BSUoS Forecast Improvement Update

26 January 2022

nationalgridESO

BSUoS Forecasting Update

Balancing Services Use of System (BSUoS) charges are a tariff on users of the network to recover the costs we incur balancing the system.

We are committed to continually improving our forecasting and to provide greater insight to the market around changing BSUoS costs.

- We have been publishing more detailed BSUoS forecasts in recent years but we recognise that recently these have not been providing sufficient insight into costs and ultimately the charges system users will face.
- In our 5 point plan to manage constraints on the system we committed to improve transparency and insight into our forecasts of the costs incurred managing flows on the network.

To address these challenges we have now published a forecast based on a new improved methodology.

- This model moves away from the previous BSUoS forecasting linear model to a more comprehensive probabilistic model.
- It takes advantage of improved data inputs and we believe it will provide better insight into BSUoS costs over both short and longer timescales.
- We plan on making incremental improvements to the modelling and datasets included, including the 24month ahead Constraint Limit dataset. This will provide increased accuracy in our modelling forecast inputs.

We want to provide clarity to the changes for our customers and other users of the forecast.

- Please continue to feedback to us on your expectations in relation to the forecasts, this helps us present the information in a way that helps you and informs our future communications.

We would note that CMP381 has been approved from the 17th January 2022. This will place a cap of £20/MWh on BSUoS charges with any amounts above that being rolled into the 2022/23 charging year up to a maximum of £200m. The impact of this is not included in this month's forecast.

BSUoS Forecast for Feb-22

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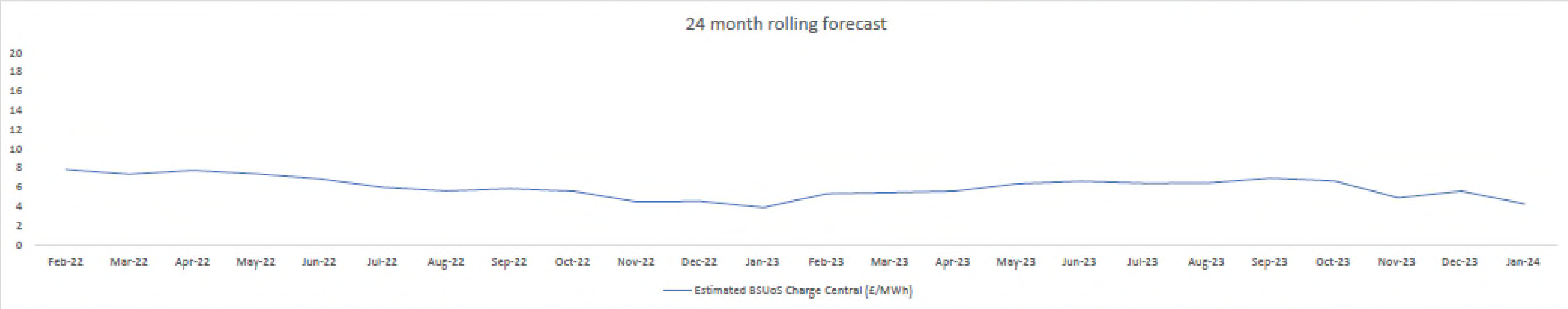


	Feb-22	Mar-22	Apr-22	May-22	Jun-22	Jul-22	Aug-22	Sep-22	Oct-22	Nov-22	Dec-22	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24
Balancing Costs (Central) £m	321	305	287	256	222	195	182	200	204	196	202	187	217	227	201	217	213	210	213	242	247	216	254	205
Estimated Internal BSUoS & ESO Incentive £m	21.71	24.04	23.26	24.04	23.26	24.04	24.04	23.26	24.04	23.26	24.04	24.04	21.71	24.04	23.26	24.04	23.26	24.04	24.04	23.26	24.04	23.26	24.04	24.04
BSUoS Cost Recovery £m	5.20	5.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ALoMCP £m	1.67	1.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CMP345/350 Deferred Costs £m	1.66	1.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CMP381 Deferred Costs £m	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total BSUoS (Central) £m	351	338	310	280	245	219	206	223	228	219	226	211	239	251	224	241	236	234	237	265	271	239	278	229
Estimated BSUoS Volume (TWh)	44.70	45.99	40.04	37.86	35.66	36.44	36.73	38.17	40.75	48.75	49.68	53.73	44.70	45.99	40.04	37.86	35.66	36.44	36.73	38.17	40.75	48.75	49.68	53.73
Estimated BSUoS Charge Central (£/MWh)	7.86	7.36	7.75	7.40	6.88	6.01	5.61	5.85	5.60	4.50	4.55	3.93	5.34	5.46	5.60	6.37	6.62	6.42	6.45	6.95	6.65	4.91	5.60	4.26

Our forecasts available at the ESO Data Portal:
https://data.nationalgrideso.com/balancing/monthly-balancing-services-use-of-system-bsuos-forecast-reports

Balancing Cost Forecast Modelling Overview

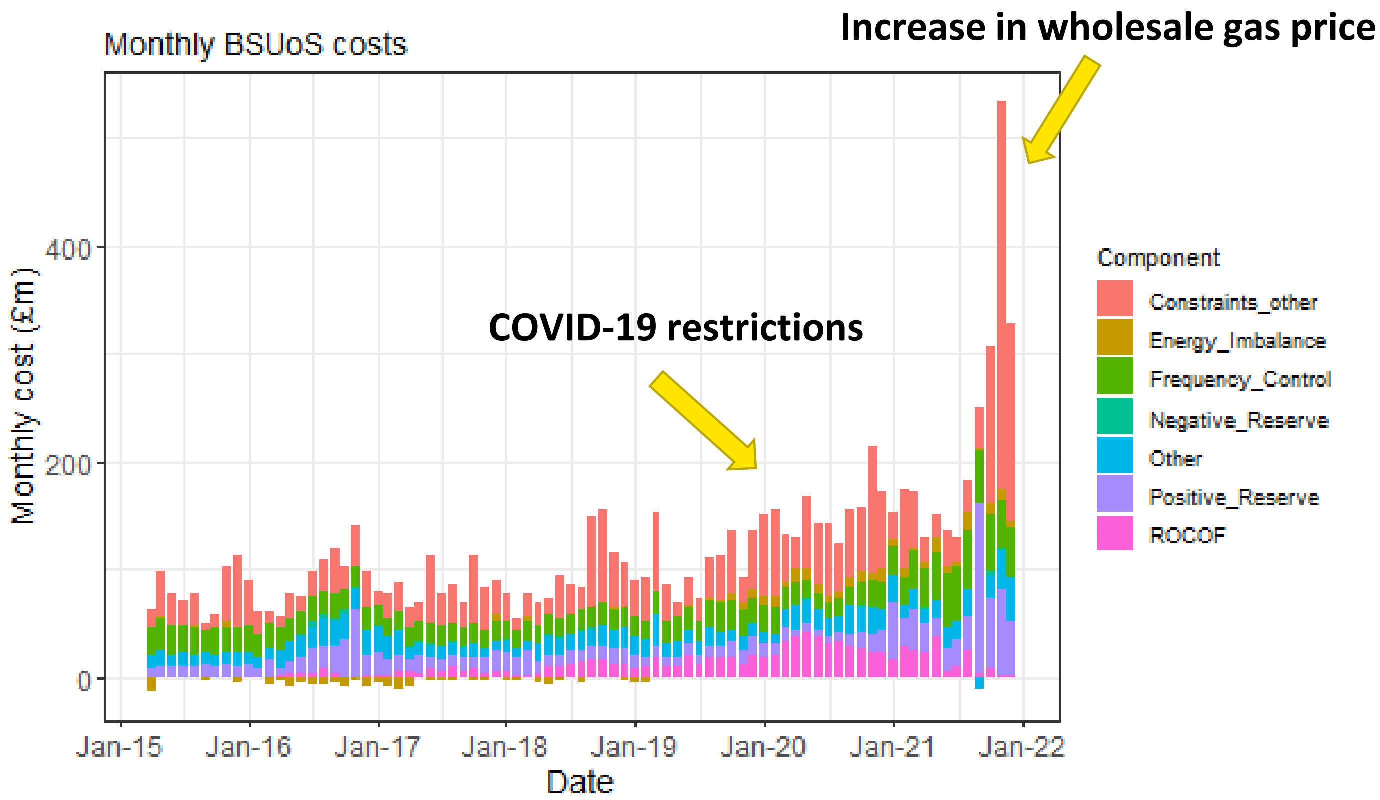
Our balancing cost forecast development sought to produce a forecast with explanatory power, which has explicit drivers capturing what we know about future changes to the system and acknowledges the level of uncertainty driven by chance or unforecastable events and conditions.

- To forecast the overall costs, we model the different component costs, each with different drivers and magnitude of variability. Then aggregate to determine the total control room balancing cost.
  - The forecast is at monthly resolution with a horizon of up to 36 months.

- To forecast for a wide timescale, we use a blended output approach. This combines the output of different models capturing the variability over different time scales.

  - For shorter time scales the forecast is mostly dependent on time-series modelling using historic costs modified to reflect future conditions, and explanatory variables to capture weather and wholesale electricity price variability.
  - For longer time scales a forecast is made based on the central scenario of network and market development.
    - Monte Carlo techniques are then employed to find the variability around the central forecast, capturing the inherent variability driven by the explanatory variables and the uncertainty in the scenarios

Balancing Cost Variability



Modelling Variability

Drivers of variability

We first identify the main drivers of cost variability.

- Wholesale electricity costs
- Government and Regulatory policy
- Network changes
- ESO Policies
- Weather variability
- Network and generator outages
- Large unexpected events

Impact of variability

- **Weather impacts:**
  - High wind output leads to higher constraint costs
- **Major outages** of generators, interconnectors or transmission equipment lead to higher management costs
- **Wholesale electricity costs**
  - Prior to recent increases we had made an assessment of reasonable variation
  - Subsequent to the gas price surge we have reassessed
- **Network improvements** alter constraint costs particularly
- Further ahead, uncertainty in **future regulatory changes or government and ESO policies** affect potential future costs

Drivers of variability

Driver	0-1 year	1-2 years	2-3 years
Wholesale electricity price	Variability due to weather and geopolitical factors		
Government Regulation and Policy	Known policies and details	Range of policies and regulation possible	
Network Changes	Network configuration known	Network upgrades known but completion date / delays unclear	
ESO policies	Known policies and details	Broad policy view, details tbc	Range of policies but no decision made
Weather variability	Weather variability: predictability approximately constant across all relevant lead times		
Network and generator outages	Planned outages known	All outages unknown	
Large unexpected events	Can occur at any time		

Time-series models

- Time-series models using historic costs and explanatory variables to capture the short-term cost variability.
- Two time series models used: Persistence and Auto-regressive integrated moving average with explanatory variables (ARIMAX).
- Explanatory variables used to capture the variability due to weather and wholesale electricity price.
- Large uncertainty in the explanatory variables at all time scales. It is not possible to accurately forecast the weather variables at lead times of greater than approximately 10-15 days.
- Monte Carlo simulation models utilise 50,000 simulations based on different magnitudes of the explanatory variables. They provide a representation of the uncertainty in the forecast.
- Residual variability (dependent on lead-time) added for each simulation to represent unexpected event variability.

Driver	0-1 year
Large unexpected events	Can occur at any time
Wholesale electricity price	Variability due to weather and geopolitical factors
Weather variability	Weather variability approximately constant across all lead times
Government Regulation and Policy	Known policy and details
Network Changes	Network configuration known
Network and generator outages	Planned outages known
ESO policies	Known policy and details

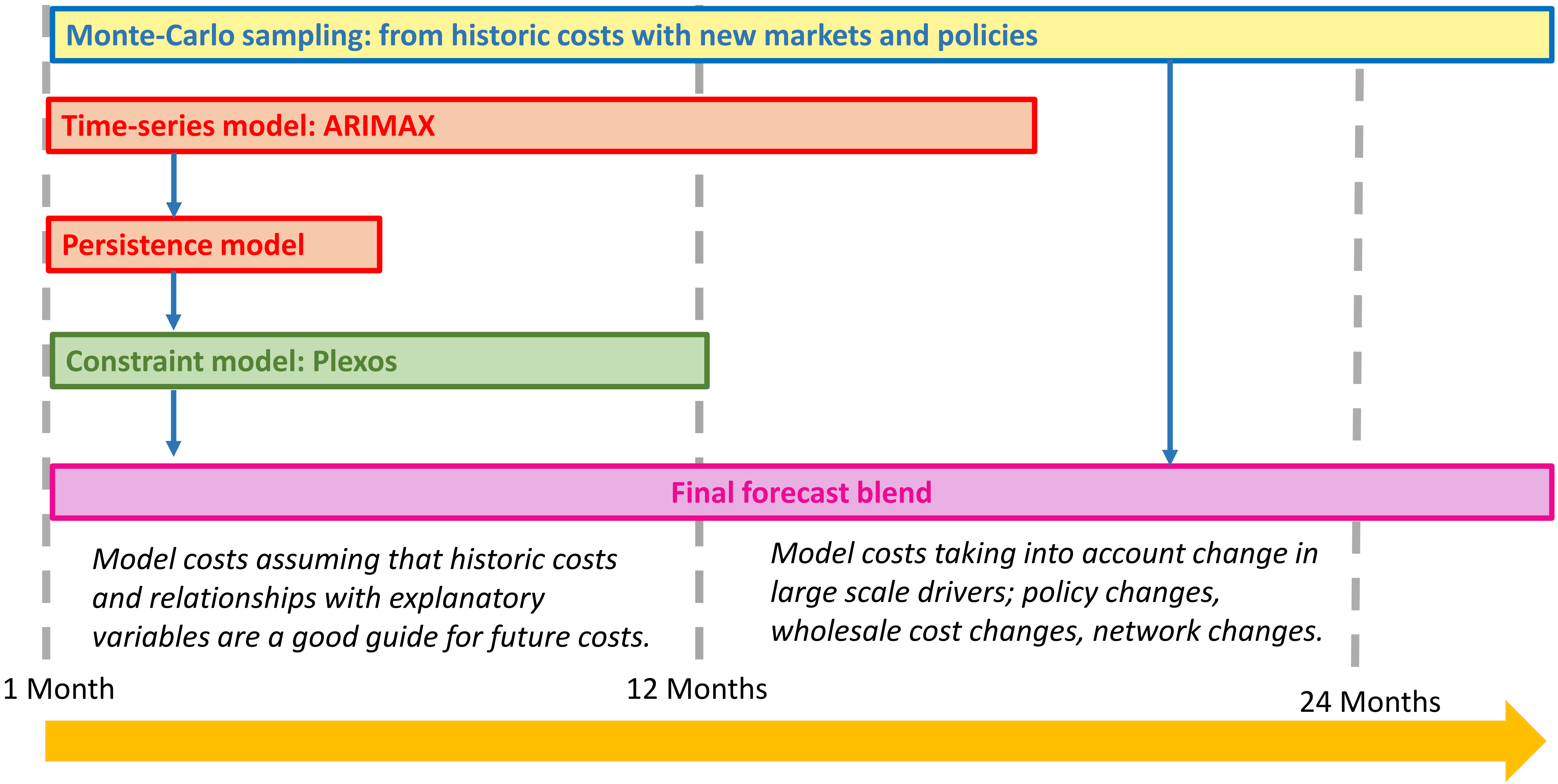
Long-term models

- Central forecast is made for each cost component based on the scenarios of network and market development.
- New costs are added for markets which are expected to develop over the forecast period based on NGESO policy.
- **Frequency control:** Central forecast based on scenarios (provided by Structuring and Optimisation team) which outline DC pipeline etc.
- **Constraints:** Central forecast based on scenarios of proposed future network developments outlined in NOA6 study[1].
- **All other components:** central forecasts based on recent costs. No large-scale driver in the pipeline leading to shift in central cost.
- Monte Carlo techniques are employed to find range for each cost element, capturing the inherent variability driven by the explanatory variables.
- Residual variability (dependent on lead-time) added for each simulation to represent unexpected event variability.

Driver	1-2 years	2-3 years
Wholesale electricity price	Variability due to weather and geopolitical factors	
Government Regulation and Policy	Range of policies and regulation possible	
Network Changes	Network upgrades known but completion date and delays unclear	
ESO policies	Policy decided but details unclear	Range of policies but no decision made
Weather variability	Weather variability approximately constant across all lead times	
Network and generator outages	All outages unknown	
Large unexpected events	Can occur at any time	

1 https://www.nationalgrideso.com/document/194436/download

Blending of models: example



Summary of BSUoS Forecasting Modelling improvements

We are committed to continually improving our forecasting and to provide greater insight to the market around changing BSUoS costs.

- There are several drivers of variability inherent in forecasting BSUOS and each brings with it impacts on the overall variability of the forecast.

We have now published a forecast based on a new improved methodology.

- This model moves away from the previous BSUoS forecasting linear model to a more comprehensive probabilistic model.
- It takes advantage of improved data inputs and we believe it will provide better insight into BSUoS costs over both short and longer timescales.
- We plan on making incremental improvements to the modelling and datasets included, including the 24month ahead Constraint Limit dataset. This will provide increased accuracy in our modelling forecast inputs.

BSUoS Forecast Improvement Timescales

January 2022

Stakeholder engagement through OTF and Elexon circular

Review and act on feedback received

w/c 24 January
Publish February 2022 forecast using improved methodology

OTF deep dive on February forecast values and model

February 2022

Publish March 2022 forecast

Modelling development & enhancement:

Inclusion of Constraint Cost dataset as model input

March 2022

Publish April 2022 forecast

Consultation launches for balancing cost model approach and methodology

This to inform further developments of modelling for BSUoS tariff setting

September 2022

Model development completed

Fixed BSUoS tariffs published ahead of April 2023 implementation

Modelling development & enhancement

For any feedback on our approach and timescales for change please get in touch: .box.NC.Customer@nationalgrideso.com

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