

# fip\_0014

April 25, 2021

## 1 FIP 0014 thematic notebook

The goal of this notebook is to explore the impact of the upcoming sector expiration wave on April / May, especially when considering the ones with V1 proofs.

### 1.1 Setup and dependences

```
[1]: %load_ext autotime
```

```
%load_ext autoreload
```

```
%autoreload 2
```

time: 8.41 ms (started: 2021-04-25 00:53:03 +00:00)

```
[2]: # External dependences
```

```
import pandas as pd
```

```
import numpy as np
```

```
import plotly.express as px
```

```
from prophet import Prophet
```

```
import matplotlib.pyplot as plt
```

```
# Move path to parent folder
```

```
import sys
```

```
sys.path.insert(1, '../')
```

```
import plotly
```

```
plotly.offline.init_notebook_mode()
```

time: 806 ms (started: 2021-04-25 00:53:03 +00:00)

```
[3]: # Create a connection object from a conn string
```

```
from filecoin_metrics.connection import get_connection, get_connection_string
```

```
conn_string = get_connection_string('../config/sentinel-conn-string.txt')
```

```
connection = get_connection(conn_string)
```

time: 286 ms (started: 2021-04-25 00:53:04 +00:00)

```
[4]: QUERY = """
/* Get the last state of the sectors */
with sector_states as (
    select
        msi.*,
        max(msi.height) over (partition by msi.sector_id, msi.miner_id) as
        ↪max_height
    from miner_sector_infos msi
    where msi.activation_epoch > 0
    and msi.expiration_epoch > msi.height /* Get only active sectors */
    order by max_height
)
select
count(*) as sector_count,
sum(ss.initial_pledge::numeric) / 1e18 as initial_pledge_in_fil,
count(*) * 32 as network_power_in_gb,
date_trunc('DAY', to_timestamp(height_to_unix(ss.activation_epoch))) as
    ↪activation_date,
date_trunc('DAY', to_timestamp(height_to_unix(ss.expiration_epoch))) as
    ↪expiration_date
from sector_states as ss
where ss.max_height = ss.height /* get the last state of the info */
group by activation_date, expiration_date
order by activation_date, expiration_date
"""

query_df = (pd.read_sql(QUERY, connection)
            .assign(network_power_in_pib=lambda df: df.network_power_in_gb /
            ↪(1024 ** 2))
            .assign(initial_pledge_in_thousand_fil=lambda df: df.
            ↪initial_pledge_in_fil / 1000))
```

time: 12min 2s (started: 2021-04-25 00:53:04 +00:00)

```
[5]: # Maximum date for V1 sectors
UPGRADE_DATE = '2020-11-25 00:00:00'

metrics = {'is_v1': lambda x: x['activation_date'] < UPGRADE_DATE}

query_df = query_df.assign(**metrics)
```

time: 14 ms (started: 2021-04-25 01:05:07 +00:00)

```
[6]: def resample_and_bar_plot(df, resample_rule, time_column, value_column, title,
    ↪**kwargs):
    fig_df = df.resample(resample_rule, on=time_column, label='left').sum()
    fig = px.bar(fig_df.reset_index(),
```

```

        x=time_column,
        y=value_column,
        title=title,
        **kwargs)

    return fig

def resample_and_bar_plot_relative(df, resample_rule, time_column,
    ↪value_column, title, **kwargs):
    fig_df = df.resample(resample_rule, on=time_column, label='left').sum()
    y = fig_df.groupby(time_column).sum()
    fig_df /= y
    fig = px.bar(fig_df.reset_index(),
        x=time_column,
        y=value_column,
        title=title,
        **kwargs)

    return fig

```

time: 15.1 ms (started: 2021-04-25 01:05:07 +00:00)

## 1.2 Sector Count

```

[7]: df = query_df.copy()

print("Basic stats")
print("----")
print(f"Total sectors (#): {df.sector_count.sum()}")
print(f"Raw bytes power (PiB): {df.network_power_in_gb.sum() / (1024 ** 2) :.
    ↪3g}")
print(f"Initial pledge (FIL): {df.initial_pledge_in_fil.sum()}")
print("----")

```

Basic stats

---

Total sectors (#): 114861452

Raw bytes power (PiB): 3.51e+03

Initial pledge (FIL): 38853901.887529984

---

time: 14 ms (started: 2021-04-25 01:05:07 +00:00)

```

[8]: resample_rule = '1m'
time_column = 'expiration_date'
value_column = 'sector_count'
title = 'Count of Expiring Sectors (#)'

```

```

groups = [pd.Grouper(key='expiration_date', freq=resample_rule),
          'is_v1']

fig_df = (df.groupby(groups)
          .sum()
          )

fig = px.bar(fig_df.reset_index(),
             x=time_column,
             y=value_column,
             color='is_v1',
             title=title)

fig.show()

```

time: 309 ms (started: 2021-04-25 01:05:07 +00:00)

```

[9]: resample_rule = '1d'
time_column = 'expiration_date'
value_column = 'sector_count'
title = 'Count of Expiring Sectors Before 15Jun2021 (log #)'

groups = [pd.Grouper(key='expiration_date', freq=resample_rule),
          'is_v1']

fig_df = (df.query("expiration_date < '2021-06-15 00:00+00:00'")
          .groupby(groups)
          .sum()
          .reset_index()
          )

fig = px.bar(fig_df,
             x=time_column,
             y=value_column,
             facet_row=fig_df.is_v1,
             title=title,
             log_y=True)

fig.show()

```

time: 110 ms (started: 2021-04-25 01:05:07 +00:00)

```

[10]: sector_count = df.sector_count.sum()
v1_count = df.query("is_v1 == True").sector_count.sum()

```

```

v1_6mo_count = (df.query("is_v1 == True & expiration_date < '2021-06-01 00:
↳00+00:00'"))

                        .sector_count
                        .sum()

v1_12mo_count = (df.query("is_v1 == True & expiration_date < '2021-12-01 00:
↳00+00:00' & expiration_date >= '2021-06-01 00:00+00:00'"))

                        .sector_count
                        .sum()

v1_18mo_count = (df.query("is_v1 == True & expiration_date < '2022-06-01 00:
↳00+00:00' & expiration_date >= '2021-12-01 00:00+00:00'"))

                        .sector_count
                        .sum()

print("----")
print(f"Total sectors (#): {sector_count}")
print(f"V1 sectors (#): {v1_count}")
print(f"V1 sectors share (%): {v1_count / sector_count :.1%}")
print("----")
print(f"6mo V1 sectors share (%) of total sectors: {v1_6mo_count / sector_count
↳:.2%}")
print(f"12mo V1 sectors share (%) of total sectors: {v1_12mo_count /
↳sector_count :.2%}")
print(f"18mo V1 sectors share (%) of total sectors: {v1_18mo_count /
↳sector_count :.2%}")
print("----")
print(f"6mo V1 sectors share (%) of total sectors: {v1_6mo_count / v1_count :.
↳2%}")
print(f"12mo V1 sectors share (%) of total sectors: {v1_12mo_count / v1_count :.
↳2%}")
print(f"18mo V1 sectors share (%) of total sectors: {v1_18mo_count / v1_count :.
↳2%}")
print("----")

```

```

---
Total sectors (#): 114861452
V1 sectors (#): 26189790
V1 sectors share (%): 22.8%
---
6mo V1 sectors share (%) of total sectors: 5.08%
12mo V1 sectors share (%) of total sectors: 1.09%
18mo V1 sectors share (%) of total sectors: 16.63%
---
6mo V1 sectors share (%) of total sectors: 22.28%
12mo V1 sectors share (%) of total sectors: 4.80%

```

18mo V1 sectors share (%) of total sectors: 72.92%

---

time: 33.5 ms (started: 2021-04-25 01:05:07 +00:00)

```
[11]: resample_rule = '1m'
time_column = 'expiration_date'
value_column = 'sector_count'
title = 'Upcoming Sector Expiration Count, grouped by sector version (#)'

groups = [pd.Grouper(key='expiration_date', freq=resample_rule),
          'is_v1']

fig_df = (df.groupby(groups)
          .sum()
          .reset_index()
          )

fig = px.bar(fig_df.reset_index(),
             x=time_column,
             y=value_column,
             facet_row='is_v1',
             title=title)
fig.show()
```

time: 95.5 ms (started: 2021-04-25 01:05:08 +00:00)

```
[12]: resample_rule = '1w'
time_column = 'activation_date'
value_column = 'sector_count'
title = 'Activated Sector Count, grouped by sector version (#)'

groups = [pd.Grouper(key='activation_date', freq=resample_rule),
          'is_v1']

fig_df = (df.groupby(groups)
          .sum()
          .reset_index()
          )

fig = px.bar(fig_df.reset_index(),
             x=time_column,
             y=value_column,
             facet_row='is_v1',
             title=title)
fig.show()
```

time: 85 ms (started: 2021-04-25 01:05:08 +00:00)

### 1.3 Forecasts

```
[13]: rename_cols = {'activation_date': 'ds',
                    'sector_count': 'y'}

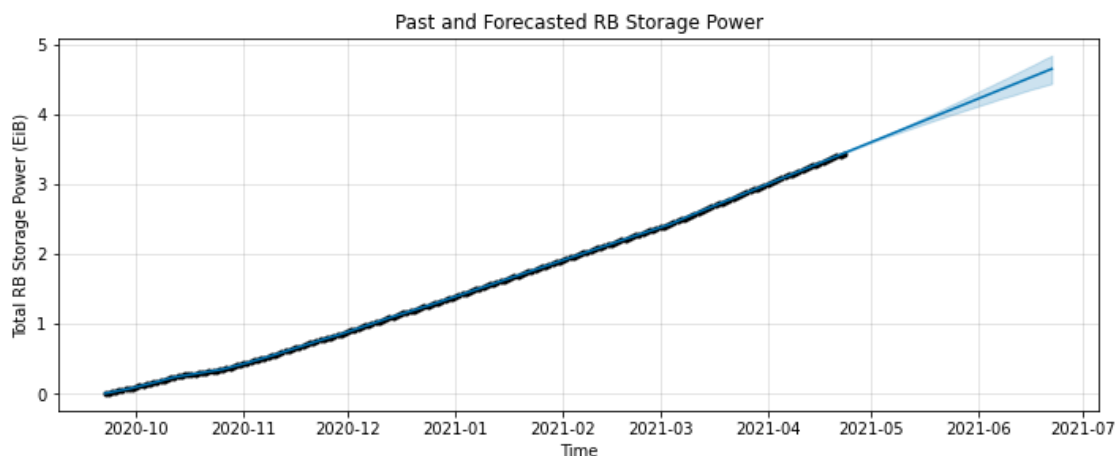
proj_df = (df.resample("1d", on="activation_date")
           .sector_count
           .sum()
           .reset_index()
           .rename(columns=rename_cols)
           .assign(ds=lambda df: df.ds.dt.tz_localize(None))
           .assign(y=lambda df: df.y.cumsum() / (32 * 1024 * 1024)))

m = Prophet(changepoint_prior_scale=0.4)
m.fit(proj_df)
future = m.make_future_dataframe(periods=60)
forecast = m.predict(future)

fig = m.plot(forecast, figsize=(10, 4))
plt.title('Past and Forecasted RB Storage Power')
plt.xlabel("Time")
plt.ylabel("Total RB Storage Power (EiB)")
plt.show()
```

INFO:prophet:Disabling yearly seasonality. Run prophet with yearly\_seasonality=True to override this.

INFO:prophet:Disabling daily seasonality. Run prophet with daily\_seasonality=True to override this.



time: 2.86 s (started: 2021-04-25 01:05:08 +00:00)

```
[14]: rename_cols = {'activation_date': 'ds',
                    'sector_count': 'y'}

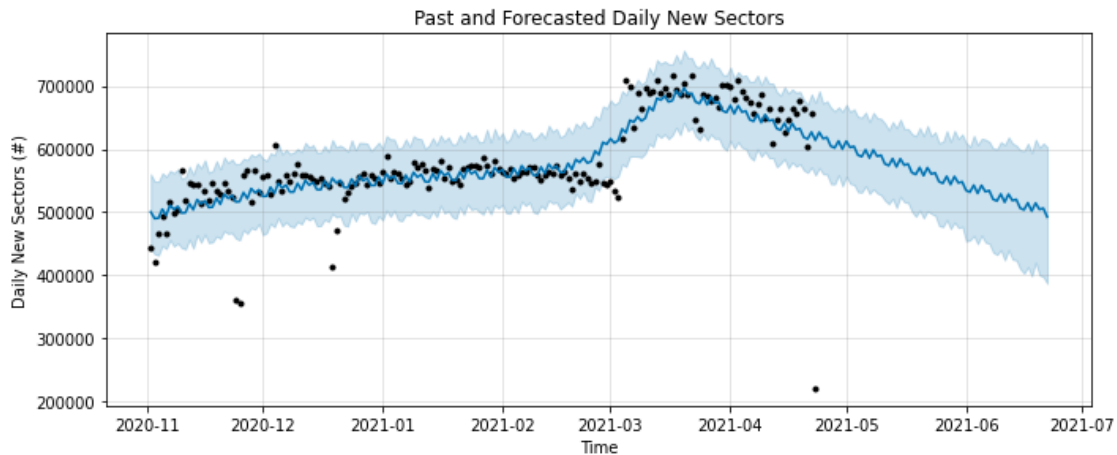
proj_df = (df.query("activation_date > '2020-11-01 00:00+00:00'")
           .resample("1d", on="activation_date")
           .sector_count
           .sum()
           .reset_index()
           .rename(columns=rename_cols)
           .assign(ds=lambda df: df.ds.dt.tz_localize(None)))

m = Prophet(changepoint_prior_scale=0.2)
m.fit(proj_df)
future = m.make_future_dataframe(periods=60)
forecast = m.predict(future)

fig = m.plot(forecast, figsize=(10, 4))
plt.title('Past and Forecasted Daily New Sectors')
plt.xlabel("Time")
plt.ylabel("Daily New Sectors (#)")
plt.show()
```

INFO:prophet:Disabling yearly seasonality. Run prophet with yearly\_seasonality=True to override this.

INFO:prophet:Disabling daily seasonality. Run prophet with daily\_seasonality=True to override this.



time: 1.96 s (started: 2021-04-25 01:05:11 +00:00)

```
[15]: rename_cols = {'activation_date': 'ds',
                    'sector_count': 'y'}
```



```

proj_df = (df.query("activation_date > '2020-11-01 00:00+00:00' &
    ↳activation_date < '2021-03-01 00:00+00:00'")
    .resample("1d", on="activation_date")
    .sector_count
    .sum()
    .reset_index()
    .rename(columns=rename_cols)
    .assign(ds=lambda df: df.ds.dt.tz_localize(None)))

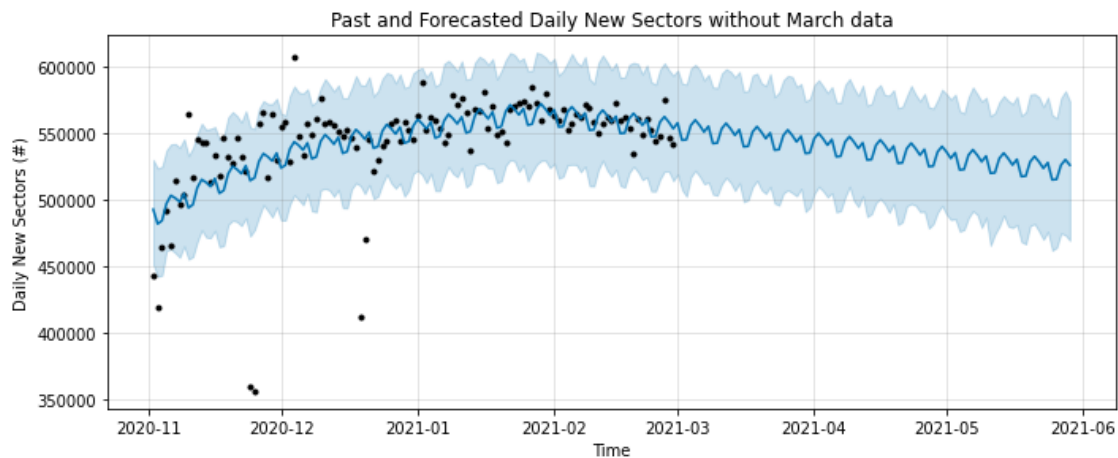
m = Prophet(changepoint_prior_scale=0.2)
m.fit(proj_df)
future = m.make_future_dataframe(periods=90)
forecast = m.predict(future)

fig = m.plot(forecast, figsize=(10, 4))
plt.title('Past and Forecasted Daily New Sectors without March data')
plt.xlabel("Time")
plt.ylabel("Daily New Sectors (#)")
plt.show()

```

INFO:prophet:Disabling yearly seasonality. Run prophet with yearly\_seasonality=True to override this.

INFO:prophet:Disabling daily seasonality. Run prophet with daily\_seasonality=True to override this.



time: 1.93 s (started: 2021-04-25 01:05:13 +00:00)

```

[16]: rename_cols = {'activation_date': 'ds',
    0: 'y'}

```

```

proj_df = (df.query("activation_date > '2020-11-01 00:00+00:00'")
           .resample("1d", on="activation_date")
           .apply(lambda x: (x.initial_pledge_in_fil / x.sector_count).mean())
           .reset_index()
           .rename(columns=rename_cols)
           .assign(ds=lambda df: df.ds.dt.tz_localize(None))
           )

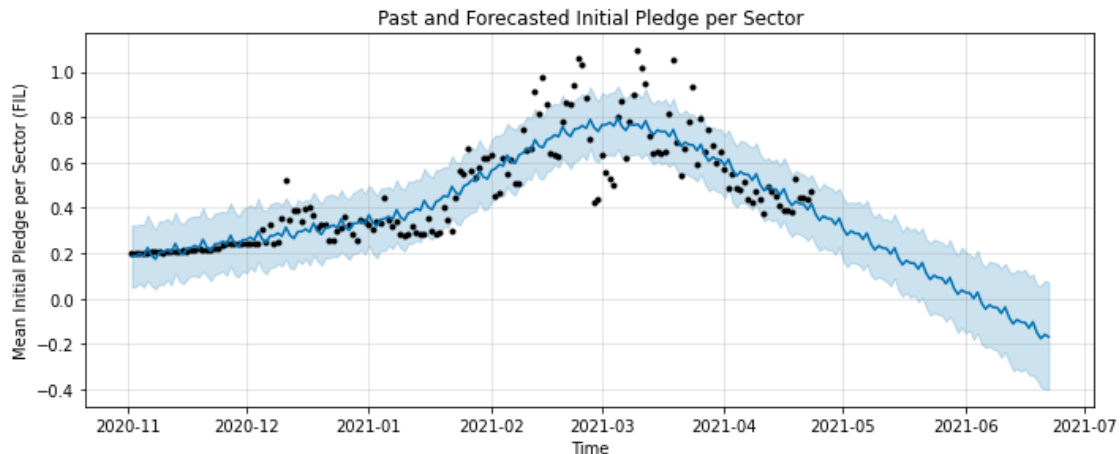
m = Prophet(changepoint_prior_scale=0.2)
m.fit(proj_df)
future = m.make_future_dataframe(periods=60)
forecast = m.predict(future)

fig = m.plot(forecast, figsize=(10, 4))
plt.title('Past and Forecasted Initial Pledge per Sector')
plt.xlabel("Time")
plt.ylabel("Mean Initial Pledge per Sector (FIL)")
plt.show()

```

INFO:prophet:Disabling yearly seasonality. Run prophet with yearly\_seasonality=True to override this.

INFO:prophet:Disabling daily seasonality. Run prophet with daily\_seasonality=True to override this.



time: 2.04 s (started: 2021-04-25 01:05:14 +00:00)

[17]: m.fit

[17]: <bound method Prophet.fit of <prophet.forecaster.Prophet object at 0x7fbe7b5b9160>>

time: 20.5 ms (started: 2021-04-25 01:05:17 +00:00)

```
[18]: resample_rule = '7d'
time_column = 'activation_date'
value_column = 'sector_count'
title = 'Count of Sector Activation Date (#)'

groups = [pd.Grouper(key='activation_date', freq=resample_rule),
           pd.Grouper(key='expiration_date', freq=resample_rule)]
fig_df = df.groupby(groups).sum().reset_index()
px.density_heatmap(fig_df,
                   x='activation_date',
                   y='expiration_date',
                   z='sector_count')
```

time: 122 ms (started: 2021-04-25 01:05:17 +00:00)

```
[19]: resample_rule = '1d'
time_column = 'activation_date'
value_column = 'sector_count'
title = 'Count of Sector Activation Date (#)'

groups = [pd.Grouper(key='activation_date', freq=resample_rule),
           pd.Grouper(key='expiration_date', freq=resample_rule)]
fig_df = df.groupby(groups).sum().reset_index()
fig = px.density_contour(fig_df,
                        x='activation_date',
                        y='expiration_date',
                        z='sector_count',
                        histfunc='sum')

fig.show()
```

time: 525 ms (started: 2021-04-25 01:05:17 +00:00)

## 1.4 Initial Pledge

```
[20]: sector_count = df.initial_pledge_in_fil.sum()
v1_count = df.query("is_v1 == True").initial_pledge_in_fil.sum()

v1_6mo_count = (df.query("is_v1 == True & expiration_date < '2021-06-01 00:
→00+00:00'")
                .initial_pledge_in_fil
                .sum())

v1_12mo_count = (df.query("is_v1 == True & expiration_date < '2021-12-01 00:
→00+00:00' & expiration_date >= '2021-06-01 00:00+00:00'")
                 .initial_pledge_in_fil
```

```

        .sum()

v1_18mo_count = (df.query("is_v1 == True & expiration_date < '2022-06-01 00:
    ↳00+00:00' & expiration_date >= '2021-12-01 00:00+00:00'")
        .initial_pledge_in_fil
        .sum())

print("----")
print(f"Total collateral (Million FIL): {sector_count / 1e6 :.3g}")
print(f"V1 collateral (Million FIL): {v1_count / 1e6 :.3g}")
print(f"V1 sectors share (%): {v1_count / sector_count :.1%}")
print("----")
print(f"6mo V1 sectors share (%) of total collateral: {v1_6mo_count /
    ↳sector_count :.2%}")
print(f"12mo V1 sectors share (%) of total collateral: {v1_12mo_count /
    ↳sector_count :.2%}")
print(f"18mo V1 sectors share (%) of total collateral: {v1_18mo_count /
    ↳sector_count :.2%}")
print("----")
print(f"6mo V1 sectors share (%) of total collateral: {v1_6mo_count / v1_count :
    ↳.2%}")
print(f"12mo V1 sectors share (%) of total collateral: {v1_12mo_count /
    ↳v1_count :.2%}")
print(f"18mo V1 sectors share (%) of total collateral: {v1_18mo_count /
    ↳v1_count :.2%}")
print("----")

```

---

Total collateral (Million FIL): 38.9

V1 collateral (Million FIL): 5.78

V1 sectors share (%): 14.9%

---

6mo V1 sectors share (%) of total collateral: 3.06%

12mo V1 sectors share (%) of total collateral: 0.71%

18mo V1 sectors share (%) of total collateral: 11.11%

---

6mo V1 sectors share (%) of total collateral: 20.58%

12mo V1 sectors share (%) of total collateral: 4.74%

18mo V1 sectors share (%) of total collateral: 74.68%

---

time: 33.9 ms (started: 2021-04-25 01:05:17 +00:00)

```

[21]: resample_rule = '1m'
      time_column = 'expiration_date'
      value_column = 'initial_pledge_in_fil'
      title = 'Initial Pledge (FIL) of Expiring Sectors (#)'

```

```

groups = [pd.Grouper(key='expiration_date', freq=resample_rule),
          'is_v1']

fig_df = (df.groupby(groups)
          .sum()
          )

fig = px.bar(fig_df.reset_index(),
             x=time_column,
             y=value_column,
             color='is_v1',
             title=title)

fig.show()

```

time: 79.4 ms (started: 2021-04-25 01:05:17 +00:00)

```

[22]: resample_rule = '1m'
time_column = 'expiration_date'
value_column = 'initial_pledge_in_fil'
title = 'Initial Pledge (FIL) of Expiring Sectors, grouped by Sector Version'

groups = [pd.Grouper(key='expiration_date', freq=resample_rule),
          'is_v1']

fig_df = (df.groupby(groups)
          .sum()
          .reset_index()
          )

fig = px.bar(fig_df,
             x=time_column,
             y=value_column,
             facet_col='is_v1',
             title=title)

fig.show()

```

time: 93.3 ms (started: 2021-04-25 01:05:17 +00:00)

```

[23]: resample_rule = '1m'
time_column = 'activation_date'
value_column = ['initial_pledge_in_thousand_fil']
title = 'Sum of Initial Pledge (FIL) across activation dates'

```

```
resample_and_bar_plot(df, resample_rule, time_column, value_column, title).  
    ↪ show()
```

time: 83.2 ms (started: 2021-04-25 01:05:18 +00:00)

## 1.5 RB Network Power

```
[24]: resample_rule = '1m'  
time_column = 'expiration_date'  
value_column = 'network_power_in_pib'  
title = 'RB Network Power (PiB) of Expiring Sectors (#)'  
  
groups = [pd.Grouper(key='expiration_date', freq=resample_rule),  
          'is_v1']  
  
fig_df = (df.groupby(groups)  
          .sum()  
          )  
  
fig = px.bar(fig_df.reset_index(),  
             x=time_column,  
             y=value_column,  
             color='is_v1',  
             title=title)  
fig.show()
```

time: 81 ms (started: 2021-04-25 01:05:18 +00:00)

```
[25]: resample_rule = '1m'  
time_column = 'expiration_date'  
value_column = 'network_power_in_pib'  
title = 'RB Network Power (PiB) of Expiring Sectors, grouped by Sector Version'  
  
groups = [pd.Grouper(key='expiration_date', freq=resample_rule),  
          'is_v1']  
  
fig_df = (df.groupby(groups)  
          .sum()  
          .reset_index()  
          )  
  
fig = px.bar(fig_df,  
             x=time_column,
```

```
y=value_column,  
facet_col='is_v1',  
title=title)  
fig.show()
```

time: 85.5 ms (started: 2021-04-25 01:05:18 +00:00)

```
[26]: resample_rule = '1m'  
time_column = 'activation_date'  
value_column = ['network_power_in_pib']  
title = 'Sum of RB Network Power (PiB) across activation dates'  
resample_and_bar_plot(df, resample_rule, time_column, value_column, title).  
    ↪ show()
```

time: 72.7 ms (started: 2021-04-25 01:05:18 +00:00)

```
[ ]:
```