Power curve simulations for anyone and any turbine

No proprietary data needed !

Challenge:

- Evaluate AEP accurately, when power curves and configurations change
- What is the power curve impact from leading edge erosion?
- Compare sites and solutions from one turbine type to another

Solution:

- Spreadsheet-based simulation tool
- No aerodynamic training needed
- Requires no proprietary information from turbine OEM or other vendors

Power curves do not have to be based on proprietary information

Evaluating small changes in power curves is time consuming and often misleading because of insufficient data, inaccurate wind speeds and unknow weather factors. Working with theoretical power curves is also time consuming and maybe even impossible because the OEM's proprietary rotor data is unavailable.

When it comes to operational evaluations, such as understanding the impact of leading-edge erosion or leading-edge protection systems, we are almost always left with insufficient information.

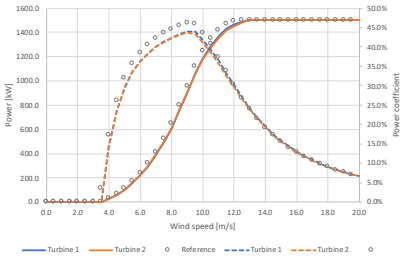
A new model-based approach

Fortunately, modern wind turbines have a lot of similarities that allows us to simulate power curves without having all of the information available. Based on these similarities, some common physics, empiric engineering and decades of experience, we have built a simple Excel sheet-based way to evaluate your own power curves, so you can make your own operational decisions. All you need are the turbines key operating parameters and a few key field observations.

The approach allows you to get accurate comparative answers, with the information that you have readily available and a better understanding of your power curves and the impact on the AEP.

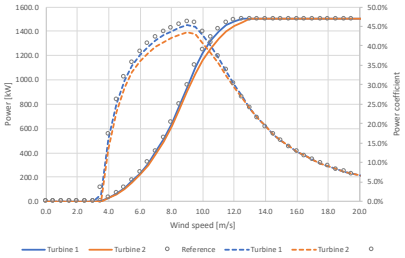
Example #1:

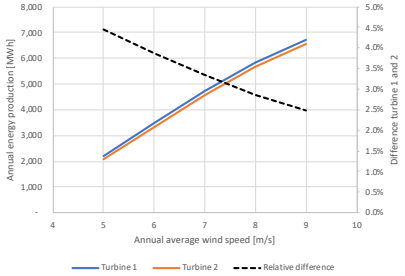
Turbine #1 has a category 3 damage on the outer 7 meters of a 77-meter turbine, and turbine #2 has 14 meters of Cat. 3 damage. Both have light dirt on the inner part. However, turbine #1 runs with a 7-degree yaw error and the power curve was evaluated with an air density of 1.21, instead of the standard sea-level 1.225 kg/m^3. The combination of these minute differences misleadingly leaves the impression that the curves are identical.



Example #2:

Turbine #1 has a category 3 damage on the outer 3 meters of a 77-meter turbine, and turbine #2 has 15 meters of unsealed leading-edge protection and underperforms 3.3% in AEP (see AEP graph) under the damaged turbine. The loss originates in reduced C_p and the loss of control (rounded power curve knee).





Specifications for simulator

- Microsoft Excel sheet, and does not contain macros
- Input:
  - Rotor diameter, rating, RPM, yaw error, drive train loss factors
  - Generic control parameter which rounds the power curve knee
  - Average wind speed (Rayleigh distribution), air density, turbulence
  - Use your own wind distribution.
  - Leading edge condition by category and effective length:
    - Clean, light, med dirt & heavy dirt
    - Damage Category 1 to 5
    - LEP, four different (generic) types
- Output:
  - Power curve for any turbine based on actual conditions
  - Annual energy production
  - Compare turbines, sites, conditions and technologies.
  - Your own graphs, custom data, financials etc.

Other products and services

- Excel based leading edge erosion simulator
- Consulting on vortex generator and other aerodynamic upgrades
- Training on rotor performance, rotor design and maintenance for owner & operators and service providers
- Consulting aerodynamics and wind load
- Test and experimentation
- General consulting and inspections

Stop guessing, compute the impact

Contact us For a free trial

Contact:
Dr. Carsten Westergaard,
Westergaard Solutions, Inc.
cw@westergaardsolutions.com
Phone: 713-494-7272

Westergaard solutions, Inc is a Houston based Renewable Energy consultancy company with unsurpassed experience in wind turbine technology