In [295]:
```
import pandas as pd
import numpy as np
```

In [296]:
```
import matplotlib.pyplot as plt
```

In [297]:
```
df = pd.read_csv("Assignment_Dataset.csv")
```

In [298]:
```
df.head()
```

Out[298]:

	Date	GHI	PR
0	01-07-2019	3.256608	69.575676
1	02-07-2019	3.976767	79.314411
2	03-07-2019	2.811867	61.020006
3	04-07-2019	3.658408	83.262576
4	05-07-2019	5.590683	82.124440

In [299]:
```
df.tail()
```

Out[299]:

	Date	GHI	PR
977	20-03-2022	4.226183	81.632736
978	21-03-2022	3.431675	71.057353
979	22-03-2022	3.500492	81.631509
980	23-03-2022	4.997617	71.906149
981	24-03-2022	5.125050	79.911798

In [300]:
```
null_counts = df.isnull().sum()
```

In [301]:
```
print(null_counts)
```

```
Date    0
GHI     0
PR      0
dtype: int64
```

In [302]:
```
df.describe()
```

Out[302]:

	GHI	PR
count	982.000000	982.000000
mean	4.638348	72.733869
std	1.011495	7.321775
min	1.413925	60.023380
25%	4.023204	66.287183
50%	4.751262	72.931286
75%	5.309566	79.158463
max	6.947317	84.980120

In [303]:
```
avg_7d = df['PR'].tail(7).mean()

avg_30d = df['PR'].tail(30).mean()

avg_60d = df['PR'].tail(60).mean()

avg_90d = df['PR'].tail(90).mean()

avg_365d = df['PR'].tail(365).mean()

avg_overall = df['PR'].mean()

print(avg_7d," ",avg_30d," ",avg_60d," ",avg_90d," ",avg_365d," ", avg_overall)
```

```
73.88366172428572   71.85599491666668   73.00928396499997   73.95066149665555   72.88325299999178   72.73386933146641
```

In [304]:
```
df['Rolling_Average_PR'] = df['PR'].rolling(window=30).mean()
```

In [ ]:
```

```

In [305]:
```
df
```

Out[305]:

	Date	GHI	PR	Rolling_Average_PR
0	01-07-2019	3.256608	69.575676	NaN
1	02-07-2019	3.976767	79.314411	NaN
2	03-07-2019	2.811867	61.020006	NaN
3	04-07-2019	3.658408	83.262576	NaN
4	05-07-2019	5.590683	82.124440	NaN
...	...	...	...	...
977	20-03-2022	4.226183	81.632736	71.181262
978	21-03-2022	3.431675	71.057353	70.799540
979	22-03-2022	3.500492	81.631509	71.231648
980	23-03-2022	4.997617	71.906149	71.249772
981	24-03-2022	5.125050	79.911798	71.855995

982 rows × 4 columns

In [306]:
```
import matplotlib.dates as mdates
```

In [307]:
```
df.head()
```

Out[307]:

	Date	GHI	PR	Rolling_Average_PR
0	01-07-2019	3.256608	69.575676	NaN
1	02-07-2019	3.976767	79.314411	NaN
2	03-07-2019	2.811867	61.020006	NaN
3	04-07-2019	3.658408	83.262576	NaN
4	05-07-2019	5.590683	82.124440	NaN

In [308]:
```
df['Rolling_Average_PR']
```

Out[308]:

```
0           NaN
1           NaN
2           NaN
3           NaN
4           NaN
          ...
977    71.181262
978    70.799540
979    71.231648
980    71.249772
981    71.855995
Name: Rolling_Average_PR, Length: 982, dtype: float64
```

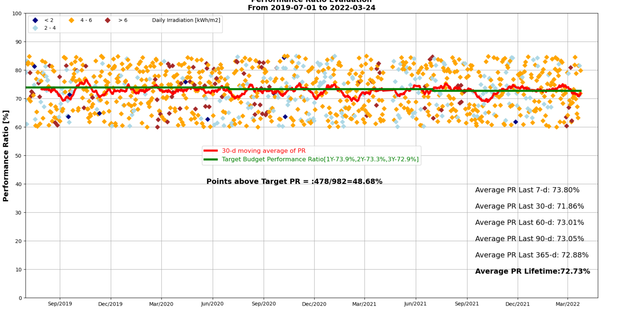
In [ ]:
```

```

In [309]:
```
# Generate the sequence of dates
#for the green line

start_date = pd.to_datetime('01-07-2019', format='%d-%m-%Y')
end_date = pd.to_datetime('24-03-2022', format='%d-%m-%Y')
num_years = end_date.year - start_date.year

# Generate the corresponding y-values
initial_value = 73.9
decrease_per_year = 0.008  # 0.8% expressed as a decimal
y_values = [initial_value * (1 - decrease_per_year) ** i for i in range(num_years)]


# Add the decreasing values as a new column to the existing DataFrame
print(y_values)
df['Target_B'] = 0

leng=len(df['PR'])

##
import datetime

i = 0
i = 0
start_date = datetime.datetime.strptime("01-07-2019", "%d-%m-%Y")
temp_date =start_date
while i < leng:
    date_str = df.loc[i, 'Date']  # Assuming 'Date' is the column name in your dataframe
    date = datetime.datetime.strptime(date_str, "%d-%m-%Y")

    if date <= start_date + datetime.timedelta(days=365):
        df.loc[i, 'Target_B'] = y_values[i]  # Assuming y_value is defined and has an appropriate value
        i += 1
    else:
        start_date = date
        i += 1



count = len(df[df['PR'] > df['Target_B']])
print(count)

total_pt_abv_T_Pr = count/ (len(df['PR']))*100
print(total_pt_abv_T_Pr)
```

```
[73.9, 73.3008, 72.7223296]
3
48.87617187942738
```

In [310]:
```
import matplotlib.patches as mpatches
import matplotlib.lines as mlines
```

In [314]:
```
import matplotlib.pyplot as plt
import pandas as pd
import matplotlib.dates as mdates

# Assuming your dataset is stored in a DataFrame called 'df' with columns 'Date', 'PR', 'GHI', and 'Rolling_Average_PR'

# Convert 'Date' column to datetime if it's not already in datetime format
date = pd.to_datetime(df['Date'], format='%d-%m-%Y')
dates = mdates.date2num(date)

plt.figure(figsize=(20, 10))

plt.title("Performance Ratio Evaluation\nFrom 2019-07-01 to 2022-03-24", fontweight='bold', fontsize=14)

for date, pr, ghi in zip(dates, df['PR'], df['GHI']):
    if ghi < 2:
        color = 'navy'
        marker = 'D'  # Diamond shape for ghi < 2
    elif ghi < 4:
        color = 'lightblue'
        marker = 'D'  # Diamond shape for 2 <= ghi < 4
    elif ghi < 6:
        color = 'orange'
        marker = 'D'  # Diamond shape for 4 <= ghi < 6
    else:
        color = 'brown'
        marker = 'D'  # Diamond shape for ghi >= 6
    plt.scatter(date, pr, color=color, marker=marker)

# Setting up the x-axis
start_date = mdates.datestr2num('2019-07-01')
end_date = mdates.datestr2num('2022-04-24')
plt.xlim(start_date, end_date)
plt.gca().xaxis.set_major_locator(mdates.MonthLocator(interval=3))

# Plotting the red line for 'Rolling_Average_PR'
l1=plt.plot(dates, df['Rolling_Average_PR'], color='red', linestyle='-', linewidth=4,label="30-d moving average of PR")


#Plotting the green line
l2=plt.plot(dates, df['Target_B'], color='green', linestyle='-', linewidth=4,label="Target Budget Performance Ratio[1Y-73.9%,2Y-73.3%,3Y-72.9%]")

#adding the text for Average PR
# Adding the text on the bottom right corner
average_text = f"Average PR Last 7-d: {avg_7d:.2f}%        \n\nAverage PR Last 30-d: {avg_30d:.2f}%      \n\nAverage PR Last 60-d: {avg_60d:.2f}%      \n\nAverage PR Last 90-d: {avg_90d:.2f}%
\n\nAverage PR Last 365-d: {avg_365d:.2f}%    \n\n"
plt.text(end_date,8 , average_text, horizontalalignment='right', verticalalignment='bottom',fontsize=14)

avg_text=f"Average PR Lifetime:{avg_overall:.2f}%   "
plt.text(end_date,8,avg_text,horizontalalignment='right', verticalalignment='bottom' ,fontsize=14,fontweight='bold')

pt_abv_TB=f"\n\n\nPoints above Target PR = :{count}/{len(df['PR'])}={total_pt_abv_T_Pr:.2f}%"
plt.text(0.47,0.45,pt_abv_TB,horizontalalignment='center', verticalalignment='center' ,fontsize=14,fontweight='bold', transform=plt.gca().transAxes)

# Setting up the grid
plt.gca().set_axisbelow(True)
plt.grid(True, linestyle='-')

# Setting up the y-axis
plt.ylim(0, 100)
plt.yticks(range(0, 101, 10))
plt.ylabel('Performance Ratio [%]', fontweight='bold', fontsize='14')
plt.gca().xaxis.set_major_formatter(mdates.DateFormatter('%b/%Y'))

#working with legends

# Create the first legend
legend1 = plt.legend(loc='center',fontsize = 'large')
legend1.get_texts()[0].set_color('red')
legend1.get_texts()[1].set_color('green')
plt.gca().add_artist(legend1)




legend_handles = [

    mlines.Line2D([], [], color='navy', marker='D', markersize=7, label='< 2', linestyle='None'),
    mlines.Line2D([], [], color='lightblue', marker='D', markersize=7, label='2 - 4', linestyle='None'),
    mlines.Line2D([], [], color='orange', marker='D', markersize=7, label='4 - 6', linestyle='None'),
    mlines.Line2D([], [], color='brown', marker='D', markersize=7, label='> 6', linestyle='None'),
    mlines.Line2D([],[], label= 'Daily Irradiation [kWh/m2]',linestyle='None')

]



plt.legend(handles=legend_handles,loc='upper left', bbox_to_anchor=(0, 1), ncol=4)

plt.show()
```



In [312]:
```
plt.savefig('graph.png')
```

```
<Figure size 640x480 with 0 Axes>
```

In [ ]: