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

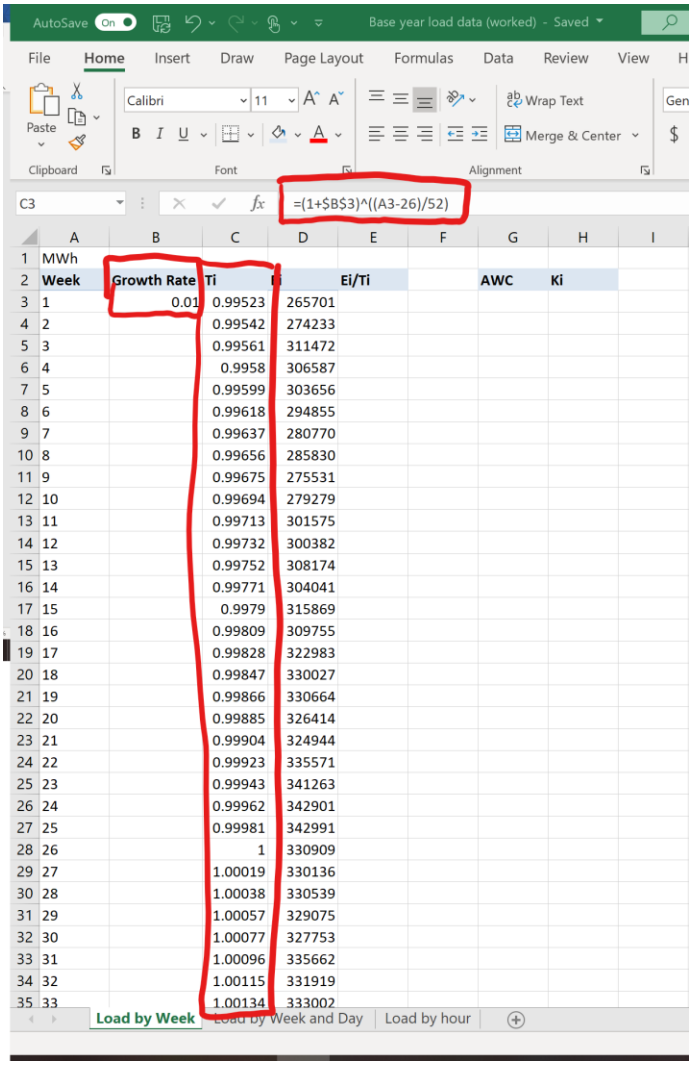
To calculate the modulating coefficients, you need hourly electricity demand data for the base year. For this hands-on session, we have provided a Microsoft Excel file with sample hourly demand data named *Base year load data.xlsx*. You can prepare your input data for MAED-el in the software of your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

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

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.

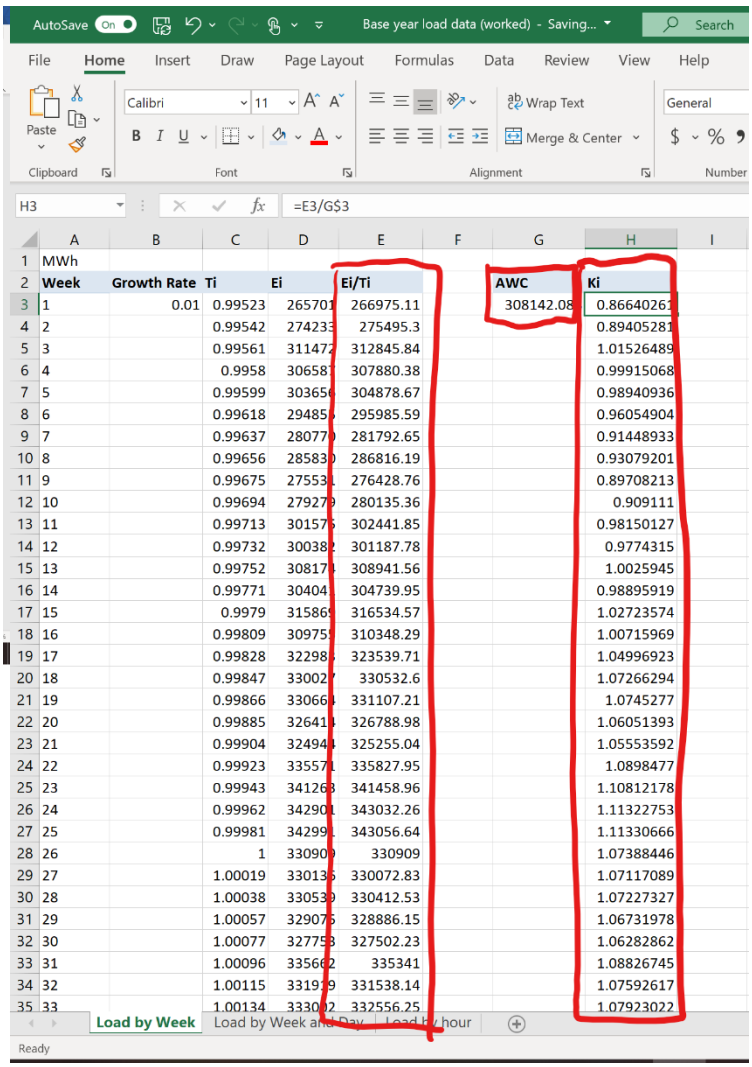


	A	B	C	D	E	F	G	H	I
1	MWh								
2	Week	Growth Rate	Ti	Ei	Ei/Ti		AWC	Ki	
3	1	0.01	0.99523	265701					
4	2		0.99542	274233					
5	3		0.99561	311472					
6	4		0.9958	306587					
7	5		0.99599	303656					
8	6		0.99618	294855					
9	7		0.99637	280770					
10	8		0.99656	285830					
11	9		0.99675	275531					
12	10		0.99694	279279					
13	11		0.99713	301575					
14	12		0.99732	300382					
15	13		0.99752	308174					
16	14		0.99771	304041					
17	15		0.9979	315869					
18	16		0.99809	309755					
19	17		0.99828	322983					
20	18		0.99847	330027					
21	19		0.99866	330664					
22	20		0.99885	326414					
23	21		0.99904	324944					
24	22		0.99923	335571					
25	23		0.99943	341263					
26	24		0.99962	342901					
27	25		0.99981	342991					
28	26		1	330909					
29	27		1.00019	330136					
30	28		1.00038	330539					
31	29		1.00057	329075					
32	30		1.00077	327753					
33	31		1.00096	335662					
34	32		1.00115	331919					
35	33		1.00134	333002					

The second step is to calculate the seasonal coefficients. To do so, the electricity demand for each week “Ei” should be divided by the corresponding growth trend deflator Ti.

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

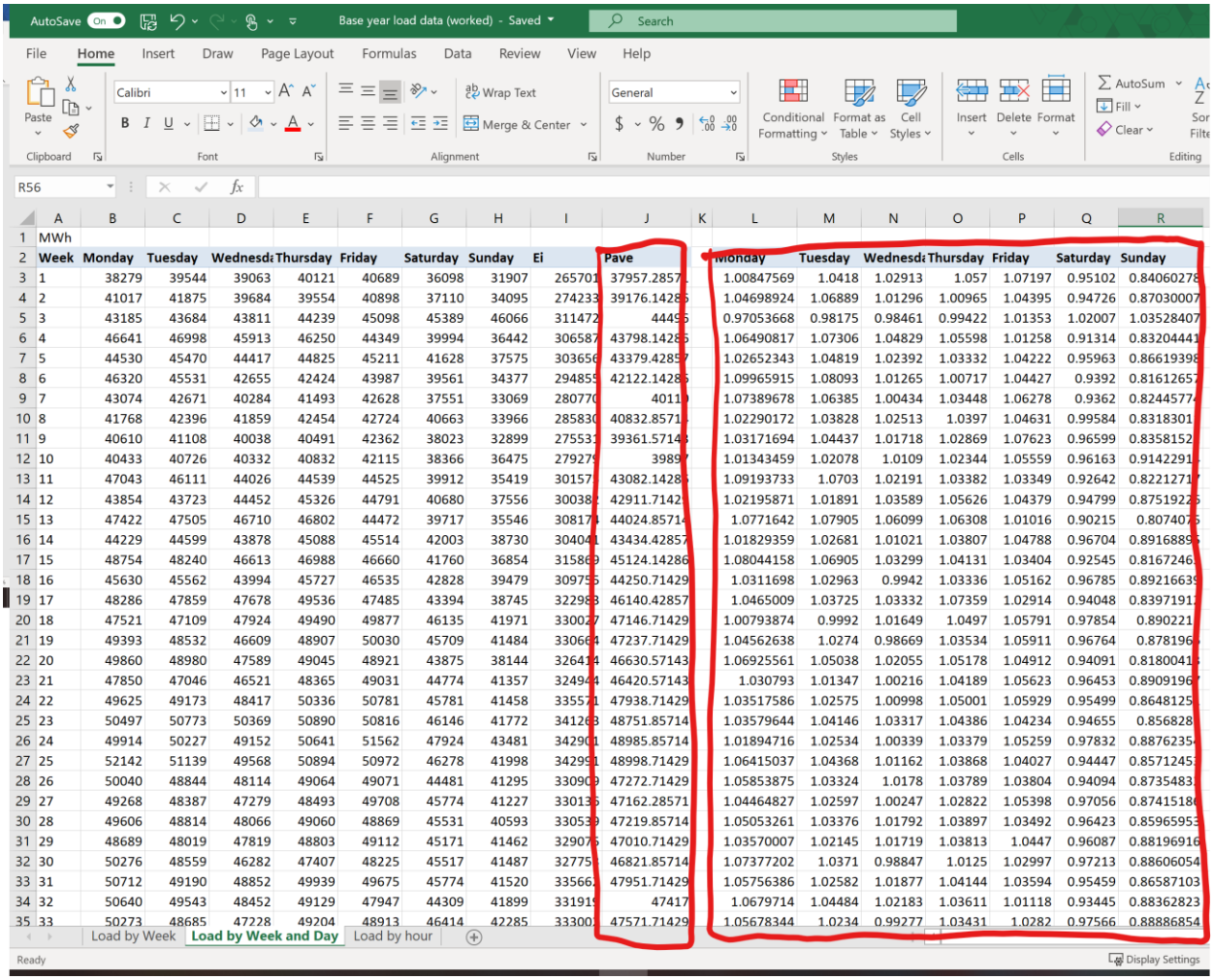
Next, calculate the seasonal coefficients “Ki” as the weekly electricity demand without the growth trend “Ei/Ti”, divided by the average weekly consumption “AWC”. You should calculate 53 values.



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.



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:

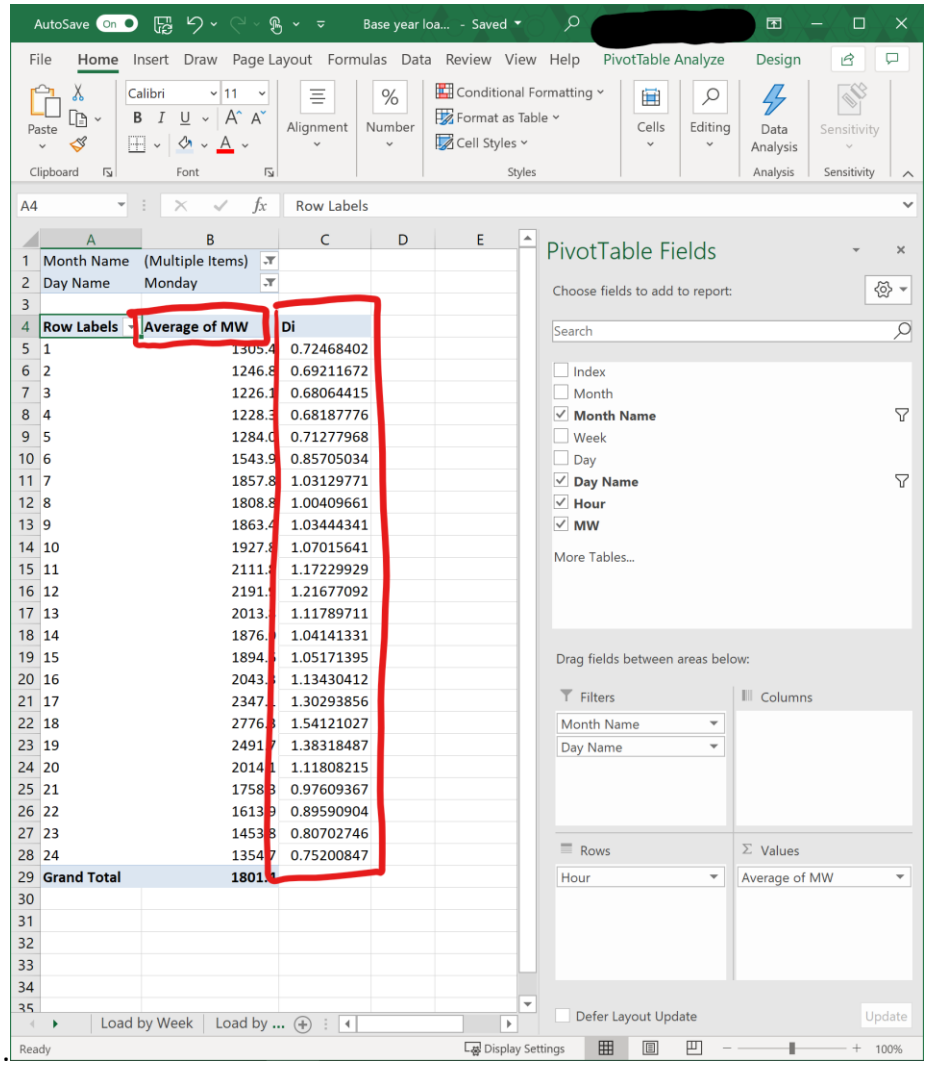
- Season 1: From January 1st to March 30th
- Season 2: From April 1st to October 31st
- Season 3: From November 1st to December 31st

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.



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.

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