

Model for Analysis of Energy Demand (MAED)

Hands-on 8: MAED-EL Input Data Preparation

Learning outcomes

By the end of this exercise you will be able to:

- 1) Account for demand growth within your base year
- 2) Calculate the seasonal coefficients for each week
- 3) Calculate the daily coefficients for each day of each week
- 4) Calculate the hourly coefficients for each day of each season

Activity 1: Seasonal coefficients

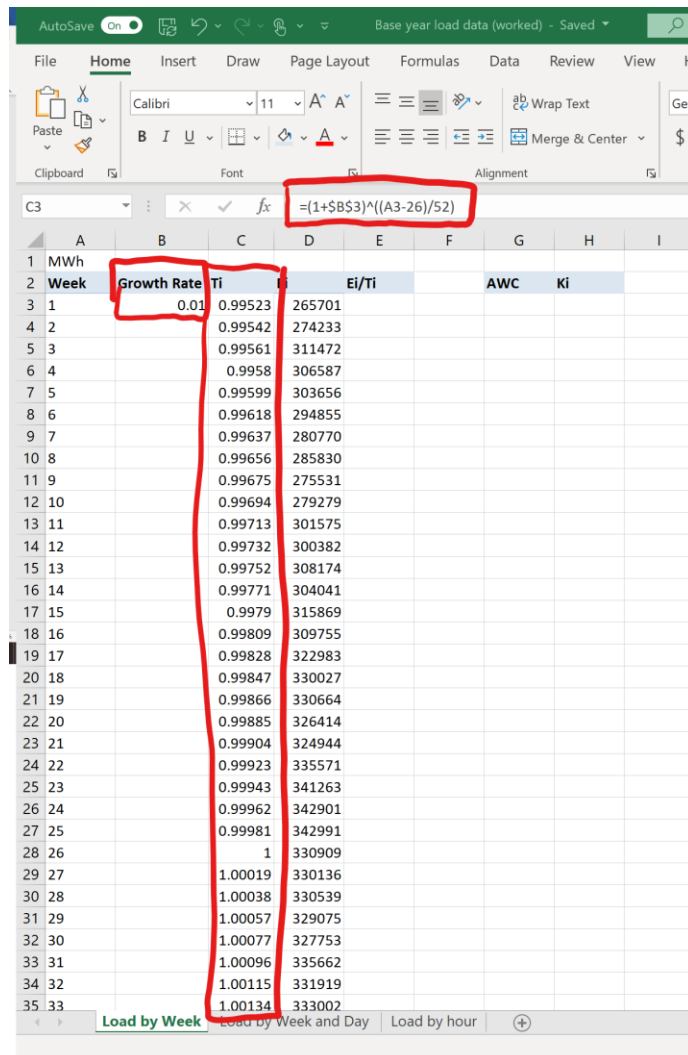
To calculate the modulating coefficients, you need hourly electricity demand data for the base year. For this hands-on session, we have provided a Microsoft Excel file with sample hourly demand data named *Base year load data.xlsx*. You can prepare your input data for MAED-el in the software of your choice, we have just chosen Excel for its simplicity and universality.

To calculate the seasonal coefficients, it is necessary to know the electricity demand growth rate, r , between the base year and the preceding year. Once this value is known, it is possible to calculate the growth trend deflator T for each week of the year, using the equation following equation:

$$T_i = \left(1 + \frac{r}{100}\right)^{\frac{i-26}{52}}$$

Let us assume that the growth rate is 1%. In the “Load by Week” tab of the workbook, input this value in the growth rate column.

Then, use the equation above to calculate the growth trend deflator for each week in the column labelled T_i . Be sure to put a dollar sign in the formula before the row number of the growth rate r , so that the same value is used for the calculation in each row.



Week	Growth Rate	T_i	E_i/T_i	AWC	K_i
1	0.01	0.99523	265701		
2		0.99542	274233		
3		0.99561	311472		
4		0.9958	306587		
5		0.99599	303656		
6		0.99618	294855		
7		0.99637	280770		
8		0.99656	285830		
9		0.99675	275531		
10		0.99694	279279		
11		0.99713	301575		
12		0.99732	300382		
13		0.99752	308174		
14		0.99771	304041		
15		0.9979	315869		
16		0.99809	309755		
17		0.99828	322983		
18		0.99847	330027		
19		0.99866	330664		
20		0.99885	326414		
21		0.99904	324944		
22		0.99923	335571		
23		0.99943	341263		
24		0.99962	342901		
25		0.99981	342991		
26		1	330909		
27		1.00019	330136		
28		1.00038	330539		
29		1.00057	329075		
30		1.00077	327753		
31		1.00096	335662		
32		1.00115	331919		
33		1.00134	333002		

The second step is to calculate the seasonal coefficients. To do so, the electricity demand for each week " E_i " should be divided by the corresponding growth trend deflator T_i .

Then find the average weekly consumption (AWC). This is the sum of all the new values for weekly electricity demand " E_i/T_i ", divided by 53, the total number of weeks in the study.

Next, calculate the seasonal coefficients " K_i " as the weekly electricity demand without the growth trend " E_i/T_i ", divided by the average weekly consumption "AWC". You should calculate 53 values.

AutoSave On Base year load data (worked) - Saving...

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H3 =E3/G\$3

	A	B	C	D	E	F	G	H	I
1	MWh								
2	Week	Growth Rate	Ti	Ei	Ei/Ti		AWC	Ki	
3	1	0.01	0.99523	265701	266975.11		308142.08	0.86640261	
4	2		0.99542	274233	275495.3			0.89405281	
5	3		0.99561	311477	312845.84			1.01526489	
6	4		0.9958	306587	307880.38			0.99915068	
7	5		0.99599	303650	304878.67			0.98940936	
8	6		0.99618	294857	295985.59			0.96054904	
9	7		0.99637	280770	281792.65			0.91448933	
10	8		0.99656	285830	286816.19			0.93079201	
11	9		0.99675	275531	276428.76			0.89708213	
12	10		0.99694	279279	280135.36			0.909111	
13	11		0.99713	301575	302441.85			0.98150127	
14	12		0.99732	300382	301187.78			0.9774315	
15	13		0.99752	308174	308941.56			1.0025945	
16	14		0.99771	304047	304739.95			0.98895919	
17	15		0.9979	315861	316534.57			1.02723574	
18	16		0.99809	309751	310348.29			1.00715969	
19	17		0.99828	322987	323539.71			1.04996923	
20	18		0.99847	330027	330532.6			1.07266294	
21	19		0.99866	330664	331107.21			1.0745277	
22	20		0.99885	326414	326788.98			1.06051393	
23	21		0.99904	324944	325255.04			1.05553592	
24	22		0.99923	335571	335827.95			1.0898477	
25	23		0.99943	341263	341458.96			1.10812178	
26	24		0.99962	342901	343032.26			1.11322753	
27	25		0.99981	342991	343056.64			1.11330666	
28	26		1	330909	330909			1.07388446	
29	27		1.00019	330135	330072.83			1.07117089	
30	28		1.00038	330539	330412.53			1.07227327	
31	29		1.00057	329075	328886.15			1.06731978	
32	30		1.00077	327753	327502.23			1.06282862	
33	31		1.00096	335662	335341			1.08826745	
34	32		1.00115	331979	331538.14			1.07592617	
35	33		1.00134	333072	332556.25			1.07923022	

Load by Week Load by Week and Day Load by hour

Activity 2: Daily coefficients

Now go to the “Load by Week and Day” tab of the workbook. First, calculate the average daily consumption in each week, “Pave”, as the sum of the electricity consumption in the week, given in the column “Ei”, divided by 7, the number of days in a week.

The daily coefficients are obtained by dividing the electricity consumption for each day by the average daily consumption for the corresponding week.

[illegible]

Activity 3: Hourly coefficients

The hourly coefficients are calculated for each type of day (e.g. Monday, Tuesday) in each season for each sector or client, if available. For example, let us assume that we have identified the following three seasons using monthly consumption data:

- Season 1: From January 1st to March 30th
- Season 2: From April 1st to October 31st
- Season 3: From November 1st to December 31st

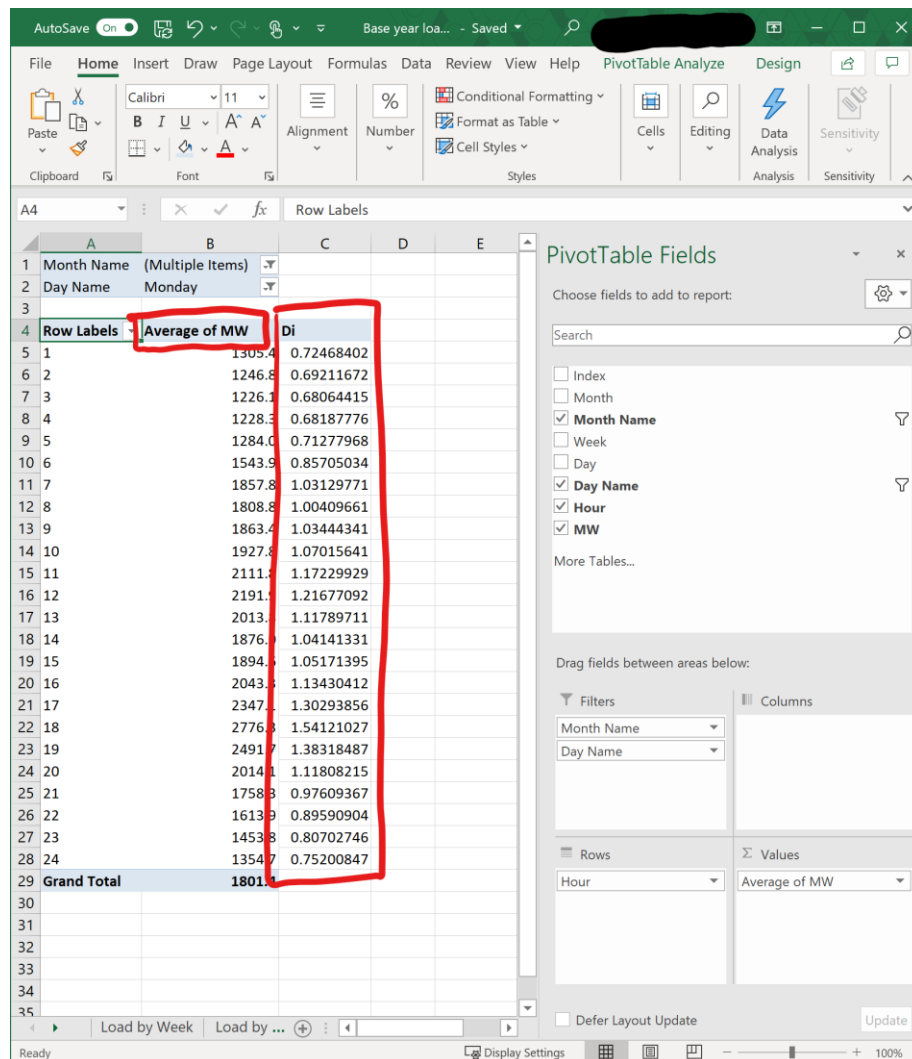


Let us focus on Mondays in Season 3, during November and December. We assume that the hourly demand in the “Load by hour” tab of the workbook is the demand of a hypothetical sector without any clients, so the whole sector is modelled as a single client.

To calculate the hourly coefficients for Mondays, we first find the average demand for each hour over the season. Using the pivot table feature in the “Insert” tab of Excel, we can use the data in the “Load by hour” tab to create a table with the average electricity demand for each of the 24 hours in every Monday in November and December.

We also need to calculate the average hourly demand as the sum of all electricity demand for each Monday divided by 24, the total number of hours in a day. Conveniently, this value appears in the bottom of the pivot table in the row labelled “Grand Total.”

To find the hourly coefficients for each hour, we divide the average demand for that hour by the average demand for all hours in that day in that season, which is in the “Grand Total” row. This technique is used to calculate the hourly coefficients for each hour of Monday in Season 3.



Month Name	Day Name	Hour	Average of MW
1	Monday	1	1305.4
2	Monday	2	1246.8
3	Monday	3	1226.1
4	Monday	4	1228.3
5	Monday	5	1284.0
6	Monday	6	1543.9
7	Monday	7	1857.8
8	Monday	8	1808.8
9	Monday	9	1863.4
10	Monday	10	1927.8
11	Monday	11	2111.1
12	Monday	12	2191.1
13	Monday	13	2013.1
14	Monday	14	1876.1
15	Monday	15	1894.1
16	Monday	16	2043.1
17	Monday	17	2347.1
18	Monday	18	2776.1
19	Monday	19	2491.1
20	Monday	20	2014.1
21	Monday	21	1758.1
22	Monday	22	1613.1
23	Monday	23	1453.1
24	Monday	24	1354.7
25	Monday	25	1801.1
26	Monday	26	1801.1
27	Monday	27	1801.1
28	Monday	28	1801.1
29	Monday	29	1801.1
30	Monday	30	1801.1
31	Monday	31	1801.1
32	Monday	32	1801.1
33	Monday	33	1801.1
34	Monday	34	1801.1
35	Monday	35	1801.1
36	Monday	36	1801.1
37	Monday	37	1801.1
38	Monday	38	1801.1
39	Monday	39	1801.1
40	Monday	40	1801.1
41	Monday	41	1801.1
42	Monday	42	1801.1
43	Monday	43	1801.1
44	Monday	44	1801.1
45	Monday	45	1801.1
46	Monday	46	1801.1
47	Monday	47	1801.1
48	Monday	48	1801.1
49	Monday	49	1801.1
50	Monday	50	1801.1
51	Monday	51	1801.1
52	Monday	52	1801.1
53	Monday	53	1801.1
54	Monday	54	1801.1
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56	Monday	56	1801.1
57	Monday	57	1801.1
58	Monday	58	1801.1
59	Monday	59	1801.1
60	Monday	60	1801.1
61	Monday	61	1801.1
62	Monday	62	1801.1
63	Monday	63	1801.1
64	Monday	64	1801.1
65	Monday	65	1801.1
66	Monday	66	1801.1
67	Monday	67	1801.1
68	Monday	68	1801.1
69	Monday	69	1801.1
70	Monday	70	1801.1
71	Monday	71	1801.1
72	Monday	72	1801.1
73	Monday	73	1801.1
74	Monday	74	1801.1
75	Monday	75	1801.1
76	Monday	76	1801.1
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82	Monday	82	1801.1
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87	Monday	87	1801.1
88	Monday	88	1801.1
89	Monday	89	1801.1
90	Monday	90	1801.1
91	Monday	91	1801.1
92	Monday	92	1801.1
93	Monday	93	1801.1
94	Monday	94	1801.1
95	Monday	95	1801.1
96	Monday	96	1801.1
97	Monday	97	1801.1
98	Monday	98	1801.1
99	Monday	99	1801.1
100	Monday	100	1801.1

To calculate the input data for MAED-EL, these steps would have to be repeated for each day of the week in every season, for each client in each sector. Thus, you need data on the hourly demand for at least each sector you wish to model in the base year and the reference years of the study period. Because typically reference years have not happened yet, these data represent your scenario assumptions.