DNV Forecast User Guide

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1 EXECUTIVE SUMMARY

The contents of this user guide are intended to provide users with the necessary information to access, consume, and interpret the forecast data once they have been onboarded to the DNV forecast system. Users will also learn how they can receive ongoing support for their forecast services.

2 API

If the user has chosen API as their primary method of forecast delivery (during the onboarding process), DNV will setup an API account and assign the proper forecast permissions to it. Credentials will be provided to the user for accessing their API forecast end points.

The following steps will allow you to test account access, become familiar with the structure of the API, and gather the necessary metadata and information for coding and automating processes around the API.

2.1 Forecaster API End Points

- GET /api/Status

  Checks the status of the API and validates authentication.

- GET /api/Catalogue

  Returns the user's catalogue of accessible resources.

- GET /api/Site/:siteId

  Returns the specified Site including metadata and ForecastCollections.

- GET /api/Aggregate/:aggregateId

  Returns the specified Aggregate including metadata and ForecastCollections.

- GET /api/ForecastCollection/:forecastCollectionId?forecastValues=<boolean>
  &issueDateTime=<dateTime>
  Returns the information about the Forecasts under the collection. If issueDateTime is omitted the most recent forecasts are returned. Set forecastValues to true to return forecast data. issueDatetime needs to be in ISO 8601 UTC format e.g. 2020-01-23T12:00:00Z

- GET /api/Forecast/:dataSeriesId?issueDateTime=<dateTime>
  Returns the requested Forecast. If issueDateTime is omitted the most recent forecast is returned. Issue date time needs to be in ISO 8601 UTC format.

2.2 Authentication

There are two headers required in any request to authenticate against the API:

- “Ocp-Apim-Subscription-Key” with the API subscription key value.

- “Bearer eyJ0eXAiOiJKV1QiLCJhbGciOiJSUzI1Ni…”, the bearer token retrieved using the supplied client credentials added as an Authorization header. The bearer token has a lifespan of 1 hour and will need to be refreshed after this period.

  The token end point for fetching the bearer token is
  https://login.microsoftonline.com/dnvglb2cprod.onmicrosoft.com/oauth2/token

2.3 Forecaster API Access

To test access to the DNV GL Forecaster API without having to write any client code first we recommend using Postman (www.postman.com) and have included a Postman collection to help you get started. You will need to have Postman installed and your access credentials to hand. Follow the steps below to test out your credentials and view the data available to you.

1) Open Postman and click on Import. On the File tab click Upload File and navigate to the Forecaster Public API CLIENT.postman_collection.json file. Click on Import and Postman will create the Forecaster API collection in the left-hand panel.

2) Mouse over the Forecaster API collection and click the three dots to view more actions. Select Edit from the menu to open the editor and select the Variables tab.

3) In the current value column type in the subscription key, client id and client secret values we have supplied separately and click update to save the values.

4) Expand the Forecaster API collection and the API menu item to see the end points supported by the API. For convenience we have included a method in the collection to fetch a bearer/access token, this would normally be handled by client code (using MSAL or some other library). Select “Get access token” and then click **Send** to retrieve an access token. This token will automatically be included as a Bearer authorization header in subsequent requests.

5) To test authentication and access to the API select “Get status” and **Send**. You should get the following returned indicating that your credentials are correct, and your account has been set up:

```
"Connection to DNV GL Forecaster API was successful."
```

6) Select “Get Catalogue” and **Send** to retrieve a set of Sites and/or Aggregates assigned to your account. Copy a site or aggregate id.

7) Select “Get Site” or “Get Aggregate” and replace the :id placeholder in the url with the id copied from the catalogue to return a set of forecast collections. Copy the id of a collection.

8) Select “Get ForecastCollection” and replace the :id placeholder in the url with the copied collection id. Delete the query parameters after the id to simply return the list of forecasts in the collection. You can set the forecastValues parameter to true to return the latest forecast data or set it to true and add an issue date time to return values from a specific time. Copy the id of a Forecast.

9) Select “Get Forecast” and replace the :id placeholder in the url with the copied forecast id. Delete the issue date time to return the latest forecast or specify an issue date time to return values from a specific time.

2.3 Other resources

Additionally supplied resources for aiding in coding around the API include the swagger.json document, which helps to describe the API spec. Also, dnv_api_sample_code.py, which provides the user a good starting place should they choose to adopt it.

3 SFTP

If the user has chosen SFTP as their primary method of forecast delivery (during the onboarding process), DNV will setup an SFTP account and route the relevant forecast output files to that location. A username and password will be provided to the user for login. No whitelisting of IPs is necessary. It is recommended the user first attempt logging into the SFTP through an FTP Client (e.g., Filezilla) to test connection and verify access to the deliverables.

hostname: sftp.forecasting.dnv.com

port: 22

username: (DNV provided username)

password: (DNV provided password)

The user then is responsible for setting up any automated processes on their end to routinely download and ingest the files.

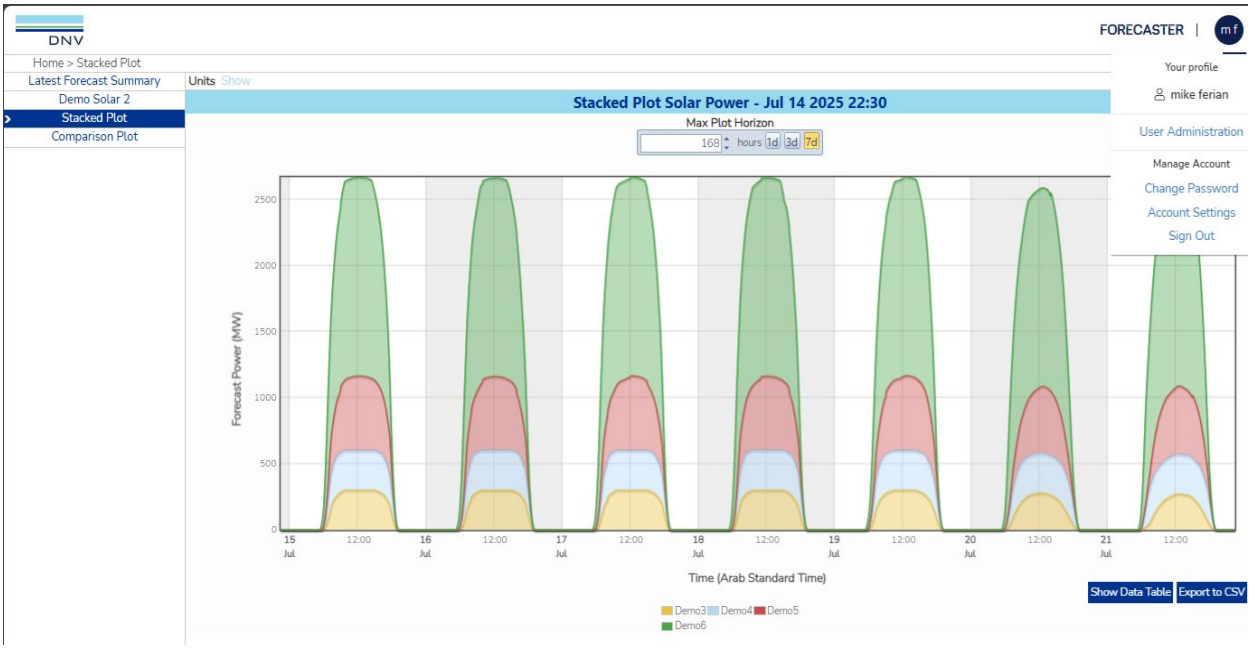
For additional information pertaining to the delivered file format and contents standards, please see “DNV_SFTP_file_standards.xlsx”.

4 WEBSITE

All users will receive access to the DNV Forecaster Web Portal. Once your account is created either by DNV staff or your company admin, you will receive an automated email from Veracity.com with instructions for setting up your account. When setting up your profile in Veracity, make sure to use a phone number for an accessible phone as that number will be used for 2 Factor Authentication (important for shared accounts!).

4.1 Navigation

1. After setting up your account, go to https://forecasting.dnv.com/ and login with your Veracity credentials.
2. You will see the Forecaster web portal and the company assigned web portals.



3. Each company has an assigned ‘Company Administrator’ who will need to create accounts and assign portals for others in the company who wish to receive website access. To do this, click on the profile button (with your initials) in the upper right corner. Click on ‘User Administration’. On the next page click ‘Manage Users’
4. Here you will see a list of all the users in your company. To add a new user, click ‘New User’. A box will pop up to provide some information. Fill out the info and click ‘Create’.

5. Hit the browser refresh button to refresh the page. Search for the user you just created and click ‘Web Portals’ next to their name.
6. Choose the web portal on the left and press ⇒ so it shows on the right column
7. Click Save
8. The next time the user logs in, the web pages for that assigned portal should appear.

4.2 Functionality

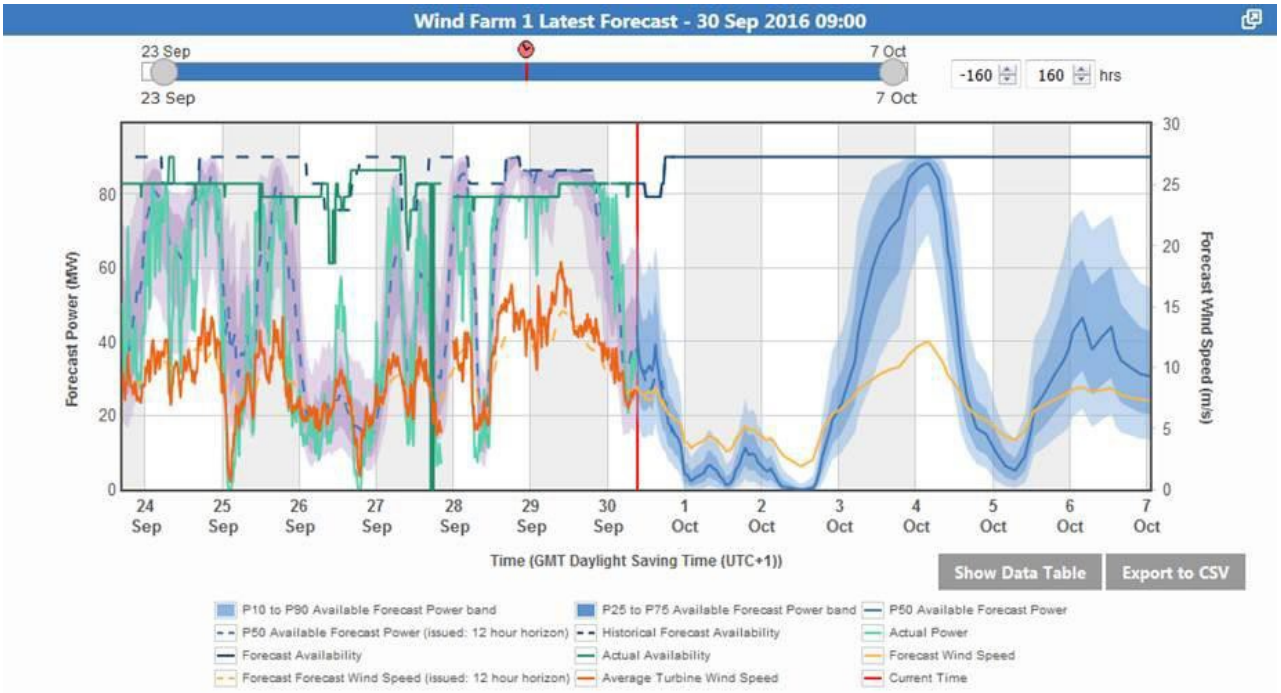
DNV’s Forecaster Web Portal has been designed in collaboration with our customers to provide the up-to-the-minute information they require to make decisions.

The web portal provides charts and numerical data for the latest DNV forecasts as well as real-time feedback data from customer sites and information and analysis regarding forecast performance.

Some example screenshots from and descriptions of the Forecaster Web Portal are shown below:

Site-Specific / Portfolio Latest Forecast View

Shows the latest forecast at site or portfolio level as well as recent measured data and forecast performance.



Here, time now is marked by the red vertical line.

To the right of the red line (future), the power forecast with uncertainty bands is shown in blue, the wind speed forecast is shown in orange, and the predicted availability (provided by the customer) is shown in dark blue.

To the left of the red line (past) is show the measured power generation (cyan) and measured wind speed (dark orange) and the dotted lines (power – dotted blue, wind speed – dotted orange) show the forecasts that were issued for those times at past horizons (in this case 12 hours before actual). Also shown is the predicted site availability (dotted dark blue) 12 hours ahead and the realised site availability (dark green). ‘Historical Forecast Plot’ options

allow the user to define their desired historical forecast look-back series. The user can view the raw data via the 'Show Data Table' button or export the data to CSV.

Historical Forecast Plot

Fix to issue time: Allows you to view a forecast issued at a certain day/time in the past.

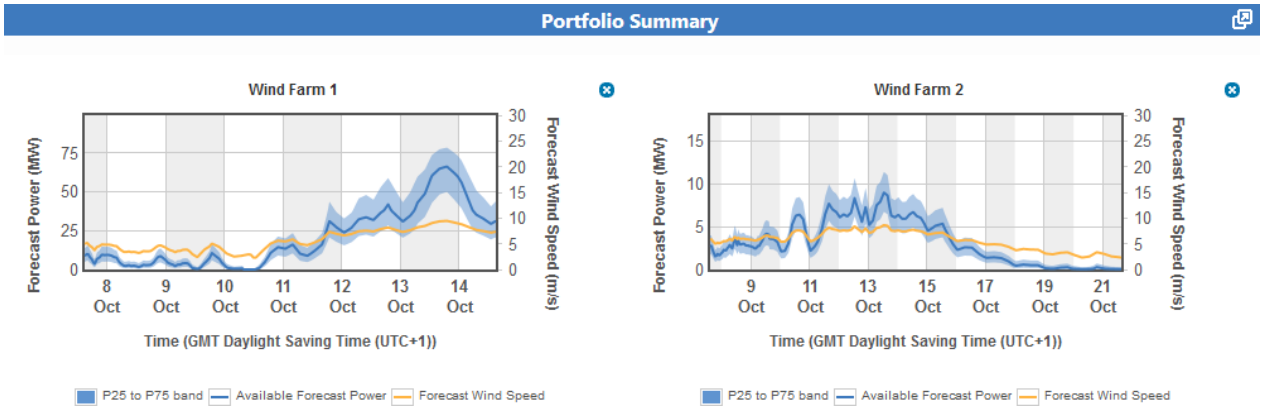
Fix to hours ago: Allows you to view a forecast issued up to 48 hours in the past.

Fix to day ahead: Plots the historical day-ahead forecast series issued at a given time each day over the 7-day look back period (e.g., Fix to day ahead 09:00, each plotted value is a prediction from the forecast issued the previous day at 9 a.m.)

Fix to horizon: Plots the historical forecast series for the given forecast horizon (e.g., Fix to horizon 1 Hour, each plotted value is a prediction from the forecast issued 1 hour prior to the forecast time.

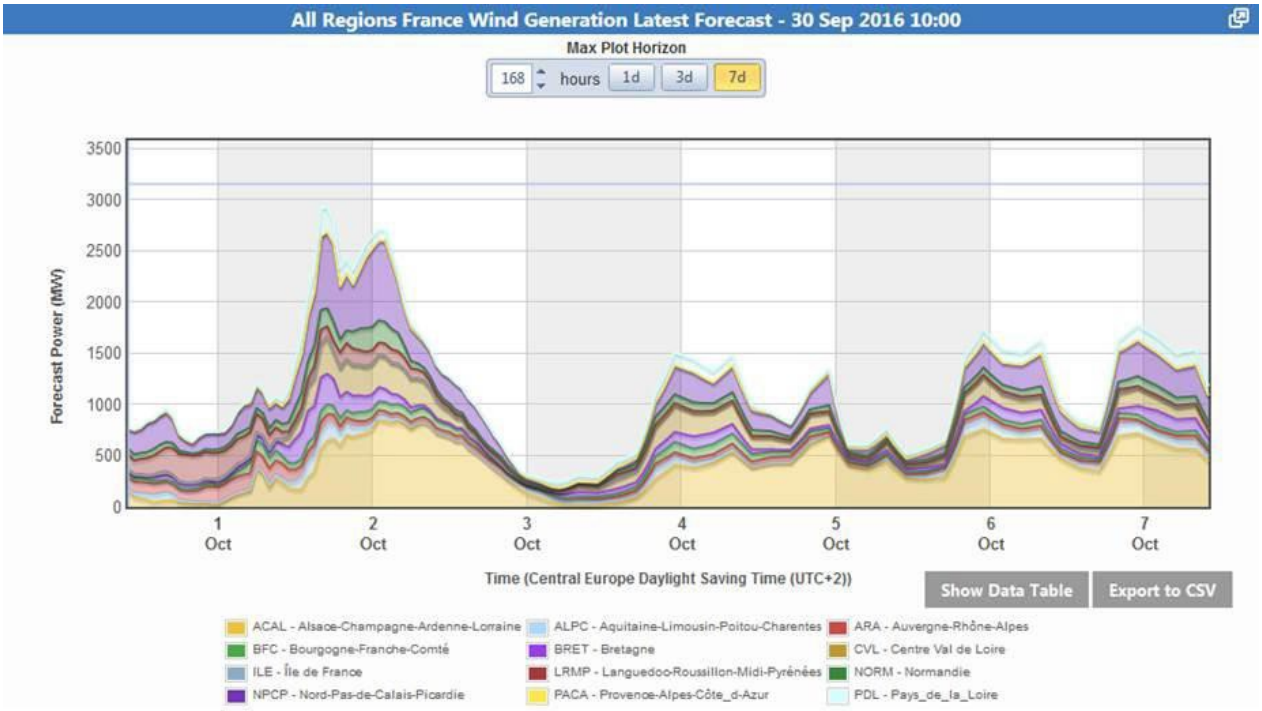
Portfolio summary view

Multiple plots on a single page of the latest forecast for each site in a portfolio for quick viewing and comparison of expected wind speeds and power generation at each site.



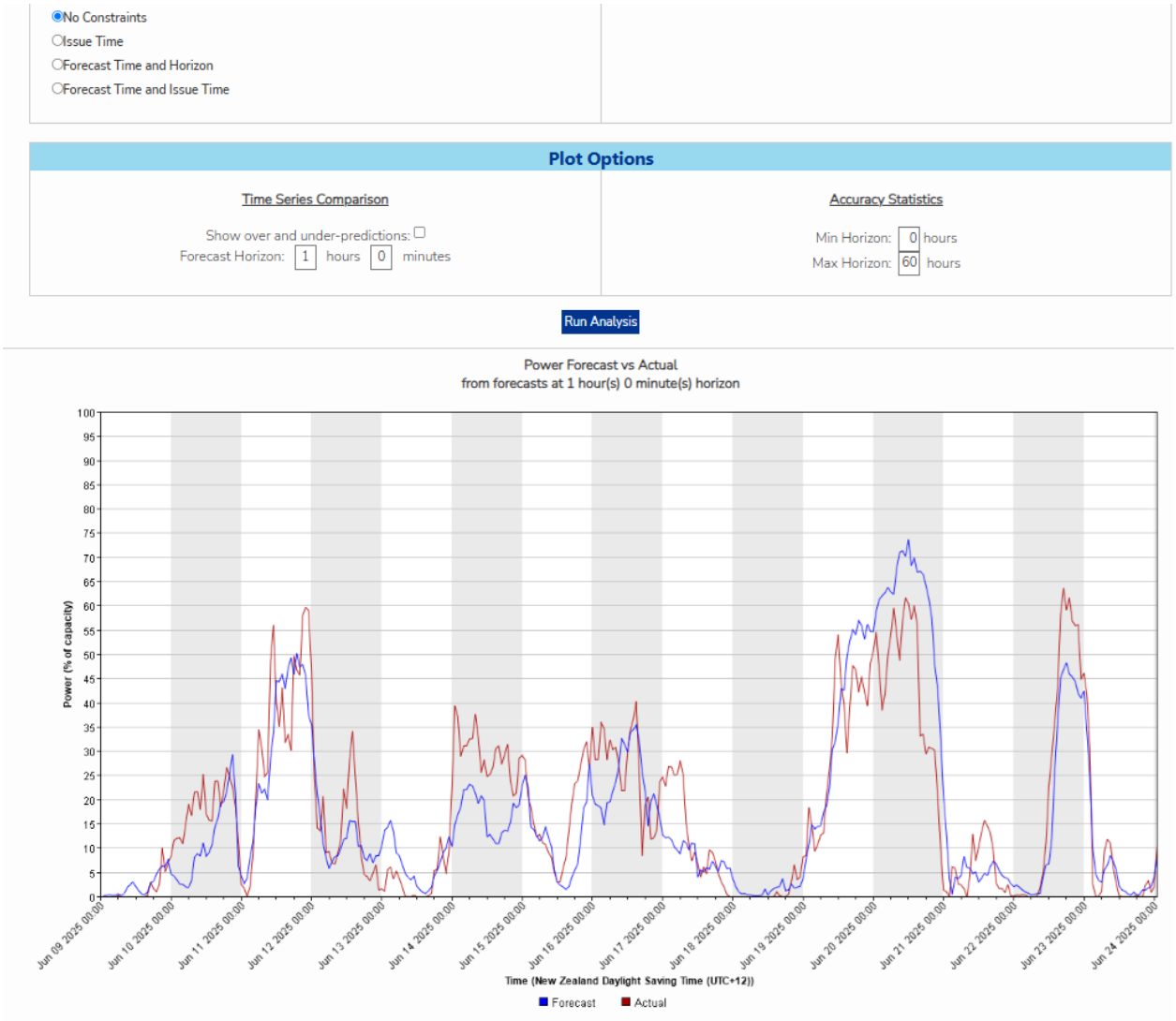
Stacked Portfolio View

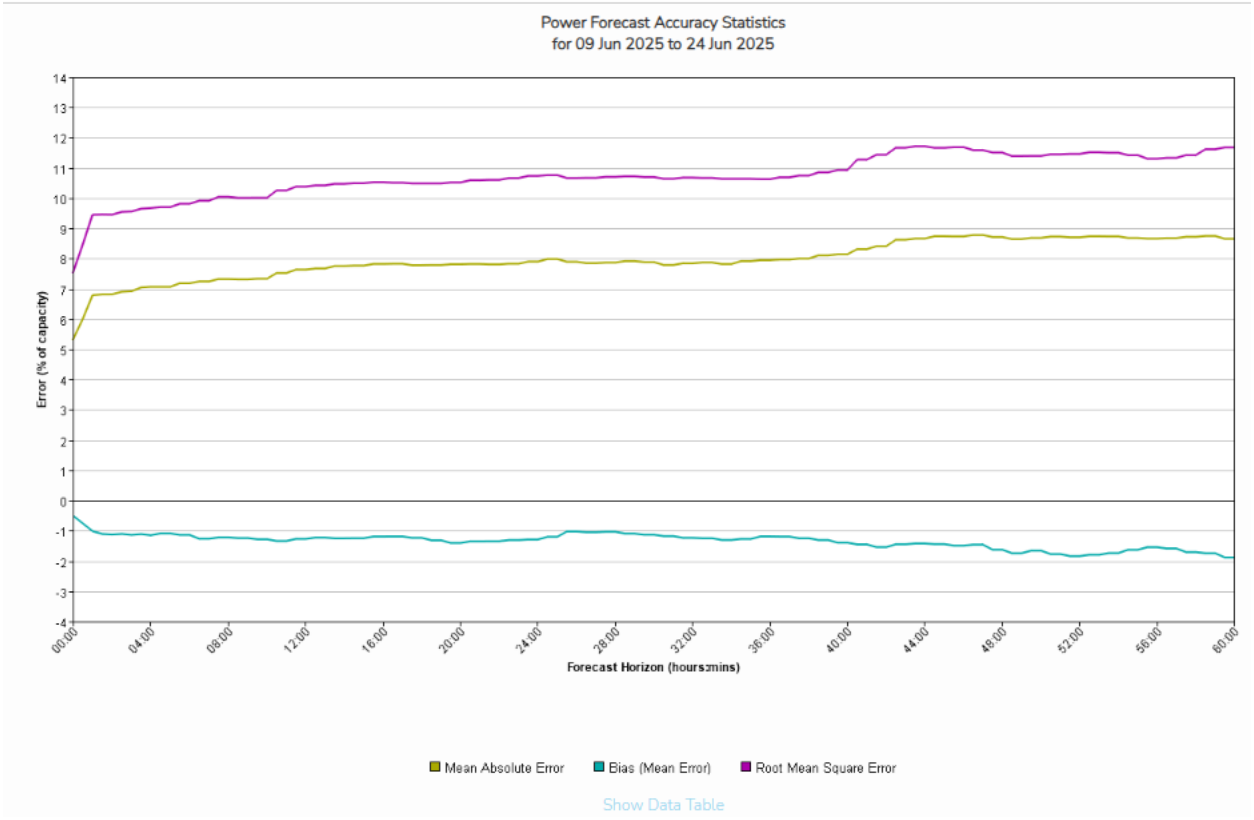
This shows the relative contribution of each site to the total portfolio power generation forecast.


All Regions France Wind Generation Latest Forecast - 30 Sep 2016 10:00
Max Plot Horizon
168
hours
1d
3d
7d
Forecast Power (MW)
3500
3000
2500
2000
1500
1000
500
0
1 Oct
2 Oct
3 Oct
4 Oct
5 Oct
6 Oct
7 Oct
Time (Central Europe Daylight Saving Time (UTC+2))
Show Data Table
Export to CSV
ACAL - Alsace-Champagne-Ardenne-Lorraine
ALPC - Aquitaine-Limousin-Poitou-Charentes
ARA - Auvergne-Rhône-Alpes
BFC - Bourgogne-Franche-Comté
BRET - Bretagne
CVL - Centre Val de Loire
ILE - Île de France
LRMP - Languedoc-Roussillon-Midi-Pyrénées
NORM - Normandie
NPCP - Nord-Pas-de-Calais-Picardie
PACA - Provence-Alpes-Côte_d-Azur
PDL - Pays_de_la_Loire

Historical Analysis

This shows historical forecasts vs. actuals for a specified time period along with relevant error metrics





Analysis Constraints

No Constraints: Will plot forecast series vs. actual for the Forecast Horizon specified in 'Time Series Comparison'. Will show accuracy stats for the horizons selected in 'Accuracy Statistics'.

Issue Time: Will plot forecast series vs. actual for the selected forecast issuance time from selected days ago. Will show average accuracy statistics across each day for forecasts issued from 1 to 7 days ago. (e.g., will show accuracy statistics on average over the sample period for 1-day-ahead forecasts, 2-days-ahead forecasts, etc.)

Forecast Time and Horizon: Allows you to select a time period across each day to focus the error calculation, as well as a particular forecast horizon. Shows accuracy statistics for 1 to 7 days ahead, as well as for Time of Day based on the horizon selected.

Forecast Time and Issue Time: Allows you to select a time period across each day to focus the error calculation, as well as a particular forecast series defined by the time and day of issuance. shows accuracy statistics for 1 to 7 days ahead, as well as for Time of Day based on the defined forecast issuance time and number of days ago.

5 SUPPORT

DNV operates a 24/7 support service for the forecasting systems which is manned by forecast analysts from Europe, Australia and North America teams who can be contacted via support email and phone number. It is preferred that any inquiry be sent to Forecaster Support, rather than a DNV employee directly. This will ensure the incident is picked up by on-call staff as quickly as possible. Below are the support phone numbers and email address:

***Phone 1** (UK/Euro based staff): +0 808 189 0383

***Phone 2** (North American staff): +1 866 281 0848

Email: Forecaster.Support@dnv.com

(*Note: you can dial either number and reach someone as during nighttime hours the call gets routed to the time zone that is awake)

Upon submitting a support email, please state that your inquiry is related to the New Zealand forecasting project. Then, provide a description of your issue, including which site is affected and any examples/screenshots you think may be helpful.

In responding to and resolving submitted issues/inquiries, DNV support staff and analysts strive to achieve the following times per incident type:

<table>
<tr><th colspan="6">Incident Response and Resolution</th></tr>
<tr><td>Definition</td><td colspan="5">This Service Level measures the following, from the time that DNV first became aware of the Incident:
• Response. The time taken for the Service Desk to acknowledge (in person and not automatically) to the Caller that the Incident is being managed by the Service Desk.
• Resolution. The time taken for the Incident to be Resolved.</td></tr>
<tr><td rowspan="5">Service Level</td><td>Priority</td><td>Definition</td><td></td><td>Response Time Target</td><td>Resolution Target</td></tr>
<tr><td>P1, Critical</td><td>Extended service outage or widespread component loss. This includes cases where there is a critical operational impact in a production environment with no workaround available.</td><td></td><td>30 minutes</td><td>4 hours</td></tr>
<tr><td>P2, High</td><td>Intermittent service outage or a material component failure. Use of the product is limited, but no production system is continuously down.</td><td></td><td>45 minutes</td><td>8 hours</td></tr>
<tr><td>P3, Average</td><td>There is a problem that causes some business impact but can be easily circumvented; a situation in which there is a problem, but the product is still usable.</td><td></td><td>2 days</td><td>4 days</td></tr>
<tr><td>P4, Low</td><td>Minor problems that have minimal business impact.</td><td></td><td>4 days</td><td>6 days</td></tr>
</table>