

Figure 2.1
Wind passing through a ring.

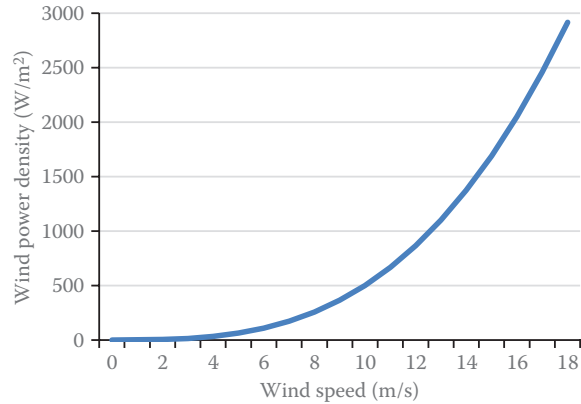


Figure 2.2

Wind power density as a function of wind speed.

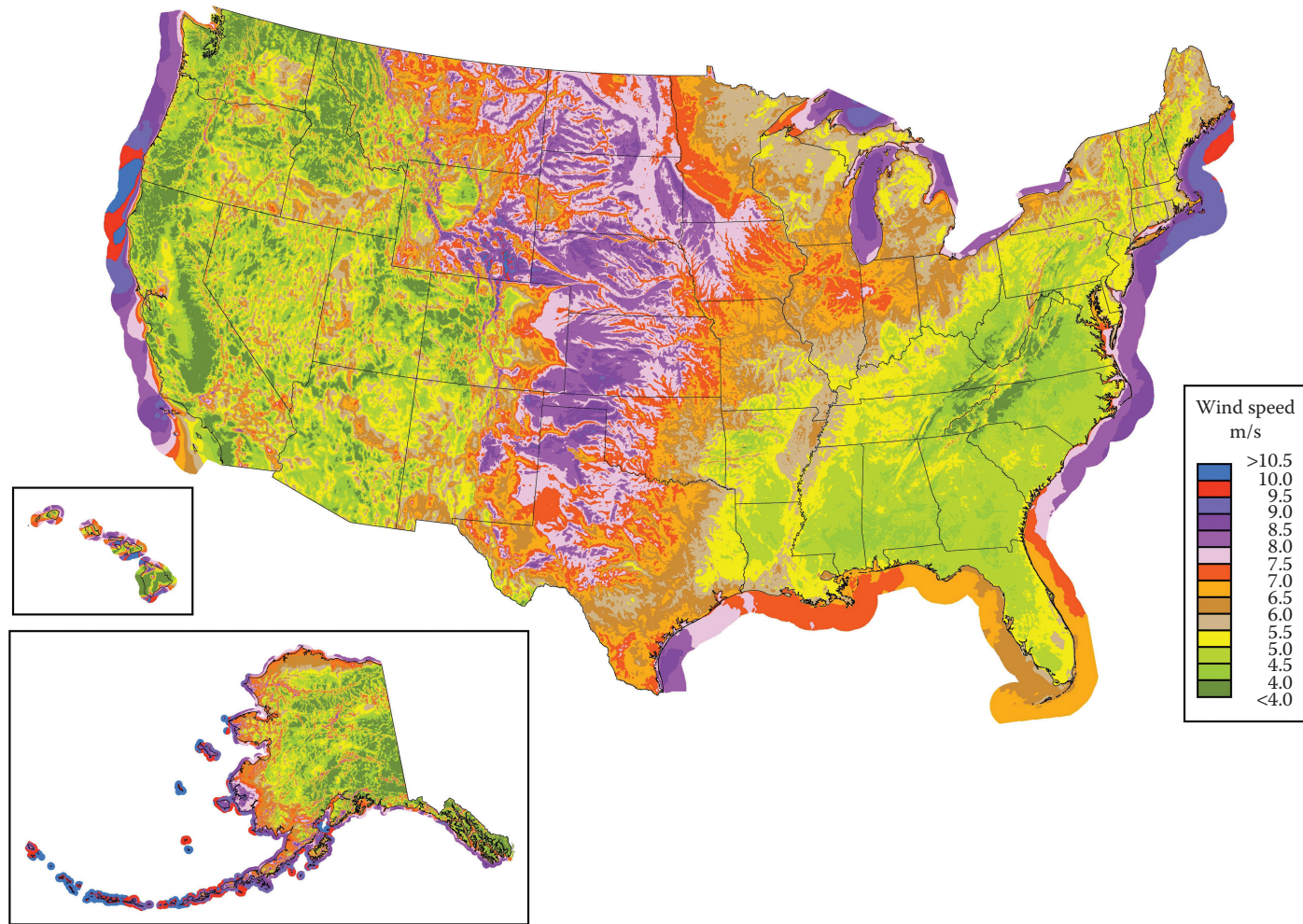


Figure 2.3

The average wind power density map of the United States at 80 m above sea level. (Courtesy of the US National Renewable Energy Laboratory.)

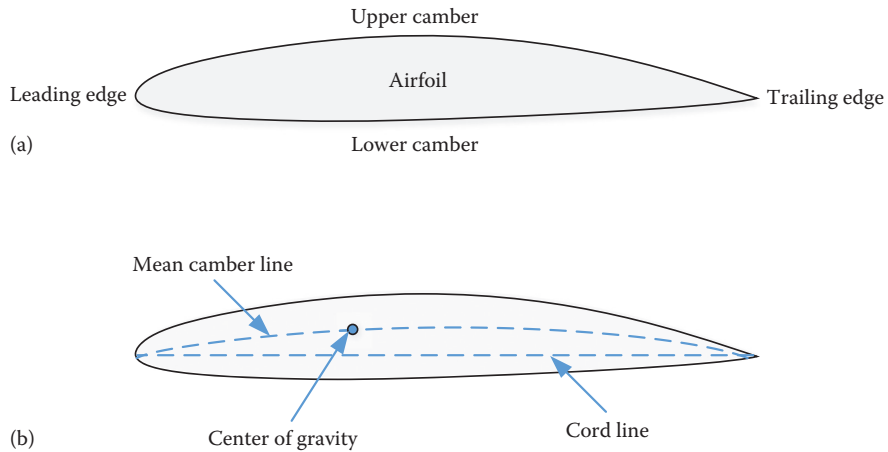


Figure 2.4

Airfoil: (a) shape and (b) design.

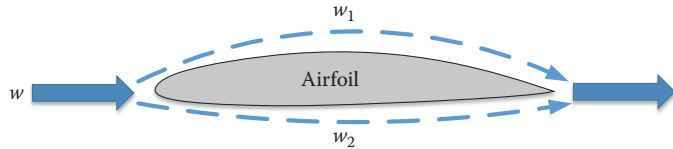


Figure 2.5
Airfoil and the flow of air.

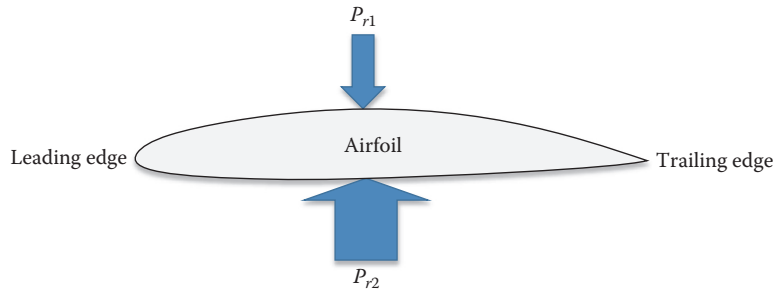


Figure 2.6
Bernoulli's principle.

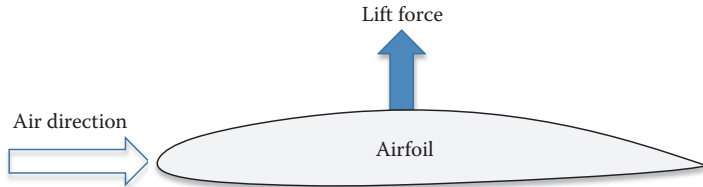


Figure 2.7
Lift force.

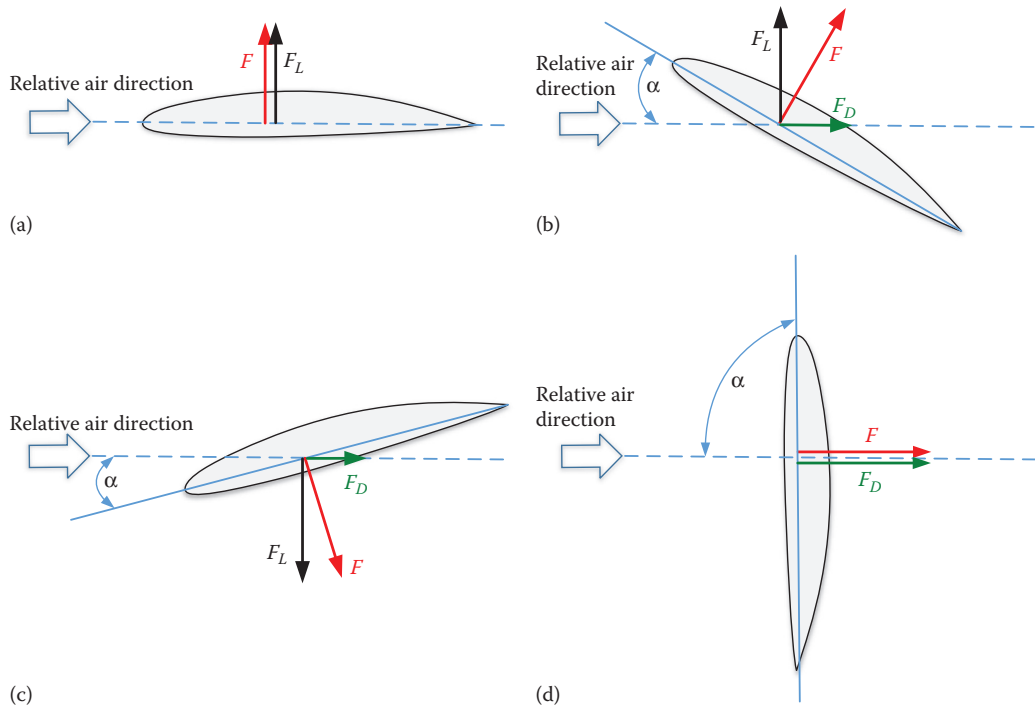


Figure 2.8

Aerodynamic forces and angle of attack: (a) horizontal position—all aerodynamic force is lift; (b) positive angle of attack—aerodynamic force has lift and drag; (c) negative angle of attack—lift is reversed; and (d) increasing positive angle of attack—until aerodynamic force is all drag.

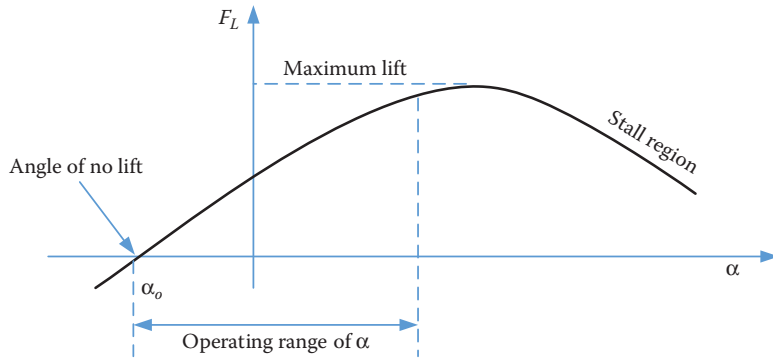


Figure 2.9

Lift force as a function of angle of attack.

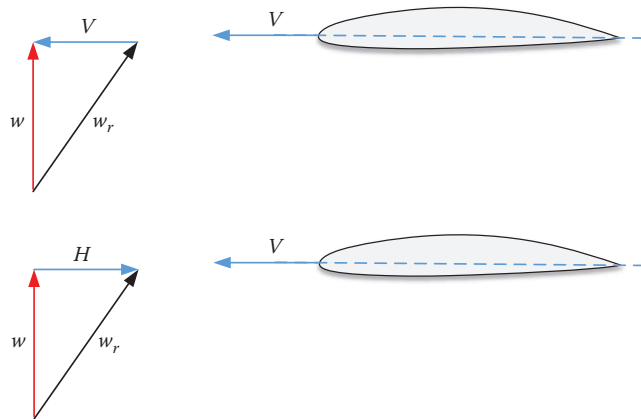


Figure 2.10
True and relative wind speed.

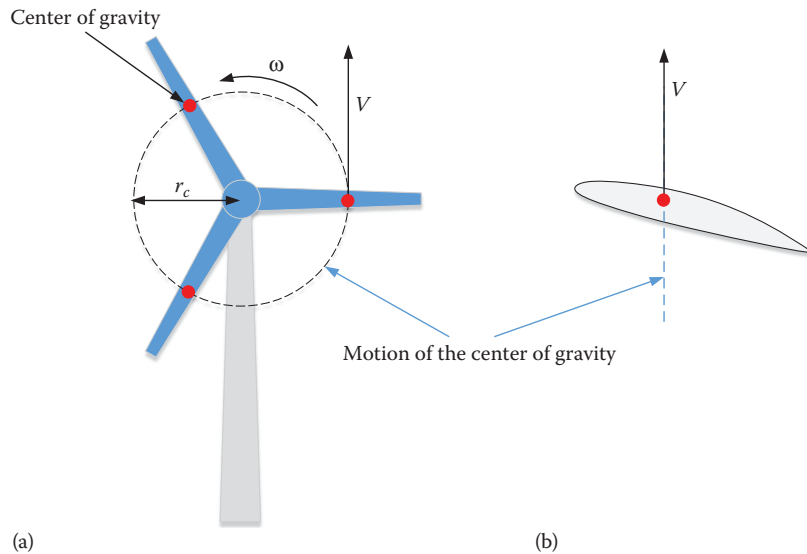


Figure 2.11
Motion of the center of gravity: (a) front view; (b) side view.

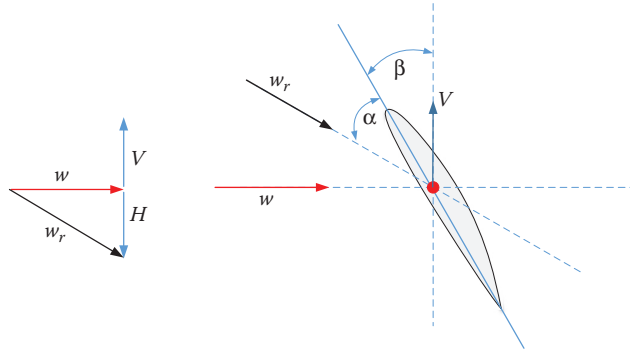


Figure 2.12
Relative wind speed for wind turbine blade.

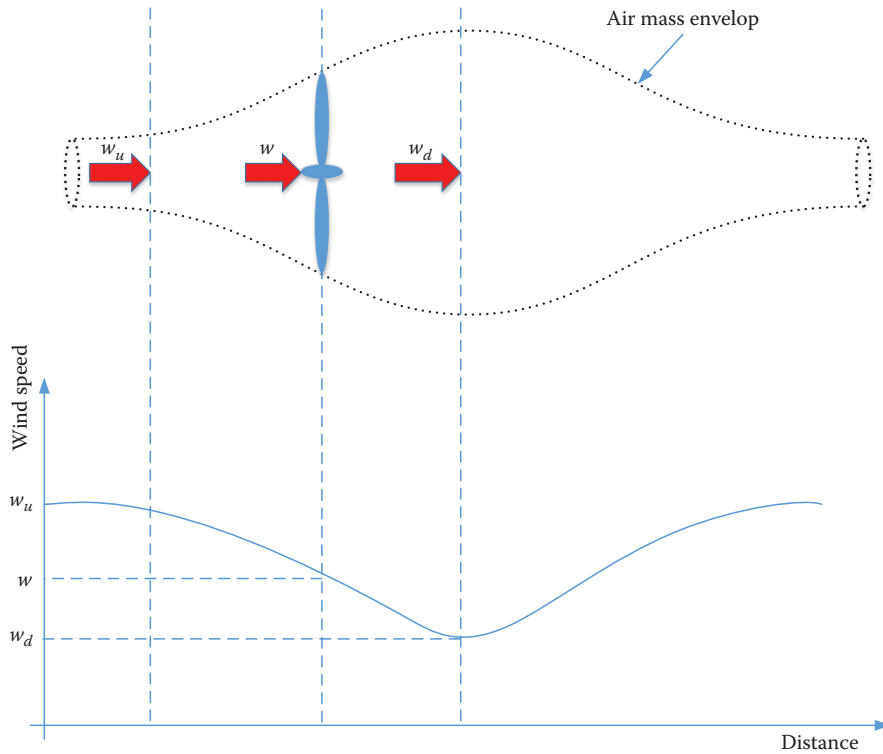


Figure 2.13
Circular tube of air flowing through a wind turbine.

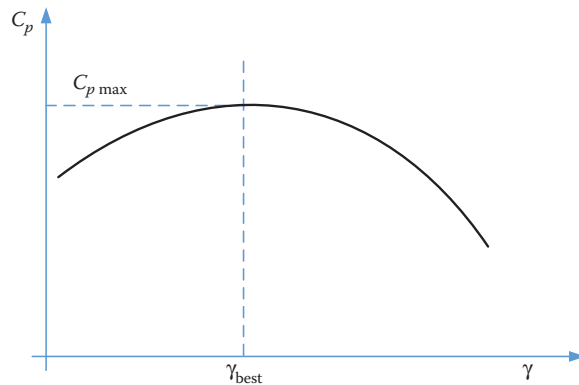


Figure 2.14
Coefficient of performance as a function of wind-speed ratio.

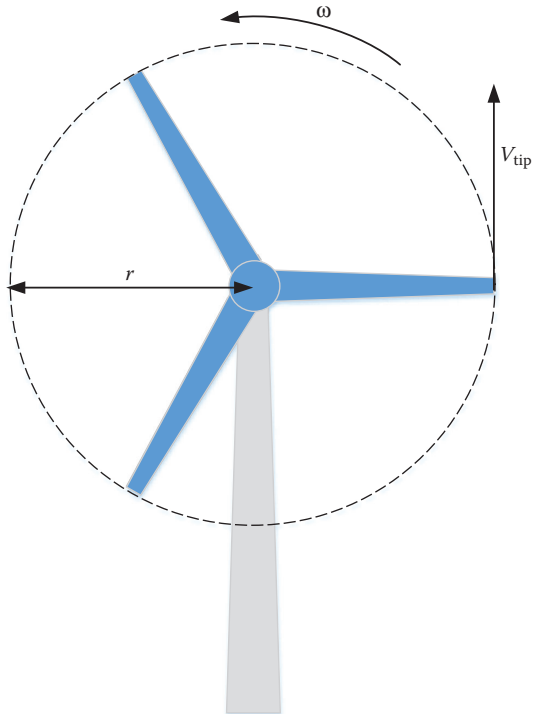


Figure 2.15
Tip velocity.

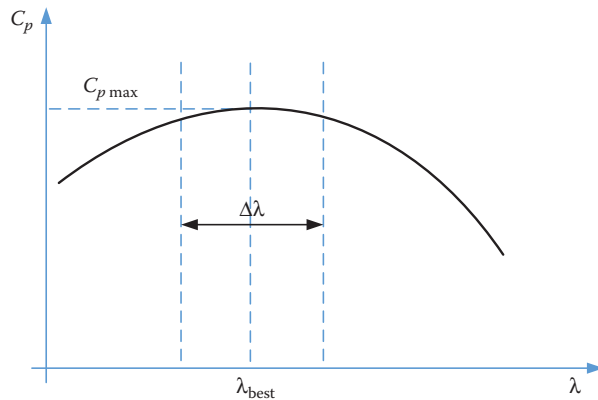


Figure 2.16
Coefficient of performance as a function of the tip-speed ratio.

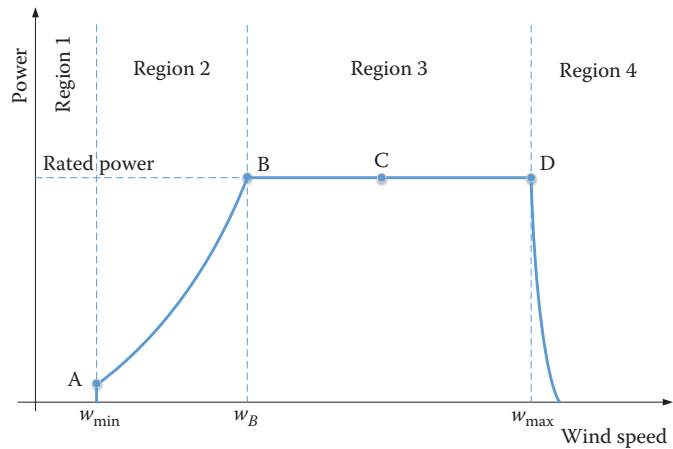


Figure 2.17
Output power of wind turbine.

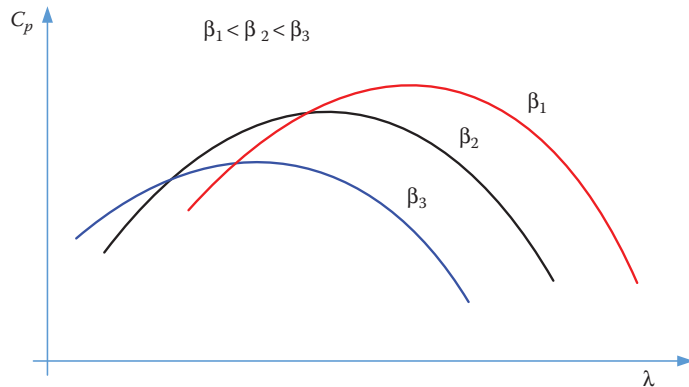


Figure 2.18
Coefficient of performance as a function of pitch angle.

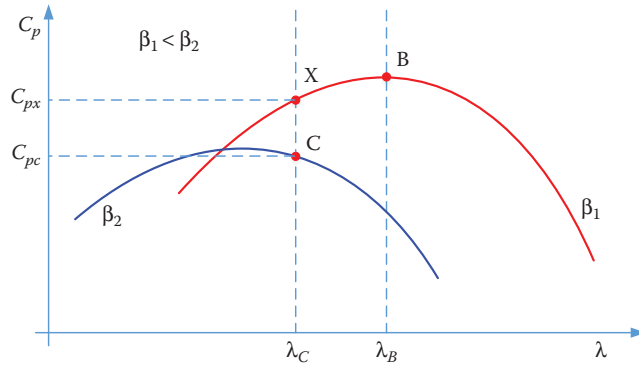


Figure 2.19
Coefficient of performance as a function of pitch angle.



Figure 2.20
Wind turbines array. (Courtesy of the US National Renewable Energy Laboratory.)

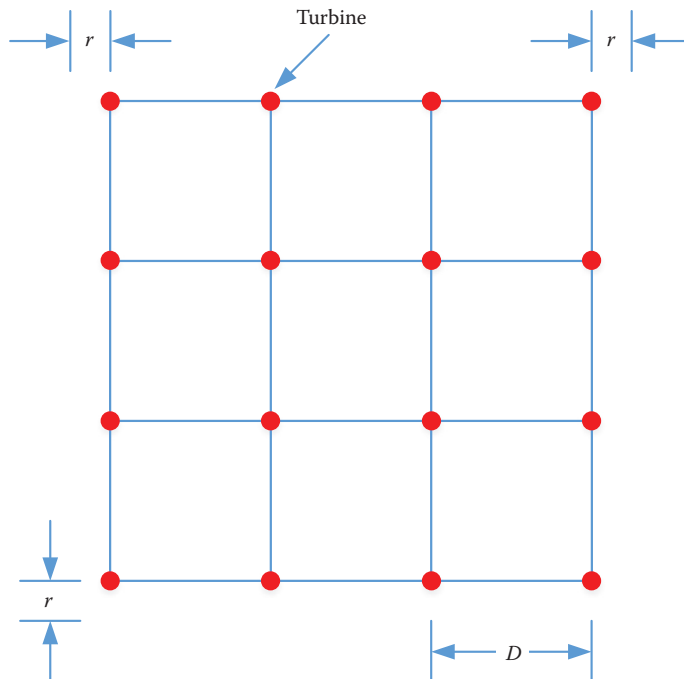


Figure 2.21
Square arrangement of a turbine array.

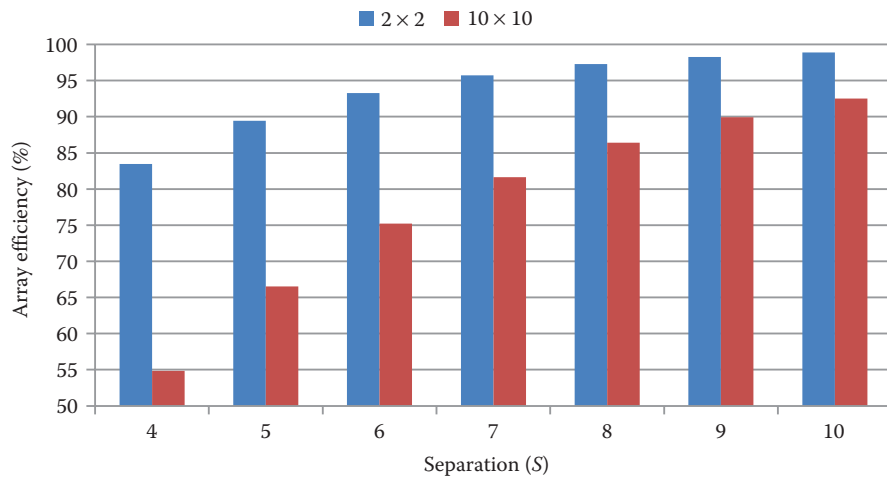


Figure 2.22
Wind array power versus separation.

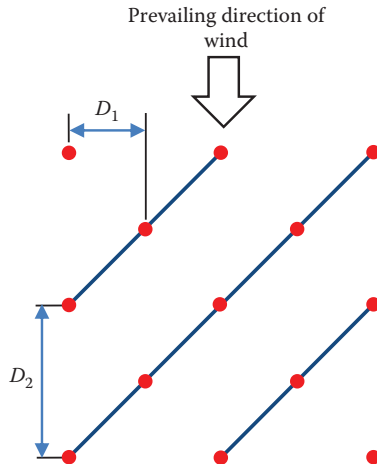


Figure 2.23
Diagonal arrangement of turbines array.