DNV Onboarding Guide

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1 EXECUTIVE SUMMARY

The purpose of this onboarding guide is to provide new Intermittent Generators (“IG”) or existing IGs looking to onboard a new site with the necessary information and documents to get their assets setup on the DNV Forecasting system and ready them to receive live forecast data.

2 IG INFORMATION

To onboard a new asset, new or existing IGs are required to fill out and submit to DNV the “IG Information Form.docx”. This will serve as formal registration of the new asset(s) to the DNV Forecast System. Registration should occur at least six weeks in advance of the time at which forecast access is desired.

3 ASSET INFORMATION

The next step is to provide DNV will the necessary site input data to begin the forecast setup process. There are two pieces of information DNV needs: site metadata and historical actuals.

3.1 Site Metadata

DNV need certain site metadata in order to build an accurate power model to assist alongside its machine learning capabilities and approaches. The information needed varies depending on the type of technology (wind/solar).

3.1.1 Wind Sites

Wind Metadata					
Name	**Definition**	**How used**	**Unit**	**Valid range**	**Defaults**
Name	The user-defined name of the site	Used to display a name for your site. Can be changed	N/A	N/A	None – Required field
Latitude (Site Centre)	Site latitude (centre of site) in decimal degrees (EPSG:4326).	Used to locate your site. Cannot be changed	°	-90 to +90	None – Required field
Longitude (Site Centre)	Site longitude (centre of site) in decimal degrees (EPSG:4326).	Used to locate your site. Cannot be changed	°	-180 to +180	None – Required field
Plant capacity	Total (nameplate) capacity in MW. This is the highest potential output of the system before any Site Export Limit is applied	Used to model the generation of site	MW	>=0	None – Required field
Turbine type	Turbine manufacturer, model, rated capacity	Used to help inform manufacturer power curve	N/A	N/A	None – Required field
Rotor diameter	Rotor diameter of installed turbines	Used to help inform manufacturer power curve	m	>=0	None – Required field
Hub height	Hub height of installed turbines	Used to inform ideal height for NWP degribbing	m	>=0	None – Required field

The above information is required for the setup of a new wind asset. If you are registering new wind assets, please fill out “Wind site metadata.xlsx” for each new asset, and provide completed document to DNV, replacing “Wind site” in the document name with the site name.

3.1.2 Solar Sites

Solar Metadata					
Name	**Definition**	**How used**	**Unit**	**Valid range**	**Defaults**
Name	The user-defined name of the site	Used to display a name for your site. Can be changed	N/A	N/A	None – Required field
Latitude (Site Centre)	Site latitude (centre of site) in decimal degrees (EPSG:4326).	Used to locate your site. Cannot be changed	°	-90 to +90	None – Required field
Longitude (Site Centre)	Site longitude (centre of site) in decimal degrees (EPSG:4326).	Used to locate your site. Cannot be changed	°	-180 to +180	None – Required field
Tracking Type	The type of sun-tracking or geometrical configuration of your site's modules	Used to calculate the incident irradiance for your modules	N/A	"Fixed_tilt"or "horizontal_ single_axis"	None – Required field
Install Date	The date when your site was installed	Used to derate your module (DC) production gradually with age, at a rate dependent on your Module Type	date	1970-01-01 to present date	Default: 1 year before date at site creation
AC Capacity (inverters) in MW	Total inverter (nameplate) capacity in MW. This is the highest potential output of the system before any Site Export Limit is applied	Used to model the conversion of DC power to AC by your inverters	MW	>=0	None – Required field
DC Capacity (modules) in MW	Total module capacity in MW. Usually slightly higher than the AC capacity.	Used to model the generation of DC power by your modules	MW	>=0	Default: 1.27*AC capacity
Grid Export Limit in MW	The maximum power export limit in MW that is allowed by the site's connection with the network operator	Used to place a final cap on your AC power output. Only impacts your AC power if the grid export limit is set lower than the AC capacity	MW	>=0	Default: Disabled

Solar Sites Optional (to increase forecast accuracy)

Name	Definition	How we use this	Unit	Valid range	Defaults
Module and inverter specification parameters					
Module Type	The type of material or technology used in your site's PV modules.	Used to estimate your module temperature derating coefficient (unless you specify your own coefficient) and used to estimate your module age derating	N/A	Monocrystalline Silicon (mono-Si) Polycrystalline Silicon (poly-Si) Amorphous Silicon (a-Si) Cadmium Telluride (CdTe) Copper Indium Gallium Selenide (CIGS)	Defaults: Polycrystalline Silicon (poly-Si) if install date is >= 2013 Monocrystalline Silicon (mono-Si) if install date <2013
Ground Coverage Ratio	The proportion of the site's ground area covered by modules.	Used to calculate the incident irradiance for your modules	fraction	0 to 1	Defaults: 0.36 if tracking_type is horizontal_single_axis; 0.47 if tracking type is fixed
Module Temperature Derating Coefficient	The factor by which your site's module (DC) production will be derated with increasing temperature	Used to derate your module (DC) production gradually with increasing temperature	K-1	-1 to 0	Defaults: 0.0039 (mono-Si) 0.0039 (poly-Si) 0.0031 (a-Si) 0.0026 (CdTe) 0.0042 (CIGS)
Peak Inverter Efficiency	The peak efficiency value in your inverter efficiency curve	Used to scale the conversion efficiency of DC to AC, as a function of the inverter load	fraction	0 to 1	Defaults: 0.985
Age Degradation Derating Coefficient	The factor by which the whole system will be derated per year since the Install Date	Used to calculate time dependent system loss	year-1	0 to 1	Defaults: 0.0023 (mono-Si) 0.0059 (poly-Si) 0.0095 (a-Si) 0.0030 (CdTe) 0.0002 (CIGS)
Other Losses Derating Coefficient	The factor by which the whole system will be derated due to causes other than temperature and degradation	Used to calculate other system losses including mismatch, wiring, and connection	fraction	0 to 1	Defaults: Inferred from AC capacity if not specified
Geometry specification parameters only for fixed tilt sites					
Module Tilt Angle	The off-horizontal tilt angle of modules for a fixed-tilt site.	Used to calculate the incident irradiance for your modules	°	0 to 90. Zero means the modules are horizontal	Default: Quadratic function of site Latitude

Module Azimuth Angle	The off-north-facing direction on the horizon in which the modules are facing for a fixed-tilt site.	Used to calculate the incident irradiance for your modules	°	-180 to 180. South is -180, East is -90, North is 0, West is 90	Default: Set to 0 if latitude is less than zero, otherwise set to 180
Geometry specification parameters only for horizontal single axis tracking sites					
Tracker Axis Azimuth Angle	The off north-south azimuth angle for a horizontal single axis tracking site. Most commonly this will be close to zero	Used to calculate the incident irradiance for your modules	°	-180 to 180. South is -180, East is -90, North is 0, West is 90	Default: 0 (north-south axis)
Tracker Maximum Rotation Angle	The maximum off-horizontal angle for a horizontal single axis tracking site.	Used to calculate the incident irradiance for your modules	°	0 to 90	Default: 50°
Tracker Backtracking	Whether the trackers backtrack at low solar elevation angles, for a horizontal single axis tracking site.	Used to calculate the incident irradiance for your modules	boolean	True, false	Default: True if install date is >Jan 2015, else false
Tracker Smart Tracking	Whether the trackers move to horizontal during cloudy periods with zero DNI, for a horizontal single axis tracking site.	Used to calculate the incident irradiance for your modules	boolean	True, false	Default: False
Module specification parameters only for bifacial modules					
Bifacial System	Indicates if the system is composed of bifacial panels.	Used to calculate the module (DC) production.	boolean	True, False	Default: False
Bifaciality Factor	Rear module efficiency as a proportion of the front efficiency subject to the same irradiance.	Used to calculate the module rear production for bifacial systems.	fraction	0 to 1	Default: 0.7
Row Height	The height of the module rows, in metres, measured from the ground to the row centre or axis.	Used to calculate the module rear incident irradiance and production for bifacial systems	metres	0.1 to 10	Default: 1.5 m
Row Width	The width of the module rows in metres. This is the cross-section width of the entire PV row (perpendicular to the tracker axis).	Used to calculate the module rear incident irradiance and production for bifacial systems.	metres	0.1 to 20	Default: 2 m
Site terrain and dust soiling specification					
Average Terrain Slope	The average terrain slope in degrees of your site. A site with no terrain slope has a value of zero.	Used to calculate the incident irradiance for your modules	°	0 to 90	Default: 0°
Average Terrain Azimuth	The average terrain slope downhill direction.	Used to calculate the incident irradiance for your modules. Terrain Azimuth is meaningful only when terrain slope>0.	°	-180 to 180. South is -180, East is -90, North is 0, West is 90.	Default: 0°

Average Dust Soiling Losses	The average proportion of module production lost due to dust soiling, from 0 to 1. E.g. 0.02 for April means a 2% soiling loss will be applied throughout April. The value entered should reflect the impact of cleaning activity at your site.	Used to calculate the module (DC) production We accept either a single yearly average value, or a set of 12 monthly average values.	fraction	0 to 1	Default: 0.015
Topographic Horizon Elevations	The elevation angle of topography (e.g. hills and mountains) surrounding the general area of your site, at a set of specified different azimuth (direction) angles.	Used to calculate the incident irradiance for your modules	°	0 to 90 for each elevation value. -180 to 180 for each azimuth value. The list must have the same number of azimuths and elevations	Default: Calculated using 90m elevation grid surrounding location

Please note there are only a few parameters marked as “Required”. Any additional information can help to improve the accuracy of the solar model. To onboard new solar sites, fill out the information in “Solar site metadata.xlsx” for each new site and return to DNV, replacing “Solar site” in the filename with the site name.

3.2 Historical Data

At a minimum, historical generation data is needed to train wind machine learning models and tune physical PV models. DNV can source historical generation data from EMS’s em6 API. Any additional parameters the IG can provide would aid in model accuracy, such as wind speed, GHI, and availability. Please discuss with DNV during the onboarding process if any additional data can be made available.

Historical Actuals
Historical actual data for: • Power (required for all sites) • Wind speed (ideal for wind sites) • GHI (ideal for solar sites) • Availability (nice to have) The data is to be provided: • Ideally in 5-minute resolution (minimum requirement is hourly resolution) • Ideally >1 year of history (or as long a history as is available if <1 year. If no data is available because site is newly constructed, a simple energy model will be used in interim period until enough data are accrued for sufficient model training.

4 MODEL TRAINING AND SETUP

Once DNV are provided with all required information and data, two weeks will be needed for model training and setup before the live forecasts can be made available. During this time, DNV also will work on creating the necessary API/SFTP/Website accounts and permissions in preparation for data delivery.

5 DATA ACCESS

DNV will provide access to forecast data no sooner than three months and no later than one month prior to the expected plant commissioning date. Access credentials to the assigned points of delivery, including API/SFTP and DNV Website, will be provided. Users will receive a DNV Forecast User Guide, which will include all the information necessary to test connections, access data, test data retrieval processes, and visualize the data on the DNV Website.

6 DNV CONTACT

For submission of required forms to DNV or any discussions that are necessary during the onboarding process, please contact:

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You can also reach a wider Forecaster support team at Forecaster.Support@dnv.com