In [1]:

```
from matplotlib import pyplot as plt
from matplotlib.dates import MonthLocator, num2date
from matplotlib.ticker import FuncFormatter
from prophet import Prophet
from prophet.diagnostics import cross_validation, performance_metrics
from prophet.plot import add_changepoints_to_plot

import pandas as pd
import numpy as np
import datetime as dt
from collections import defaultdict
import time
import datetime as dt
from pytz import timezone
tz = timezone('EST')
from tqdm import tqdm

from sklearn.metrics import mean_absolute_error, mean_absolute_percentage_error,

import seaborn as sns
%config InlineBackend.figure_format = 'retina'
%matplotlib inline
from matplotlib import pyplot as plt
from matplotlib import style
sns.set()
```

In [3]:

```
semass2011 = pd.ExcelFile(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly_
semass2011 = pd.read_excel(semass2011, 'SEMASS')
semass2012 = pd.ExcelFile(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly_
semass2012 = pd.read_excel(semass2012, 'SEMASS')
semass2013 = pd.ExcelFile(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly_
semass2013 = pd.read_excel(semass2013, 'SEMASS')
semass2014 = pd.ExcelFile(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly_
semass2014 = pd.read_excel(semass2014, 'SEMASS')
semass2015 = pd.ExcelFile(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly_
semass2015 = pd.read_excel(semass2015, 'SEMASS')
semass2016 = pd.ExcelFile(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly_
semass2016 = pd.read_excel(semass2016, 'SEMA')
```

In [4]:

```
semass2017 = pd.read_excel(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly
semass2018 = pd.read_excel(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly
semass2019 = pd.read_excel(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly
semass2020 = pd.read_excel(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly
semass2021 = pd.read_excel(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly
semass2022 = pd.read_excel(r"C:\Users\Rohan\Desktop\Big Data\Load Data\smd_hourly
```

In [5]:
```
semass2022
```

Out[5]:

	Date	Hr_End	DA_Demand	RT_Demand	DA_LMP	DA_EC	DA_CC	DA_MLC	RT_LMP	RT_l
0	2022-01-01	1	1257.6	1269.542	32.81	32.35	0.22	0.24	26.13	25.
1	2022-01-01	2	1216.9	1199.337	32.86	32.31	0.28	0.27	26.10	25.
2	2022-01-01	3	1156.9	1153.599	31.05	30.85	0.00	0.20	27.75	27.
3	2022-01-01	4	1140.4	1129.515	29.88	29.69	0.00	0.19	25.36	25.
4	2022-01-01	5	1148.7	1128.633	31.06	30.86	0.00	0.20	29.53	29.
...	...	...	...	...	...	...	...	...	...	
739	2022-01-31	20	2023.9	2139.115	228.11	226.40	0.00	1.71	297.40	295.
740	2022-01-31	21	1933.2	2060.195	203.96	202.82	0.00	1.14	265.61	264.
741	2022-01-31	22	1772.2	1942.939	185.11	183.42	0.00	1.69	253.18	251.
742	2022-01-31	23	1656.1	1803.142	181.10	179.93	0.00	1.17	191.47	190.
743	2022-01-31	24	1537.0	1692.781	192.08	190.54	0.00	1.54	189.98	189.

744 rows × 14 columns

In [6]:
```
val2011 = semass2011['DEMAND']
val2012 = semass2012['DEMAND']
val2013 = semass2013['DEMAND']
val2014 = semass2014['DEMAND']
val2015 = semass2015['DEMAND']
val2016 = semass2016['RT_Demand']
val2017 = semass2017['RT_Demand']
val2018 = semass2018['RT_Demand']
val2019 = semass2019['RT_Demand']
val2020 = semass2020['RT_Demand']
val2021 = semass2021['RT_Demand']
val2022 = semass2022['RT_Demand']
```

In [7]:
```
values = [val2011, val2012, val2013, val2014, val2015, val2016, val2017, val2018,
values_df = pd.concat(values, axis=0, ignore_index=False)
values_df = values_df.reset_index()
period = len(values_df)
```

In [8]:
```
rng = pd.date_range('2011-01-01', periods=period, freq='1H')
date_df = pd.DataFrame({ 'ds': rng})
date_df = date_df.reset_index()
```

In [9]:
```
frames = [date_df, values_df]
semass_load = pd.concat(frames, axis=1, ignore_index=False)
semass_load = semass_load.rename(columns={semass_load.columns[1]: 'ds', semass_lo
frames2 = [semass_load['ds'], semass_load['y']]
semass_load = pd.concat(frames2, axis=1, ignore_index=False)
semass_load
```

Out[9]:

	ds	y
0	2011-01-01 00:00:00	1438.000
1	2011-01-01 01:00:00	1348.000
2	2011-01-01 02:00:00	1286.000
3	2011-01-01 03:00:00	1252.000
4	2011-01-01 04:00:00	1242.000
...	...	...
97171	2022-01-31 19:00:00	2139.115
97172	2022-01-31 20:00:00	2060.195
97173	2022-01-31 21:00:00	1942.939
97174	2022-01-31 22:00:00	1803.142
97175	2022-01-31 23:00:00	1692.781

97176 rows × 2 columns

In [10]:
```
model = Prophet(
        changepoint_prior_scale=0.5,
        seasonality_mode='multiplicative',
        interval_width=0.95,
    )
model.add_country_holidays(country_name='US')
```

Out[10]:
```
<prophet.forecaster.Prophet at 0x2a03cb8a490>
```

In [11]:
```
model.fit(semass_load)
```

Out[11]:
```
<prophet.forecaster.Prophet at 0x2a03cb8a490>
```

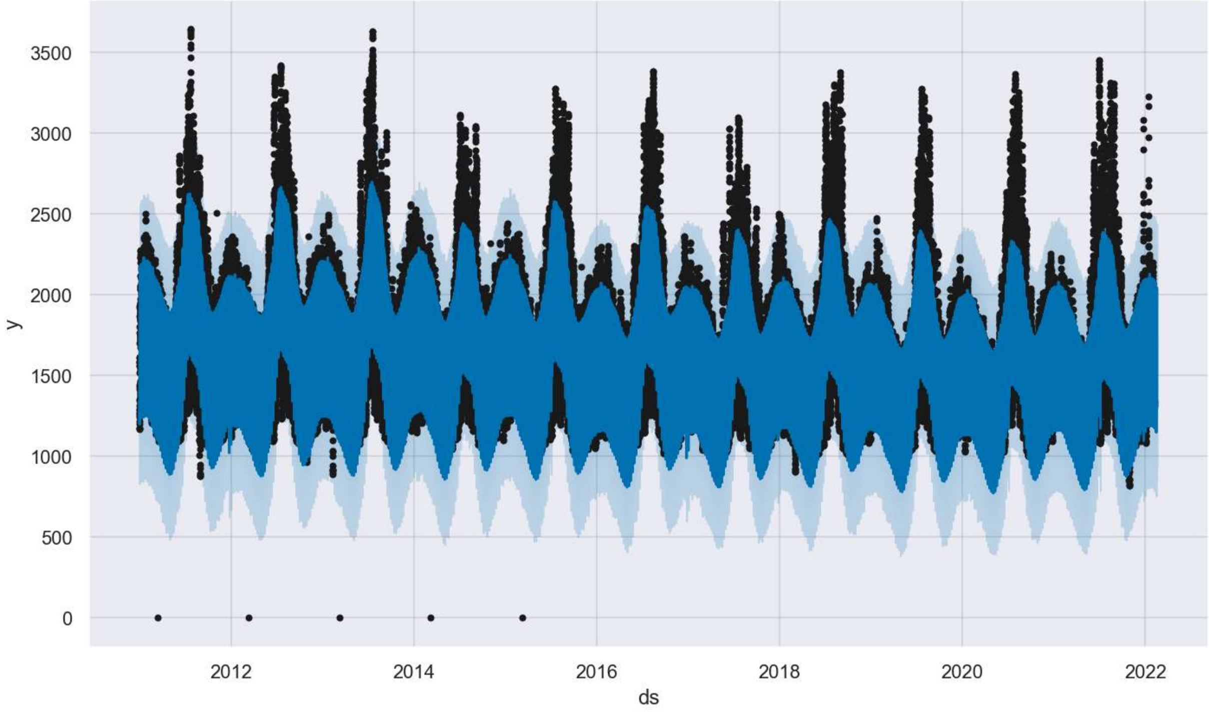
In [12]:
```
future_pd = model.make_future_dataframe(
        periods=365,
        freq='1H',
        include_history=True
    )

# make predictions
forecast_pd = model.predict(future_pd)
```

In [13]:
```
forecast_pd[['ds', 'yhat', 'yhat_lower', 'yhat_upper']].tail()
```

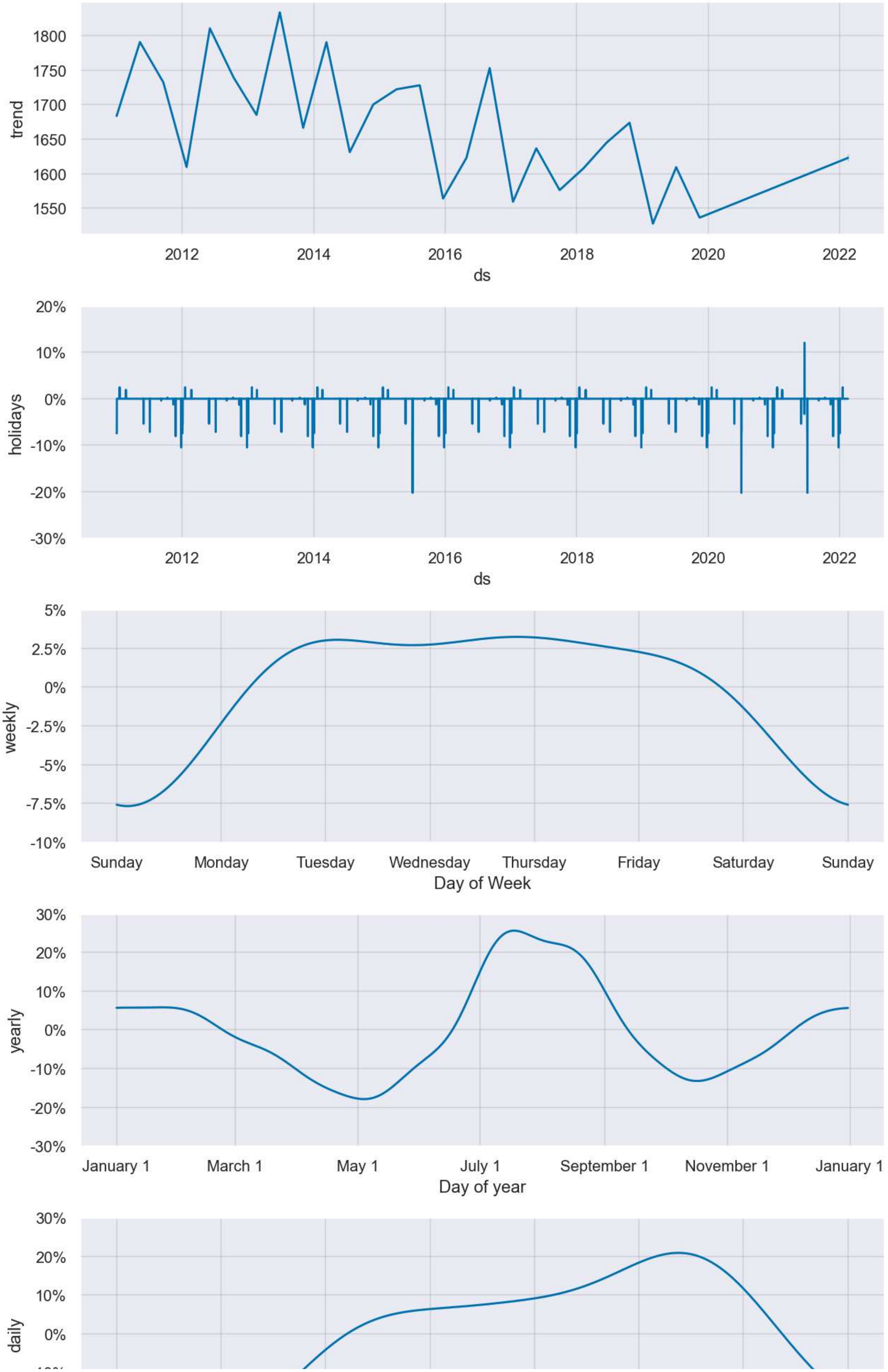
Out[13]:

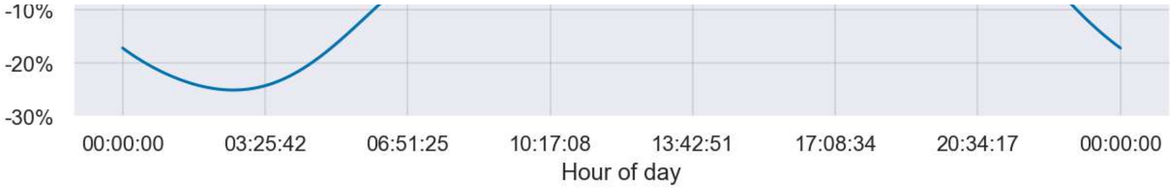
	ds	yhat	yhat_lower	yhat_upper
97536	2022-02-16 00:00:00	1426.971672	1039.208572	1807.200194
97537	2022-02-16 01:00:00	1350.727326	1003.248952	1729.392796
97538	2022-02-16 02:00:00	1307.367120	949.880895	1675.369753
97539	2022-02-16 03:00:00	1301.069964	934.501568	1664.933515
97540	2022-02-16 04:00:00	1340.636815	932.634856	1736.582344

In [14]:
```
fig1 = model.plot(forecast_pd)
```



```
In [15]: fig2 = model.plot_components(forecast_pd)
```





```
In [16]: forecast_pd
```

Out[16]:

	ds	trend	yhat_lower	yhat_upper	trend_lower	trend_upper	Christmas Day	Chr Day
0	2011-01-01 00:00:00	1683.556238	956.709070	1720.361468	1683.556238	1683.556238	0.0	
1	2011-01-01 01:00:00	1683.590692	880.208675	1642.450980	1683.590692	1683.590692	0.0	
2	2011-01-01 02:00:00	1683.625147	829.863216	1577.331687	1683.625147	1683.625147	0.0	
3	2011-01-01 03:00:00	1683.659601	827.987769	1575.766836	1683.659601	1683.659601	0.0	
4	2011-01-01 04:00:00	1683.694056	873.416783	1611.148052	1683.694056	1683.694056	0.0	
...	...	...	...	...	...	...	...	
97536	2022-02-16 00:00:00	1622.764795	1039.208572	1807.200194	1619.202485	1627.602753	0.0	
97537	2022-02-16 01:00:00	1622.769168	1003.248952	1729.392796	1619.182639	1627.667468	0.0	
97538	2022-02-16 02:00:00	1622.773540	949.880895	1675.369753	1619.162792	1627.732184	0.0	
97539	2022-02-16 03:00:00	1622.777913	934.501568	1664.933515	1619.136337	1627.796899	0.0	
97540	2022-02-16 04:00:00	1622.782285	932.634856	1736.582344	1619.083068	1627.861615	0.0	

97541 rows × 73 columns

```
In [ ]:
```