Power HH Scalars

Methodology Document

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## Half hourly scalars

Half hourly scalars are forecast based on historical data, using the following methodology:

1. **Blended price calculation:**

A weighted price is calculated based on historical N2EX day ahead and APX spot prices. The weight of N2EX and APX prices is based on the traded volumes on each exchange over the previous year (reviewed every 6 months). For each half hour:

Where is the historical ratio of APX volumes divided by the total N2EX+APX traded volumes:

1. **Filtering of Bank Holidays and Clock Changes:**

Bank holidays are removed from the data set due to their shape being similar to Sunday (and not like other weekdays) and are not used to forecast future bank holidays due to their small number (see next step). The only exception is Christmas day which has a very specific shape and is forecast separately.

Clock change days are also removed due to the shifting of hours making it harder to use in the forecast.

1. **Filtering of outliers:**
   1. **Automatic Filtering**

Very spiky days and very flat days are filtered from the historical data to improve forecast stability.

An indicator of price spikiness is calculated for each day in the historical horizon as:

The P5 and P95 of the indicator are calculated separately:

1. For groups of months with similar half hourly shape (3 groups):
   * + Winter months == 1 (see footnote below)
     + April & September == 2 (N.B. Days post March clock change are included in group 2)
     + May to August == 3
2. For weekdays, Saturday and Sunday.

All the days for which the indicator is higher than the P95 (5% most spiky days) or lower than the P5 (5% flattest days) are then filtered from the data.

* 1. **Manual Filtering**

Days can also be removed or re-added manually if they are close to the threshold or if adding/removing them impacts the stability of the forecast. Check the shape of the day against other values to see if there is a significant impact on the output.

1. **Historical scalars calculation:**

Historical scalars are then calculated as:

Note that the monthly average blended price excludes any data filtered in the previous step.

1. **Generate One Year Forecast:**

Historical scalars are aggregated to create a one year set of scalars. The historical scalars are aggregated based on the following parameters (see current parameters in section 4):

* 1. Weights on the past years, for example using a straight average or exponential average of the past 3 years.
  2. Number of sets per year, for example using one set per month or one set for months with high correlations.
  3. Numbers of sets per week, for example one set for each day of the week or one set for weekdays and one for weekends.

In addition:

* 1. Bank holidays have the same scalars as Sundays except Christmas which is forecast using historical Christmas days.
  2. Clock change months (March and October) are separated into two periods. The beginning of the month is forecast like other months but the scalars of post-clock change period are forecast using the following month data (April and November). This is because the clock shift makes the shape of these days closer to the following month.

1. **Bias adjustment:**

Although one expects scalars for some months to be similar (e.g. July and August), future scalars are forecast month by month (Forecasting several months at the same time has proven to be less accurate (based on historical analysis)). It means that if a significant change to the scalars appears in the data, it could take several months to be added to the whole forecast and creating a bias in the meantime. An adjustment is being made to the forecast to correct for potential biases:

* 1. The adjustment is only being made to the future months of the current season (if the forecast is done in August, only August and September will be adjusted)
  2. The adjustment is calculated based on the past months of the current season (if the forecast is done in August, the adjustment will be calculated based on April to August data)
  3. The adjustment is calculated, for each HH, as the average ratio of the current forecast for the past months of the current season to the previous forecast for these same months.

Where n is the number of months since the beginning of the season (4 in the above example).

* Future months’ scalars (within the season) are finally multiplied by the adjustment.

1. **Six Year Forecast:**

The one year set of scalars is projected into a set of scalars that spans over 6 years (horizon of the authority curve). It is finally adjusted so that the average of every month is equal to one. The adjustment factor is calculated as:

The factor is generally very close to 1.

## **Model update process**

1. **Scalars update**

The new set of scalars is produced once a month (around the middle of the month). The naming convention for the model used to create the monthly update of the scalars is: Scalars model\_mmm-yy.xlsb

1. On the ‘Cover’ tab, update the Report Date (1st day of the current month). All the other dates are updated automatically. For reference, the forward curve starts on the 1st day of the following month and ends at the end of the 10th season. The start date of the current season is used in the Bias adjustment. The start of historical data is always 3 years prior to the start of the current season date – please note it always starts on the last day of the month before the start of the current season due to EFA day structure (23:00 to 22:30).
2. Copy the previous scalars in "Previous scalars" tab (starting from column C)
3. Update Market Prices (N2EX and APX spot prices) in horizontal layout. There is currently an issue with Data Genic which prevents the automatic refresh of data with hourly or HH horizontal layout. Therefore, each month the the price data populated the previous month needs to be deleted and replaced by the required data by searching for N2EX Hourly Spot Day Ahead GBP Prices and APX UK Electricity Spot Price Full day in Data Genic. Prices are extracted from the date defined as ‘Start of historical data' on the Cover tab until the last day of the month before current month.

1. The updated HH scalars and comparison with the previous ones are shown in the tabs ‘New scalars – charts’ and ‘New vs previous – charts’; EFA Blocks scalars are calculated in ‘Block scalars’. Historical data can also be further analysed (Average, percentiles…) using the tab ‘Statistics’. Check if the updated scalars are consistent between months and in line with trends observed. If not go to 5, otherwise to 6.
2. The model automatically filters the most spiky and flattest days (beyond P5/P95). However, dates can be manually added/removed from the data set to improve the forecast. For example, dates which fall very close to the P5/P95 can be re added/filtered if their impact on the forecast is too great, or dates can be re added if as a result of filtering there is not sufficient data to forecast some scalars (such as Saturdays or Sundays). The dates under the title Added (column A) are dates added manually to the model – column B defines if they are excluded under the automated process or not. Similarly, dates under the Dates Excluded (column E) are dates that are manually excluded from the model –column F defines if they are excluded from the model under the automated process or not.
3. Click the button "Generate Scalar Release" on the ‘Cover’ tab. A macro copies the final scalars (‘Fwd scalars final’ tab) into a separate spread sheet and save it under: P:\Analysis and Risk Team\Scalars Derivation\release\Scalarsyyyymm.xlsx
4. Email ESH the new released scalars saved in the release folder along with the charts showing new vs. current, new and current scalars for the month before current (month that reflects the price update). Also request the latest authority curve model in order to evaluate the impact of the new scalars.
5. **Six Month Parameters Update:**
6. Update the model’s parameters based on the outcome of the methodology review. APX/N2EX %, weights across the last 3 years and how days are aggregated .
7. Update Holiday and BST Calendar to include all the dates needed for the scalars creation.

**Comparison of impact of current and new scalars on curve**

The **PowerCurveModel\_II\_v**… is used to calculate the current authority curve based on the new scalars. This can be requested from EM&T.

1. The current authority curve based on the current scalars is copied from the “**DailyCurve\_Output**” tab in “PowerCurveModel\_II\_v…” to the Curves\_Mmm\_YY file
2. The new released scalars saved in the release folder are copied to the “**HH\_Scalars\_Value\_INPUT**” tab in PowerCurveModel\_II\_v….
3. The “DailyCurve\_Output” tab in “PowerCurveModel\_II\_v…” with the new scalars is copied to the Curves\_Mmm\_YY file.

**Financial impact and approval**

The financial impact is calculated based on the Impact mmm-yy.xlsx model

1. On the ‘Cover’ tab, update the Report Date (1st day of the following month).
2. Copy the curves based on the current and new scalars from the **Curves\_Mmm\_YY** file to the “**Fwd curve\_current**” and “**Fwd curve\_HH update”** tabs in the Impact mmm-yy.xlsx model respectively
3. For the UKB impact, The ‘Power Demand Forecast’ is extracted from Entrader and pasted to the ‘Forecast DCRM’ tab
4. The UKH impact is requested from the UKH Commodity Hedging Finance team. Send them the “Curves\_Mmm\_YY” file to calculate this. This is then inputted into the ‘Email’ tab.
5. The financial impact of the new set of scalars is summarised for UKB and UKH on the Email tab.
6. Send an email to the Head of UKB Energy Procurement (for UKB) and the Head of ESH (for UKH) seeking their approval of the updated scalars before the end of the current month.

The email includes:

* 1. The financial impact of updating the scalars for both UKB and UKH
  2. Charts showing current scalars, proposed scalars and the difference between proposed and current scalars.
  3. Chart showing the monthly impact of TOTEM scalars update.
  4. The proposed half hourly scalars to be used by ESH.

1. Once approved the new scalars must be used by ESH to produce the daily authority curve.

## **Current parameters of the model**

The parameters used in the model are (as of March 2017):

|  |  |
| --- | --- |
| **Parameter** | **Value** |
| N2EX volume ratio | 66% |
| APX volume ratio | 34% |
| Weights on past years | Y-1= 60% ; Y-2=30%; Y-3=10% |
| Sets per week | 1 for weekdays, 1 for Saturdays and 1 for Sundays |

## **Six monthly parameters review**

The parameters of the model are reviewed every 6 months:

1. The N2EX/APX volume ratios are updated in line with the volumes traded on both markets over the past year for BGT.
2. The forecasting accuracy of the methodology with the parameters in use is tested over the past 3 years and compared to other possible historical methodologies. The following parameters of the model are tested:
   1. Number of years of historical data used: 1, 2 or 3 years
   2. Weights on the past years: straight or exponential average
   3. Number of sets per week: a different set for each day of the week, one set for weekdays and one set for weekends or a different set for weekdays/Saturdays/Sundays.

Other parameters can also be tested if deemed relevant.

The forecasting performance is assessed using the following measures:

1. MAPE (Mean Average Percentage Error) over each half hour:
2. Mean Absolute Price Error (£/MWh) over each half hour:

If using different parameters is found to have a better performance over the past 3 years, an update of the parameters can be proposed.