In [4]:

```
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt
import pandas as pd
import numpy as np
from sklearn.metrics import accuracy_score
import seaborn as sns
from sklearn.metrics import confusion_matrix

#importing dataset
df = pd.read_csv('/content/Global_PowerPlant_Database.csv')
df
```

Out[4]:

	country_id	country_name	powerplant_name	gppd_idnr	capacity_mw	latitude	longitude
0	1	Australia	Albany Wind Farm	AUS0000065	216.0	-350641	1177977
1	1	Australia	Appin (Mine)	AUS0000264	556.0	-342082	1507722
2	1	Australia	Awaba	AUS0000049	11.0	-330250	1515497
3	1	Australia	Bairnsdale	AUS0000081	940.0	-378429	1475639
4	1	Australia	Ballarat Base Hospital	AUS0000113	30.0	-375596	1438469
...	...	...	...	...	...	...	...
6812	3	United States of America	Zion Energy Center	USA0055392	5967.0	424776	-878950
6813	3	United States of America	Zion Landfill Gas to Energy Facility	USA0056871	70.0	424803	-878861
6814	3	United States of America	Zorn	USA0001368	180.0	382803	-857023
6815	3	United States of America	Zotos International WPGF	USA0057648	34.0	428869	-769683
6816	3	United States of America	eBay - South Jordan	USA0059281	98.0	405606	-1120478

6817 rows × 17 columns

cleaning data

In [49]:

```
print(df.shape)
```

```
(6817, 17)
```

In [50]:

```
 #Dropping the missing rows.
df_dropped = df.dropna(how = 'any')
#there is no null value in this dataset
```

In [6]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6817 entries, 0 to 6816
Data columns (total 17 columns):
 #   Column              Non-Null Count  Dtype  
---  ------              --------------  -----  
 0   country_id          6817 non-null   int64  
 1   country_name        6817 non-null   object 
 2   powerplant_name     6817 non-null   object 
 3   gppd_idnr           6817 non-null   object 
 4   capacity_mw         6817 non-null   float64
 5   latitude            6817 non-null   int64  
 6   longitude           6817 non-null   int64  
 7   primary_fuel_id     6817 non-null   int64  
 8   primary_fuel        6817 non-null   object 
 9   source              6817 non-null   object 
 10  url                 6817 non-null   object 
 11  geolocation_source  6817 non-null   object 
 12  generation_gwh_2013  6817 non-null   float64
 13  generation_gwh_2014  6817 non-null   float64
 14  generation_gwh_2015  6817 non-null   float64
 15  generation_gwh_2016  6817 non-null   float64
 16  generation_gwh_2017  6817 non-null   float64
dtypes: float64(6), int64(4), object(7)
memory usage: 905.5+ KB
```

In [7]:

```
df.describe()
```

Out[7]:

	country_id	capacity_mw	latitude	longitude	primary_fuel_id	generation_gwh_
count	6817.000000	6.817000e+03	6817.000000	6.817000e+03	6817.000000	6.81700
mean	2.886460	1.784192e+15	363351.969781	-7.945646e+05	4.396362	4.17600
std	0.399552	7.520842e+15	140160.924371	5.811068e+05	3.303483	1.13547
min	1.000000	1.000000e+01	-428883.000000	-1.717124e+06	1.000000	-6.00000
25%	3.000000	5.000000e+01	341452.000000	-1.105739e+06	2.000000	2.66100
50%	3.000000	3.640000e+02	393740.000000	-9.017970e+05	4.000000	5.71580
75%	3.000000	2.547000e+03	426260.000000	-7.711890e+05	6.000000	1.95470
max	3.000000	7.900000e+16	712920.000000	1.531236e+06	14.000000	7.91998

In [8]:

```
df1 = df.append(df.iloc[1:6817,:])

df1.duplicated()
```

Out[8]:

```
0       False
1       False
2       False
3       False
4       False
        ...  
6812     True
6813     True
6814     True
6815     True
6816     True
Length: 13633, dtype: bool
```

traning and testing data

In [9]:

```
# x and y values for test-train datas.
y = df.primary_fuel_id.values
x = df[['capacity_mw','latitude','longitude','country_id','generation_gwh_2013','gene
```

In [10]:

```
y
```

Out[10]:

```
array([1, 2, 3, ..., 2, 1, 2])
```

In [11]:

```
x
```

Out[11]:

	capacity_mw	latitude	longitude	country_id	generation_gwh_2013	generation_gwh_2014	ge
0	216.0	-350641	1177977	1	8.959530e+15	1.026430e+16	
1	556.0	-342082	1507722	1	2.048040e+16	2.382940e+16	
2	11.0	-330250	1515497	1	7.655280e+15	8.338610e+15	
3	940.0	-378429	1475639	1	1.324570e+16	1.548860e+16	
4	30.0	-375596	1438469	1	4.194440e+15	4.213060e+15	
...	...	...	...	...	...	...	
6812	5967.0	424776	-878950	3	0.000000e+00	6.365600e+16	
6813	70.0	424803	-878861	3	4.359200e+04	4.913400e+04	
6814	180.0	382803	-857023	3	2.030000e+02	7.800000e+01	
6815	34.0	428869	-769683	3	3.671000e+16	2.460150e+05	
6816	98.0	405606	-1120478	3	1.296800e+04	5.127600e+04	

6817 rows × 9 columns

In [12]:

```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(x,y,test_size=0.2,random_state =
#test_size=0.2 means %20 test datas, %80 train datas
method_names = []
method_scores = []
print(x_train)
print(y_train)
```

```
      capacity_mw  latitude  longitude  country_id  generation_gwh_201
3  \
6443  1.520000e+16    391992    -963086           3        0.000000e+0
0
1620  4.000000e+01    335683   -1149181           3        5.403000e+1
6
2820  1.720000e+02    421212   -1225479           3        5.696000e+0
3
1643  1.375600e+04    360875   -1150507           3        6.544230e+0
5
2877  1.656000e+03    327683    -994228           3        4.821470e+0
5
...            ...       ...        ...         ...
...
3772  1.100000e+01    407576   -1214145           3        4.893000e+0
3
5191  2.490000e+02    262697    -978670           3        3.377000e+1
6
5226  9.120000e+03    450038    -747994           3        6.672860e+1
5
5390  2.000000e+01    372875    -800771           3        1.140000e+0
2
860   2.020000e+02    358950   -1195108           3        4.216100e+0
4

      generation_gwh_2014  generation_gwh_2015  generation_gwh_2016  \
6443        -3.280000e+02        -7.330000e+15        -7.460000e+02
1620         5.543000e+03         5.376000e+03         9.016000e+03
2820         6.442300e+04         5.448100e+04         5.225500e+04
1643         5.184870e+15         8.991210e+15         9.075430e+15
2877         5.144550e+05         4.413090e+05         4.594550e+05
...                   ...                  ...                  ...
3772         4.772000e+03         4.284000e+03         4.032000e+03
5191         2.342000e+16         4.210000e+02         2.192000e+03
5226         7.052696e+06         6.932867e+06         7.088396e+06
5390         1.020000e+16         1.040000e+16         1.710000e+02
860          4.202500e+04         4.131400e+04         4.125500e+04

      generation_gwh_2017
6443        -6.760000e+15
1620         8.962000e+03
2820         4.368500e+04
1643         8.439040e+05
2877         4.366440e+05
...                   ...
3772         5.393000e+03
5191         1.937000e+03
5226         7.632069e+06
5390         9.800000e+01
860          3.806300e+04

[5453 rows x 9 columns]
[ 2 13  4 ...  4  6 13]
```

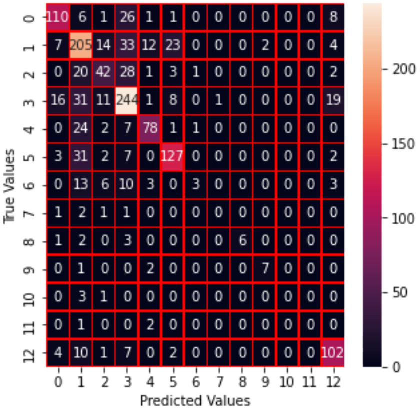
Random Forest Classification

In [13]:

```
from sklearn.ensemble import RandomForestClassifier
RF = RandomForestClassifier()
RF.fit(x_train,y_train)
print("random forest classification test Accuracy: ",RF.score(x_test,y_test))
method_names.append("Random Forest Classification")
method_scores.append(RF.score(x_test,y_test))

#Confusion Matrix
y_pred = RF.predict(x_test)
conf_mat = confusion_matrix(y_test,y_pred)
#Visualization Confusion Matrix
f, ax = plt.subplots(figsize=(5,5))
sns.heatmap(conf_mat,annot=True,linewidths=0.5,linecolor="red",fmt=".0f",ax=ax)
plt.xlabel("Predicted Values")
plt.ylabel("True Values")
plt.show()
```

```
random forest classification test Accuracy:  0.6774193548387096
```



	0	1	2	3	4	5	6	7	8	9	10	11	12
0	110	6	1	26	1	1	0	0	0	0	0	0	8
1	7	205	14	33	12	23	0	0	0	2	0	0	4
2	0	20	42	28	1	3	1	0	0	0	0	0	2
3	16	31	11	244	1	8	0	1	0	0	0	0	19
4	0	24	2	7	78	1	1	0	0	0	0	0	0
5	3	31	2	7	0	127	0	0	0	0	0	0	2
6	0	13	6	10	3	0	3	0	0	0	0	0	3
7	1	2	1	1	0	0	0	0	0	0	0	0	0
8	1	2	0	3	0	0	0	0	6	0	0	0	0
9	0	1	0	0	2	0	0	0	0	7	0	0	0
10	0	3	1	0	0	0	0	0	0	0	0	0	0
11	0	1	0	0	2	0	0	0	0	0	0	0	0
12	4	10	1	7	0	2	0	0	0	0	0	0	102

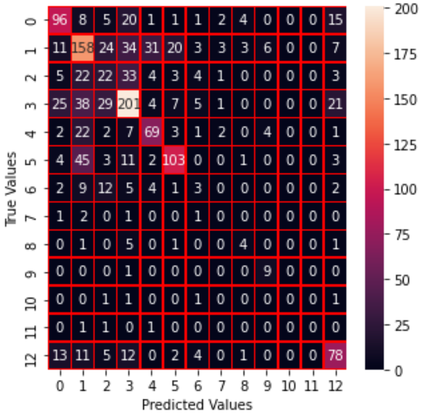
Decision Tree Classification

```
In [14]:
```

```
from sklearn.tree import DecisionTreeClassifier
dec_tree = DecisionTreeClassifier()
dec_tree.fit(x_train,y_train)
print("Decision Tree Classification test Accuracy: ",dec_tree.score(x_test,y_test))
method_names.append("Decision Tree")
method_scores.append(dec_tree.score(x_test,y_test))

#Confusion Matrix
y_pred = dec_tree.predict(x_test)
conf_mat = confusion_matrix(y_test,y_pred)
#Visualization Confusion Matrix
f, ax = plt.subplots(figsize=(5,5))
sns.heatmap(conf_mat,annot=True,linewidths=0.5,linecolor="red",fmt=".0f",ax=ax)
plt.xlabel("Predicted Values")
plt.ylabel("True Values")
plt.show()
```

```
Decision Tree Classification test Accuracy:  0.5447214076246334
```



hyposthesis testing

In [42]:

```
from scipy.stats import zscore, norm
#Calculating the z-score for the dataset
z_score = zscore(df.capacity_mw)

#Calculating the p-value
p_value = norm.sf(abs(z_score))

#Printing the results
print ("The z-score is :", z_score)
print ("The p-value is :", p_value)
```

```
The z-score is : 0      -0.23725
1      -0.23725
2      -0.23725
3      -0.23725
4      -0.23725
         ...
6812   -0.23725
6813   -0.23725
6814   -0.23725
6815   -0.23725
6816   -0.23725
Name: capacity_mw, Length: 6817, dtype: float64
The p-value is : [0.40623127 0.40623127 0.40623127 ... 0.40623127 0.406
23127 0.40623127]
```

data visualization

In [30]:

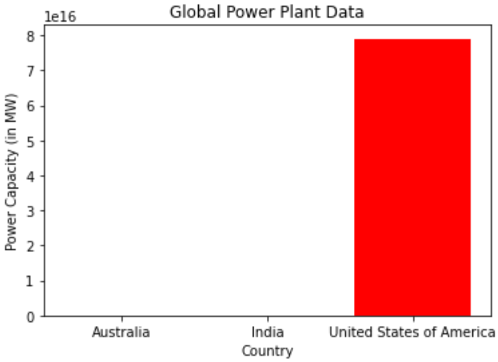
```
import matplotlib.pyplot as plt

# Input Data
country = df.country_name
power_capacity = df.capacity_mw

# Plotting a bar graph
plt.bar(country, power_capacity, color ='red')

# Naming the x-axis
plt.xlabel('Country')
# Naming the y-axis
plt.ylabel('Power Capacity (in MW)')
# Graph Title
plt.title('Global Power Plant Data')

# Show the plot
plt.show()
```



In [36]:

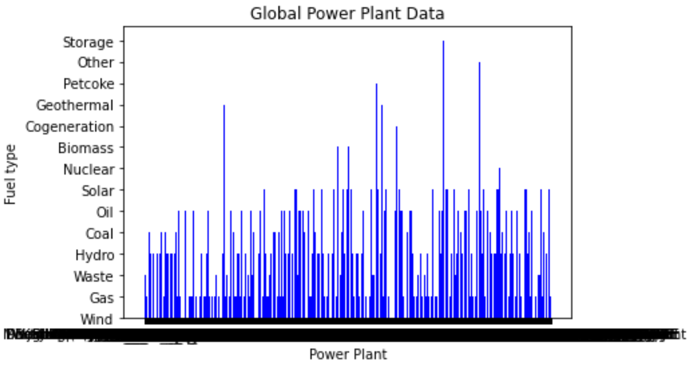
```
import matplotlib.pyplot as plt

# Input Data
powerplant = df.powerplant_name
fuel = df.primary_fuel

# Plotting a bar graph
plt.bar(powerplant, fuel, color ='blue')

# Naming the x-axis
plt.xlabel('Power Plant')
# Naming the y-axis
plt.ylabel('Fuel type')
# Graph Title
plt.title('Global Power Plant Data')

# Show the plot
plt.show()
```



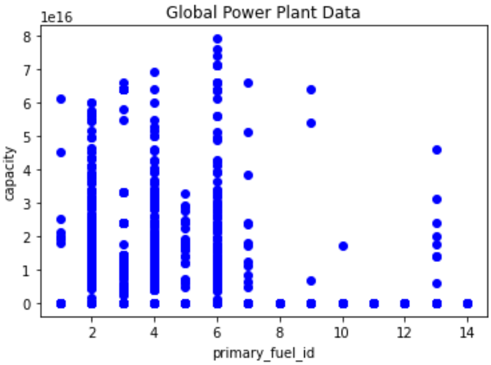
In [48]:

```
import matplotlib.pyplot as plt

# Input Data
powerplant = df.primary_fuel_id
fuel = df.capacity_mw
# Plotting a bar graph
plt.scatter(powerplant, fuel, color ='blue')

# Naming the x-axis
plt.xlabel('primary_fuel_id')
# Naming the y-axis
plt.ylabel('capacity')
# Graph Title
plt.title('Global Power Plant Data')

# Show the plot
plt.show()
```


Global Power Plant Data
1e16
capacity
primary_fuel_id