Horari

December 21, 2019

1 Horari

1.1 Carreguem llibreries

```
In [1]: import pandas as pd
        import numpy as np
        from pandas import datetime
        from matplotlib import pyplot as plt
```

1.2 Carreguem dataset horari

```
In [27]: hourly=pd.read_csv('C:/Users/Laura/Desktop/Smart meters London/workspace R/Dades netes
```

```
In [28]: hourly
```

```
Out[28]:         Unnamed: 0    LCLid                       tstp  energy(kWh/hh)
         0                1  MAC000002  2012-10-12 00:30:00.0000000           0.000
         1                2  MAC000002  2012-10-12 01:00:00.0000000           0.000
         2                3  MAC000002  2012-10-12 01:30:00.0000000           0.000
         3                4  MAC000002  2012-10-12 02:00:00.0000000           0.000
         4                5  MAC000002  2012-10-12 02:30:00.0000000           0.000
         5                6  MAC000002  2012-10-12 03:00:00.0000000           0.000
         6                7  MAC000002  2012-10-12 03:30:00.0000000           0.000
         7                8  MAC000002  2012-10-12 04:00:00.0000000           0.000
         8                9  MAC000002  2012-10-12 04:30:00.0000000           0.000
         9               10  MAC000002  2012-10-12 05:00:00.0000000           0.000
         10              11  MAC000002  2012-10-12 05:30:00.0000000           0.000
         11              12  MAC000002  2012-10-12 06:00:00.0000000           0.000
         12              13  MAC000002  2012-10-12 06:30:00.0000000           0.000
         13              14  MAC000002  2012-10-12 07:00:00.0000000           0.000
         14              15  MAC000002  2012-10-12 07:30:00.0000000           0.000
         15              16  MAC000002  2012-10-12 08:00:00.0000000           0.000
         16              17  MAC000002  2012-10-12 08:30:00.0000000           0.000
         17              18  MAC000002  2012-10-12 09:00:00.0000000           0.000
         18              19  MAC000002  2012-10-12 09:30:00.0000000           0.000
         19              20  MAC000002  2012-10-12 10:00:00.0000000           0.000
         20              21  MAC000002  2012-10-12 10:30:00.0000000           0.000
         21              22  MAC000002  2012-10-12 11:30:00.0000000           0.143
```

```
22                23  MAC000002  2012-10-12 12:00:00.0000000              0.663
23                24  MAC000002  2012-10-12 12:30:00.0000000              0.256
24                25  MAC000002  2012-10-12 13:00:00.0000000              0.155
25                26  MAC000002  2012-10-12 13:30:00.0000000              0.199
26                27  MAC000002  2012-10-12 14:00:00.0000000              0.125
27                28  MAC000002  2012-10-12 14:30:00.0000000              0.165
28                29  MAC000002  2012-10-12 15:00:00.0000000              0.140
29                30  MAC000002  2012-10-12 15:30:00.0000000              0.148
...              ...  ...                                    ...          ...
87885041    87885042  MAC005517  2014-02-27 09:30:00.0000000              0.067
87885042    87885043  MAC005517  2014-02-27 10:00:00.0000000              0.061
87885043    87885044  MAC005517  2014-02-27 10:30:00.0000000              0.048
87885044    87885045  MAC005517  2014-02-27 11:00:00.0000000              0.055
87885045    87885046  MAC005517  2014-02-27 11:30:00.0000000              0.072
87885046    87885047  MAC005517  2014-02-27 12:00:00.0000000              0.058
87885047    87885048  MAC005517  2014-02-27 12:30:00.0000000              0.103
87885048    87885049  MAC005517  2014-02-27 13:00:00.0000000              0.055
87885049    87885050  MAC005517  2014-02-27 13:30:00.0000000              0.028
87885050    87885051  MAC005517  2014-02-27 14:00:00.0000000              0.013
87885051    87885052  MAC005517  2014-02-27 14:30:00.0000000              0.030
87885052    87885053  MAC005517  2014-02-27 15:00:00.0000000              0.030
87885053    87885054  MAC005517  2014-02-27 15:30:00.0000000              0.012
87885054    87885055  MAC005517  2014-02-27 16:00:00.0000000              0.028
87885055    87885056  MAC005517  2014-02-27 16:30:00.0000000              0.143
87885056    87885057  MAC005517  2014-02-27 17:00:00.0000000              0.094
87885057    87885058  MAC005517  2014-02-27 17:30:00.0000000              0.090
87885058    87885059  MAC005517  2014-02-27 18:00:00.0000000              0.101
87885059    87885060  MAC005517  2014-02-27 18:30:00.0000000              0.100
87885060    87885061  MAC005517  2014-02-27 19:00:00.0000000              0.073
87885061    87885062  MAC005517  2014-02-27 19:30:00.0000000              0.048
87885062    87885063  MAC005517  2014-02-27 20:00:00.0000000              0.035
87885063    87885064  MAC005517  2014-02-27 20:30:00.0000000              0.020
87885064    87885065  MAC005517  2014-02-27 21:00:00.0000000              0.040
87885065    87885066  MAC005517  2014-02-27 21:30:00.0000000              0.027
87885066    87885067  MAC005517  2014-02-27 22:00:00.0000000              0.013
87885067    87885068  MAC005517  2014-02-27 22:30:00.0000000              0.029
87885068    87885069  MAC005517  2014-02-27 23:00:00.0000000              0.023
87885069    87885070  MAC005517  2014-02-27 23:30:00.0000000              0.019
87885070    87885071  MAC005517  2014-02-28 00:00:00.0000000              0.031

[87885071 rows x 4 columns]
```

In [29]: *#Eliminem columna unnamed*
```python
hourly=hourly.drop(['Unnamed: 0'], axis='columns')
hourly
```

Out[29]:   LCLid   tstp energy(kWh/hh)
```
0          MAC000002  2012-10-12 00:30:00.0000000           0.000
```

```
1          MAC000002  2012-10-12 01:00:00.0000000              0.000
2          MAC000002  2012-10-12 01:30:00.0000000              0.000
3          MAC000002  2012-10-12 02:00:00.0000000              0.000
4          MAC000002  2012-10-12 02:30:00.0000000              0.000
5          MAC000002  2012-10-12 03:00:00.0000000              0.000
6          MAC000002  2012-10-12 03:30:00.0000000              0.000
7          MAC000002  2012-10-12 04:00:00.0000000              0.000
8          MAC000002  2012-10-12 04:30:00.0000000              0.000
9          MAC000002  2012-10-12 05:00:00.0000000              0.000
10         MAC000002  2012-10-12 05:30:00.0000000              0.000
11         MAC000002  2012-10-12 06:00:00.0000000              0.000
12         MAC000002  2012-10-12 06:30:00.0000000              0.000
13         MAC000002  2012-10-12 07:00:00.0000000              0.000
14         MAC000002  2012-10-12 07:30:00.0000000              0.000
15         MAC000002  2012-10-12 08:00:00.0000000              0.000
16         MAC000002  2012-10-12 08:30:00.0000000              0.000
17         MAC000002  2012-10-12 09:00:00.0000000              0.000
18         MAC000002  2012-10-12 09:30:00.0000000              0.000
19         MAC000002  2012-10-12 10:00:00.0000000              0.000
20         MAC000002  2012-10-12 10:30:00.0000000              0.000
21         MAC000002  2012-10-12 11:30:00.0000000              0.143
22         MAC000002  2012-10-12 12:00:00.0000000              0.663
23         MAC000002  2012-10-12 12:30:00.0000000              0.256
24         MAC000002  2012-10-12 13:00:00.0000000              0.155
25         MAC000002  2012-10-12 13:30:00.0000000              0.199
26         MAC000002  2012-10-12 14:00:00.0000000              0.125
27         MAC000002  2012-10-12 14:30:00.0000000              0.165
28         MAC000002  2012-10-12 15:00:00.0000000              0.140
29         MAC000002  2012-10-12 15:30:00.0000000              0.148
...            ...                    ...                        ...
87885041   MAC005517  2014-02-27 09:30:00.0000000              0.067
87885042   MAC005517  2014-02-27 10:00:00.0000000              0.061
87885043   MAC005517  2014-02-27 10:30:00.0000000              0.048
87885044   MAC005517  2014-02-27 11:00:00.0000000              0.055
87885045   MAC005517  2014-02-27 11:30:00.0000000              0.072
87885046   MAC005517  2014-02-27 12:00:00.0000000              0.058
87885047   MAC005517  2014-02-27 12:30:00.0000000              0.103
87885048   MAC005517  2014-02-27 13:00:00.0000000              0.055
87885049   MAC005517  2014-02-27 13:30:00.0000000              0.028
87885050   MAC005517  2014-02-27 14:00:00.0000000              0.013
87885051   MAC005517  2014-02-27 14:30:00.0000000              0.030
87885052   MAC005517  2014-02-27 15:00:00.0000000              0.030
87885053   MAC005517  2014-02-27 15:30:00.0000000              0.012
87885054   MAC005517  2014-02-27 16:00:00.0000000              0.028
87885055   MAC005517  2014-02-27 16:30:00.0000000              0.143
87885056   MAC005517  2014-02-27 17:00:00.0000000              0.094
87885057   MAC005517  2014-02-27 17:30:00.0000000              0.090
87885058   MAC005517  2014-02-27 18:00:00.0000000              0.101
```

```
87885059   MAC005517   2014-02-27 18:30:00.0000000              0.100
87885060   MAC005517   2014-02-27 19:00:00.0000000              0.073
87885061   MAC005517   2014-02-27 19:30:00.0000000              0.048
87885062   MAC005517   2014-02-27 20:00:00.0000000              0.035
87885063   MAC005517   2014-02-27 20:30:00.0000000              0.020
87885064   MAC005517   2014-02-27 21:00:00.0000000              0.040
87885065   MAC005517   2014-02-27 21:30:00.0000000              0.027
87885066   MAC005517   2014-02-27 22:00:00.0000000              0.013
87885067   MAC005517   2014-02-27 22:30:00.0000000              0.029
87885068   MAC005517   2014-02-27 23:00:00.0000000              0.023
87885069   MAC005517   2014-02-27 23:30:00.0000000              0.019
87885070   MAC005517   2014-02-28 00:00:00.0000000              0.031

[87885071 rows x 3 columns]
```

In [30]: *#Convertim variable tstp a timestamp*

```python
hourly["tstp"] = pd.to_datetime(hourly["tstp"], format='%Y-%m-%d %H:%M:%S')
hourly
```

Out[30]:
```
              LCLid                tstp  energy(kWh/hh)
0        MAC000002 2012-10-12 00:30:00           0.000
1        MAC000002 2012-10-12 01:00:00           0.000
2        MAC000002 2012-10-12 01:30:00           0.000
3        MAC000002 2012-10-12 02:00:00           0.000
4        MAC000002 2012-10-12 02:30:00           0.000
5        MAC000002 2012-10-12 03:00:00           0.000
6        MAC000002 2012-10-12 03:30:00           0.000
7        MAC000002 2012-10-12 04:00:00           0.000
8        MAC000002 2012-10-12 04:30:00           0.000
9        MAC000002 2012-10-12 05:00:00           0.000
10       MAC000002 2012-10-12 05:30:00           0.000
11       MAC000002 2012-10-12 06:00:00           0.000
12       MAC000002 2012-10-12 06:30:00           0.000
13       MAC000002 2012-10-12 07:00:00           0.000
14       MAC000002 2012-10-12 07:30:00           0.000
15       MAC000002 2012-10-12 08:00:00           0.000
16       MAC000002 2012-10-12 08:30:00           0.000
17       MAC000002 2012-10-12 09:00:00           0.000
18       MAC000002 2012-10-12 09:30:00           0.000
19       MAC000002 2012-10-12 10:00:00           0.000
20       MAC000002 2012-10-12 10:30:00           0.000
21       MAC000002 2012-10-12 11:30:00           0.143
22       MAC000002 2012-10-12 12:00:00           0.663
23       MAC000002 2012-10-12 12:30:00           0.256
24       MAC000002 2012-10-12 13:00:00           0.155
25       MAC000002 2012-10-12 13:30:00           0.199
26       MAC000002 2012-10-12 14:00:00           0.125
```

```
27          MAC000002 2012-10-12 14:30:00           0.165
28          MAC000002 2012-10-12 15:00:00           0.140
29          MAC000002 2012-10-12 15:30:00           0.148
...               ...                 ...              ...
87885041    MAC005517 2014-02-27 09:30:00           0.067
87885042    MAC005517 2014-02-27 10:00:00           0.061
87885043    MAC005517 2014-02-27 10:30:00           0.048
87885044    MAC005517 2014-02-27 11:00:00           0.055
87885045    MAC005517 2014-02-27 11:30:00           0.072
87885046    MAC005517 2014-02-27 12:00:00           0.058
87885047    MAC005517 2014-02-27 12:30:00           0.103
87885048    MAC005517 2014-02-27 13:00:00           0.055
87885049    MAC005517 2014-02-27 13:30:00           0.028
87885050    MAC005517 2014-02-27 14:00:00           0.013
87885051    MAC005517 2014-02-27 14:30:00           0.030
87885052    MAC005517 2014-02-27 15:00:00           0.030
87885053    MAC005517 2014-02-27 15:30:00           0.012
87885054    MAC005517 2014-02-27 16:00:00           0.028
87885055    MAC005517 2014-02-27 16:30:00           0.143
87885056    MAC005517 2014-02-27 17:00:00           0.094
87885057    MAC005517 2014-02-27 17:30:00           0.090
87885058    MAC005517 2014-02-27 18:00:00           0.101
87885059    MAC005517 2014-02-27 18:30:00           0.100
87885060    MAC005517 2014-02-27 19:00:00           0.073
87885061    MAC005517 2014-02-27 19:30:00           0.048
87885062    MAC005517 2014-02-27 20:00:00           0.035
87885063    MAC005517 2014-02-27 20:30:00           0.020
87885064    MAC005517 2014-02-27 21:00:00           0.040
87885065    MAC005517 2014-02-27 21:30:00           0.027
87885066    MAC005517 2014-02-27 22:00:00           0.013
87885067    MAC005517 2014-02-27 22:30:00           0.029
87885068    MAC005517 2014-02-27 23:00:00           0.023
87885069    MAC005517 2014-02-27 23:30:00           0.019
87885070    MAC005517 2014-02-28 00:00:00           0.031

[87885071 rows x 3 columns]
```

In [6]: `#Comprovem nuls`
`hourly[hourly['energy(kWh/hh)']=='Null']`

```
Out[6]:             LCLid                 tstp energy(kWh/hh)
        3238      MAC000002 2012-12-19 12:37:27          Null
        42441     MAC000246 2012-12-18 15:13:37          Null
        76341     MAC000450 2012-12-18 15:15:38          Null
        94080     MAC001074 2012-12-18 15:18:11          Null
        98616     MAC003223 2012-12-18 15:23:00          Null
        123942    MAC003239 2012-12-18 15:23:02          Null
        149094    MAC003252 2012-12-18 15:23:03          Null
```

```
173986     MAC003281 2012-12-18 15:23:08          Null
199021     MAC003305 2012-12-18 15:23:11          Null
220332     MAC003348 2012-12-18 15:24:27          Null
245131     MAC003388 2012-12-18 15:23:21          Null
269975     MAC003394 2012-12-18 15:23:22          Null
294670     MAC003400 2012-12-18 15:23:23          Null
319358     MAC003422 2012-12-18 15:23:26          Null
343572     MAC003423 2012-12-18 15:23:26          Null
368209     MAC003428 2012-12-18 15:23:26          Null
392807     MAC003449 2012-12-18 15:23:29          Null
417449     MAC003463 2012-12-18 15:23:31          Null
432446     MAC003482 2012-12-18 15:23:33          Null
456803     MAC003553 2012-12-18 15:23:42          Null
481122     MAC003557 2012-12-18 15:23:43          Null
500635     MAC003566 2012-12-18 15:23:44          Null
524946     MAC003579 2012-12-18 15:23:45          Null
549209     MAC003597 2012-12-18 15:23:47          Null
573382     MAC003613 2012-12-18 15:23:49          Null
597549     MAC003646 2012-12-18 15:23:53          Null
621717     MAC003656 2012-12-18 15:23:54          Null
645701     MAC003668 2012-12-18 15:23:55          Null
669686     MAC003680 2012-12-18 15:23:57          Null
693617     MAC003686 2012-12-18 15:23:57          Null
...           ...                ...               ...
86951980   MAC002247 2012-12-18 15:16:53          Null
86980797   MAC002358 2012-12-18 15:17:22          Null
87012985   MAC002380 2012-12-18 15:17:25          Null
87041665   MAC002555 2012-12-18 15:22:27          Null
87072989   MAC003093 2012-12-18 15:19:05          Null
87100540   MAC003100 2012-12-18 15:22:52          Null
87125901   MAC003229 2012-12-18 15:23:01          Null
87150697   MAC003364 2012-12-18 15:23:18          Null
87181590   MAC004318 2012-12-18 15:20:11          Null
87215834   MAC004360 2012-12-18 15:15:22          Null
87249887   MAC004439 2012-12-18 15:15:31          Null
87283937   MAC004448 2012-12-18 15:15:32          Null
87312577   MAC004590 2012-12-18 15:22:35          Null
87341157   MAC004653 2012-12-18 15:22:42          Null
87369694   MAC004666 2012-12-18 15:22:44          Null
87398235   MAC004677 2012-12-18 15:22:45          Null
87426773   MAC004686 2012-12-18 15:22:46          Null
87455308   MAC004704 2012-12-18 15:22:48          Null
87480484   MAC004718 2012-12-18 15:15:48          Null
87513827   MAC004760 2012-12-18 15:15:53          Null
87550835   MAC004911 2012-12-18 15:14:19          Null
87587823   MAC004915 2012-12-18 15:14:19          Null
87624813   MAC004916 2012-12-18 15:14:19          Null
87661755   MAC004924 2012-12-18 15:14:20          Null
```

```
87698347  MAC004976 2012-12-18 15:14:26               Null
87727171  MAC004987 2012-12-18 15:14:28               Null
87763628  MAC005015 2012-12-18 15:14:31               Null
87798791  MAC005380 2012-12-18 15:14:58               Null
87831508  MAC005504 2012-12-18 15:16:29               Null
87864126  MAC005517 2012-12-18 15:16:30               Null


[2847 rows x 3 columns]
```

Veiem que tots els Nulls corresponen al 18-12-2010 a les 15 (menys un que correspon al 19-12-2018 a les 12)

```
In [31]: hourly=pd.DataFrame(hourly)

In [32]: #Eliminem nuls

         hourly=hourly.dropna(subset=['energy(kWh/hh)'])
         hourly

Out[32]:             LCLid              tstp   energy(kWh/hh)
         0       MAC000002 2012-10-12 00:30:00           0.000
         1       MAC000002 2012-10-12 01:00:00           0.000
         2       MAC000002 2012-10-12 01:30:00           0.000
         3       MAC000002 2012-10-12 02:00:00           0.000
         4       MAC000002 2012-10-12 02:30:00           0.000
         5       MAC000002 2012-10-12 03:00:00           0.000
         6       MAC000002 2012-10-12 03:30:00           0.000
         7       MAC000002 2012-10-12 04:00:00           0.000
         8       MAC000002 2012-10-12 04:30:00           0.000
         9       MAC000002 2012-10-12 05:00:00           0.000
         10      MAC000002 2012-10-12 05:30:00           0.000
         11      MAC000002 2012-10-12 06:00:00           0.000
         12      MAC000002 2012-10-12 06:30:00           0.000
         13      MAC000002 2012-10-12 07:00:00           0.000
         14      MAC000002 2012-10-12 07:30:00           0.000
         15      MAC000002 2012-10-12 08:00:00           0.000
         16      MAC000002 2012-10-12 08:30:00           0.000
         17      MAC000002 2012-10-12 09:00:00           0.000
         18      MAC000002 2012-10-12 09:30:00           0.000
         19      MAC000002 2012-10-12 10:00:00           0.000
         20      MAC000002 2012-10-12 10:30:00           0.000
         21      MAC000002 2012-10-12 11:30:00           0.143
         22      MAC000002 2012-10-12 12:00:00           0.663
         23      MAC000002 2012-10-12 12:30:00           0.256
         24      MAC000002 2012-10-12 13:00:00           0.155
         25      MAC000002 2012-10-12 13:30:00           0.199
         26      MAC000002 2012-10-12 14:00:00           0.125
         27      MAC000002 2012-10-12 14:30:00           0.165
         28      MAC000002 2012-10-12 15:00:00           0.140
```

```
29          MAC000002 2012-10-12 15:30:00                  0.148
...                ...                       ...                  ...
87885041    MAC005517 2014-02-27 09:30:00                  0.067
87885042    MAC005517 2014-02-27 10:00:00                  0.061
87885043    MAC005517 2014-02-27 10:30:00                  0.048
87885044    MAC005517 2014-02-27 11:00:00                  0.055
87885045    MAC005517 2014-02-27 11:30:00                  0.072
87885046    MAC005517 2014-02-27 12:00:00                  0.058
87885047    MAC005517 2014-02-27 12:30:00                  0.103
87885048    MAC005517 2014-02-27 13:00:00                  0.055
87885049    MAC005517 2014-02-27 13:30:00                  0.028
87885050    MAC005517 2014-02-27 14:00:00                  0.013
87885051    MAC005517 2014-02-27 14:30:00                  0.030
87885052    MAC005517 2014-02-27 15:00:00                  0.030
87885053    MAC005517 2014-02-27 15:30:00                  0.012
87885054    MAC005517 2014-02-27 16:00:00                  0.028
87885055    MAC005517 2014-02-27 16:30:00                  0.143
87885056    MAC005517 2014-02-27 17:00:00                  0.094
87885057    MAC005517 2014-02-27 17:30:00                  0.090
87885058    MAC005517 2014-02-27 18:00:00                  0.101
87885059    MAC005517 2014-02-27 18:30:00                  0.100
87885060    MAC005517 2014-02-27 19:00:00                  0.073
87885061    MAC005517 2014-02-27 19:30:00                  0.048
87885062    MAC005517 2014-02-27 20:00:00                  0.035
87885063    MAC005517 2014-02-27 20:30:00                  0.020
87885064    MAC005517 2014-02-27 21:00:00                  0.040
87885065    MAC005517 2014-02-27 21:30:00                  0.027
87885066    MAC005517 2014-02-27 22:00:00                  0.013
87885067    MAC005517 2014-02-27 22:30:00                  0.029
87885068    MAC005517 2014-02-27 23:00:00                  0.023
87885069    MAC005517 2014-02-27 23:30:00                  0.019
87885070    MAC005517 2014-02-28 00:00:00                  0.031

[87882224 rows x 3 columns]
```

In [33]: *#Renombrem columna energia*

```
hourly.rename(columns={'energy(kWh/hh)':'energy_hh'}, inplace=True)
hourly
```

Out[33]:   LCLid   tstp   energy_hh
```
0          MAC000002 2012-10-12 00:30:00      0.000
1          MAC000002 2012-10-12 01:00:00      0.000
2          MAC000002 2012-10-12 01:30:00      0.000
3          MAC000002 2012-10-12 02:00:00      0.000
4          MAC000002 2012-10-12 02:30:00      0.000
5          MAC000002 2012-10-12 03:00:00      0.000
6          MAC000002 2012-10-12 03:30:00      0.000
```

```
7         MAC000002 2012-10-12 04:00:00      0.000
8         MAC000002 2012-10-12 04:30:00      0.000
9         MAC000002 2012-10-12 05:00:00      0.000
10        MAC000002 2012-10-12 05:30:00      0.000
11        MAC000002 2012-10-12 06:00:00      0.000
12        MAC000002 2012-10-12 06:30:00      0.000
13        MAC000002 2012-10-12 07:00:00      0.000
14        MAC000002 2012-10-12 07:30:00      0.000
15        MAC000002 2012-10-12 08:00:00      0.000
16        MAC000002 2012-10-12 08:30:00      0.000
17        MAC000002 2012-10-12 09:00:00      0.000
18        MAC000002 2012-10-12 09:30:00      0.000
19        MAC000002 2012-10-12 10:00:00      0.000
20        MAC000002 2012-10-12 10:30:00      0.000
21        MAC000002 2012-10-12 11:30:00      0.143
22        MAC000002 2012-10-12 12:00:00      0.663
23        MAC000002 2012-10-12 12:30:00      0.256
24        MAC000002 2012-10-12 13:00:00      0.155
25        MAC000002 2012-10-12 13:30:00      0.199
26        MAC000002 2012-10-12 14:00:00      0.125
27        MAC000002 2012-10-12 14:30:00      0.165
28        MAC000002 2012-10-12 15:00:00      0.140
29        MAC000002 2012-10-12 15:30:00      0.148
...          ...              ...            ...
87885041  MAC005517 2014-02-27 09:30:00      0.067
87885042  MAC005517 2014-02-27 10:00:00      0.061
87885043  MAC005517 2014-02-27 10:30:00      0.048
87885044  MAC005517 2014-02-27 11:00:00      0.055
87885045  MAC005517 2014-02-27 11:30:00      0.072
87885046  MAC005517 2014-02-27 12:00:00      0.058
87885047  MAC005517 2014-02-27 12:30:00      0.103
87885048  MAC005517 2014-02-27 13:00:00      0.055
87885049  MAC005517 2014-02-27 13:30:00      0.028
87885050  MAC005517 2014-02-27 14:00:00      0.013
87885051  MAC005517 2014-02-27 14:30:00      0.030
87885052  MAC005517 2014-02-27 15:00:00      0.030
87885053  MAC005517 2014-02-27 15:30:00      0.012
87885054  MAC005517 2014-02-27 16:00:00      0.028
87885055  MAC005517 2014-02-27 16:30:00      0.143
87885056  MAC005517 2014-02-27 17:00:00      0.094
87885057  MAC005517 2014-02-27 17:30:00      0.090
87885058  MAC005517 2014-02-27 18:00:00      0.101
87885059  MAC005517 2014-02-27 18:30:00      0.100
87885060  MAC005517 2014-02-27 19:00:00      0.073
87885061  MAC005517 2014-02-27 19:30:00      0.048
87885062  MAC005517 2014-02-27 20:00:00      0.035
87885063  MAC005517 2014-02-27 20:30:00      0.020
87885064  MAC005517 2014-02-27 21:00:00      0.040
```

```
87885065  MAC005517  2014-02-27 21:30:00       0.027
87885066  MAC005517  2014-02-27 22:00:00       0.013
87885067  MAC005517  2014-02-27 22:30:00       0.029
87885068  MAC005517  2014-02-27 23:00:00       0.023
87885069  MAC005517  2014-02-27 23:30:00       0.019
87885070  MAC005517  2014-02-28 00:00:00       0.031

[87882224 rows x 3 columns]
```

In [36]: `hourly_h=hourly.resample('H', on='tstp').mean()`
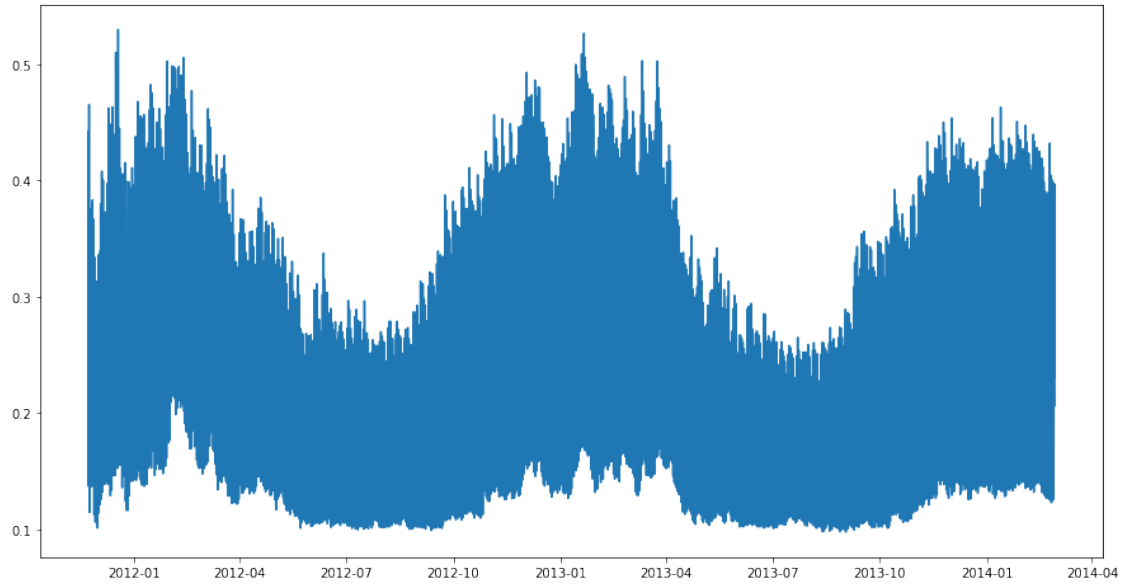
In [37]: `hourly_h`

Out[37]:
```
                        energy_hh
tstp
2011-11-23 09:00:00    0.384500
2011-11-23 10:00:00    0.137300
2011-11-23 11:00:00    0.164200
2011-11-23 12:00:00    0.443071
2011-11-23 13:00:00    0.263000
2011-11-23 14:00:00    0.254056
2011-11-23 15:00:00    0.200333
2011-11-23 16:00:00    0.196389
2011-11-23 17:00:00    0.257722
2011-11-23 18:00:00    0.261222
2011-11-23 19:00:00    0.363111
2011-11-23 20:00:00    0.465333
2011-11-23 21:00:00    0.386611
2011-11-23 22:00:00    0.329611
2011-11-23 23:00:00    0.261500
2011-11-24 00:00:00    0.304833
2011-11-24 01:00:00    0.324444
2011-11-24 02:00:00    0.183111
2011-11-24 03:00:00    0.150833
2011-11-24 04:00:00    0.136944
2011-11-24 05:00:00    0.114556
2011-11-24 06:00:00    0.146556
2011-11-24 07:00:00    0.205500
2011-11-24 08:00:00    0.160833
2011-11-24 09:00:00    0.160222
2011-11-24 10:00:00    0.218174
2011-11-24 11:00:00    0.187917
2011-11-24 12:00:00    0.200200
2011-11-24 13:00:00    0.217647
2011-11-24 14:00:00    0.214917
...                         ...
2014-02-26 19:00:00    0.398326
2014-02-26 20:00:00    0.392014
```

```
2014-02-26 21:00:00    0.361412
2014-02-26 22:00:00    0.321322
2014-02-26 23:00:00    0.257047
2014-02-27 00:00:00    0.214636
2014-02-27 01:00:00    0.166721
2014-02-27 02:00:00    0.141002
2014-02-27 03:00:00    0.130712
2014-02-27 04:00:00    0.125984
2014-02-27 05:00:00    0.131438
2014-02-27 06:00:00    0.163112
2014-02-27 07:00:00    0.230463
2014-02-27 08:00:00    0.265486
2014-02-27 09:00:00    0.243217
2014-02-27 10:00:00    0.232092
2014-02-27 11:00:00    0.223184
2014-02-27 12:00:00    0.217468
2014-02-27 13:00:00    0.216917
2014-02-27 14:00:00    0.205666
2014-02-27 15:00:00    0.216515
2014-02-27 16:00:00    0.228163
2014-02-27 17:00:00    0.264094
2014-02-27 18:00:00    0.352217
2014-02-27 19:00:00    0.397044
2014-02-27 20:00:00    0.384705
2014-02-27 21:00:00    0.364505
2014-02-27 22:00:00    0.329392
2014-02-27 23:00:00    0.264843
2014-02-28 00:00:00    0.231215

[19864 rows x 1 columns]
```

```
In [41]: plt.figure(figsize=(15,8))
         plt.plot(hourly_h)

Out[41]: [<matplotlib.lines.Line2D at 0x1f00064dfd0>]
```

```
In [48]: hourly_h['h-1']=hourly_h['energy_hh'].shift(1)
         hourly_h['h-2']=hourly_h['energy_hh'].shift(2)
         hourly_h['h-3']=hourly_h['energy_hh'].shift(3)
         hourly_h['h-4']=hourly_h['energy_hh'].shift(4)
         hourly_h['h-5']=hourly_h['energy_hh'].shift(5)
         hourly_h['h-6']=hourly_h['energy_hh'].shift(6)
         hourly_h['h-7']=hourly_h['energy_hh'].shift(7)
         hourly_h['h-8']=hourly_h['energy_hh'].shift(8)
         hourly_h['h-9']=hourly_h['energy_hh'].shift(9)
         hourly_h['h-10']=hourly_h['energy_hh'].shift(10)
         hourly_h['h-11']=hourly_h['energy_hh'].shift(11)
         hourly_h['h-12']=hourly_h['energy_hh'].shift(12)
         hourly_h['h-13']=hourly_h['energy_hh'].shift(13)
         hourly_h['h-14']=hourly_h['energy_hh'].shift(14)
         hourly_h['h-15']=hourly_h['energy_hh'].shift(15)
         hourly_h['h-16']=hourly_h['energy_hh'].shift(16)
         hourly_h['h-17']=hourly_h['energy_hh'].shift(17)
         hourly_h['h-18']=hourly_h['energy_hh'].shift(18)
         hourly_h['h-19']=hourly_h['energy_hh'].shift(19)
         hourly_h['h-20']=hourly_h['energy_hh'].shift(20)
         hourly_h['h-21']=hourly_h['energy_hh'].shift(21)
         hourly_h['h-22']=hourly_h['energy_hh'].shift(22)
         hourly_h['h-23']=hourly_h['energy_hh'].shift(23)
         hourly_h['h-24']=hourly_h['energy_hh'].shift(24)
         hourly_h['h-25']=hourly_h['energy_hh'].shift(25)
         hourly_h['h-26']=hourly_h['energy_hh'].shift(26)
         hourly_h['h-27']=hourly_h['energy_hh'].shift(27)
         hourly_h['h-28']=hourly_h['energy_hh'].shift(28)
```

```
hourly_h['h-29']=hourly_h['energy_hh'].shift(29)
hourly_h['h-30']=hourly_h['energy_hh'].shift(30)
hourly_h['h-31']=hourly_h['energy_hh'].shift(31)
hourly_h['h-32']=hourly_h['energy_hh'].shift(32)
hourly_h['h-33']=hourly_h['energy_hh'].shift(33)
hourly_h['h-34']=hourly_h['energy_hh'].shift(34)
hourly_h['h-35']=hourly_h['energy_hh'].shift(35)
hourly_h['h-36']=hourly_h['energy_hh'].shift(36)
hourly_h['h-37']=hourly_h['energy_hh'].shift(37)
hourly_h['h-38']=hourly_h['energy_hh'].shift(38)
hourly_h['h-39']=hourly_h['energy_hh'].shift(39)
hourly_h['h-40']=hourly_h['energy_hh'].shift(40)
hourly_h['h-41']=hourly_h['energy_hh'].shift(41)
hourly_h['h-42']=hourly_h['energy_hh'].shift(42)
hourly_h['h-43']=hourly_h['energy_hh'].shift(43)
hourly_h['h-44']=hourly_h['energy_hh'].shift(44)
hourly_h['h-45']=hourly_h['energy_hh'].shift(45)
hourly_h['h-46']=hourly_h['energy_hh'].shift(46)
hourly_h['h-47']=hourly_h['energy_hh'].shift(47)
hourly_h['h-48']=hourly_h['energy_hh'].shift(48)

In [49]: hourly_h

Out[49]:                      energy_hh       h-1       h-2       h-3       h-4  \
        tstp
        2011-11-23 09:00:00   0.384500       NaN       NaN       NaN       NaN
        2011-11-23 10:00:00   0.137300  0.384500       NaN       NaN       NaN
        2011-11-23 11:00:00   0.164200  0.137300  0.384500       NaN       NaN
        2011-11-23 12:00:00   0.443071  0.164200  0.137300  0.384500       NaN
        2011-11-23 13:00:00   0.263000  0.443071  0.164200  0.137300  0.384500
        2011-11-23 14:00:00   0.254056  0.263000  0.443071  0.164200  0.137300
        2011-11-23 15:00:00   0.200333  0.254056  0.263000  0.443071  0.164200
        2011-11-23 16:00:00   0.196389  0.200333  0.254056  0.263000  0.443071
        2011-11-23 17:00:00   0.257722  0.196389  0.200333  0.254056  0.263000
        2011-11-23 18:00:00   0.261222  0.257722  0.196389  0.200333  0.254056
        2011-11-23 19:00:00   0.363111  0.261222  0.257722  0.196389  0.200333
        2011-11-23 20:00:00   0.465333  0.363111  0.261222  0.257722  0.196389
        2011-11-23 21:00:00   0.386611  0.465333  0.363111  0.261222  0.257722
        2011-11-23 22:00:00   0.329611  0.386611  0.465333  0.363111  0.261222
        2011-11-23 23:00:00   0.261500  0.329611  0.386611  0.465333  0.363111
        2011-11-24 00:00:00   0.304833  0.261500  0.329611  0.386611  0.465333
        2011-11-24 01:00:00   0.324444  0.304833  0.261500  0.329611  0.386611
        2011-11-24 02:00:00   0.183111  0.324444  0.304833  0.261500  0.329611
        2011-11-24 03:00:00   0.150833  0.183111  0.324444  0.304833  0.261500
        2011-11-24 04:00:00   0.136944  0.150833  0.183111  0.324444  0.304833
        2011-11-24 05:00:00   0.114556  0.136944  0.150833  0.183111  0.324444
        2011-11-24 06:00:00   0.146556  0.114556  0.136944  0.150833  0.183111
        2011-11-24 07:00:00   0.205500  0.146556  0.114556  0.136944  0.150833
```

```
2011-11-24 08:00:00    0.160833   0.205500   0.146556   0.114556   0.136944
2011-11-24 09:00:00    0.160222   0.160833   0.205500   0.146556   0.114556
2011-11-24 10:00:00    0.218174   0.160222   0.160833   0.205500   0.146556
2011-11-24 11:00:00    0.187917   0.218174   0.160222   0.160833   0.205500
2011-11-24 12:00:00    0.200200   0.187917   0.218174   0.160222   0.160833
2011-11-24 13:00:00    0.217647   0.200200   0.187917   0.218174   0.160222
2011-11-24 14:00:00    0.214917   0.217647   0.200200   0.187917   0.218174
...                         ...        ...        ...        ...        ...
2014-02-26 19:00:00    0.398326   0.341063   0.253750   0.211036   0.207114
2014-02-26 20:00:00    0.392014   0.398326   0.341063   0.253750   0.211036
2014-02-26 21:00:00    0.361412   0.392014   0.398326   0.341063   0.253750
2014-02-26 22:00:00    0.321322   0.361412   0.392014   0.398326   0.341063
2014-02-26 23:00:00    0.257047   0.321322   0.361412   0.392014   0.398326
2014-02-27 00:00:00    0.214636   0.257047   0.321322   0.361412   0.392014
2014-02-27 01:00:00    0.166721   0.214636   0.257047   0.321322   0.361412
2014-02-27 02:00:00    0.141002   0.166721   0.214636   0.257047   0.321322
2014-02-27 03:00:00    0.130712   0.141002   0.166721   0.214636   0.257047
2014-02-27 04:00:00    0.125984   0.130712   0.141002   0.166721   0.214636
2014-02-27 05:00:00    0.131438   0.125984   0.130712   0.141002   0.166721
2014-02-27 06:00:00    0.163112   0.131438   0.125984   0.130712   0.141002
2014-02-27 07:00:00    0.230463   0.163112   0.131438   0.125984   0.130712
2014-02-27 08:00:00    0.265486   0.230463   0.163112   0.131438   0.125984
2014-02-27 09:00:00    0.243217   0.265486   0.230463   0.163112   0.131438
2014-02-27 10:00:00    0.232092   0.243217   0.265486   0.230463   0.163112
2014-02-27 11:00:00    0.223184   0.232092   0.243217   0.265486   0.230463
2014-02-27 12:00:00    0.217468   0.223184   0.232092   0.243217   0.265486
2014-02-27 13:00:00    0.216917   0.217468   0.223184   0.232092   0.243217
2014-02-27 14:00:00    0.205666   0.216917   0.217468   0.223184   0.232092
2014-02-27 15:00:00    0.216515   0.205666   0.216917   0.217468   0.223184
2014-02-27 16:00:00    0.228163   0.216515   0.205666   0.216917   0.217468
2014-02-27 17:00:00    0.264094   0.228163   0.216515   0.205666   0.216917
2014-02-27 18:00:00    0.352217   0.264094   0.228163   0.216515   0.205666
2014-02-27 19:00:00    0.397044   0.352217   0.264094   0.228163   0.216515
2014-02-27 20:00:00    0.384705   0.397044   0.352217   0.264094   0.228163
2014-02-27 21:00:00    0.364505   0.384705   0.397044   0.352217   0.264094
2014-02-27 22:00:00    0.329392   0.364505   0.384705   0.397044   0.352217
2014-02-27 23:00:00    0.264843   0.329392   0.364505   0.384705   0.397044
2014-02-28 00:00:00    0.231215   0.264843   0.329392   0.364505   0.384705


                            h-5        h-6        h-7        h-8        h-9   ...  \
tstp                                                                           ...
2011-11-23 09:00:00        NaN        NaN        NaN        NaN        NaN   ...
2011-11-23 10:00:00        NaN        NaN        NaN        NaN        NaN   ...
2011-11-23 11:00:00        NaN        NaN        NaN        NaN        NaN   ...
2011-11-23 12:00:00        NaN        NaN        NaN        NaN        NaN   ...
2011-11-23 13:00:00        NaN        NaN        NaN        NaN        NaN   ...
2011-11-23 14:00:00   0.384500        NaN        NaN        NaN        NaN   ...
2011-11-23 15:00:00   0.137300   0.384500        NaN        NaN        NaN   ...
```

```
2011-11-23 16:00:00  0.164200  0.137300  0.384500       NaN       NaN  ...
2011-11-23 17:00:00  0.443071  0.164200  0.137300  0.384500       NaN  ...
2011-11-23 18:00:00  0.263000  0.443071  0.164200  0.137300  0.384500  ...
2011-11-23 19:00:00  0.254056  0.263000  0.443071  0.164200  0.137300  ...
2011-11-23 20:00:00  0.200333  0.254056  0.263000  0.443071  0.164200  ...
2011-11-23 21:00:00  0.196389  0.200333  0.254056  0.263000  0.443071  ...
2011-11-23 22:00:00  0.257722  0.196389  0.200333  0.254056  0.263000  ...
2011-11-23 23:00:00  0.261222  0.257722  0.196389  0.200333  0.254056  ...
2011-11-24 00:00:00  0.363111  0.261222  0.257722  0.196389  0.200333  ...
2011-11-24 01:00:00  0.465333  0.363111  0.261222  0.257722  0.196389  ...
2011-11-24 02:00:00  0.386611  0.465333  0.363111  0.261222  0.257722  ...
2011-11-24 03:00:00  0.329611  0.386611  0.465333  0.363111  0.261222  ...
2011-11-24 04:00:00  0.261500  0.329611  0.386611  0.465333  0.363111  ...
2011-11-24 05:00:00  0.304833  0.261500  0.329611  0.386611  0.465333  ...
2011-11-24 06:00:00  0.324444  0.304833  0.261500  0.329611  0.386611  ...
2011-11-24 07:00:00  0.183111  0.324444  0.304833  0.261500  0.329611  ...
2011-11-24 08:00:00  0.150833  0.183111  0.324444  0.304833  0.261500  ...
2011-11-24 09:00:00  0.136944  0.150833  0.183111  0.324444  0.304833  ...
2011-11-24 10:00:00  0.114556  0.136944  0.150833  0.183111  0.324444  ...
2011-11-24 11:00:00  0.146556  0.114556  0.136944  0.150833  0.183111  ...
2011-11-24 12:00:00  0.205500  0.146556  0.114556  0.136944  0.150833  ...
2011-11-24 13:00:00  0.160833  0.205500  0.146556  0.114556  0.136944  ...
2011-11-24 14:00:00  0.160222  0.160833  0.205500  0.146556  0.114556  ...
...                       ...       ...       ...       ...       ...  ...
2014-02-26 19:00:00  0.208619  0.215434  0.213732  0.214957  0.226463  ...
2014-02-26 20:00:00  0.207114  0.208619  0.215434  0.213732  0.214957  ...
2014-02-26 21:00:00  0.211036  0.207114  0.208619  0.215434  0.213732  ...
2014-02-26 22:00:00  0.253750  0.211036  0.207114  0.208619  0.215434  ...
2014-02-26 23:00:00  0.341063  0.253750  0.211036  0.207114  0.208619  ...
2014-02-27 00:00:00  0.398326  0.341063  0.253750  0.211036  0.207114  ...
2014-02-27 01:00:00  0.392014  0.398326  0.341063  0.253750  0.211036  ...
2014-02-27 02:00:00  0.361412  0.392014  0.398326  0.341063  0.253750  ...
2014-02-27 03:00:00  0.321322  0.361412  0.392014  0.398326  0.341063  ...
2014-02-27 04:00:00  0.257047  0.321322  0.361412  0.392014  0.398326  ...
2014-02-27 05:00:00  0.214636  0.257047  0.321322  0.361412  0.392014  ...
2014-02-27 06:00:00  0.166721  0.214636  0.257047  0.321322  0.361412  ...
2014-02-27 07:00:00  0.141002  0.166721  0.214636  0.257047  0.321322  ...
2014-02-27 08:00:00  0.130712  0.141002  0.166721  0.214636  0.257047  ...
2014-02-27 09:00:00  0.125984  0.130712  0.141002  0.166721  0.214636  ...
2014-02-27 10:00:00  0.131438  0.125984  0.130712  0.141002  0.166721  ...
2014-02-27 11:00:00  0.163112  0.131438  0.125984  0.130712  0.141002  ...
2014-02-27 12:00:00  0.230463  0.163112  0.131438  0.125984  0.130712  ...
2014-02-27 13:00:00  0.265486  0.230463  0.163112  0.131438  0.125984  ...
2014-02-27 14:00:00  0.243217  0.265486  0.230463  0.163112  0.131438  ...
2014-02-27 15:00:00  0.232092  0.243217  0.265486  0.230463  0.163112  ...
2014-02-27 16:00:00  0.223184  0.232092  0.243217  0.265486  0.230463  ...
2014-02-27 17:00:00  0.217468  0.223184  0.232092  0.243217  0.265486  ...
2014-02-27 18:00:00  0.216917  0.217468  0.223184  0.232092  0.243217  ...
```

```
2014-02-27 19:00:00  0.205666  0.216917  0.217468  0.223184  0.232092  ...
2014-02-27 20:00:00  0.216515  0.205666  0.216917  0.217468  0.223184  ...
2014-02-27 21:00:00  0.228163  0.216515  0.205666  0.216917  0.217468  ...
2014-02-27 22:00:00  0.264094  0.228163  0.216515  0.205666  0.216917  ...
2014-02-27 23:00:00  0.352217  0.264094  0.228163  0.216515  0.205666  ...
2014-02-28 00:00:00  0.397044  0.352217  0.264094  0.228163  0.216515  ...

                          h-39      h-40      h-41      h-42      h-43  \
tstp
2011-11-23 09:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 10:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 11:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 12:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 13:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 14:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 15:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 16:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 17:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 18:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 19:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 20:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 21:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 22:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-23 23:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 00:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 01:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 02:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 03:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 04:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 05:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 06:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 07:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 08:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 09:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 10:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 11:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 12:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 13:00:00        NaN       NaN       NaN       NaN       NaN
2011-11-24 14:00:00        NaN       NaN       NaN       NaN       NaN
...                        ...       ...       ...       ...       ...
2014-02-26 19:00:00  0.122872  0.128418  0.136327  0.159063  0.204375
2014-02-26 20:00:00  0.129602  0.122872  0.128418  0.136327  0.159063
2014-02-26 21:00:00  0.156865  0.129602  0.122872  0.128418  0.136327
2014-02-26 22:00:00  0.225861  0.156865  0.129602  0.122872  0.128418
2014-02-26 23:00:00  0.257033  0.225861  0.156865  0.129602  0.122872
2014-02-27 00:00:00  0.242793  0.257033  0.225861  0.156865  0.129602
2014-02-27 01:00:00  0.237093  0.242793  0.257033  0.225861  0.156865
2014-02-27 02:00:00  0.225474  0.237093  0.242793  0.257033  0.225861
```

16

2014-02-27 03:00:00	0.219841	0.225474	0.237093	0.242793	0.257033
2014-02-27 04:00:00	0.218353	0.219841	0.225474	0.237093	0.242793
2014-02-27 05:00:00	0.211628	0.218353	0.219841	0.225474	0.237093
2014-02-27 06:00:00	0.212213	0.211628	0.218353	0.219841	0.225474
2014-02-27 07:00:00	0.227387	0.212213	0.211628	0.218353	0.219841
2014-02-27 08:00:00	0.265711	0.227387	0.212213	0.211628	0.218353
2014-02-27 09:00:00	0.351498	0.265711	0.227387	0.212213	0.211628
2014-02-27 10:00:00	0.400632	0.351498	0.265711	0.227387	0.212213
2014-02-27 11:00:00	0.387031	0.400632	0.351498	0.265711	0.227387
2014-02-27 12:00:00	0.360566	0.387031	0.400632	0.351498	0.265711
2014-02-27 13:00:00	0.322798	0.360566	0.387031	0.400632	0.351498
2014-02-27 14:00:00	0.259397	0.322798	0.360566	0.387031	0.400632
2014-02-27 15:00:00	0.211590	0.259397	0.322798	0.360566	0.387031
2014-02-27 16:00:00	0.168859	0.211590	0.259397	0.322798	0.360566
2014-02-27 17:00:00	0.141816	0.168859	0.211590	0.259397	0.322798
2014-02-27 18:00:00	0.130937	0.141816	0.168859	0.211590	0.259397
2014-02-27 19:00:00	0.124425	0.130937	0.141816	0.168859	0.211590
2014-02-27 20:00:00	0.131991	0.124425	0.130937	0.141816	0.168859
2014-02-27 21:00:00	0.164714	0.131991	0.124425	0.130937	0.141816
2014-02-27 22:00:00	0.227026	0.164714	0.131991	0.124425	0.130937
2014-02-27 23:00:00	0.256613	0.227026	0.164714	0.131991	0.124425
2014-02-28 00:00:00	0.240898	0.256613	0.227026	0.164714	0.131991

	h-44	h-45	h-46	h-47	h-48
tstp					
2011-11-23 09:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 10:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 11:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 12:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 13:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 14:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 15:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 16:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 17:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 18:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 19:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 20:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 21:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 22:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-23 23:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 00:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 01:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 02:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 03:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 04:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 05:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 06:00:00	NaN	NaN	NaN	NaN	NaN
2011-11-24 07:00:00	NaN	NaN	NaN	NaN	NaN

```
        2011-11-24 08:00:00       NaN       NaN       NaN       NaN       NaN
        2011-11-24 09:00:00       NaN       NaN       NaN       NaN       NaN
        2011-11-24 10:00:00       NaN       NaN       NaN       NaN       NaN
        2011-11-24 11:00:00       NaN       NaN       NaN       NaN       NaN
        2011-11-24 12:00:00       NaN       NaN       NaN       NaN       NaN
        2011-11-24 13:00:00       NaN       NaN       NaN       NaN       NaN
        2011-11-24 14:00:00       NaN       NaN       NaN       NaN       NaN
        ...                       ...       ...       ...       ...       ...
        2014-02-26 19:00:00  0.245562  0.311922  0.351628  0.388410  0.404668
        2014-02-26 20:00:00  0.204375  0.245562  0.311922  0.351628  0.388410
        2014-02-26 21:00:00  0.159063  0.204375  0.245562  0.311922  0.351628
        2014-02-26 22:00:00  0.136327  0.159063  0.204375  0.245562  0.311922
        2014-02-26 23:00:00  0.128418  0.136327  0.159063  0.204375  0.245562
        2014-02-27 00:00:00  0.122872  0.128418  0.136327  0.159063  0.204375
        2014-02-27 01:00:00  0.129602  0.122872  0.128418  0.136327  0.159063
        2014-02-27 02:00:00  0.156865  0.129602  0.122872  0.128418  0.136327
        2014-02-27 03:00:00  0.225861  0.156865  0.129602  0.122872  0.128418
        2014-02-27 04:00:00  0.257033  0.225861  0.156865  0.129602  0.122872
        2014-02-27 05:00:00  0.242793  0.257033  0.225861  0.156865  0.129602
        2014-02-27 06:00:00  0.237093  0.242793  0.257033  0.225861  0.156865
        2014-02-27 07:00:00  0.225474  0.237093  0.242793  0.257033  0.225861
        2014-02-27 08:00:00  0.219841  0.225474  0.237093  0.242793  0.257033
        2014-02-27 09:00:00  0.218353  0.219841  0.225474  0.237093  0.242793
        2014-02-27 10:00:00  0.211628  0.218353  0.219841  0.225474  0.237093
        2014-02-27 11:00:00  0.212213  0.211628  0.218353  0.219841  0.225474
        2014-02-27 12:00:00  0.227387  0.212213  0.211628  0.218353  0.219841
        2014-02-27 13:00:00  0.265711  0.227387  0.212213  0.211628  0.218353
        2014-02-27 14:00:00  0.351498  0.265711  0.227387  0.212213  0.211628
        2014-02-27 15:00:00  0.400632  0.351498  0.265711  0.227387  0.212213
        2014-02-27 16:00:00  0.387031  0.400632  0.351498  0.265711  0.227387
        2014-02-27 17:00:00  0.360566  0.387031  0.400632  0.351498  0.265711
        2014-02-27 18:00:00  0.322798  0.360566  0.387031  0.400632  0.351498
        2014-02-27 19:00:00  0.259397  0.322798  0.360566  0.387031  0.400632
        2014-02-27 20:00:00  0.211590  0.259397  0.322798  0.360566  0.387031
        2014-02-27 21:00:00  0.168859  0.211590  0.259397  0.322798  0.360566
        2014-02-27 22:00:00  0.141816  0.168859  0.211590  0.259397  0.322798
        2014-02-27 23:00:00  0.130937  0.141816  0.168859  0.211590  0.259397
        2014-02-28 00:00:00  0.124425  0.130937  0.141816  0.168859  0.211590

        [19864 rows x 49 columns]

In [60]: hourly_h=hourly_h.reset_index()
         hourly_h

Out[60]:                       tstp  energy_hh       h-1       h-2       h-3       h-4  \
         0     2011-11-23 09:00:00   0.384500       NaN       NaN       NaN       NaN
         1     2011-11-23 10:00:00   0.137300  0.384500       NaN       NaN       NaN
         2     2011-11-23 11:00:00   0.164200  0.137300  0.384500       NaN       NaN
```

```
3     2011-11-23 12:00:00    0.443071  0.164200  0.137300  0.384500       NaN
4     2011-11-23 13:00:00    0.263000  0.443071  0.164200  0.137300  0.384500
5     2011-11-23 14:00:00    0.254056  0.263000  0.443071  0.164200  0.137300
6     2011-11-23 15:00:00    0.200333  0.254056  0.263000  0.443071  0.164200
7     2011-11-23 16:00:00    0.196389  0.200333  0.254056  0.263000  0.443071
8     2011-11-23 17:00:00    0.257722  0.196389  0.200333  0.254056  0.263000
9     2011-11-23 18:00:00    0.261222  0.257722  0.196389  0.200333  0.254056
10    2011-11-23 19:00:00    0.363111  0.261222  0.257722  0.196389  0.200333
11    2011-11-23 20:00:00    0.465333  0.363111  0.261222  0.257722  0.196389
12    2011-11-23 21:00:00    0.386611  0.465333  0.363111  0.261222  0.257722
13    2011-11-23 22:00:00    0.329611  0.386611  0.465333  0.363111  0.261222
14    2011-11-23 23:00:00    0.261500  0.329611  0.386611  0.465333  0.363111
15    2011-11-24 00:00:00    0.304833  0.261500  0.329611  0.386611  0.465333
16    2011-11-24 01:00:00    0.324444  0.304833  0.261500  0.329611  0.386611
17    2011-11-24 02:00:00    0.183111  0.324444  0.304833  0.261500  0.329611
18    2011-11-24 03:00:00    0.150833  0.183111  0.324444  0.304833  0.261500
19    2011-11-24 04:00:00    0.136944  0.150833  0.183111  0.324444  0.304833
20    2011-11-24 05:00:00    0.114556  0.136944  0.150833  0.183111  0.324444
21    2011-11-24 06:00:00    0.146556  0.114556  0.136944  0.150833  0.183111
22    2011-11-24 07:00:00    0.205500  0.146556  0.114556  0.136944  0.150833
23    2011-11-24 08:00:00    0.160833  0.205500  0.146556  0.114556  0.136944
24    2011-11-24 09:00:00    0.160222  0.160833  0.205500  0.146556  0.114556
25    2011-11-24 10:00:00    0.218174  0.160222  0.160833  0.205500  0.146556
26    2011-11-24 11:00:00    0.187917  0.218174  0.160222  0.160833  0.205500
27    2011-11-24 12:00:00    0.200200  0.187917  0.218174  0.160222  0.160833
28    2011-11-24 13:00:00    0.217647  0.200200  0.187917  0.218174  0.160222
29    2011-11-24 14:00:00    0.214917  0.217647  0.200200  0.187917  0.218174
...                   ...         ...       ...       ...       ...       ...
19834 2014-02-26 19:00:00    0.398326  0.341063  0.253750  0.211036  0.207114
19835 2014-02-26 20:00:00    0.392014  0.398326  0.341063  0.253750  0.211036
19836 2014-02-26 21:00:00    0.361412  0.392014  0.398326  0.341063  0.253750
19837 2014-02-26 22:00:00    0.321322  0.361412  0.392014  0.398326  0.341063
19838 2014-02-26 23:00:00    0.257047  0.321322  0.361412  0.392014  0.398326
19839 2014-02-27 00:00:00    0.214636  0.257047  0.321322  0.361412  0.392014
19840 2014-02-27 01:00:00    0.166721  0.214636  0.257047  0.321322  0.361412
19841 2014-02-27 02:00:00    0.141002  0.166721  0.214636  0.257047  0.321322
19842 2014-02-27 03:00:00    0.130712  0.141002  0.166721  0.214636  0.257047
19843 2014-02-27 04:00:00    0.125984  0.130712  0.141002  0.166721  0.214636
19844 2014-02-27 05:00:00    0.131438  0.125984  0.130712  0.141002  0.166721
19845 2014-02-27 06:00:00    0.163112  0.131438  0.125984  0.130712  0.141002
19846 2014-02-27 07:00:00    0.230463  0.163112  0.131438  0.125984  0.130712
19847 2014-02-27 08:00:00    0.265486  0.230463  0.163112  0.131438  0.125984
19848 2014-02-27 09:00:00    0.243217  0.265486  0.230463  0.163112  0.131438
19849 2014-02-27 10:00:00    0.232092  0.243217  0.265486  0.230463  0.163112
19850 2014-02-27 11:00:00    0.223184  0.232092  0.243217  0.265486  0.230463
19851 2014-02-27 12:00:00    0.217468  0.223184  0.232092  0.243217  0.265486
19852 2014-02-27 13:00:00    0.216917  0.217468  0.223184  0.232092  0.243217
19853 2014-02-27 14:00:00    0.205666  0.216917  0.217468  0.223184  0.232092
```

```
19854 2014-02-27 15:00:00    0.216515  0.205666  0.216917  0.217468  0.223184
19855 2014-02-27 16:00:00    0.228163  0.216515  0.205666  0.216917  0.217468
19856 2014-02-27 17:00:00    0.264094  0.228163  0.216515  0.205666  0.216917
19857 2014-02-27 18:00:00    0.352217  0.264094  0.228163  0.216515  0.205666
19858 2014-02-27 19:00:00    0.397044  0.352217  0.264094  0.228163  0.216515
19859 2014-02-27 20:00:00    0.384705  0.397044  0.352217  0.264094  0.228163
19860 2014-02-27 21:00:00    0.364505  0.384705  0.397044  0.352217  0.264094
19861 2014-02-27 22:00:00    0.329392  0.364505  0.384705  0.397044  0.352217
19862 2014-02-27 23:00:00    0.264843  0.329392  0.364505  0.384705  0.397044
19863 2014-02-28 00:00:00    0.231215  0.264843  0.329392  0.364505  0.384705
```

	h-5	h-6	h-7	h-8	...	h-39	h-40 \
0	NaN	NaN	NaN	NaN	...	NaN	NaN
1	NaN	NaN	NaN	NaN	...	NaN	NaN
2	NaN	NaN	NaN	NaN	...	NaN	NaN
3	NaN	NaN	NaN	NaN	...	NaN	NaN
4	NaN	NaN	NaN	NaN	...	NaN	NaN
5	0.384500	NaN	NaN	NaN	...	NaN	NaN
6	0.137300	0.384500	NaN	NaN	...	NaN	NaN
7	0.164200	0.137300	0.384500	NaN	...	NaN	NaN
8	0.443071	0.164200	0.137300	0.384500	...	NaN	NaN
9	0.263000	0.443071	0.164200	0.137300	...	NaN	NaN
10	0.254056	0.263000	0.443071	0.164200	...	NaN	NaN
11	0.200333	0.254056	0.263000	0.443071	...	NaN	NaN
12	0.196389	0.200333	0.254056	0.263000	...	NaN	NaN
13	0.257722	0.196389	0.200333	0.254056	...	NaN	NaN
14	0.261222	0.257722	0.196389	0.200333	...	NaN	NaN
15	0.363111	0.261222	0.257722	0.196389	...	NaN	NaN
16	0.465333	0.363111	0.261222	0.257722	...	NaN	NaN
17	0.386611	0.465333	0.363111	0.261222	...	NaN	NaN
18	0.329611	0.386611	0.465333	0.363111	...	NaN	NaN
19	0.261500	0.329611	0.386611	0.465333	...	NaN	NaN
20	0.304833	0.261500	0.329611	0.386611	...	NaN	NaN
21	0.324444	0.304833	0.261500	0.329611	...	NaN	NaN
22	0.183111	0.324444	0.304833	0.261500	...	NaN	NaN
23	0.150833	0.183111	0.324444	0.304833	...	NaN	NaN
24	0.136944	0.150833	0.183111	0.324444	...	NaN	NaN
25	0.114556	0.136944	0.150833	0.183111	...	NaN	NaN
26	0.146556	0.114556	0.136944	0.150833	...	NaN	NaN
27	0.205500	0.146556	0.114556	0.136944	...	NaN	NaN
28	0.160833	0.205500	0.146556	0.114556	...	NaN	NaN
29	0.160222	0.160833	0.205500	0.146556	...	NaN	NaN
...	...	...	...	...	...	...	...
19834	0.208619	0.215434	0.213732	0.214957	...	0.122872	0.128418
19835	0.207114	0.208619	0.215434	0.213732	...	0.129602	0.122872
19836	0.211036	0.207114	0.208619	0.215434	...	0.156865	0.129602
19837	0.253750	0.211036	0.207114	0.208619	...	0.225861	0.156865
19838	0.341063	0.253750	0.211036	0.207114	...	0.257033	0.225861

19839	0.398326	0.341063	0.253750	0.211036	...	0.242793	0.257033
19840	0.392014	0.398326	0.341063	0.253750	...	0.237093	0.242793
19841	0.361412	0.392014	0.398326	0.341063	...	0.225474	0.237093
19842	0.321322	0.361412	0.392014	0.398326	...	0.219841	0.225474
19843	0.257047	0.321322	0.361412	0.392014	...	0.218353	0.219841
19844	0.214636	0.257047	0.321322	0.361412	...	0.211628	0.218353
19845	0.166721	0.214636	0.257047	0.321322	...	0.212213	0.211628
19846	0.141002	0.166721	0.214636	0.257047	...	0.227387	0.212213
19847	0.130712	0.141002	0.166721	0.214636	...	0.265711	0.227387
19848	0.125984	0.130712	0.141002	0.166721	...	0.351498	0.265711
19849	0.131438	0.125984	0.130712	0.141002	...	0.400632	0.351498
19850	0.163112	0.131438	0.125984	0.130712	...	0.387031	0.400632
19851	0.230463	0.163112	0.131438	0.125984	...	0.360566	0.387031
19852	0.265486	0.230463	0.163112	0.131438	...	0.322798	0.360566
19853	0.243217	0.265486	0.230463	0.163112	...	0.259397	0.322798
19854	0.232092	0.243217	0.265486	0.230463	...	0.211590	0.259397
19855	0.223184	0.232092	0.243217	0.265486	...	0.168859	0.211590
19856	0.217468	0.223184	0.232092	0.243217	...	0.141816	0.168859
19857	0.216917	0.217468	0.223184	0.232092	...	0.130937	0.141816
19858	0.205666	0.216917	0.217468	0.223184	...	0.124425	0.130937
19859	0.216515	0.205666	0.216917	0.217468	...	0.131991	0.124425
19860	0.228163	0.216515	0.205666	0.216917	...	0.164714	0.131991
19861	0.264094	0.228163	0.216515	0.205666	...	0.227026	0.164714
19862	0.352217	0.264094	0.228163	0.216515	...	0.256613	0.227026
19863	0.397044	0.352217	0.264094	0.228163	...	0.240898	0.256613

	h-41	h-42	h-43	h-44	h-45	h-46	h-47	\
0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
1	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
2	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
3	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
4	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
5	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
6	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
7	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
8	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
9	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
10	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
11	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
12	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
13	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
14	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
15	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
16	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
17	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
18	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
19	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
20	NaN	NaN	NaN	NaN	NaN	NaN	NaN	

21	NaN	NaN	NaN	NaN	NaN	NaN	NaN
22	NaN	NaN	NaN	NaN	NaN	NaN	NaN
23	NaN	NaN	NaN	NaN	NaN	NaN	NaN
24	NaN	NaN	NaN	NaN	NaN	NaN	NaN
25	NaN	NaN	NaN	NaN	NaN	NaN	NaN
26	NaN	NaN	NaN	NaN	NaN	NaN	NaN
27	NaN	NaN	NaN	NaN	NaN	NaN	NaN
28	NaN	NaN	NaN	NaN	NaN	NaN	NaN
29	NaN	NaN	NaN	NaN	NaN	NaN	NaN
...	...	...	...	...	...	...	...
19834	0.136327	0.159063	0.204375	0.245562	0.311922	0.351628	0.388410
19835	0.128418	0.136327	0.159063	0.204375	0.245562	0.311922	0.351628
19836	0.122872	0.128418	0.136327	0.159063	0.204375	0.245562	0.311922
19837	0.129602	0.122872	0.128418	0.136327	0.159063	0.204375	0.245562
19838	0.156865	0.129602	0.122872	0.128418	0.136327	0.159063	0.204375
19839	0.225861	0.156865	0.129602	0.122872	0.128418	0.136327	0.159063
19840	0.257033	0.225861	0.156865	0.129602	0.122872	0.128418	0.136327
19841	0.242793	0.257033	0.225861	0.156865	0.129602	0.122872	0.128418
19842	0.237093	0.242793	0.257033	0.225861	0.156865	0.129602	0.122872
19843	0.225474	0.237093	0.242793	0.257033	0.225861	0.156865	0.129602
19844	0.219841	0.225474	0.237093	0.242793	0.257033	0.225861	0.156865
19845	0.218353	0.219841	0.225474	0.237093	0.242793	0.257033	0.225861
19846	0.211628	0.218353	0.219841	0.225474	0.237093	0.242793	0.257033
19847	0.212213	0.211628	0.218353	0.219841	0.225474	0.237093	0.242793
19848	0.227387	0.212213	0.211628	0.218353	0.219841	0.225474	0.237093
19849	0.265711	0.227387	0.212213	0.211628	0.218353	0.219841	0.225474
19850	0.351498	0.265711	0.227387	0.212213	0.211628	0.218353	0.219841
19851	0.400632	0.351498	0.265711	0.227387	0.212213	0.211628	0.218353
19852	0.387031	0.400632	0.351498	0.265711	0.227387	0.212213	0.211628
19853	0.360566	0.387031	0.400632	0.351498	0.265711	0.227387	0.212213
19854	0.322798	0.360566	0.387031	0.400632	0.351498	0.265711	0.227387
19855	0.259397	0.322798	0.360566	0.387031	0.400632	0.351498	0.265711
19856	0.211590	0.259397	0.322798	0.360566	0.387031	0.400632	0.351498
19857	0.168859	0.211590	0.259397	0.322798	0.360566	0.387031	0.400632
19858	0.141816	0.168859	0.211590	0.259397	0.322798	0.360566	0.387031
19859	0.130937	0.141816	0.168859	0.211590	0.259397	0.322798	0.360566
19860	0.124425	0.130937	0.141816	0.168859	0.211590	0.259397	0.322798
19861	0.131991	0.124425	0.130937	0.141816	0.168859	0.211590	0.259397
19862	0.164714	0.131991	0.124425	0.130937	0.141816	0.168859	0.211590
19863	0.227026	0.164714	0.131991	0.124425	0.130937	0.141816	0.168859

	h-48
0	NaN
1	NaN
2	NaN
3	NaN
4	NaN
5	NaN

```
6        NaN
7        NaN
8        NaN
9        NaN
10       NaN
11       NaN
12       NaN
13       NaN
14       NaN
15       NaN
16       NaN
17       NaN
18       NaN
19       NaN
20       NaN
21       NaN
22       NaN
23       NaN
24       NaN
25       NaN
26       NaN
27       NaN
28       NaN
29       NaN
...      ...
19834  0.404668
19835  0.388410
19836  0.351628
19837  0.311922
19838  0.245562
19839  0.204375
19840  0.159063
19841  0.136327
19842  0.128418
19843  0.122872
19844  0.129602
19845  0.156865
19846  0.225861
19847  0.257033
19848  0.242793
19849  0.237093
19850  0.225474
19851  0.219841
19852  0.218353
19853  0.211628
19854  0.212213
19855  0.227387
19856  0.265711
```

```
19857   0.351498
19858   0.400632
19859   0.387031
19860   0.360566
19861   0.322798
19862   0.259397
19863   0.211590

[19864 rows x 50 columns]
```

In [62]: hourly_h=hourly_h.drop([0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23
         hourly_h=hourly_h.drop(['tstp'],axis=1)
         hourly_h.head(5)

Out[62]:   energy_hh   h-1   h-2   h-3   h-4   h-5   h-6 \
         49   0.192949 0.196711 0.196139 0.186861 0.170111 0.159056 0.197111
         50   0.164786 0.192949 0.196711 0.196139 0.186861 0.170111 0.159056
         51   0.177800 0.164786 0.192949 0.196711 0.196139 0.186861 0.170111
         52   0.180500 0.177800 0.164786 0.192949 0.196711 0.196139 0.186861
         53   0.168130 0.180500 0.177800 0.164786 0.192949 0.196711 0.196139

                 h-7   h-8   h-9 ...   h-39   h-40   h-41   h-42 \
         49   0.270833 0.294750 0.286889 ... 0.363111 0.261222 0.257722 0.196389
         50   0.197111 0.270833 0.294750 ... 0.465333 0.363111 0.261222 0.257722
         51   0.159056 0.197111 0.270833 ... 0.386611 0.465333 0.363111 0.261222
         52   0.170111 0.159056 0.197111 ... 0.329611 0.386611 0.465333 0.363111
         53   0.186861 0.170111 0.159056 ... 0.261500 0.329611 0.386611 0.465333

                 h-43   h-44   h-45   h-46   h-47   h-48
         49   0.200333 0.254056 0.263000 0.443071 0.164200 0.137300
         50   0.196389 0.200333 0.254056 0.263000 0.443071 0.164200
         51   0.257722 0.196389 0.200333 0.254056 0.263000 0.443071
         52   0.261222 0.257722 0.196389 0.200333 0.254056 0.263000
         53   0.363111 0.261222 0.257722 0.196389 0.200333 0.254056

         [5 rows x 49 columns]

In [64]: import keras
         from keras.models import Sequential
         from keras.layers import Dense
         from keras.layers import LSTM

         from keras.optimizers import SGD
         from sklearn.model_selection import StratifiedKFold
         from scipy.stats import uniform as sp_rand
         from scipy.stats import randint
         from time import time
         from sklearn import preprocessing
```

```
        import math
        from sklearn.metrics import mean_squared_error
```

Using TensorFlow backend.

In [65]: # definim model
        import tensorflow as tf
        model =Sequential()
        model.add(LSTM(50, activation='relu', input_shape=(48, 1)))
        model.add(Dense(1))
        model.compile(optimizer='adam', loss='mse')

WARNING:tensorflow:From c:\users\laura\appdata\local\programs\python\python37\lib\site-packages
Instructions for updating:
Colocations handled automatically by placer.

In [66]: #normalitzem
        scaler=preprocessing.MinMaxScaler(feature_range=(0, 1))
        hourly_norm=scaler.fit_transform(hourly_h)

In [72]: #Seleccionem dades per y i X
        y_hourly=hourly_norm[:,0]
        X_hourly=hourly_norm[:,1:49]

        #Reshape de [samples,timesteps] a [samples,timesteps,features]
        #X_daily_list=X_daily.values#.tolist()
        X_hourly=np.reshape(X_hourly, (X_hourly.shape[0],48,1))

In [68]: len(X_hourly)

Out[68]: 19815

In [73]: #Walk forward per test i train
        minim=5000
        n_train=6464
        lenght=7928

        llista_prediccions=list()
        llista_preditrain=list()
        real=list()

        for i in range(n_train,lenght):
            minim=minim+1
            X_train,X_test= X_hourly[minim:i],X_hourly[i:i+1]
            y_train,y_test= y_hourly[minim:i],y_hourly[i:i+1]
```

```python
        #fem fit al model
        model.fit(X_train, y_train, epochs=50, verbose=0)

        #Predim per cadascun
        preditest=model.predict(X_test)
        llista_prediccions.append(preditest)

        preditrain=model.predict(X_train)
        llista_preditrain.append(preditrain)

        real.append(y_test)
```

```
    KeyboardInterrupt                         Traceback (most recent call last)

    <ipython-input-73-1e9c9d61dff0> in <module>
      14
      15      #fem fit al model
---> 16      model.fit(X_train, y_train, epochs=50, verbose=0)
      17
      18      #Predim per cadascun


    c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\keras\engine\t
      1037                                         initial_epoch=initial_epoch,
      1038                                         steps_per_epoch=steps_per_epoch,
-> 1039                                         validation_steps=validation_steps)
      1040
      1041      def evaluate(self, x=None, y=None,


    c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\keras\engine\t
      197                    ins_batch[i] = ins_batch[i].toarray()
      198
--> 199                outs = f(ins_batch)
      200                outs = to_list(outs)
      201                for l, o in zip(out_labels, outs):


    c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\keras\backend\t
      2713                return self._legacy_call(inputs)
      2714
-> 2715            return self._call(inputs)
      2716        else:
      2717            if py_any(is_tensor(x) for x in inputs):
```

```
      c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\keras\backend\
      2673              fetched = self._callable_fn(*array_vals, run_metadata=self.run_metadata
      2674          else:
  -> 2675              fetched = self._callable_fn(*array_vals)
      2676          return fetched[:len(self.outputs)]
      2677


      c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\tensorflow\pyt
      1437              ret = tf_session.TF_SessionRunCallable(
      1438                  self._session._session, self._handle, args, status,
  -> 1439                  run_metadata_ptr)
      1440          if run_metadata:
      1441              proto_data = tf_session.TF_GetBuffer(run_metadata_ptr)


      c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\tensorflow\pyt
      522  def __exit__(self, type_arg, value_arg, traceback_arg):
      523      try:
  --> 524        if c_api.TF_GetCode(self.status.status) != 0:
      525          raise _make_specific_exception(
      526              None, None,


      KeyboardInterrupt:
```

In [ ]: *#Després de 72 hores executant, encara no ha acabat. Parem ja que sinó ens apareix Mem*

In [ ]:
```python
testScore=list()
llistaerror=list()
for i in range(len(llista_prediccions)):
    #Calculem RMSE
    testScore.append(math.sqrt(mean_squared_error(real[i], llista_prediccions[i])))

    #Calculem error
    error= math.fabs(real[i]-llista_prediccions[i])/real[i]
    llistaerror.append(error)
```

In [ ]:
```python
plt.plot(llista_prediccions)
plt.plot(real)
plt.title("Consum real i predit")
plt.show()
```

```
          plt.plot(testScore)
          plt.title('Error RMSE')
          plt.show()

          plt.plot(llistaerror)
          plt.title("Error percentual")
          plt.show()

In [ ]: prova=hourly_h.iloc[n_train:lenght]
          prova
          #len(predis)
          #lenght-n_train
          prova['predi']=llista_prediccions
          prova['y']=real
          prova=prova.drop(['energy_hh'], axis=1)
          prova

          prova=prova[['predi','y','h-1','h-2','h-3','h-4','h-5','h-6','h-7','h-8','h-9','h-10',
          prova

In [ ]: # Convert predictions back to normal values

          predi = scaler.inverse_transform(prova)

In [ ]: #Fem una llista amb les prediccions i una llista amb y(valor real)

          listpredi=list()
          for i in range(len(predi)):
              listpredi.append(predi[i][0])
          listpredi

          listy=list()
          for i in range(len(predi)):
              listy.append(predi[i][1])
          listy

In [ ]: ##Mostrem
          plt.plot(listpredi, label="predit")
          plt.plot(listy, label="real")
          plt.legend(loc="lower right")
          plt.show()

In [ ]: llista_errors=list()
          llista_errorsabs=list()
          llista_errorsres=list()


          for i in range(len(listpredi)):
```

```
            valor=listy[i]-listpredi[i]
            valorabs=math.fabs(valor)
            valorrespecte=valorabs/listy[i]
            llista_errors.append(valor)
            llista_errorsabs.append(valorabs)
            llista_errorsres.append(valorrespecte)

        plt.plot(llista_errorsres)
        print(sum(llista_errorsres)/(len(llista_errorsres)))
```

In [ ]:

In [70]:
```
         #Walk forward per test i train
         minim=2000
         n_train=10760
         lenght=len(hourly_h)-48

         llista_prediccions=list()
         llista_preditrain=list()
         llista_scores=list()
         llista_scoretrain=list()
         sumScores=0

         for i in range(n_train,lenght):
             #minim=minim+1
             X_train,X_test= X_hourly[minim:i],X_hourly[i:i+1]
             y_train,y_test= y_hourly[minim:i],y_hourly[i:i+1]

             #fem fit al model
             model.fit(X_train, y_train, epochs=50, verbose=0)

             #Predim per cadascun
             preditest=model.predict(X_test)
             llista_prediccions.append(preditest)

             preditrain=model.predict(X_train)
             llista_preditrain.append(preditrain)

             trainScore = math.sqrt(mean_squared_error(y_train, preditrain))
             llista_scoretrain.append(trainScore )


             testScore = math.sqrt(mean_squared_error(y_test, preditest))
             llista_scores.append(testScore)

             sumScores=sumScores+testScore
```

```
WARNING:tensorflow:From c:\users\laura\appdata\local\programs\python\python37\lib\site-packages
Instructions for updating:
```

Use tf.cast instead.

```
    ---------------------------------------------------------------------------

    ValueError                                Traceback (most recent call last)

    <ipython-input-70-3acd1a6cced8> in <module>
     25     llista_preditrain.append(preditrain)
     26
---> 27     trainScore = math.sqrt(mean_squared_error(y_train, preditrain))
     28     llista_scoretrain.append(trainScore )
     29


    c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\sklearn\metrics
    237     """
    238     y_type, y_true, y_pred, multioutput = _check_reg_targets(
--> 239         y_true, y_pred, multioutput)
    240     check_consistent_length(y_true, y_pred, sample_weight)
    241     output_errors = np.average((y_true - y_pred) ** 2, axis=0,


    c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\sklearn\metrics
     75     check_consistent_length(y_true, y_pred)
     76     y_true = check_array(y_true, ensure_2d=False)
---> 77     y_pred = check_array(y_pred, ensure_2d=False)
     78
     79     if y_true.ndim == 1:


    c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\sklearn\utils\
    571             if force_all_finite:
    572                 _assert_all_finite(array,
--> 573                                    allow_nan=force_all_finite == 'allow-nan')
    574
    575     shape_repr = _shape_repr(array.shape)


    c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\sklearn\utils\
     54                 not allow_nan and not np.isfinite(X).all()):
     55             type_err = 'infinity' if allow_nan else 'NaN, infinity'
---> 56             raise ValueError(msg_err.format(type_err, X.dtype))
     57
     58
```

```
ValueError: Input contains NaN, infinity or a value too large for dtype('float32').
```

In [ ]:

In [ ]: #Insertem variable hora
        hourly['hour']= hourly['tstp'].dt.hour

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: