M08 _Xarxa_walkforard_normalitzat_multivariate_tempmin_14dies

December 21, 2019

1 Xarxa neuronal

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

        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
```

```
Using TensorFlow backend.
```

1.1 Consum diari total multivariate one-step

```
In [72]: daily=pd.read_csv('C:/Users/Laura/Desktop/Smart meters London/workspace R/Dades netes,
         daily.head(5)
```

```
Out[72]:          date  apparentTemperatureMax  apparentTemperatureMin  humidity  \
         0  2013-05-01                   16.96                    3.39      0.43
         1  2013-07-14                   29.30                   17.96      0.45
         2  2012-03-27                   21.14                    4.88      0.49
         3  2012-03-26                   18.26                    4.77      0.53
         4  2013-07-16                   30.28                   17.14      0.54

            energy_sum
         0    8.793503
```

```
1    8.329979
2    9.567694
3    9.984956
4    8.023428
```

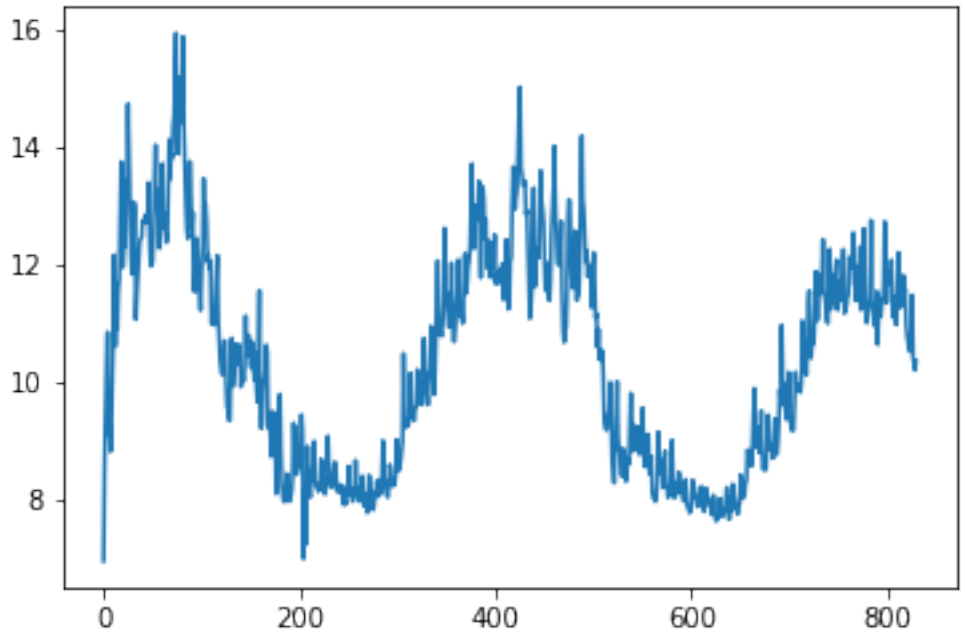
In [73]:
```
#Ens quedem amb date i energy_sum, ordenem valors per data i resetejem index
daily_dia=daily[['date','energy_sum','apparentTemperatureMax','apparentTemperatureMin
daily_dia.head(5)
```

Out[73]:

	index	date	energy_sum	apparentTemperatureMax	apparentTemperatureMin
0	809	2011-11-23	6.952692	10.36	2.18
1	728	2011-11-24	8.536480	12.93	7.01
2	423	2011-11-25	9.499781	13.03	4.84
3	478	2011-11-26	10.267707	12.96	4.69
4	212	2011-11-27	10.850805	13.54	2.94

In [18]:
```
plt.plot(daily_dia.energy_sum )
```

Out[18]:
```
[<matplotlib.lines.Line2D at 0x1d48d92d710>]
```



In [74]:
```
daily_dia['t-1']=daily_dia['energy_sum'].shift(1)
daily_dia['t-2']=daily_dia['energy_sum'].shift(2)
daily_dia['t-3']=daily_dia['energy_sum'].shift(3)
daily_dia['t-4']=daily_dia['energy_sum'].shift(4)
daily_dia['t-5']=daily_dia['energy_sum'].shift(5)
daily_dia['t-6']=daily_dia['energy_sum'].shift(6)
daily_dia['t-7']=daily_dia['energy_sum'].shift(7)
daily_dia['t-8']=daily_dia['energy_sum'].shift(8)
daily_dia['t-9']=daily_dia['energy_sum'].shift(9)
daily_dia['t-10']=daily_dia['energy_sum'].shift(10)
daily_dia['t-11']=daily_dia['energy_sum'].shift(11)
daily_dia['t-12']=daily_dia['energy_sum'].shift(12)
daily_dia['t-13']=daily_dia['energy_sum'].shift(13)
daily_dia['t-14']=daily_dia['energy_sum'].shift(14)

daily_dia['temp(t-1)']=daily_dia['apparentTemperatureMax'].shift(1)
daily_dia['temp(t-2)']=daily_dia['apparentTemperatureMax'].shift(2)
daily_dia['temp(t-3)']=daily_dia['apparentTemperatureMax'].shift(3)
daily_dia['temp(t-4)']=daily_dia['apparentTemperatureMax'].shift(4)
daily_dia['temp(t-5)']=daily_dia['apparentTemperatureMax'].shift(5)
daily_dia['temp(t-6)']=daily_dia['apparentTemperatureMax'].shift(6)
daily_dia['temp(t-7)']=daily_dia['apparentTemperatureMax'].shift(7)
daily_dia['temp(t-8)']=daily_dia['apparentTemperatureMax'].shift(8)
daily_dia['temp(t-9)']=daily_dia['apparentTemperatureMax'].shift(9)
daily_dia['temp(t-10)']=daily_dia['apparentTemperatureMax'].shift(10)
daily_dia['temp(t-11)']=daily_dia['apparentTemperatureMax'].shift(11)
daily_dia['temp(t-12)']=daily_dia['apparentTemperatureMax'].shift(12)
daily_dia['temp(t-13)']=daily_dia['apparentTemperatureMax'].shift(13)
daily_dia['temp(t-14)']=daily_dia['apparentTemperatureMax'].shift(14)

daily_dia['tempmin(t-1)']=daily_dia['apparentTemperatureMin'].shift(1)
daily_dia['tempmin(t-2)']=daily_dia['apparentTemperatureMin'].shift(2)
daily_dia['tempmin(t-3)']=daily_dia['apparentTemperatureMin'].shift(3)
daily_dia['tempmin(t-4)']=daily_dia['apparentTemperatureMin'].shift(4)
daily_dia['tempmin(t-5)']=daily_dia['apparentTemperatureMin'].shift(5)
daily_dia['tempmin(t-6)']=daily_dia['apparentTemperatureMin'].shift(6)
daily_dia['tempmin(t-7)']=daily_dia['apparentTemperatureMin'].shift(7)
daily_dia['tempmin(t-8)']=daily_dia['apparentTemperatureMin'].shift(8)
daily_dia['tempmin(t-9)']=daily_dia['apparentTemperatureMin'].shift(9)
daily_dia['tempmin(t-10)']=daily_dia['apparentTemperatureMin'].shift(10)
daily_dia['tempmin(t-11)']=daily_dia['apparentTemperatureMin'].shift(11)
daily_dia['tempmin(t-12)']=daily_dia['apparentTemperatureMin'].shift(12)
daily_dia['tempmin(t-13)']=daily_dia['apparentTemperatureMin'].shift(13)
daily_dia['tempmin(t-14)']=daily_dia['apparentTemperatureMin'].shift(14)

daily_dia
```

Out[74]:
```
      index        date  energy_sum  apparentTemperatureMax  \
```

0	809	2011-11-23	6.952692	10.36
1	728	2011-11-24	8.536480	12.93
2	423	2011-11-25	9.499781	13.03
3	478	2011-11-26	10.267707	12.96
4	212	2011-11-27	10.850805	13.54
5	633	2011-11-28	9.103382	12.58
6	508	2011-11-29	9.274873	13.47
7	382	2011-11-30	8.813513	11.87
8	510	2011-12-01	9.227707	12.15
9	664	2011-12-02	10.145910	5.33
10	422	2011-12-03	10.780273	11.42
11	499	2011-12-04	12.163127	6.66
12	329	2011-12-05	10.609714	3.13
13	530	2011-12-06	11.673417	3.77
14	131	2011-12-07	10.889362	5.14
15	466	2011-12-08	11.525150	12.89
16	184	2011-12-09	11.759837	3.99
17	461	2011-12-10	12.633801	3.14
18	699	2011-12-11	13.749174	5.72
19	570	2011-12-12	11.951958	5.94
20	277	2011-12-13	11.957446	12.08
21	417	2011-12-14	12.392776	2.88
22	334	2011-12-15	12.307079	4.38
23	695	2011-12-16	13.376080	0.99
24	627	2011-12-17	13.511968	1.72
25	565	2011-12-18	14.732271	1.98
26	812	2011-12-19	13.774471	4.02
27	471	2011-12-20	12.709106	4.98
28	815	2011-12-21	12.148570	12.14
29	676	2011-12-22	11.839403	12.14
..	...	...	...	...
800	744	2014-01-29	11.800777	2.53
801	769	2014-01-30	11.685169	5.86
802	768	2014-01-31	11.857957	5.27
803	311	2014-02-01	11.710582	6.86
804	213	2014-02-02	12.078164	6.48
805	419	2014-02-03	11.280011	4.59
806	278	2014-02-04	11.095584	5.63
807	333	2014-02-05	11.415105	5.86
808	504	2014-02-06	11.445403	7.34
809	411	2014-02-07	10.972318	8.44
810	341	2014-02-08	11.569300	5.67
811	100	2014-02-09	12.202967	3.91
812	572	2014-02-10	11.264175	7.07
813	307	2014-02-11	11.452649	4.06
814	276	2014-02-12	11.679099	4.73
815	130	2014-02-13	11.285737	3.42
816	465	2014-02-14	11.816914	12.02

```
817    146  2014-02-15   11.490470                  5.79
818    306  2014-02-16   11.582159                  7.88
819    546  2014-02-17   10.979566                 10.67
820    671  2014-02-18   10.781898                 10.13
821    666  2014-02-19   10.674624                 10.13
822    581  2014-02-20   10.573835                 12.50
823    207  2014-02-21   10.518126                 10.15
824    185  2014-02-22   10.776242                 11.63
825    316  2014-02-23   11.480411                 11.94
826    261  2014-02-24   10.411403                 14.23
827    383  2014-02-25   10.294997                 11.43
828    238  2014-02-26   10.202945                 11.29
829    252  2014-02-27   10.356350                 10.31

     apparentTemperatureMin        t-1        t-2        t-3        t-4  \
0                      2.18        NaN        NaN        NaN        NaN
1                      7.01   6.952692        NaN        NaN        NaN
2                      4.84   8.536480   6.952692        NaN        NaN
3                      4.69   9.499781   8.536480   6.952692        NaN
4                      2.94  10.267707   9.499781   8.536480   6.952692
5                      1.31  10.850805  10.267707   9.499781   8.536480
6                      3.39   9.103382  10.850805  10.267707   9.499781
7                      3.34   9.274873   9.103382  10.850805  10.267707
8                      5.29   8.813513   9.274873   9.103382  10.850805
9                      0.46   9.227707   8.813513   9.274873   9.103382
10                     4.71  10.145910   9.227707   8.813513   9.274873
11                     1.03  10.780273  10.145910   9.227707   8.813513
12                    -1.69  12.163127  10.780273  10.145910   9.227707
13                    -1.61  10.609714  12.163127  10.780273  10.145910
14                     0.94  11.673417  10.609714  12.163127  10.780273
15                     0.63  10.889362  11.673417  10.609714  12.163127
16                    -1.42  11.525150  10.889362  11.673417  10.609714
17                    -3.42  11.759837  11.525150  10.889362  11.673417
18                     0.11  12.633801  11.759837  11.525150  10.889362
19                    -0.64  13.749174  12.633801  11.759837  11.525150
20                     0.22  11.951958  13.749174  12.633801  11.759837
21                     0.78  11.957446  11.951958  13.749174  12.633801
22                     1.07  12.392776  11.957446  11.951958  13.749174
23                    -2.65  12.307079  12.392776  11.957446  11.951958
24                    -3.56  13.376080  12.307079  12.392776  11.957446
25                    -4.12  13.511968  13.376080  12.307079  12.392776
26                    -3.67  14.732271  13.511968  13.376080  12.307079
27                     1.68  13.774471  14.732271  13.511968  13.376080
28                     3.84  12.709106  13.774471  14.732271  13.511968
29                     5.37  12.148570  12.709106  13.774471  14.732271
..                      ...        ...        ...        ...        ...
800                    0.18  11.344805  11.753871  12.729659  11.620778
801                    0.61  11.800777  11.344805  11.753871  12.729659
```

802	0.29	11.685169	11.800777	11.344805	11.753871
803	1.10	11.857957	11.685169	11.800777	11.344805
804	3.21	11.710582	11.857957	11.685169	11.800777
805	1.96	12.078164	11.710582	11.857957	11.685169
806	1.12	11.280011	12.078164	11.710582	11.857957
807	1.03	11.095584	11.280011	12.078164	11.710582
808	1.96	11.415105	11.095584	11.280011	12.078164
809	-0.86	11.445403	11.415105	11.095584	11.280011
810	2.19	10.972318	11.445403	11.415105	11.095584
811	1.38	11.569300	10.972318	11.445403	11.415105
812	0.89	12.202967	11.569300	10.972318	11.445403
813	-0.57	11.264175	12.202967	11.569300	10.972318
814	-1.20	11.452649	11.264175	12.202967	11.569300
815	0.05	11.679099	11.452649	11.264175	12.202967
816	0.45	11.285737	11.679099	11.452649	11.264175
817	1.77	11.816914	11.285737	11.679099	11.452649
818	-1.03	11.490470	11.816914	11.285737	11.679099
819	2.84	11.582159	11.490470	11.816914	11.285737
820	3.83	10.979566	11.582159	11.490470	11.816914
821	2.65	10.781898	10.979566	11.582159	11.490470
822	3.95	10.674624	10.781898	10.979566	11.582159
823	0.19	10.573835	10.674624	10.781898	10.979566
824	1.59	10.518126	10.573835	10.674624	10.781898
825	5.53	10.776242	10.518126	10.573835	10.674624
826	5.52	11.480411	10.776242	10.518126	10.573835
827	3.89	10.411403	11.480411	10.776242	10.518126
828	1.67	10.294997	10.411403	11.480411	10.776242
829	1.41	10.202945	10.294997	10.411403	11.480411

	t-5	...	tempmin(t-5)	tempmin(t-6)	tempmin(t-7)	tempmin(t-8)	\
0	NaN	...	NaN	NaN	NaN	NaN	
1	NaN	...	NaN	NaN	NaN	NaN	
2	NaN	...	NaN	NaN	NaN	NaN	
3	NaN	...	NaN	NaN	NaN	NaN	
4	NaN	...	NaN	NaN	NaN	NaN	
5	6.952692	...	2.18	NaN	NaN	NaN	
6	8.536480	...	7.01	2.18	NaN	NaN	
7	9.499781	...	4.84	7.01	2.18	NaN	
8	10.267707	...	4.69	4.84	7.01	2.18	
9	10.850805	...	2.94	4.69	4.84	7.01	
10	9.103382	...	1.31	2.94	4.69	4.84	
11	9.274873	...	3.39	1.31	2.94	4.69	
12	8.813513	...	3.34	3.39	1.31	2.94	
13	9.227707	...	5.29	3.34	3.39	1.31	
14	10.145910	...	0.46	5.29	3.34	3.39	
15	10.780273	...	4.71	0.46	5.29	3.34	
16	12.163127	...	1.03	4.71	0.46	5.29	
17	10.609714	...	-1.69	1.03	4.71	0.46	

```
18   11.673417  ...        -1.61        -1.69         1.03         4.71
19   10.889362  ...         0.94        -1.61        -1.69         1.03
20   11.525150  ...         0.63         0.94        -1.61        -1.69
21   11.759837  ...        -1.42         0.63         0.94        -1.61
22   12.633801  ...        -3.42        -1.42         0.63         0.94
23   13.749174  ...         0.11        -3.42        -1.42         0.63
24   11.951958  ...        -0.64         0.11        -3.42        -1.42
25   11.957446  ...         0.22        -0.64         0.11        -3.42
26   12.392776  ...         0.78         0.22        -0.64         0.11
27   12.307079  ...         1.07         0.78         0.22        -0.64
28   13.376080  ...        -2.65         1.07         0.78         0.22
29   13.511968  ...        -3.56        -2.65         1.07         0.78
..         ...  ...          ...          ...          ...          ...
800  11.409880  ...         0.19         0.25         3.08         1.97
801  11.620778  ...         1.76         0.19         0.25         3.08
802  12.729659  ...        -1.30         1.76         0.19         0.25
803  11.753871  ...        -2.02        -1.30         1.76         0.19
804  11.344805  ...         1.96        -2.02        -1.30         1.76
805  11.800777  ...         0.18         1.96        -2.02        -1.30
806  11.685169  ...         0.61         0.18         1.96        -2.02
807  11.857957  ...         0.29         0.61         0.18         1.96
808  11.710582  ...         1.10         0.29         0.61         0.18
809  12.078164  ...         3.21         1.10         0.29         0.61
810  11.280011  ...         1.96         3.21         1.10         0.29
811  11.095584  ...         1.12         1.96         3.21         1.10
812  11.415105  ...         1.03         1.12         1.96         3.21
813  11.445403  ...         1.96         1.03         1.12         1.96
814  10.972318  ...        -0.86         1.96         1.03         1.12
815  11.569300  ...         2.19        -0.86         1.96         1.03
816  12.202967  ...         1.38         2.19        -0.86         1.96
817  11.264175  ...         0.89         1.38         2.19        -0.86
818  11.452649  ...        -0.57         0.89         1.38         2.19
819  11.679099  ...        -1.20        -0.57         0.89         1.38
820  11.285737  ...         0.05        -1.20        -0.57         0.89
821  11.816914  ...         0.45         0.05        -1.20        -0.57
822  11.490470  ...         1.77         0.45         0.05        -1.20
823  11.582159  ...        -1.03         1.77         0.45         0.05
824  10.979566  ...         2.84        -1.03         1.77         0.45
825  10.781898  ...         3.83         2.84        -1.03         1.77
826  10.674624  ...         2.65         3.83         2.84        -1.03
827  10.573835  ...         3.95         2.65         3.83         2.84
828  10.518126  ...         0.19         3.95         2.65         3.83
829  10.776242  ...         1.59         0.19         3.95         2.65

     tempmin(t-9)  tempmin(t-10)  tempmin(t-11)  tempmin(t-12)  tempmin(t-13)  \
0             NaN            NaN            NaN            NaN            NaN
1             NaN            NaN            NaN            NaN            NaN
2             NaN            NaN            NaN            NaN            NaN
```

3	NaN	NaN	NaN	NaN	NaN
4	NaN	NaN	NaN	NaN	NaN
5	NaN	NaN	NaN	NaN	NaN
6	NaN	NaN	NaN	NaN	NaN
7	NaN	NaN	NaN	NaN	NaN
8	NaN	NaN	NaN	NaN	NaN
9	2.18	NaN	NaN	NaN	NaN
10	7.01	2.18	NaN	NaN	NaN
11	4.84	7.01	2.18	NaN	NaN
12	4.69	4.84	7.01	2.18	NaN
13	2.94	4.69	4.84	7.01	2.18
14	1.31	2.94	4.69	4.84	7.01
15	3.39	1.31	2.94	4.69	4.84
16	3.34	3.39	1.31	2.94	4.69
17	5.29	3.34	3.39	1.31	2.94
18	0.46	5.29	3.34	3.39	1.31
19	4.71	0.46	5.29	3.34	3.39
20	1.03	4.71	0.46	5.29	3.34
21	-1.69	1.03	4.71	0.46	5.29
22	-1.61	-1.69	1.03	4.71	0.46
23	0.94	-1.61	-1.69	1.03	4.71
24	0.63	0.94	-1.61	-1.69	1.03
25	-1.42	0.63	0.94	-1.61	-1.69
26	-3.42	-1.42	0.63	0.94	-1.61
27	0.11	-3.42	-1.42	0.63	0.94
28	-0.64	0.11	-3.42	-1.42	0.63
29	0.22	-0.64	0.11	-3.42	-1.42
..	...	...	...	...	...
800	1.30	2.11	4.83	2.83	3.91
801	1.97	1.30	2.11	4.83	2.83
802	3.08	1.97	1.30	2.11	4.83
803	0.25	3.08	1.97	1.30	2.11
804	0.19	0.25	3.08	1.97	1.30
805	1.76	0.19	0.25	3.08	1.97
806	-1.30	1.76	0.19	0.25	3.08
807	-2.02	-1.30	1.76	0.19	0.25
808	1.96	-2.02	-1.30	1.76	0.19
809	0.18	1.96	-2.02	-1.30	1.76
810	0.61	0.18	1.96	-2.02	-1.30
811	0.29	0.61	0.18	1.96	-2.02
812	1.10	0.29	0.61	0.18	1.96
813	3.21	1.10	0.29	0.61	0.18
814	1.96	3.21	1.10	0.29	0.61
815	1.12	1.96	3.21	1.10	0.29
816	1.03	1.12	1.96	3.21	1.10
817	1.96	1.03	1.12	1.96	3.21
818	-0.86	1.96	1.03	1.12	1.96
819	2.19	-0.86	1.96	1.03	1.12

820	1.38	2.19	-0.86	1.96	1.03
821	0.89	1.38	2.19	-0.86	1.96
822	-0.57	0.89	1.38	2.19	-0.86
823	-1.20	-0.57	0.89	1.38	2.19
824	0.05	-1.20	-0.57	0.89	1.38
825	0.45	0.05	-1.20	-0.57	0.89
826	1.77	0.45	0.05	-1.20	-0.57
827	-1.03	1.77	0.45	0.05	-1.20
828	2.84	-1.03	1.77	0.45	0.05
829	3.83	2.84	-1.03	1.77	0.45

	tempmin(t-14)
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	2.18
15	7.01
16	4.84
17	4.69
18	2.94
19	1.31
20	3.39
21	3.34
22	5.29
23	0.46
24	4.71
25	1.03
26	-1.69
27	-1.61
28	0.94
29	0.63
..	...
800	2.89
801	3.91
802	2.83
803	4.83
804	2.11

```
805           1.30
806           1.97
807           3.08
808           0.25
809           0.19
810           1.76
811          -1.30
812          -2.02
813           1.96
814           0.18
815           0.61
816           0.29
817           1.10
818           3.21
819           1.96
820           1.12
821           1.03
822           1.96
823          -0.86
824           2.19
825           1.38
826           0.89
827          -0.57
828          -1.20
829           0.05

[830 rows x 47 columns]
```

In [60]:
```
daily_dia_prova1=daily_dia
```

In [75]:
```
#Ens quedem amb energies i temperatures
#No agafem apparent temperature max ja que quan fem la predicció representa que no ho
daily_dia=daily_dia.drop(['index','date','apparentTemperatureMax','apparentTemperatur
daily_dia.head(5)
```

Out[75]:

	energy_sum	t-1	t-2	t-3	t-4	t-5	t-6	t-7	t-8	\
0	6.952692	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
1	8.536480	6.952692	NaN	NaN	NaN	NaN	NaN	NaN	NaN	
2	9.499781	8.536480	6.952692	NaN	NaN	NaN	NaN	NaN	NaN	
3	10.267707	9.499781	8.536480	6.952692	NaN	NaN	NaN	NaN	NaN	
4	10.850805	10.267707	9.499781	8.536480	6.952692	NaN	NaN	NaN	NaN	

	t-9	...	tempmin(t-5)	tempmin(t-6)	tempmin(t-7)	tempmin(t-8)	\
0	NaN	...	NaN	NaN	NaN	NaN	
1	NaN	...	NaN	NaN	NaN	NaN	
2	NaN	...	NaN	NaN	NaN	NaN	
3	NaN	...	NaN	NaN	NaN	NaN	
4	NaN	...	NaN	NaN	NaN	NaN	

```
   tempmin(t-9)  tempmin(t-10)  tempmin(t-11)  tempmin(t-12)  tempmin(t-13)  \
0           NaN            NaN            NaN            NaN            NaN
1           NaN            NaN            NaN            NaN            NaN
2           NaN            NaN            NaN            NaN            NaN
3           NaN            NaN            NaN            NaN            NaN
4           NaN            NaN            NaN            NaN            NaN

   tempmin(t-14)
0            NaN
1            NaN
2            NaN
3            NaN
4            NaN

[5 rows x 43 columns]
```

In [76]:
```
#Eliminem les 14 primeres files ja que contenen NaN (valors buits)


daily_dia=daily_dia.drop([0,1,2,3,4,5,6,7,8,9,10,11,12,13])
daily_dia.head(5)
```

Out[76]:
```
    energy_sum        t-1        t-2        t-3        t-4        t-5  \
14   10.889362  11.673417  10.609714  12.163127  10.780273  10.145910
15   11.525150  10.889362  11.673417  10.609714  12.163127  10.780273
16   11.759837  11.525150  10.889362  11.673417  10.609714  12.163127
17   12.633801  11.759837  11.525150  10.889362  11.673417  10.609714
18   13.749174  12.633801  11.759837  11.525150  10.889362  11.673417

          t-6        t-7        t-8        t-9  ...  tempmin(t-5)  \
14   9.227707   8.813513   9.274873   9.103382  ...          0.46
15  10.145910   9.227707   8.813513   9.274873  ...          4.71
16  10.780273  10.145910   9.227707   8.813513  ...          1.03
17  12.163127  10.780273  10.145910   9.227707  ...         -1.69
18  10.609714  12.163127  10.780273  10.145910  ...         -1.61

    tempmin(t-6)  tempmin(t-7)  tempmin(t-8)  tempmin(t-9)  tempmin(t-10)  \
14          5.29          3.34          3.39          1.31           2.94
15          0.46          5.29          3.34          3.39           1.31
16          4.71          0.46          5.29          3.34           3.39
17          1.03          4.71          0.46          5.29           3.34
18         -1.69          1.03          4.71          0.46           5.29

    tempmin(t-11)  tempmin(t-12)  tempmin(t-13)  tempmin(t-14)
14           4.69           4.84           7.01           2.18
15           2.94           4.69           4.84           7.01
16           1.31           2.94           4.69           4.84
```

```
17          3.39          1.31          2.94          4.69
18          3.34          3.39          1.31          2.94

[5 rows x 43 columns]
```

```
In [8]: len(daily_dia)
```

```
Out[8]: 816
```

```
In [77]: #normalitzem
         scaler=preprocessing.MinMaxScaler(feature_range=(0, 1))
         daily_dia_norm=scaler.fit_transform(daily_dia)
```

```
In [78]: #Seleccionem dades per test i train
         y_daily=daily_dia_norm[:,0]
         X_daily=daily_dia_norm[:,1:44]

         #y_daily=daily_dia['energy_sum']
         #X_daily=daily_dia.drop(['energy_sum'], axis='columns')



         #Reshape de [samples,timesteps] a [samples,timesteps,features]

         #Enlloc de 14 features en son 7 de una feature i 7 duna altre
         X_daily=np.reshape(X_daily, (X_daily.shape[0], 14,3))
```

```
In [9]: # definim model
        import tensorflow as tf
        model =Sequential()
        model.add(LSTM(50, activation='relu', input_shape=(14, 3)))
        model.add(Dense(1))
        model.compile(optimizer='adam', loss='mse', metrics=['accuracy'])
```

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

```
In [10]: import math
         from sklearn.metrics import mean_squared_error

         #Walk forward per test i train
         minim=100
         n_train=465
         lenght=len(daily_dia)

         llista_evaluate=list()
         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_daily[minim:i],X_daily[i:i+1]
    y_train,y_test= y_daily[minim:i],y_daily[i:i+1]

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

    #mostrem score per cada model
    score=model.evaluate(X_test,y_test,verbose=0)
    llista_evaluate.append(score)

    #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.
```

```
In [11]: #Dividim la suma de scores de test entre el nombre de prediccions per obtenir la mitj
         sumScores/(lenght-n_train)
```

```
Out[11]: 0.03591068968262813
```

```
In [15]: llista_scores
```

```
Out[15]: [0.0014121823089174868,
          0.007333743349649646,
          0.005706578724862688,
          0.014390639406105743,
```

0.009098549057546812,
0.01329279513443038,
0.021471329631422842,
0.043919121252529614,
0.05675942116270338,
0.03814397811253434,
0.0301952933990961,
0.027583659796252435,
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0.018120284378466023,
0.015910385607023736,
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0.011021278416565305,
0.02075996211712683,
0.0061041358197790885,
0.03121007033289991,
0.03202142755408777,
0.022834378326306082,
0.029856269551842507,
0.010570422073528984,
0.03734184813973429,
0.014990387098861913,
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0.03317802432324024,
0.0037378817789441854,
0.003131140457460768,
0.011696923143695859,
0.03906096161751016,
0.05354054870984171,
0.03885372153132716,
0.02022711336901617,
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0.05459492795294052,
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```
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```

```
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```
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0.06695034937043842,
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0.05826395972062404,
0.03661519245028311,
0.07619261902297847,
0.038728156338173836,
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0.035070407737501474,
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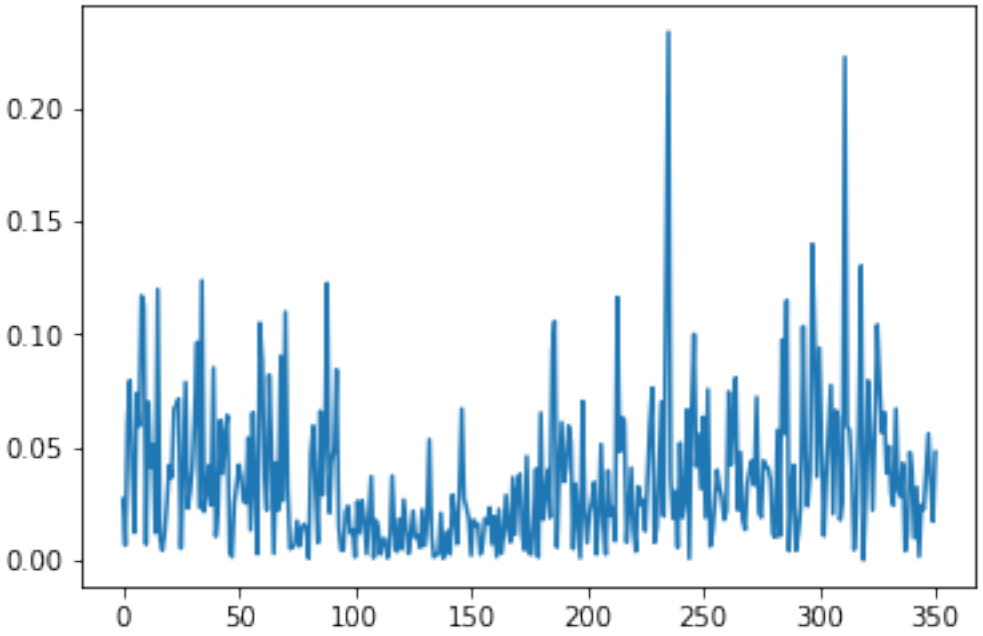
0.04091228332628316,
0.03519906183804333,
0.02134296157872151,
```

```
 0.02375163300779226,
 0.011701683052106393,
 0.046496312261036676,
 0.065977077048198,
 0.07648841998155653,
 0.05151217078467529,
 0.030723955856095886,
 0.04109439229001688,
 0.0038711244246152354,
 0.03780730038035229,
 0.05108708355903735]
```

In [14]:
```
plt.plot(llista_scores)
```

Out[14]:
```
[<matplotlib.lines.Line2D at 0x28d9f6d2e80>]
```



In [67]:
```
predis=list()

for i in range(len(llista_prediccions)):
    predi=llista_prediccions[i].tolist()
    predis.append(predi)

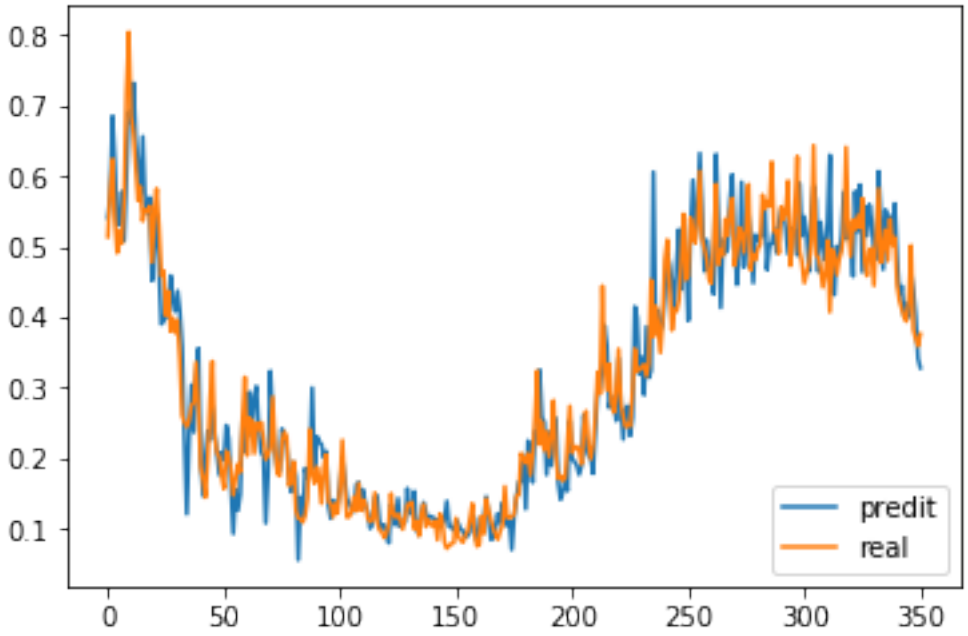
predis=np.reshape(predis, (351)  )

predis
```

```
Out[67]: array([0.54116654, 0.57393068, 0.68530273, 0.61891246, 0.52990532,
                0.53442967, 0.57835191, 0.50829613, 0.60232764, 0.69160676,
                0.67762238, 0.73213685, 0.65655786, 0.61642909, 0.57343376,
                0.6564998 , 0.56184936, 0.54781044, 0.57002831, 0.45183975,
                0.50909448, 0.54570383, 0.46266815, 0.39022547, 0.3942278 ,
                0.40791589, 0.39984766, 0.45886242, 0.42201483, 0.40837985,
                0.43737972, 0.40769699, 0.35690212, 0.22690158, 0.12076373,
                0.23099419, 0.30397385, 0.23680213, 0.31141868, 0.35577616,
                0.19779859, 0.1465455 , 0.20642559, 0.23819169, 0.22617614,
                0.27327108, 0.2356149 , 0.20558643, 0.17637326, 0.20843944,
                0.19904143, 0.24654925, 0.22869858, 0.15966555, 0.09287649,
                0.15571466, 0.12594317, 0.14899674, 0.25261056, 0.20979887,
                0.29145148, 0.29355872, 0.23098885, 0.28862447, 0.30201262,
                0.23841172, 0.20752817, 0.20439216, 0.10782072, 0.17853622,
                0.32365495, 0.25456282, 0.21011484, 0.18391794, 0.18230602,
                0.24161373, 0.23088998, 0.21603009, 0.17724088, 0.15224975,
                0.19430846, 0.17285863, 0.05551853, 0.14486989, 0.11695074,
                0.18559128, 0.17184207, 0.18951097, 0.29990658, 0.18519947,
                0.23080608, 0.22276725, 0.22011083, 0.20086727, 0.20970328,
                0.13344842, 0.11438878, 0.14046481, 0.12302911, 0.13538447,
                0.16055377, 0.19937208, 0.17191574, 0.14239249, 0.13543583,
                0.12729867, 0.12463418, 0.1620481 , 0.16567914, 0.14356233,
                0.15475562, 0.131963  , 0.12392527, 0.10014127, 0.11151988,
                0.14398505, 0.14676364, 0.1106142 , 0.09968982, 0.10562037,
                0.09725031, 0.07963321, 0.13448772, 0.12331922, 0.10463548,
                0.14286804, 0.10290331, 0.10989435, 0.10868969, 0.15702128,
                0.12639458, 0.11948215, 0.15290688, 0.09900989, 0.09109852,
                0.11824241, 0.13710874, 0.12343753, 0.11379194, 0.1174118 ,
                0.11623435, 0.10819989, 0.11285738, 0.10207087, 0.10563758,
                0.11281167, 0.13898245, 0.10291062, 0.10209867, 0.09789748,
                0.11263692, 0.10656928, 0.09874342, 0.09674478, 0.08791503,
                0.08974972, 0.09525146, 0.1193442 , 0.11498024, 0.08217909,
                0.09655123, 0.11616743, 0.11538494, 0.14538972, 0.11536448,
                0.08424923, 0.08642162, 0.09982827, 0.12142344, 0.10814571,
                0.13641924, 0.12159491, 0.10418305, 0.11061561, 0.07019311,
                0.11768584, 0.14394441, 0.16610643, 0.16631445, 0.202418  ,
                0.12787032, 0.22467515, 0.20441636, 0.1654896 , 0.23831989,
                0.23150054, 0.32512707, 0.25751862, 0.25146189, 0.17650399,
                0.23713118, 0.18902034, 0.22238564, 0.25663173, 0.16556615,
                0.14135286, 0.15162559, 0.1727889 , 0.15372972, 0.25310752,
                0.19959417, 0.19452249, 0.18992567, 0.17671679, 0.18870865,
                0.2610977 , 0.21525127, 0.20283569, 0.20151404, 0.17826433,
                0.23751079, 0.29895556, 0.29991138, 0.32797569, 0.38785508,
                0.35957533, 0.27134597, 0.28523189, 0.28569061, 0.25304049,
                0.34152144, 0.27343041, 0.22677234, 0.26940724, 0.27405632,
                0.23191135, 0.25750318, 0.41501349, 0.39945379, 0.3188245 ,
                0.34329739, 0.28974193, 0.38652909, 0.31426579, 0.32431743,
                0.60607886, 0.37907618, 0.408539  , 0.38025534, 0.38996816,
```

```
0.43036216, 0.49103191, 0.47494936, 0.44818032, 0.41031098,
0.47470781, 0.52446878, 0.43951583, 0.49086291, 0.48467398,
0.39518744, 0.52223849, 0.59460372, 0.51129538, 0.54663491,
0.63269722, 0.55150783, 0.46541202, 0.50964814, 0.47201955,
0.46946773, 0.43265736, 0.63138318, 0.53450531, 0.41344136,
0.51010287, 0.49128816, 0.4976787 , 0.56496108, 0.6023894 ,
0.51310921, 0.44619858, 0.49392945, 0.59192765, 0.47077048,
0.51130211, 0.54446626, 0.50894767, 0.44865355, 0.51712   ,
0.5094499 , 0.51295763, 0.51603204, 0.5639956 , 0.46731168,
0.5017212 , 0.50541645, 0.52555692, 0.49144876, 0.53264034,
0.55247426, 0.55129409, 0.52617347, 0.49002659, 0.52179754,
0.52667308, 0.52058417, 0.48816347, 0.59016216, 0.51502043,
0.54275215, 0.51414144, 0.46478215, 0.54521996, 0.58655381,
0.56629622, 0.46474576, 0.53511876, 0.50607133, 0.48143879,
0.53482288, 0.63000607, 0.43662643, 0.43181908, 0.50084668,
0.48632762, 0.51445955, 0.57739848, 0.51093602, 0.53246653,
0.51503557, 0.45800069, 0.57871199, 0.52173525, 0.5878607 ,
0.46426401, 0.5571267 , 0.51530164, 0.5599038 , 0.53647363,
0.49543819, 0.48250657, 0.60679555, 0.54460794, 0.4678241 ,
0.55232614, 0.52291435, 0.54349673, 0.5144825 , 0.56096202,
0.48469594, 0.43350741, 0.44406152, 0.40214321, 0.41871166,
0.40038961, 0.46169484, 0.43836743, 0.40218666, 0.3417356 ,
0.32813805])
```

In [68]:
```
##Mostrem
plt.plot(predis, label="predit")
plt.plot(y_daily[n_train:lenght], label="real")
plt.legend(loc="lower right")
plt.show()
```



In [80]:
```
#Creem un dataset amb format (nombre prediccions,17) per tornar les prediccions i els
#El necessitem d'questa mida encara que només volguem passar 2 variables ja que al fe
#per fer la inversa necessitem 17 variables
#Com que només en tenim 2, les ajuntem al dataset inicial i ens quedem amb 15 variabl
#Obtenint un dataset amb 15 variables aleatories i les 2 variables que ens interessen


prova=daily_dia.iloc[n_train:lenght]
prova
#len(predis)
#lenght-n_train
prova['predi']=predis
prova['y']=y_daily[n_train:lenght]
prova=prova.drop(['energy_sum','t-1'], axis=1)
prova

prova=prova[['predi','y','t-2','t-3','t-4','t-5','t-6','t-7','t-8','t-9','t-10','t-11
prova
```

```
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
  if sys.path[0] == '':
c:\users\laura\appdata\local\programs\python\python37\lib\site-packages\ipykernel_launcher.py:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html
  del sys.path[0]
```

Out[80]:

	predi	y	t-2	t-3	t-4	t-5	\
479	0.541167	0.514061	12.119938	12.852295	13.106773	12.823073	
480	0.573931	0.580609	11.786082	12.119938	12.852295	13.106773	
481	0.685303	0.624326	11.590859	11.786082	12.119938	12.852295	
482	0.618912	0.539280	12.186487	11.590859	11.786082	12.119938	
483	0.529905	0.491355	12.577783	12.186487	11.590859	11.786082	
484	0.534430	0.522145	11.816573	12.577783	12.186487	11.590859	
485	0.578352	0.504442	11.387627	11.816573	12.577783	12.186487	
486	0.508296	0.567725	11.663214	11.387627	11.816573	12.577783	
487	0.602328	0.719460	11.504756	11.663214	11.387627	11.816573	
488	0.691607	0.804631	12.071173	11.504756	11.663214	11.387627	
489	0.677622	0.684716	13.429271	12.071173	11.504756	11.663214	

490	0.732137	0.662177	14.191591	13.429271	12.071173	11.504756
491	0.656558	0.615194	13.118295	14.191591	13.429271	12.071173
492	0.616429	0.565466	12.916559	13.118295	14.191591	13.429271
493	0.573434	0.585646	12.496044	12.916559	13.118295	14.191591
494	0.656500	0.536523	12.050954	12.496044	12.916559	13.118295
495	0.561849	0.552256	12.231576	12.050954	12.496044	12.916559
496	0.547810	0.552256	11.791904	12.231576	12.050954	12.496044
497	0.570028	0.557809	11.932721	11.791904	12.231576	12.050954
498	0.451840	0.477794	11.932721	11.932721	11.791904	12.231576
499	0.509094	0.551195	11.982423	11.932721	11.932721	11.791904
500	0.545704	0.582339	11.266252	11.982423	11.932721	11.932721
501	0.462668	0.529772	11.923226	11.266252	11.982423	11.932721
502	0.390225	0.458904	12.201972	11.923226	11.266252	11.982423
503	0.394228	0.465733	11.731479	12.201972	11.923226	11.266252
504	0.407916	0.402622	11.097177	11.731479	12.201972	11.923226
505	0.399848	0.436918	11.158295	11.097177	11.731479	12.201972
506	0.458862	0.380048	10.593420	11.158295	11.097177	11.731479
507	0.422015	0.398860	10.900388	10.593420	11.158295	11.097177
508	0.408380	0.377916	10.391372	10.900388	10.593420	11.158295
..	...	...	...	...	...	...
800	0.458001	0.537515	11.753871	12.729659	11.620778	11.409880
801	0.578712	0.524598	11.344805	11.753871	12.729659	11.620778
802	0.521735	0.543903	11.800777	11.344805	11.753871	12.729659
803	0.587861	0.527438	11.685169	11.800777	11.344805	11.753871
804	0.464264	0.568506	11.857957	11.685169	11.800777	11.344805
805	0.557127	0.479332	11.710582	11.857957	11.685169	11.800777
806	0.515302	0.458726	12.078164	11.710582	11.857957	11.685169
807	0.559904	0.494425	11.280011	12.078164	11.710582	11.857957
808	0.536474	0.497810	11.095584	11.280011	12.078164	11.710582
809	0.495438	0.444954	11.415105	11.095584	11.280011	12.078164
810	0.482507	0.511653	11.445403	11.415105	11.095584	11.280011
811	0.606796	0.582450	10.972318	11.445403	11.415105	11.095584
812	0.544608	0.477562	11.569300	10.972318	11.445403	11.415105
813	0.467824	0.498620	12.202967	11.569300	10.972318	11.445403
814	0.552326	0.523920	11.264175	12.202967	11.569300	10.972318
815	0.522914	0.479971	11.452649	11.264175	12.202967	11.569300
816	0.543497	0.539318	11.679099	11.452649	11.264175	12.202967
817	0.514482	0.502845	11.285737	11.679099	11.452649	11.264175
818	0.560962	0.513089	11.816914	11.285737	11.679099	11.452649
819	0.484696	0.445764	11.490470	11.816914	11.285737	11.679099
820	0.433507	0.423680	11.582159	11.490470	11.816914	11.285737
821	0.444062	0.411694	10.979566	11.582159	11.490470	11.816914
822	0.402143	0.400434	10.781898	10.979566	11.582159	11.490470
823	0.418712	0.394209	10.674624	10.781898	10.979566	11.582159
824	0.400390	0.423048	10.573835	10.674624	10.781898	10.979566
825	0.461695	0.501722	10.518126	10.573835	10.674624	10.781898
826	0.438367	0.382286	10.776242	10.518126	10.573835	10.674624
827	0.402187	0.369280	11.480411	10.776242	10.518126	10.573835

```
828  0.341736  0.358995  10.411403  11.480411  10.776242  10.518126
829  0.328138  0.376135  10.294997  10.411403  11.480411  10.776242

           t-6        t-7        t-8        t-9  ...  tempmin(t-5)  \
479  11.559878  10.930170  10.889469  10.675248  ...         -4.03
480  12.823073  11.559878  10.930170  10.889469  ...         -8.57
481  13.106773  12.823073  11.559878  10.930170  ...         -8.88
482  12.852295  13.106773  12.823073  11.559878  ...         -2.39
483  12.119938  12.852295  13.106773  12.823073  ...         -3.72
484  11.786082  12.119938  12.852295  13.106773  ...         -0.32
485  11.590859  11.786082  12.119938  12.852295  ...          1.78
486  12.186487  11.590859  11.786082  12.119938  ...         -0.32
487  12.577783  12.186487  11.590859  11.786082  ...         -1.32
488  11.816573  12.577783  12.186487  11.590859  ...          0.65
489  11.387627  11.816573  12.577783  12.186487  ...          0.18
490  11.663214  11.387627  11.816573  12.577783  ...         -1.24
491  11.504756  11.663214  11.387627  11.816573  ...         -2.80
492  12.071173  11.504756  11.663214  11.387627  ...         -4.48
493  13.429271  12.071173  11.504756  11.663214  ...         -6.34
494  14.191591  13.429271  12.071173  11.504756  ...         -4.96
495  13.118295  14.191591  13.429271  12.071173  ...         -4.31
496  12.916559  13.118295  14.191591  13.429271  ...         -4.06
497  12.496044  12.916559  13.118295  14.191591  ...         -3.85
498  12.050954  12.496044  12.916559  13.118295  ...         -2.99
499  12.231576  12.050954  12.496044  12.916559  ...         -2.65
500  11.791904  12.231576  12.050954  12.496044  ...         -2.33
501  11.932721  11.791904  12.231576  12.050954  ...         -3.14
502  11.932721  11.932721  11.791904  12.231576  ...         -4.26
503  11.982423  11.932721  11.932721  11.791904  ...         -3.72
504  11.266252  11.982423  11.932721  11.932721  ...         -3.52
505  11.923226  11.266252  11.982423  11.932721  ...         -2.80
506  12.201972  11.923226  11.266252  11.982423  ...         -2.67
507  11.731479  12.201972  11.923226  11.266252  ...         -1.21
508  11.097177  11.731479  12.201972  11.923226  ...         -0.38
..         ...        ...        ...        ...  ...           ...
800  11.300414  11.109560  11.370601  11.430883  ...          0.19
801  11.409880  11.300414  11.109560  11.370601  ...          1.76
802  11.620778  11.409880  11.300414  11.109560  ...         -1.30
803  12.729659  11.620778  11.409880  11.300414  ...         -2.02
804  11.753871  12.729659  11.620778  11.409880  ...          1.96
805  11.344805  11.753871  12.729659  11.620778  ...          0.18
806  11.800777  11.344805  11.753871  12.729659  ...          0.61
807  11.685169  11.800777  11.344805  11.753871  ...          0.29
808  11.857957  11.685169  11.800777  11.344805  ...          1.10
809  11.710582  11.857957  11.685169  11.800777  ...          3.21
810  12.078164  11.710582  11.857957  11.685169  ...          1.96
811  11.280011  12.078164  11.710582  11.857957  ...          1.12
812  11.095584  11.280011  12.078164  11.710582  ...          1.03
```

813	11.415105	11.095584	11.280011	12.078164	...	1.96
814	11.445403	11.415105	11.095584	11.280011	...	-0.86
815	10.972318	11.445403	11.415105	11.095584	...	2.19
816	11.569300	10.972318	11.445403	11.415105	...	1.38
817	12.202967	11.569300	10.972318	11.445403	...	0.89
818	11.264175	12.202967	11.569300	10.972318	...	-0.57
819	11.452649	11.264175	12.202967	11.569300	...	-1.20
820	11.679099	11.452649	11.264175	12.202967	...	0.05
821	11.285737	11.679099	11.452649	11.264175	...	0.45
822	11.816914	11.285737	11.679099	11.452649	...	1.77
823	11.490470	11.816914	11.285737	11.679099	...	-1.03
824	11.582159	11.490470	11.816914	11.285737	...	2.84
825	10.979566	11.582159	11.490470	11.816914	...	3.83
826	10.781898	10.979566	11.582159	11.490470	...	2.65
827	10.674624	10.781898	10.979566	11.582159	...	3.95
828	10.573835	10.674624	10.781898	10.979566	...	0.19
829	10.518126	10.573835	10.674624	10.781898	...	1.59

	tempmin(t-6)	tempmin(t-7)	tempmin(t-8)	tempmin(t-9)	tempmin(t-10)	\
479	0.97	6.61	6.67	6.51	1.49	
480	-4.03	0.97	6.61	6.67	6.51	
481	-8.57	-4.03	0.97	6.61	6.67	
482	-8.88	-8.57	-4.03	0.97	6.61	
483	-2.39	-8.88	-8.57	-4.03	0.97	
484	-3.72	-2.39	-8.88	-8.57	-4.03	
485	-0.32	-3.72	-2.39	-8.88	-8.57	
486	1.78	-0.32	-3.72	-2.39	-8.88	
487	-0.32	1.78	-0.32	-3.72	-2.39	
488	-1.32	-0.32	1.78	-0.32	-3.72	
489	0.65	-1.32	-0.32	1.78	-0.32	
490	0.18	0.65	-1.32	-0.32	1.78	
491	-1.24	0.18	0.65	-1.32	-0.32	
492	-2.80	-1.24	0.18	0.65	-1.32	
493	-4.48	-2.80	-1.24	0.18	0.65	
494	-6.34	-4.48	-2.80	-1.24	0.18	
495	-4.96	-6.34	-4.48	-2.80	-1.24	
496	-4.31	-4.96	-6.34	-4.48	-2.80	
497	-4.06	-4.31	-4.96	-6.34	-4.48	
498	-3.85	-4.06	-4.31	-4.96	-6.34	
499	-2.99	-3.85	-4.06	-4.31	-4.96	
500	-2.65	-2.99	-3.85	-4.06	-4.31	
501	-2.33	-2.65	-2.99	-3.85	-4.06	
502	-3.14	-2.33	-2.65	-2.99	-3.85	
503	-4.26	-3.14	-2.33	-2.65	-2.99	
504	-3.72	-4.26	-3.14	-2.33	-2.65	
505	-3.52	-3.72	-4.26	-3.14	-2.33	
506	-2.80	-3.52	-3.72	-4.26	-3.14	
507	-2.67	-2.80	-3.52	-3.72	-4.26	

508	-1.21	-2.67	-2.80	-3.52	-3.72
..	...	...	...	...	...
800	0.25	3.08	1.97	1.30	2.11
801	0.19	0.25	3.08	1.97	1.30
802	1.76	0.19	0.25	3.08	1.97
803	-1.30	1.76	0.19	0.25	3.08
804	-2.02	-1.30	1.76	0.19	0.25
805	1.96	-2.02	-1.30	1.76	0.19
806	0.18	1.96	-2.02	-1.30	1.76
807	0.61	0.18	1.96	-2.02	-1.30
808	0.29	0.61	0.18	1.96	-2.02
809	1.10	0.29	0.61	0.18	1.96
810	3.21	1.10	0.29	0.61	0.18
811	1.96	3.21	1.10	0.29	0.61
812	1.12	1.96	3.21	1.10	0.29
813	1.03	1.12	1.96	3.21	1.10
814	1.96	1.03	1.12	1.96	3.21
815	-0.86	1.96	1.03	1.12	1.96
816	2.19	-0.86	1.96	1.03	1.12
817	1.38	2.19	-0.86	1.96	1.03
818	0.89	1.38	2.19	-0.86	1.96
819	-0.57	0.89	1.38	2.19	-0.86
820	-1.20	-0.57	0.89	1.38	2.19
821	0.05	-1.20	-0.57	0.89	1.38
822	0.45	0.05	-1.20	-0.57	0.89
823	1.77	0.45	0.05	-1.20	-0.57
824	-1.03	1.77	0.45	0.05	-1.20
825	2.84	-1.03	1.77	0.45	0.05
826	3.83	2.84	-1.03	1.77	0.45
827	2.65	3.83	2.84	-1.03	1.77
828	3.95	2.65	3.83	2.84	-1.03
829	0.19	3.95	2.65	3.83	2.84

	tempmin(t-11)	tempmin(t-12)	tempmin(t-13)	tempmin(t-14)
479	-1.41	-1.14	-0.01	-1.08
480	1.49	-1.41	-1.14	-0.01
481	6.51	1.49	-1.41	-1.14
482	6.67	6.51	1.49	-1.41
483	6.61	6.67	6.51	1.49
484	0.97	6.61	6.67	6.51
485	-4.03	0.97	6.61	6.67
486	-8.57	-4.03	0.97	6.61
487	-8.88	-8.57	-4.03	0.97
488	-2.39	-8.88	-8.57	-4.03
489	-3.72	-2.39	-8.88	-8.57
490	-0.32	-3.72	-2.39	-8.88
491	1.78	-0.32	-3.72	-2.39
492	-0.32	1.78	-0.32	-3.72

493	-1.32	-0.32	1.78	-0.32
494	0.65	-1.32	-0.32	1.78
495	0.18	0.65	-1.32	-0.32
496	-1.24	0.18	0.65	-1.32
497	-2.80	-1.24	0.18	0.65
498	-4.48	-2.80	-1.24	0.18
499	-6.34	-4.48	-2.80	-1.24
500	-4.96	-6.34	-4.48	-2.80
501	-4.31	-4.96	-6.34	-4.48
502	-4.06	-4.31	-4.96	-6.34
503	-3.85	-4.06	-4.31	-4.96
504	-2.99	-3.85	-4.06	-4.31
505	-2.65	-2.99	-3.85	-4.06
506	-2.33	-2.65	-2.99	-3.85
507	-3.14	-2.33	-2.65	-2.99
508	-4.26	-3.14	-2.33	-2.65
..	...	...	...	...
800	4.83	2.83	3.91	2.89
801	2.11	4.83	2.83	3.91
802	1.30	2.11	4.83	2.83
803	1.97	1.30	2.11	4.83
804	3.08	1.97	1.30	2.11
805	0.25	3.08	1.97	1.30
806	0.19	0.25	3.08	1.97
807	1.76	0.19	0.25	3.08
808	-1.30	1.76	0.19	0.25
809	-2.02	-1.30	1.76	0.19
810	1.96	-2.02	-1.30	1.76
811	0.18	1.96	-2.02	-1.30
812	0.61	0.18	1.96	-2.02
813	0.29	0.61	0.18	1.96
814	1.10	0.29	0.61	0.18
815	3.21	1.10	0.29	0.61
816	1.96	3.21	1.10	0.29
817	1.12	1.96	3.21	1.10
818	1.03	1.12	1.96	3.21
819	1.96	1.03	1.12	1.96
820	-0.86	1.96	1.03	1.12
821	2.19	-0.86	1.96	1.03
822	1.38	2.19	-0.86	1.96
823	0.89	1.38	2.19	-0.86
824	-0.57	0.89	1.38	2.19
825	-1.20	-0.57	0.89	1.38
826	0.05	-1.20	-0.57	0.89
827	0.45	0.05	-1.20	-0.57
828	1.77	0.45	0.05	-1.20
829	-1.03	1.77	0.45	0.05

```
[351 rows x 43 columns]
```

In [81]:
```
# Convert predictions back to normal values

predi = scaler.inverse_transform(prova)
print(predi)
print(predi[0][0])
print(predi[0][1])

#Les variables en posició 15 i 16 són predicció i y respectivament
```

```
[[ 11.83346227  11.59085917 115.46893021 ... -42.4188      -9.1742
  -40.6536    ]
 [ 12.12671675  12.18648691 112.48075791 ... -50.3622     -42.4188
   -9.1742    ]
 [ 13.12354917  12.57778255 110.7334244  ...  34.9558     -50.3622
  -42.4188    ]
 ...
 [ 10.58952675  10.2949966  109.74485905 ...  -7.409      -44.184
  -25.6494    ]
 [ 10.04846124  10.20294532 100.17673598 ...   4.359       -7.409
  -44.184     ]
 [  9.92675677  10.3563499   99.13484299 ...  43.1934       4.359
   -7.409     ]]
11.83346226762975
11.590859170709699
```

In [82]:
```
#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
```

Out[82]:
```
[11.590859170709699,
 12.186486909458,
 12.5777825527296,
 11.816572589134799,
 11.3876267050719,
 11.6632140210701,
 11.5047561338867,
 12.071172692490801,
 13.4292708131623,
```

```
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11.9327208888355,
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11.266251710893302,
11.923225859637402,
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11.097177003906697,
11.158295184648098,
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9.48570009257196,
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 10.7762421096284,
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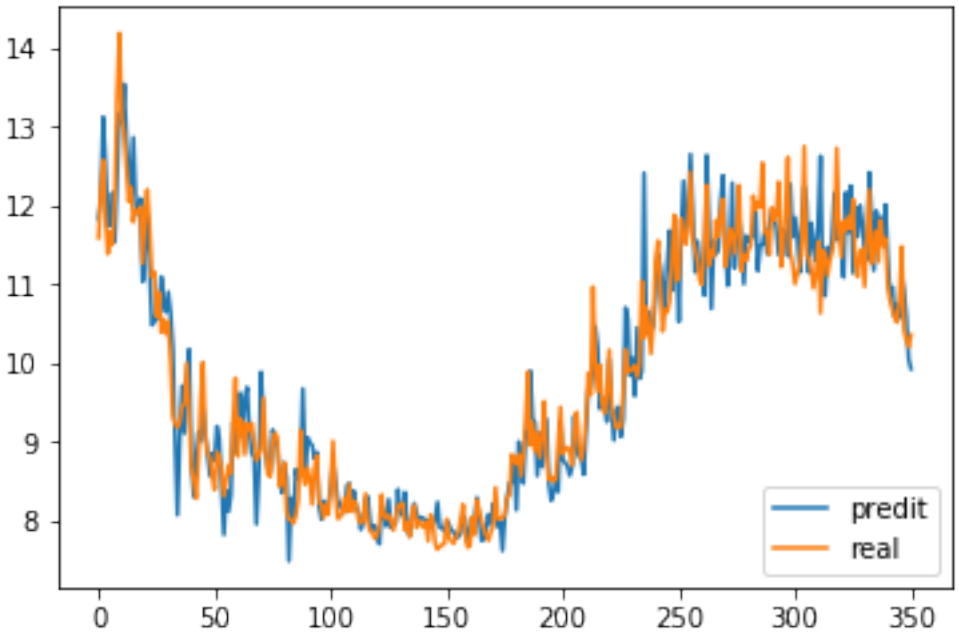
 10.411403084521401,
 10.294996596876901,
 10.202945322371301,
 10.3563498993587]
```

In [83]:
```
##Mostrem
plt.plot(listpredi, label="predit")
plt.plot(listy, label="real")
plt.legend(loc="lower right")
plt.show()
```



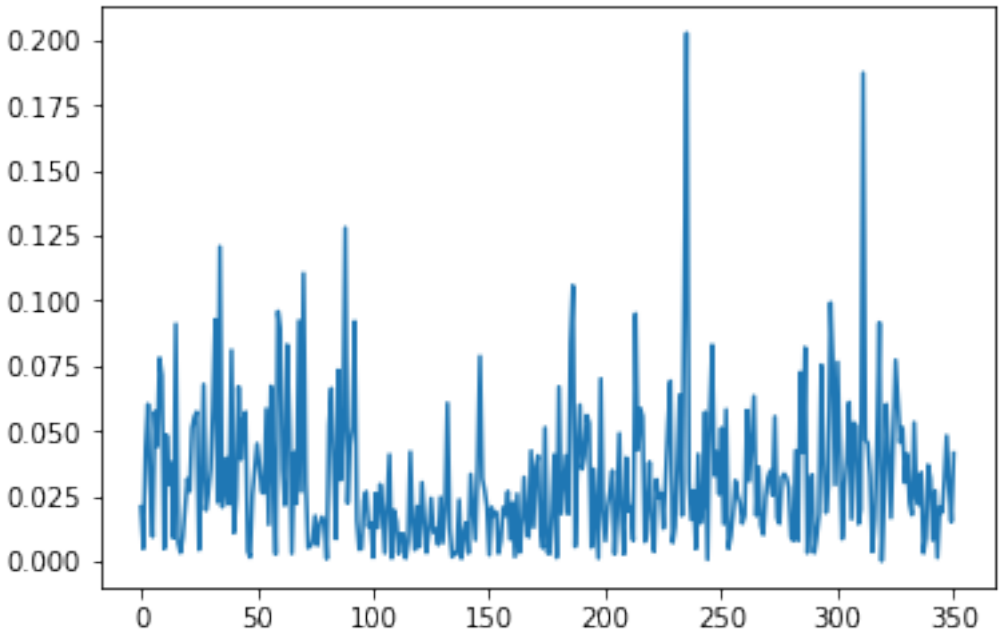
In [84]:
```
llista_errors=list()
llista_errorsabs=list()
llista_errorsres=list()


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)

        error_mitja=sum(llista_errorsres)/(len(llista_errorsres))*100
        print("L'error mitjà és de {} % " .format(error_mitja))
```

```
L'error mitjà és de 3.187415645185859 %
```



In [61]:
```
        #Eliminem les 14 primeres files ja que contenen NaN (valors buits)

        #Ens quedem amb energies i temperatures
        #No agafem apparent temperature max ja que quan fem la predicció representa que no ho
        daily_dia_prova1=daily_dia_prova1.drop(['index'], axis=1)
        daily_dia_prova1.head(5)


        daily_dia_prova1=daily_dia_prova1.drop([0,1,2,3,4,5,6,7,8,9,10,11,12,13])
        daily_dia_prova1.head(5)
```

Out[61]:

	date	energy_sum	apparentTemperatureMax	apparentTemperatureMin
14	2011-12-07	10.889362	5.14	0.94
15	2011-12-08	11.525150	12.89	0.63
16	2011-12-09	11.759837	3.99	-1.42
17	2011-12-10	12.633801	3.14	-3.42
18	2011-12-11	13.749174	5.72	0.11

```
In [63]: prova1=daily_dia_prova1[n_train:lenght]
         prova1.head(5)
         prova1.date=pd.to_datetime (prova1["date"], format='%Y-%m-%d')
         prova1.head(5)
```

Out[63]:

	date	energy_sum	apparentTemperatureMax	apparentTemperatureMin
479	2013-03-15	11.590859	4.56	-0.32
480	2013-03-16	12.186487	3.91	1.78
481	2013-03-17	12.577783	5.13	-0.32
482	2013-03-18	11.816573	7.06	-1.32
483	2013-03-19	11.387627	5.81	0.65

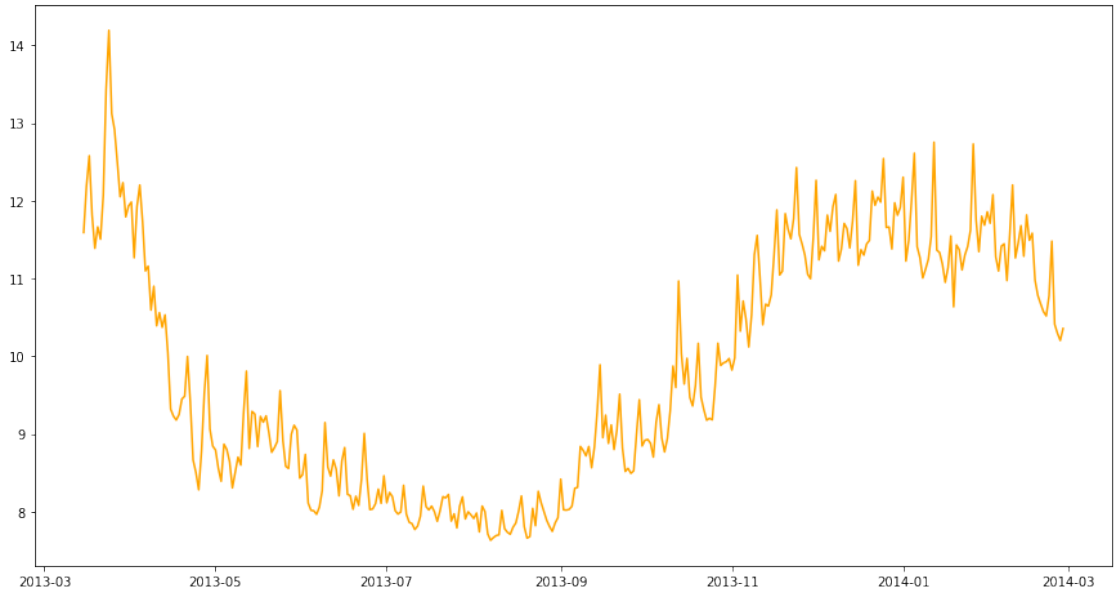
```
In [58]: #prova1=prova1.sort_values(by=['date'])
         #prova1.head(5)
```

Out[58]:

	date	energy_sum	apparentTemperatureMax	apparentTemperatureMin
809	2011-11-23	10.972318	8.44	-0.86
728	2011-11-24	11.044272	8.54	5.02
633	2011-11-28	7.800674	21.73	16.98
508	2011-11-29	10.372293	11.42	3.30
510	2011-12-01	10.044256	15.43	10.08

```
In [65]: plt.figure (figsize=(15,8))
         plt.plot(prova1.date, prova1.energy_sum, color="orange")
         #fig.autofmt_xdate()
         #import matplotlib.dates as mdates
         #myFmt = mdates.DateFormatter(prova1.date)
         #ax.xaxis_date()
         #ax.xaxis.set_major_formatter(myFmt)
```

Out[65]: [<matplotlib.lines.Line2D at 0x28da3236470>]



In [ ]: