

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

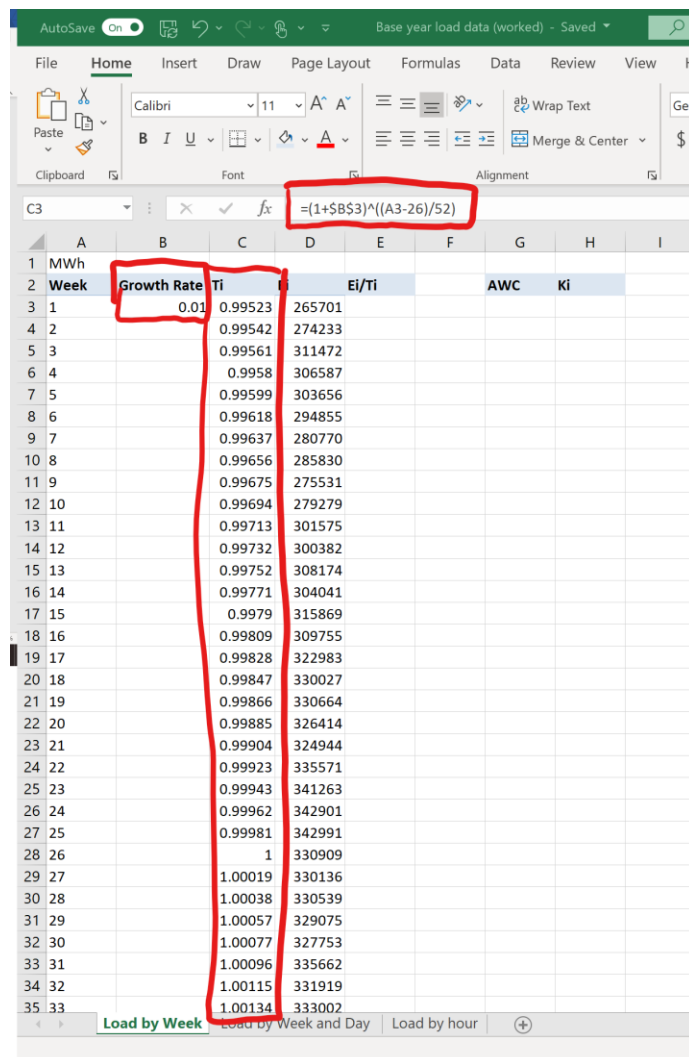
To calculate the modulating coefficients, you need hourly electricity demand data for the base year. For this hands-on session, we have provided a Microsoft Excel file with sample hourly demand data named *Base year load data.xlsx*. You can prepare your input data for MAED-el in the software of your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

File Home Insert Draw Page Layout Formulas Data Review View Help

Clipboard Font Alignment Number

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	280779	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.

AutoSave

Base year load data (workbook) - Saved

Search

FileHomeInsertDrawPage LayoutFormulasDataReviewViewHelp

Paste

Clipboard

Calibri11

B I U

Font

Wrap Text

Alignment

General

\$ %

Number

Conditional Formatting

Format as Table

Cell Styles

Styles

Insert

Delete

Format

Cells

AutoSum

Fill

Clear

Editing

R56

1

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

2

Week

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

El

Pave

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

3

1

38279

39544

39063

40121

40689

36098

31907

265701

37957.2857

1.00847569

1.0418

1.02913

1.0057

1.07197

0.95102

0.84060278

4

2

41017

41875

39684

39554

40898

37110

34095

274233

39176.14285

1.04698924

1.06889

1.01296

1.00965

1.04395

0.94726

0.87030007

5

3

43185

43684

43811

44239

45098

45389

46066

311472

44495

0.97053668

0.98175

0.98461

0.99422

1.01353

1.02007

1.03528407

6

4

46641

46998

45913

46250

44349

39994

36442

306587

43798.14285

1.06490817

1.07306

1.04829

1.05598

1.01258

0.91314

0.83204441

7

5

44530

45470

44417

44825

45211

41628

37575

303656

43379.42857

1.02652343

1.04819

1.02392

1.03332

1.04222

0.95963

0.86619398

8

6

46320

45531

42655

42424

43987

39561

34377

294855

42122.14285

1.09965915

1.08093

1.01265

1.00717

1.04427

0.9392

0.81612657

9

7

43074

42671

40284

41493

42628

37551

33069

280770

40111

1.07389678

1.06385

1.00434

1.03448

1.06278

0.9362

0.82445777

10

8

41768

42396

41859

42454

42724

40663

33966

285830

40832.8571

1.02290172

1.03828

1.02513

1.0397

1.04631

0.99584

0.8318301

11

9

40610

41108

40038

40491

42362

38023

32899

275533

39361.5714

1.03171694

1.04437

1.01718

1.02869

1.07623

0.96599

0.8358152

12

10

40433

40726

40332

40832

42115

38366

36475

279275

39897

1.01343459

1.02078

1.0109

1.02344

1.05559

0.96163

0.9142291

13

11

47043

46111

44026

44539

44525

39912

35419

30157

43082.1428

1.09193733

1.0703

1.02191

1.03382

1.03349

0.92642

0.82122717

14

12

43854

43723

44452

45326

44791

40680

37556

300382

42911.7142

1.02195871

1.01891

1.03589

1.05626

1.04379

0.94799

0.87519225

15

13

47422

47505

46710

46802

44472

39717

35546

308174

40424.8571

1.0771642

1.07905

1.06099

1.06308

1.01016

0.90215

0.8074075

16

14

44229

44599

43878

45088

45514

42003

38730

304404

43434.42857

1.01829631

1.02681

1.01021

1.03807

1.04788

0.96704

0.8916885

17

15

48754

48240

46613

46988

46660

41760

36854

315869

45124.14286

1.08044158

1.06905

1.03299

1.04131

1.03404

0.92545

0.8167246

18

16

45630

45562

43994

45727

46535

42828

39479

309755

44250.71429

1.0311698

1.02963

0.9942

1.03336

1.05162

0.96785

0.89216639

19

17

48286

47859

47678

49536

47845

43394

38745

322988

46140.42857

1.0465009

1.03725

1.03332

1.07359

1.02410

0.94048

0.8397191

20

18

47521

47109

47924

49490

49877

46135

41971

330027

47146.71429

1.00793874

0.9992

1.01649

1.0497

1.05791

0.97854

0.890221

21

19

49393

48532

46609

48907

50030

45709

41484

330664

47237.71429

1.04562638

1.0274

0.98669

1.03534

1.05911

0.96764

0.878196

22

20

49860

48980

47589

49045

48921

43875

38144

326414

46630.57143

1.06925561

1.05038

1.02055

1.05178

1.04912

0.94001

0.8180041

23

21

47850

47046

46521

48365

49031

44774

41357

324944

46420.57143

1.030793

1.01347

1.00216

1.04189

1.05623

0.96453

0.8909196

24

22

49625

49173

48417

50336

50781

45781

41458

335511

47938.71429

1.03517586

1.02575

1.00998

1.05001

1.05929

0.95449

0.8648125

25

23

50497

50773

50369

50890

50816

46146

41772

341263

47931.85714

1.03579634

1.04146

1.03317

1.04386

1.04234

0.94655

0.856828

26

24

49914

50227

49152

50641

51562

47924

43481

342901

48985.85714

1.01894716

1.02534

1.00339

1.03379

1.05259

0.97832

0.8876235

27

25

52142

51139

49568

50894

50972

46278

41998

342951

48998.71429

1.06415037

1.04368

1.01162

1.03868

1.04027

0.94447

0.8571245

28

26

50040

48844

48114

49064

49071

44481

41295

330909

47772.71429

1.05853875

1.03324

1.0178

1.03789

1.03804

0.94044

0.8735483

29

27

49268

48387

47279

48493

49708

45774

41227

330135

47162.28571

1.04464827

1.02597

1.00247

1.02822

1.05398

0.97056

0.8741518

30

28

49606

48814

48066

49060

48869

45531

40593

330539

47129.85714

1.05053261

1.03376

1.01792

1.03897

1.03492

0.96423

0.85965953

31

29

48689

48019

47819

48083

49112

45171

41462

329076

47010.71429

1.03570007

1.02145

1.01719

1.03813

1.0447

0.96087

0.88196916

32

30

50276

48559

46282

47407

48225

45517

41487

32775

46821.85714

1.07377202

1.0371

0.98847

1.0125

1.02997

0.97213

0.88606054

33

31

50712

49190

48852

49939

49675

45774

41520

33566

47951.71429

1.05756386

1.02582

1.01877

1.04144

1.03594

0.95459

0.86587103

34

32

50640

49543

48452

49129

47947

44309

41899

331911

47417

1.0679714

1.04484

1.02183

1.03611

1.01118

0.94345

0.88362823

35

33

50273

48685

47228

49204

48913

46414

42285

33300

47571.71429

1.05678344

1.0234

0.99277

1.03431

1.0282

0.97566

0.88886854

Load by Week

Load by Week and Day

Load by hour

Ready

Display Settings

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

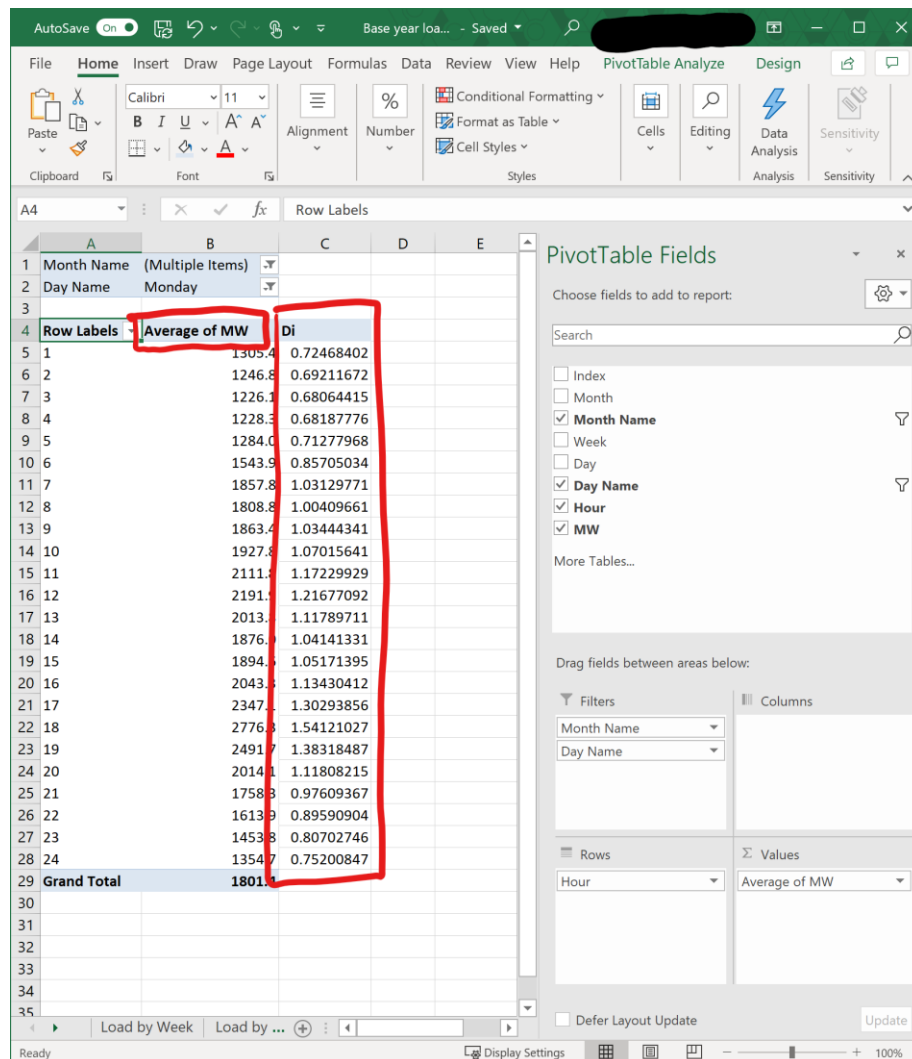


Let us focus on Mondays in Season 3, during November and December. We assume that the hourly demand in the “Load by hour” tab of the workbook is the demand of a hypothetical sector without any clients, so the whole sector is modelled as a single client.

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.



Row Labels	Average of MW	Di
1	1305.4	0.72468402
2	1246.8	0.69211672
3	1226.1	0.68064415
4	1228.3	0.68187776
5	1284.0	0.71277968
6	1543.9	0.85705034
7	1857.8	1.03129771
8	1808.8	1.00409661
9	1863.4	1.03444341
10	1927.8	1.07015641
11	2111.1	1.17229929
12	2191.1	1.21677092
13	2013.1	1.11789711
14	1876.1	1.04141331
15	1894.1	1.05171395
16	2043.1	1.13430412
17	2347.1	1.30293856
18	2776.1	1.54121027
19	2491.1	1.38318487
20	2014.1	1.11808215
21	1758.1	0.97609367
22	1613.1	0.89590904
23	1453.1	0.80702746
24	1354.1	0.75200847
Grand Total	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.



This document was updated on 01.11.2024