Frequently Asked Questions
User Interface and General

How were the wind maps for *Small windExplorer* generated and validated?

The wind map displayed in the New York State *Small windExplorer* was created with AWS Truepower's MesoMap® system, which is well known in the wind industry as the technology behind ground-breaking wind maps published for the United States as well as many other countries.

MesoMap is a combination of mesoscale and microscale atmospheric models. The mesoscale model simulates weather conditions for a representative meteorological year on a horizontal grid of 2.5 km. Starting from an initial condition established by regional weather data and using the complete set of physical equations governing the atmosphere, the model simulates the evolution of weather conditions from the start to end of each day in the representative year. The microscale model then refines the wind fields from the mesoscale model to capture the local influences of topography and surface roughness changes at a high resolution of 200 m.

The wind map and associated data are fine-tuned using the best available surface observations including Automated Surface Observation Systems (ASOS), tall towers instrumented for wind resource assessment, as well as AWS Truepower's knowledge of local wind regimes.

What is the accuracy of the wind maps?

To produce a true estimate of the map accuracy for the wind map, each station was withheld from the fine-tuning procedure and the difference between the map speed and the observed speed at that station was determined.

With this objective procedure, the standard error (after accounting for uncertainty in the data) is 0.35 m/s (0.8 mph). The standard error is the standard deviation of the map errors at the wind-monitoring stations used in the fine-tuning procedure. Assuming these stations are representative of all locations in the wind map and that the errors are normally distributed (follow a bell curve), the true mean speed should be within the standard error of the map speed in 68% of the mapped area.

The error margin may vary; however, depending on nearby obstructions, the complexity of the terrain and surface conditions and on the density and quality of wind-monitoring stations in the surrounding region. However, in all cases AWS Truepower recommends that the wind resource be measured on-site to confirm the stated wind resource.

How does the *Small windExplorer* map and data differ from the former map published by AWS Truepower and hosted on the Wind Resource Explorer?

In 2003, AWS Truepower created a public wind map for New York State, hosted on the Wind Resource Explorer application. The new map, available on the *Small windExplorer* application, was created and validated in 2009. This map is more accurate because it has been subjected to an error-correction procedure using a larger number of observation stations having greater geographic diversity and accuracy. According to our best estimates, this procedure has eliminated almost all bias between the map and observations and has reduced the standard error from a typical range of 0.5-0.7 m/s to 0.35 m/s (1.1-1.6 mph to 0.8 mph)

In addition, the data has been interpolated to hub heights that are more useful for the small wind industry including 24.4, 30.5, and 36.6 meters (80, 100, and 120 feet) as opposed to the previous heights at 30, 50, 70 and 100 meters (98, 164, 230, 328 feet) above ground level.

For information at 30 meters or above, maps and data can be accessed via windNavigator® at a 2.5 km resolution, and is also available for purchase at a 200 m resolution.

Is this application available for other States?

Yes, the *Small windExplorer* application is available to state agencies and other interested parties as a tool to promote and facilitate responsible small wind development. The site can be customized to include an organization's branding and tools to support small wind program requirements. For more information regarding about this application and pricing please contact AWS Truepower.

Can I obtain wind resource data for heights other than 80, 100, 120 ft?

While the wind maps are only available for 80, 100, and 120 ft, the Wind Professional Report will calculate the annual average wind speed at heights between 60 and 140 ft. The desired hub height is entered on the data entry page and the program estimates the wind speed from the two closest data points.

Lower-resolution (2.5 km grid cell) data is publicly available at 30, 60, 80 and 100 m through windNavigator®. Additionally, 200 m grid cell resolution data is available from windNavigator® for purchase.

Can I enter turbines that are not included on the NYSERDA list?

Turbines not included on the NYSERDA list cannot be selected for the Wind Professional Report. The turbines included on the list have been individually reviewed and accepted by NYSERDA as meeting the requirements of the incentive program. The list of approved turbines changes occasionally and if the newly added turbines are not included in the *Small windExplorer*, please contact NYSERDA to have the new turbine added to the program.

What are the NYSERDA incentives for the available turbines?

New York State incentives for the approved turbine models can be found at NYSERDA's website: http://www.powernaturally.org/.

I click "Generate Report," but the *Small windExplorer* doesn't seem to respond. Why is this?

Some internet browsers automatically block pop-up windows, preventing the *Small windExplorer* from generating its report. To address this, you can disable pop-up blocking:

In Internet Explorer, a message will appear at the top of the browser indicating that a pop-up was blocked. Click on the message to "always allow pop-ups from the site."

In Google Chrome, a message will appear in the lower right corner indicating that a pop-up was blocked. Click on this message and select the hyperlink to allow the report data entry window to load.

Safari automatically blocks pop-up windows without notifying the user. Enable pop-up windows under the Settings menu in the upper-right corner of the browser, or press Ctrl+Shift+K to achieve the same functionality.

How can I print/save the report?

Once you have generated a report, you can print the report by clicking the Print button located at the top of the page or by pressing CTRL+P. If you have a PDF printer, you can save the report as a PDF by selecting the appropriate printer in the printer selection box. Alternatively, you can press CTRL+S to save the webpage to your computer.

CUSTOMER REPORT

What is included in a Customer Report?

The Customer Report includes an assessment of the Wind Energy Potential at the selected location (from "very poor" to "very high"), the Estimated Wind Resource and Annual Net Energy for a range of hub heights and rotor diameters, the expected Wind Rose, and a topographic map depicting the location selected.

How is the Wind Energy Potential determined?

The site's Wind Energy Potential is a qualitative assessment of the proposed location's available wind resource. The Wind Energy Potential category ("very poor" through "very high") is assessed based on the 120 ft wind speed, as described in the table below. The Wind Energy Potential is an estimate based on the modeled wind map data and may not account for the effect of all obstructions, terrain, and surface roughness factors at the site.

120 ft Wind Speed (WS) Range	Wind Energy Potential
WS < 10 mph	Very Poor
10 mph ≤ WS < 11 mph	Below Average
11 mph ≤ WS < 12 mph	Average
12 mph ≤ WS < 13 mph	Above Average
WS ≥ 13 mph	Very High

How are the energy estimates on the Customer Report calculated?

The energy estimates are calculated using a generic power curve and a location specific wind speed frequency distribution. The generic power curve was derived from a combination of several normalized small wind power curves. The wind speed frequency distribution is assumed to be a Weibull distribution defined by a location specific shape and scale parameters and adjusted to the given height. Net energy estimates include 20% losses for turbulence, 2% losses for availability, and a correction factor for the site's air density change from sea level. For more information on the internal calculations of the program, please refer to the Small windExplorer Help page.

Where do I find a wind turbine installer?

In order to qualify for a NYSERDA sponsored incentive, the turbine installer must be a NYSERDA Eligible Installer. A list of the current NYSERDA Eligible Installers is located on NYSERDA's website: www.powernaturally.org.

How is the wind speed calculated for the height that I entered?

Wind speed generally increases with height above the ground level. The *Small windExplorer* models the vertical wind shear profile using the following mathematical equation, known as the Power Law.

The Power Law is described using the following equation:

$$\frac{V_2}{V_1} = \left(\frac{h_2}{h_1}\right)^{\alpha}$$

Where V and h represent wind velocity and height above ground for two separate heights.

The wind shear exponent, α, is calculated using the following expression:

$$\alpha = \frac{ln\left({}^{V_2}/_{V_1}\right)}{ln\left({}^{h_2}/_{h_1}\right)}$$

Combining the above two expressions results in the following expression for V3 (extrapolated hub height wind speed at h3) as a function of known parameters:

$$V_3 = V_1 \left(\frac{h_3}{h_1}\right)^{\left[\frac{ln\left({}^{V_2}/_{V_1}\right)}{ln\left({}^{h_2}/_{h_1}\right)}\right]}$$

Why does the terrain affect the turbine's production?

Terrain affects turbine production in two ways. First, average annual wind speeds at the site are reduced due to wind being slowed down by terrain obstacles (vegetation, buildings, topographic features, etc.). Lower wind speeds observed at the turbine correspond to less energy production. The wind resource maps associated with the *Small windExplorer* accounts for the average terrain roughness for the given 200 m grid cell.

Second, the turbine's efficiency will decrease due to local obstacles and terrain that increase turbulence. Turbulence is a measure of the irregularity of the wind's flow.

How are the turbulence induced losses calculated?

Turbulence induced losses are calculated individually for each directional sector. The user selects a terrain description that best matches the site characteristics in each direction (N, NE, E, SE, S, SW, W, and NW). An assumed turbulence loss is estimated for each direction based on the user selected terrain description. Each terrain description has a corresponding surface roughness parameter. Roughness values used in the program include:

- Cut grass – 0.007 m
- Short-grass prairie – 0.020 m
- Crops, tall-grass prairie – 0.050 m
- Hedges – 0.085 m
- Scattered trees and hedges – 0.150 m
- Trees, hedges, a few buildings – 0.300 m
- Suburbs – 0.400 m
- Woodlands – 1.000 m

The *Small windExplorer* estimates turbulence losses by calculating the estimated ambient turbulence intensity using the surface roughness and turbine hub height:

$$TI\ Loss\ (\%) = \frac{1}{\ln\left(\frac{hub\ height\ (m)}{roughness\ (m)}\right)} \times 100$$

Turbulence losses are weighted by the percentage of energy that is expected from each direction and then combined to compute a total turbulence loss for the site.

If no direction specific information is entered by the user, a general turbulence loss is applied uniformly.

What is a typical Availability Loss?

The Availability Loss used in the *Small windExplorer* is 2%. However, the actual availability of the small wind turbine can change with location, turbine type, and level of maintenance.

What should be entered into the Additional Known Losses box?

If the inverter or wire specifications are different than those in the power curve performance test or if the system is expected to have additional environmental/system losses, the losses can be adjusted accordingly in the Wind Professional Report using the Additional Known Losses field on the data entry page.

What power curves were used in the program?

The *Small windExplorer* uses power curves obtained from the manufacturer websites. The program assumes that the turbine power curves were measured using the AWEA Small Wind Turbine Performance and Safety Standard as a guideline and certified per the requirements of clause 1.4.1 of this standard. As such, the power curve will be sea level normalized and will be measured at the connection to the load; therefore, the losses associated with the turbine, inverter, and wiring will be included in the performance testing. It is the responsibility of the installer to adjust the output estimates if the turbine has not been certified and to account for siting related losses in power. The AWEA Small Wind Turbine standard can be found here. For siting related losses, refer to the NYSERDA Customer Sited Wind Handbook.

How is the wind speed frequency distribution calculated?

The wind speed frequency distribution is assumed to be a Weibull distribution defined by a location specific shape and scale parameter and adjusted to the given height. The Weibull distribution is modeled using the following equation within the Small windExplorer:

$$p(U) = \int_{U}^{U+1} \left(\frac{k}{c}\right)\left(\frac{u}{c}\right)^{k-1} exp\left[-\left(\frac{u}{c}\right)^{k}\right] du$$

Where: p(U) = Probability wind speed will be between U and U+1 (in m/s)
k = Weibull scale factor
c = Weibull shape factor.

Why is there a range given for losses and annual energy?

There are many uncertainties in the energy prediction process, which lead to uncertainties in the annual energy estimate. The main sources of uncertainty include the estimation of the wind speed and loss factors. The Customer Report does not take these factors into account and instead gives a basic approximation for net energy. The Wind Professional Report uses approximated uncertainties for the different sources to create a range in energy production.

The wind speed estimates used in the *Small windExplorer* have an uncertainty of approximately 7.0%, which accounts for the inter-annual variability of the wind speed. Therefore, the upper and lower bounds of the gross energy estimate are calculated by increasing and decreasing the annual average wind speed by 7.0%, respectively. Adjusting the wind speed changes the frequency distribution, which has a direct effect on the total amount of energy available in the wind; therefore, the program runs three different scenarios for the varying wind speeds to calculate the range in energy production.

The uncertainty in estimating the losses is much harder to predict. Therefore, this uncertainty is estimated at 20% of the total loss, which is applied directly to the above energy range.

Additional Questions

For answers to additional questions please contact us.