Comments on plots for *brownfield\_heat*

# Electricity Analysis – Mismatch PC 1 & 2

## 2020

1. Clear European monopole with Germany being of most significance
2. Division between Germany and the rest of Europa
3. For PC 1 a half day pattern emerges with 2 peaks (at 6 and 18) while for PC 2 its more of a daily fluctuation without a clear pattern
4. Large seasonal fluctuation for PC 1 but without seasonal variance. For PC 2 the flucuation are smaller but have more of a seasonal tendency
5. PC 1 has a high half day frequency. It also have a bit lower but still high daily and weekly frequency
6. A clear daily frequency for PC 2 with some half day frequency
7. High contribution for Load Electric for both PC 1 and PC 2 with Wind contribtution being slightly lower
8. For PC 1 the response is split out between Backup Generator, Import-Export and their covairance. For PC 2 it has a high percentage for Import-Export and Heat Couple and large negative covariances
9. PC 1 highest covariance is between Load Electric and Backup Generators while for PC 2 its between Load Electric and Import-Export

## 2025

1. Clear European monopole with Germany being of most significance
2. Division between Spain and Italy and the rest of Europa
3. PC 1 has same half day pattern than the previous year just slightly smaller. PC 2 shows a clear daily pattern with peak mid-day
4. Large seasonal fluctuations for PC 1 with some seasonal variance. PC 2 follows the same pattern with just a lower fluctuation
5. Clear half day frequency for PC 1 with some frequency for daily and weekly markers
6. PC 2 shows a clear daily frequency with some half day frequency as well
7. Equal contribution from Wind, Solar PV and Load Electric for PC 1 while PC 2 shows has more magnitude for Solar PV while Wind is almost the same
8. Response shows an almost equal distribution between Backup Generator and covariance with Import-Export for PC 1 while Backup Generator is the primary response type for PC 2
9. For PC 1 its mostly Wind covariances and Backup Generator that are most dominant. For PC 2 it’s the Solar PV and Backup Generator that has the larges contribution

## 2030

1. Clear European monopole with France and Germany being of most significance
2. A slight north-west European division with Germany and United Kingdom being significant for the positive countries and Spain and Italy in the negative
3. PC 1 has a daily pattern but with maxima at 6 and 18 like previously seen. PC 2 follows the same structure but without the maxima and not as low a minimum as PC 1
4. Larger fluctuation during winter month for both PC 1 and PC 2
5. For PC 1 a large daily frequency but also a high half daily frequency.
6. PC 2 has a large daily frequency with only a semi half daily frequency
7. PC 1 shows a high contribution of Solar PV with a slight lower contribution of Wind, for PC 2 the two have switched placed
8. The responses for PC 1 shows the four highest being almost equal in size. For PC 2 Import-Export is the highest contributor with Import-Export/Backup Generator as second
9. The covariance show that many of the covariance are almost equal in size with only the contribution generators being present now. This is the case for both PC 1 and PC 2

## 2035

1. Clear European monopole with Spain and Italy being of most significance
2. Division between Spain and Italy and the rest of Europa with Germany being of high significance
3. Large daily pattern for PC 1 while PC 2 shows a much smaller and opposite pattern
4. Large fluctuations for the winter month for both PC 1 and PC 2 with much less during summer which indicate seasonal variation
5. High daily frequency for PC 1 with only a semi half daily frequency
6. Shows only a semi frequency for day with no other being present
7. PC 1 shows a high contribution of Solar PV while PC 2 shows a high contribution of Wind. In both case the opposite as present but much less
8. For PC 1 Storage is the main response type while the Heat Couple is the largest for PC2 with Import-Export/Heat Couple being second
9. High covariance between Solar PV and Storage of PC 1 while PC2 it’s a mix between Wind/Heat Couple and Wind/Import-Export

## 2040

1. Clear European monopole with Spain and Italy being of most significance
2. Division between Spain and Italy and the rest of Europa with Germany being of high significance
3. Large daily pattern for PC 1 with minimum at 11 while PC 2 does not have much of a daily pattern though it seem to have a minimum at 11 and maximum at 2
4. For both PC 1 and PC 2 the seasonal variation is large. During winter month the fluctuations are large while the summer month its much less
5. PC 1 shows a high daily frequency but also a semi frequency at the half day mark
6. For PC 2 only a semi frequency for day seem to be present
7. Large contribution of Solar PV for PC 1 while its Wind that’s most dominant for PC 2
8. PC 1 has a large Storage response while PC 2 mix between multiple with Heat Couple being the most significant
9. The covariance between Solar PV and Storage is of most significance for PC 1 while PC 2 it’s a mix with Wind/Heat Couple being the largest

## 2045

1. Clear European monopole with the largest countries being of most significance
2. Division between Spain and Italy and the rest of Europa with Germany being of high significance
3. PC 1 shows a clear daily pattern with maximum at the middle of the day. For PC 2 its pattern is much more unclear with only a small variation
4. Both PC 1 and PC2 shows a seasonal variance with the largest fluctuations during the winter month
5. Using the FFT it can be seen that PC 1 shows a large daily frequency with only a semi frequency for the half day
6. PC 2 shows only a semi frequency by the daily marker
7. For PC 1 Solar PV has the highest contribution while for PC 2 its Wind that has the highest contribution with a large negative covariance Wind/Solar PV
8. Storage is the main response type for PC 1 while PC 2 is much more distributed between Heating Couple, Storage and Import-Export
9. A large covariance of Solar PV/Storage for PC 1. PC 2 the two largest are Wind covariance being between Storage and Heat Couple

## 2050

1. Clear European monopole with the largest countries being of most significance
2. Division between Spain and Italy and the rest of Europa with Germany being of high significance
3. High daily pattern for PC 1 with a mid-day peak at 11-12. For PC 2 a pattern is not emerging the same way
4. Both PC 1 and PC2 shows a seasonal variance with the largest fluctuations during the winter month
5. Large daily frequency in the FFT of PC 1 with a semi half day frequency
6. PC 2 shows only a semi daily frequency with only a very small half day peak as well
7. A clear contribution from Solar PV for PC 1 while Wind has the largest contribution for PC 2 with also a significance contribution from Solar PV and a negative covariance between the two
8. PC 1 response is mainly Storage driven while PC 2 it’s a mix between multiple with Storage and Heat Couple being the largest
9. Large covariance between Solar PV and Storage for PC 1. For PC 2 the highest is the covariance Wind/Heat Couple and Wind/Import-Export

# Heating Analysis – Mismatch PC 1 & 2

## 2020

1. Clear European monopole with the large central European countries being of most significance
2. No clear pattern. Spain and Italy being most significance of the positive countries and United Kingdom being highly significance for the negative countries
3. PC 1 carries over 90\% and shows a small daily pattern with maximum at 13 and a minimum around 4. For PC 2 its shows no daily pattern
4. For PC 1 a large seasonal variance can be seen with negative values during the winter month and positive during summer while the seasonal variance is not present for PC 2
5. The FFT of PC 1 shows a small daily frequency
6. PC 2 showcases a large daily frequency and a small half day aswell
7. The largest contribute for both PC 1 and PC 2 are Load Heat while for PC 2 the Load Cooling is the second largest
8. The Backup Generator is the largest response type for PC 1 and the second for PC 2 while Electricity Couple is the largest for PC 2. PC 2 also showcases a large covariance between the two
9. The Load Heat/Backup Generator is the main covariance for PC 1 while for PC 2 it’s the Load Heat/Electricity Couple that are the most significant

## 2025

1. The largest contribute for both PC 1 and PC 2 are Load Heat while for PC 2 the Load Cooling is the second largest
2. For PC 1 the largest response type is the Backup Generator and also the second largest for PC 2. Here the Electricity Generator is just slightly larger. Included in PC 2 are also a negative covariance between them
3. Main covariance for PC 1 is Load Heat/Backup Generator and for PC 2 it’s the Load Heat/Electricity Couple

## 2030

1. The largest contribute for both PC 1 and PC 2 are Load Heat while for PC 2 the Load Cooling is the second largest
2. For PC 1 the most significant response type is the Backup Generator while for PC 2 it’s the Electricity Couple. Backup Generator is also significant as well as a covariance between them
3. Main covariance for PC 1 is Load Heat/Backup Generator and for PC 2 it’s the Load Heat/Electricity Couple

## 2035

1. The largest contribute for both PC 1 and PC 2 are Load Heat while for PC 2 the Load Cooling is the second largest
2. For PC 1 the most significant response type is the Backup Generator with Electricity Couple and covariance between them are also of significant. For PC 2 its switched around and the covariance is now negative
3. Main covariance for PC 1 is Load Heat/Backup Generator and for PC 2 it’s the Load Heat/Electricity Couple

## 2040

1. The largest contribute for both PC 1 and PC 2 are Load Heat while for PC 2 the Load Cooling is the second largest
2. PC 1 highest response type is Electricity Couple with backup generation being less significance as well as a covariance between them. This is also the case for PC 2 but now the covariance is negative
3. PC 1 and PC 2 main covariance are the Heat Load/Electricity Couple

## 2045

1. The largest contribute for both PC 1 and PC 2 are Load Heat while for PC 2 the Load Cooling is the second largest
2. The main responses for PC 1 and PC 2 are Electricity Couple with backup generator being secondor third. A covariance between them is also of significance though its of negative value for PC 2
3. Largest covariance for PC 1 and PC 2 are the Load Heat/Electricity Couple with Load Cooling/Electricity couple being second for PC 2

## 2050

1. The largest contribute for both PC 1 and PC 2 are Load Heat while for PC 2 the Load Cooling is the second largest
2. Electricity Couple is the largest response type for both PC 1 and PC 2 with Backup Generator being less significant. A positive covariance between them can be seen for PC 1 while its negative for PC 2
3. The main covariance type for both PC 1 and PC 2 is the Load Heat/Electricity Couple