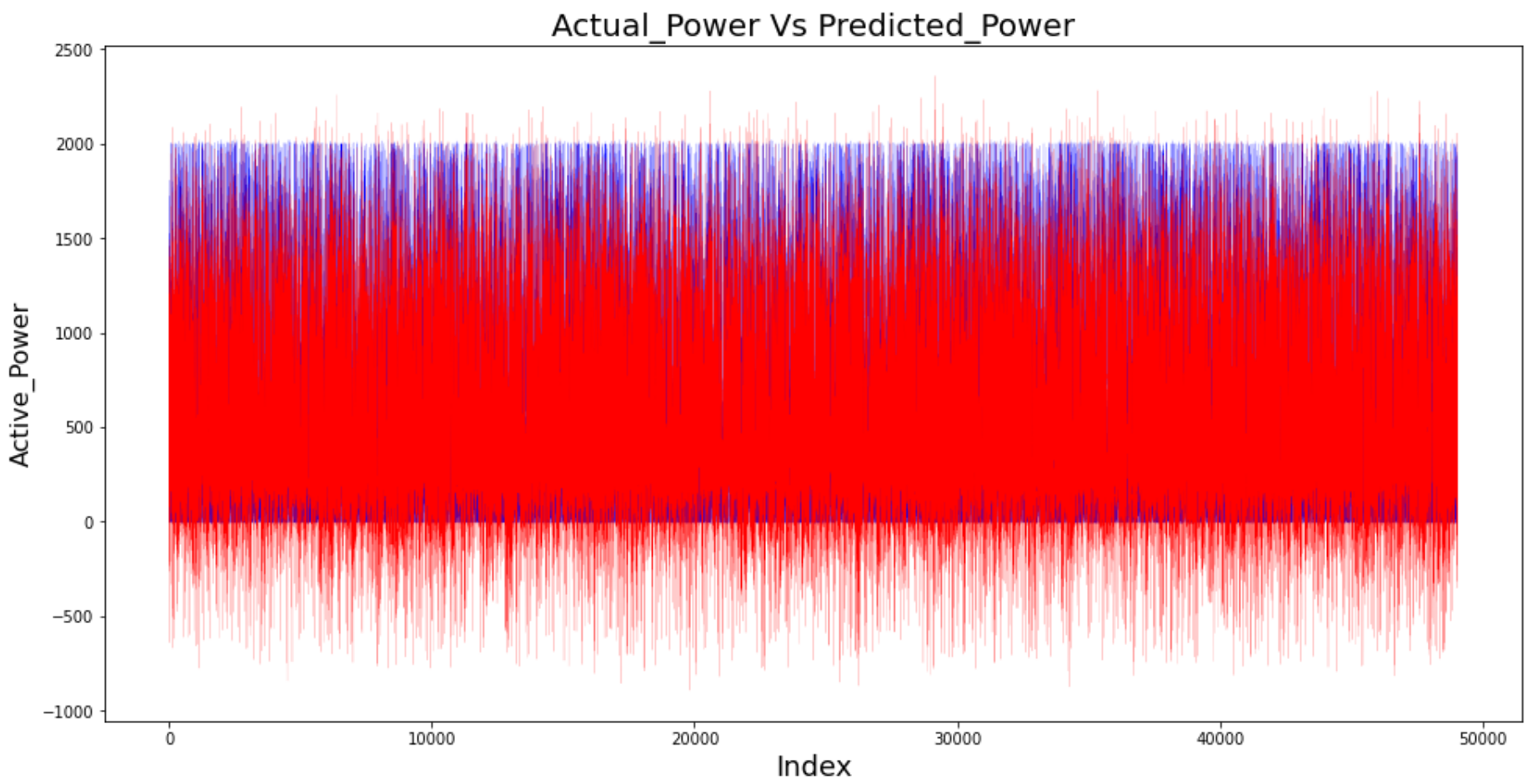
In [79]:
```
lr8 = lr.fit(x8_train,y_train)
```

In [80]:
```
y_pred8 = lr8.predict(x8_test)
```

In [81]:
```
import statsmodels.api as sm
x8_train_sm = x8_train

x8_train_sm = sm.add_constant(x8_train_sm)

mlm8 = sm.OLS(y_train,x8_train_sm).fit()

mlm8.params
print(mlm8.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.930
Model:                            OLS   Adj. R-squared:                  0.930
Method:                 Least Squares   F-statistic:                 2.380e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:49   Log-Likelihood:            -1.2555e+06
No. Observations:              196159   AIC:                         2.511e+06
Df Residuals:                  196147   BIC:                         2.511e+06
Df Model:                          11
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3126.5294      9.531   -328.042      0.000   -3145.210   -3107.849
Avg_Ambient_Temp                -6.8243      0.097    -70.454      0.000      -7.014      -6.634
Avg_Pitch_Angle                 14.3342      0.043    332.803      0.000      14.250      14.419
Avg_Rotor_Speed                120.5063      0.334    360.910      0.000     119.852     121.161
Avg_Wind_Speed                  36.9414      0.329    112.361      0.000      36.297      37.586
Bearing_DE_Temp                -14.3849      0.131   -110.143      0.000     -14.641     -14.129
Gearbox_oil_Temp                25.3162      0.217    116.567      0.000      24.890      25.742
Generator_wind_Temp_1            6.0969      0.085     71.535      0.000       5.930       6.264
Generators_sliprings_Temp       16.2095      0.150    108.055      0.000      15.915      16.504
Hidraulic_group_pressure         0.2131      0.015     14.399      0.000       0.184       0.242
Trafo_2_wind_Temp               -0.2131      0.050     -4.277      0.000      -0.311      -0.115
Trafo_3_wind_Temp                3.3676      0.067     50.175      0.000       3.236       3.499
==============================================================================
Omnibus:                    44892.103   Durbin-Watson:                   1.999
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           317595.110
Skew:                           0.920   Prob(JB):                         0.00
Kurtosis:                       8.956   Cond. No.                     7.50e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 7.5e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

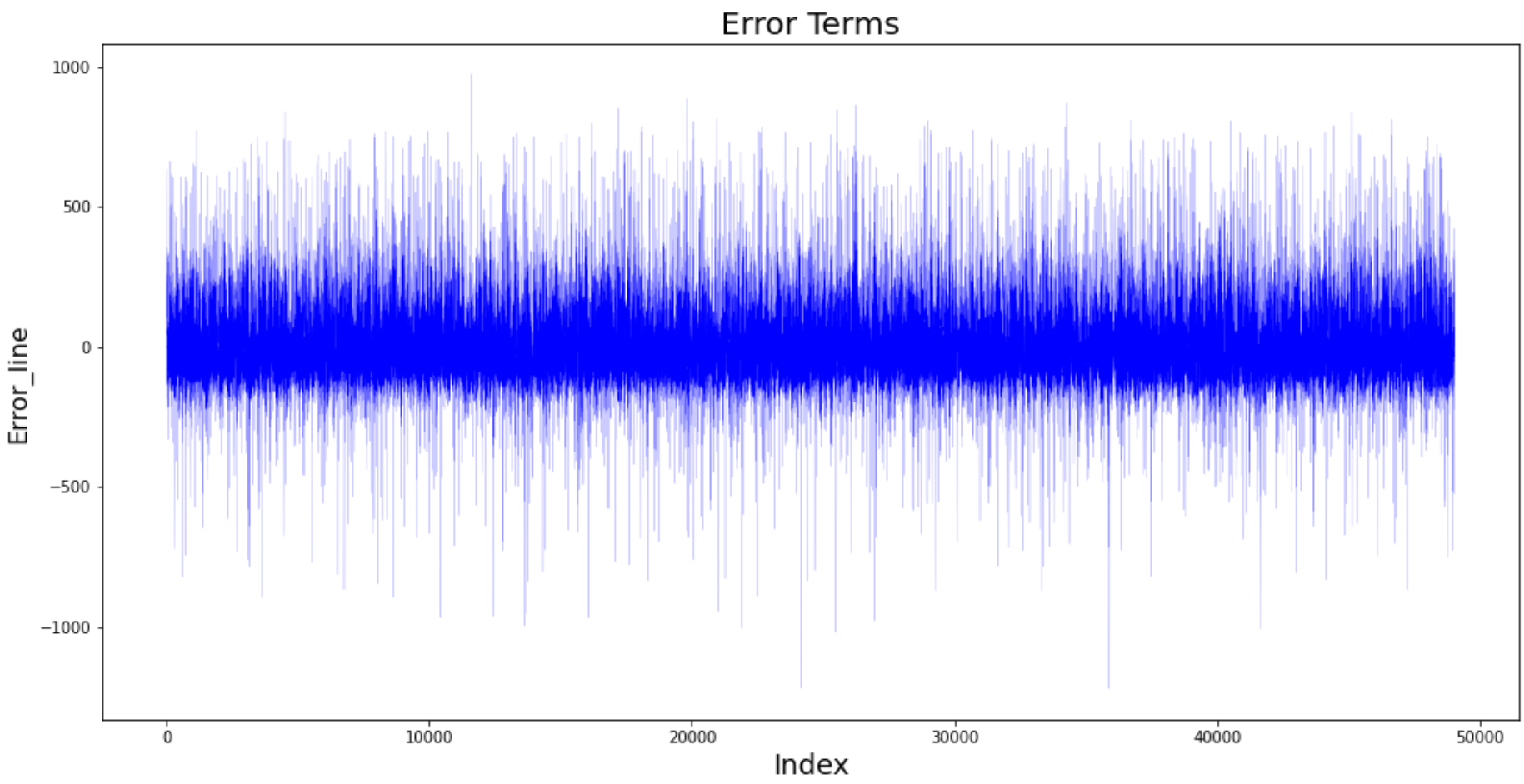
In [82]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred8, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [83]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x8_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x8_train.values, i)
                          for i in range(len(x8_train.columns))]

print(vif_data)
```

```
                     feature         VIF
0           Avg_Ambient_Temp   65.952156
1            Avg_Pitch_Angle   11.302001
2            Avg_Rotor_Speed  122.102926
3             Avg_Wind_Speed   40.566746
4            Bearing_DE_Temp  404.377687
5          Gearbox_oil_Temp   495.460649
6      Generator_wind_Temp_1  280.816467
7   Generators_sliprings_Temp  385.166722
8    Hidraulic_group_pressure   80.314856
9          Trafo_2_wind_Temp  120.734064
10         Trafo_3_wind_Temp  210.089479
```

In [84]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred8, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [85]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred8)
r_squared = r2_score(y_test, y_pred8)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 21034.049515555536
r_square_value : 0.93 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-10

In [86]:
```
x9_train = x_train[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                    'Generator_wind_Temp_1', 'Generators_sliprings_Temp', 'Gearbox_oil_Temp']]
x9_test = x_test[['Avg_Ambient_Temp', 'Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed', 'Bearing_DE_Temp',
                  'Generator_wind_Temp_1', 'Generators_sliprings_Temp', 'Gearbox_oil_Temp']]
```

'Hidraulic_group_pressure', 'Trafo_2_wind_Temp', 'Trafo_3_wind_Temp' These varibles are Auto Correlated. So, i removed the variable

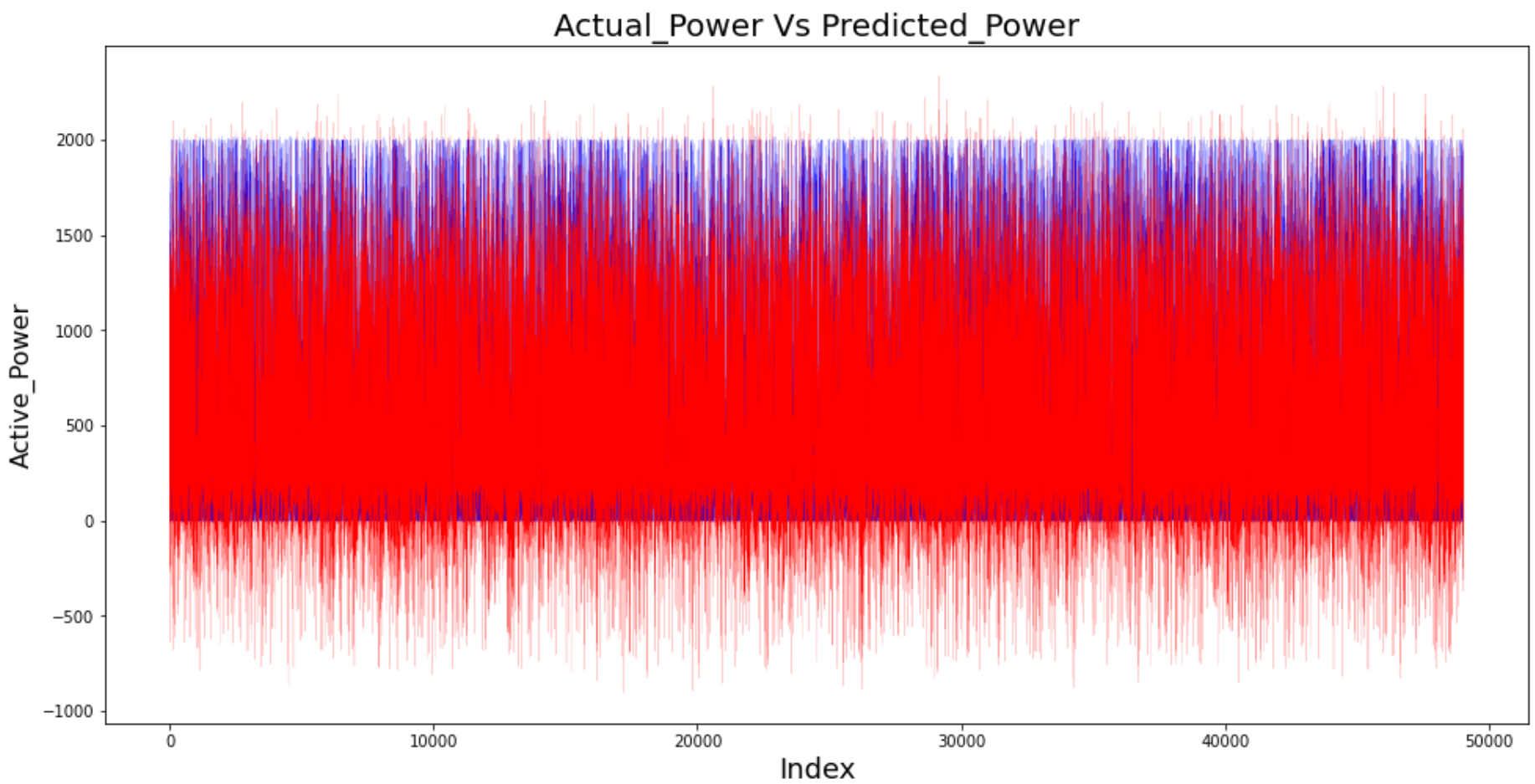
In [87]:
```
lr9 = lr.fit(x9_train,y_train)
```

In [88]:
```
y_pred9 = lr9.predict(x9_test)
```

In [89]:
```
import statsmodels.api as sm
x9_train_sm = x9_train

x9_train_sm = sm.add_constant(x9_train_sm)

mlm9 = sm.OLS(y_train,x9_train_sm).fit()

mlm9.params
print(mlm9.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.929
Model:                            OLS   Adj. R-squared:                  0.929
Method:                 Least Squares   F-statistic:                 3.206e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:54   Log-Likelihood:            -1.2574e+06
No. Observations:              196159   AIC:                         2.515e+06
Df Residuals:                  196150   BIC:                         2.515e+06
Df Model:                           8
Covariance Type:            nonrobust
================================================================================================
                                   coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------------------------
const                        -3055.6816      9.234   -330.900      0.000   -3073.781   -3037.582
Avg_Ambient_Temp                -6.3651      0.096    -66.020      0.000      -6.554      -6.176
Avg_Pitch_Angle                 14.3732      0.040    359.233      0.000      14.295      14.452
Avg_Rotor_Speed                120.9132      0.328    368.437      0.000     120.270     121.556
Avg_Wind_Speed                  35.6474      0.326    109.257      0.000      35.008      36.287
Bearing_DE_Temp                -13.6919      0.131   -104.309      0.000     -13.949     -13.435
Generator_wind_Temp_1            6.7556      0.085     79.484      0.000       6.589       6.922
Generators_sliprings_Temp       16.0050      0.151    106.030      0.000      15.709      16.301
Gearbox_oil_Temp                27.1594      0.216    125.792      0.000      26.736      27.583
==============================================================================
Omnibus:                    46906.283   Durbin-Watson:                   1.999
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           338443.212
Skew:                           0.963   Prob(JB):                         0.00
Kurtosis:                       9.140   Cond. No.                     3.33e+03
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
[2] The condition number is large, 3.33e+03. This might indicate that there are
strong multicollinearity or other numerical problems.
```

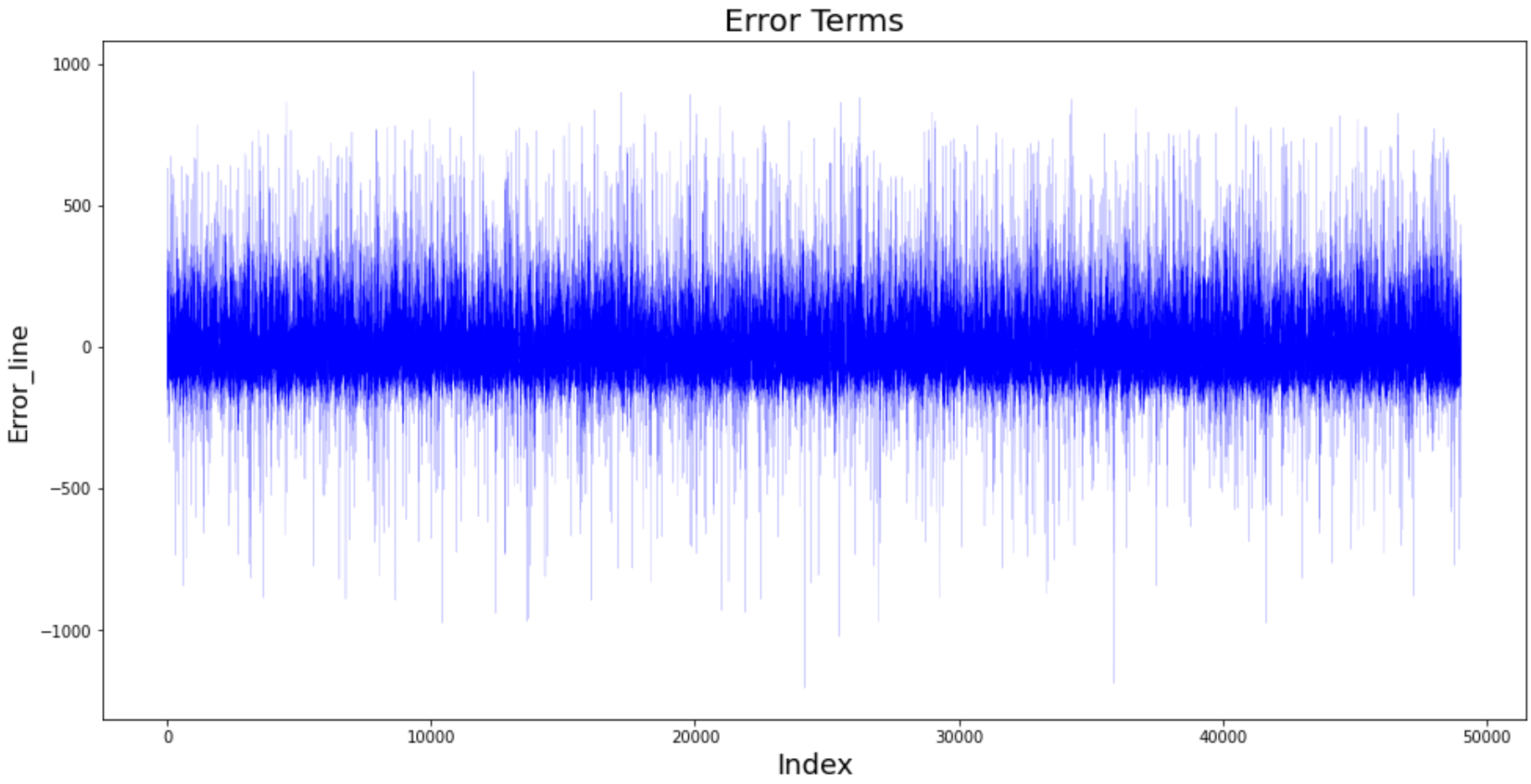
In [90]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred9, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [91]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x9_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x9_train.values, i)
                          for i in range(len(x9_train.columns))]

print(vif_data)
```

```
                    feature         VIF
0           Avg_Ambient_Temp   63.729292
1            Avg_Pitch_Angle    9.520462
2            Avg_Rotor_Speed  112.348573
3             Avg_Wind_Speed   39.174582
4            Bearing_DE_Temp  400.707358
5     Generator_wind_Temp_1   264.268772
6  Generators_sliprings_Temp  383.082762
7           Gearbox_oil_Temp  230.627366
```

In [92]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred9, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [93]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred9)
r_squared = r2_score(y_test, y_pred9)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 21443.519337970352
r_square_value : 0.929 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed
```

MODEL-10

In [94]:
```
x10_train = x_train[['Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed']]
x10_test = x_test[['Avg_Pitch_Angle', 'Avg_Rotor_Speed', 'Avg_Wind_Speed']]
```

Removed all temperature variables.

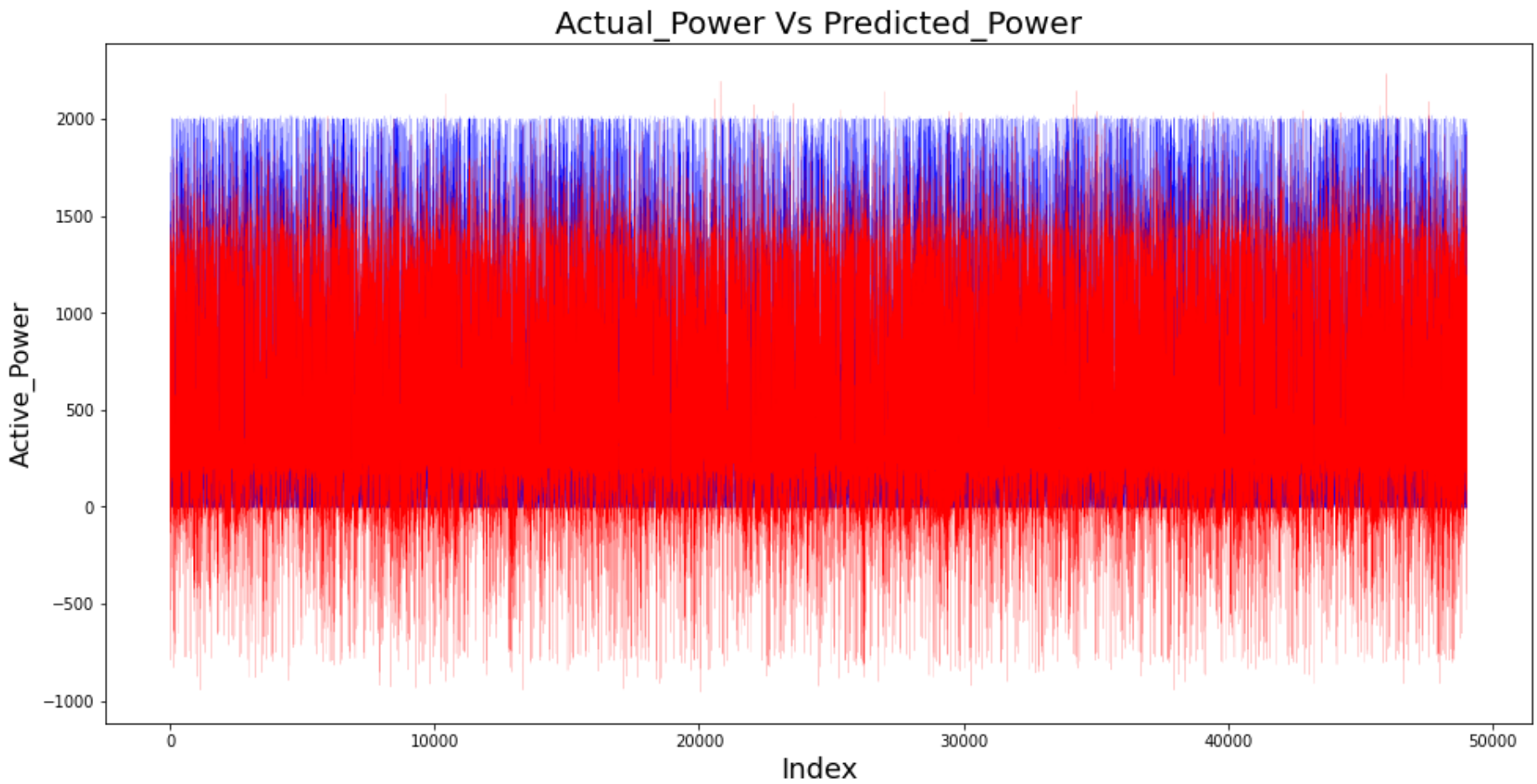
In [95]:
```
lr10 = lr.fit(x10_train,y_train)
```

In [96]:
```
y_pred10 = lr10.predict(x10_test)
```

In [97]:
```
import statsmodels.api as sm
x10_train_sm = x10_train

x10_train_sm = sm.add_constant(x10_train_sm)

mlm10 = sm.OLS(y_train,x10_train_sm).fit()

mlm10.params
print(mlm10.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:       Avg_Active_Power   R-squared:                       0.901
Model:                            OLS   Adj. R-squared:                  0.901
Method:                 Least Squares   F-statistic:                 5.930e+05
Date:                Mon, 10 May 2021   Prob (F-statistic):               0.00
Time:                        00:41:58   Log-Likelihood:            -1.2903e+06
No. Observations:              196159   AIC:                         2.581e+06
Df Residuals:                  196155   BIC:                         2.581e+06
Df Model:                           3
Covariance Type:            nonrobust
==============================================================================
                     coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
const          -1667.8072      2.493   -668.920      0.000   -1672.694   -1662.920
Avg_Pitch_Angle    17.4895      0.045    391.660      0.000      17.402      17.577
Avg_Rotor_Speed   163.9809      0.332    494.522      0.000     163.331     164.631
Avg_Wind_Speed     54.4955      0.308    176.775      0.000      53.891      55.100
==============================================================================
Omnibus:                    54262.901   Durbin-Watson:                   1.997
Prob(Omnibus):                  0.000   Jarque-Bera (JB):           227683.002
Skew:                           1.313   Prob(JB):                         0.00
Kurtosis:                       7.578   Cond. No.                         165.
==============================================================================

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.
```

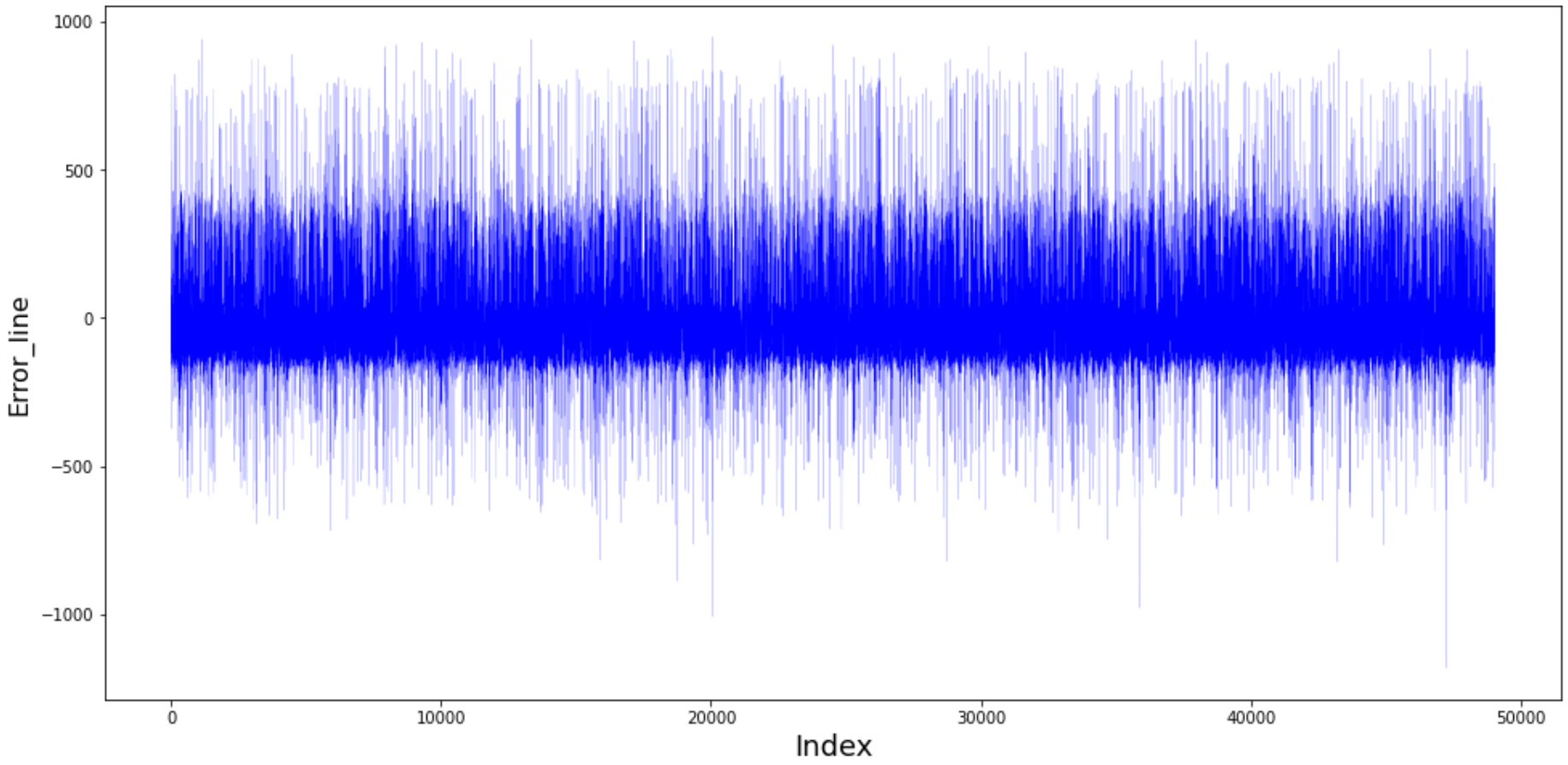
In [98]:
```
#Actual vs Predicted
c = [i for i in range(1,49041,1)]
plt.plot(c,y_test, color="blue", linewidth=0.1, linestyle="-")
plt.plot(c,y_pred10, color="red",  linewidth=0.1, linestyle="-")
plt.title('Actual_Power Vs Predicted_Power', fontsize=20)
plt.xlabel('Index', fontsize=18)
plt.ylabel('Active_Power', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [99]:
```
from statsmodels.stats.outliers_influence import variance_inflation_factor
# VIF dataframe
vif_data = pd.DataFrame()
vif_data["feature"] = x10_train.columns
# calculating VIF for each feature
vif_data["VIF"] = [variance_inflation_factor(x10_train.values, i)
                          for i in range(len(x10_train.columns))]

print(vif_data)
```

```
           feature        VIF
0  Avg_Pitch_Angle   1.699851
1  Avg_Rotor_Speed  15.872537
2   Avg_Wind_Speed  16.956543
```

In [100]:
```
c = [i for i in range(1,49041,1)]

plt.plot(c,y_test-y_pred10, color="blue", linewidth=0.1, linestyle="-")
plt.title('Error Terms', fontsize=20)              # Plot heading
plt.xlabel('Index', fontsize=18)                      # X-label
plt.ylabel('Error_line', fontsize=16)
plt.subplots_adjust(left=0.4, bottom=0.1, right=2.5, top=1.6)
```



In [101]:
```
from sklearn.metrics import mean_squared_error, r2_score
mse = mean_squared_error(y_test, y_pred10)
r_squared = r2_score(y_test, y_pred10)
print('Mean_Squared_Error :' ,mse)
print('r_square_value :', round(r_squared,3),"% Variance of the Active Power is Explained by the Wind Speed, Pitch Angle
```

```
Mean_Squared_Error : 30233.20183664925
r_square_value : 0.9 % Variance of the Active Power is Explained by the Wind Speed, Pitch Angle and Rotor Speed


 REGRESSION EQUATION
```

In [102]:
```
@widgets.interact(Wind_Speed = range(1, 25, 1),
                  Pitch_Angle = range(1, 95, 1), Rotor_Speed = range(1, 20, 1))
def Regression_Equation(Wind_Speed, Pitch_Angle, Rotor_Speed):
    Intercept = mlm10.params[0]
    Coefficient = mlm10.params[1]*Pitch_Angle + mlm10.params[2]*Rotor_Speed + mlm10.params[3]*Wind_Speed

    y_Predicted = Intercept + Coefficient  # y = a + bx  Equation.
    if y_Predicted < 0:
        print("Please Choose Other Values: Active Power is '0' at these values")
    else:
        print('Active Power Predicted: ',y_Predicted)  # Basic Starting Values are 3, 77, 1
```

```
interactive(children=(Dropdown(description='Wind_Speed', options=(1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 1…
```

```
Thank You...
```