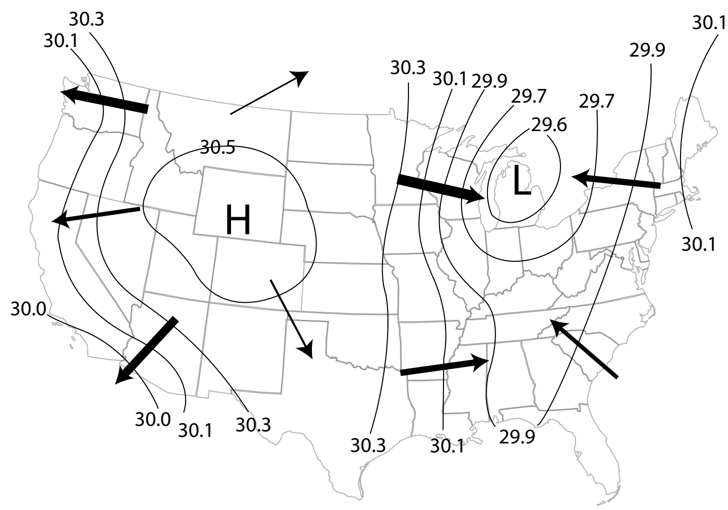
READING PASSAGE



Wind is the result of air moving from areas of high pressure to areas of low pressure. Air pressure changes are created by the uneven heating of the Earth. As parts of the Earth heat up, the air heats up, becomes less dense, and rises. As the hot air rises (convection), cooler air moves in, creating a breeze. This pressure difference, which causes wind, is called the pressure gradient force.

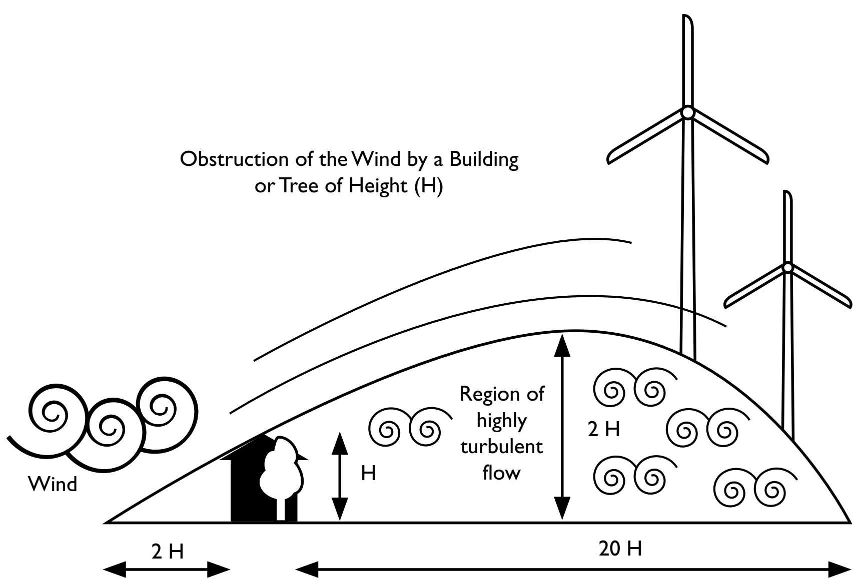
A number of factors determine the speed and direction of wind. Some factors, like the rotation of the Earth, create large-scale wind patterns, while other factors, such as the type of landscape, only affect local wind speeds. Wind developers may look at large-scale wind patterns to determine in what region to place a wind farm. When determining an exact location for the turbines, however, the wind developer collects years of wind data from proposed turbine locations.

Earth's Rotation

While wind is the movement of air from high to low pressure areas, the wind does not actually move in a straight line. Why not? The Earth's rotation actually causes the wind to flow in a curved path rather than a straight line. This is known as the Coriolis effect. The winds in the Northern Hemisphere turn to the right and the winds in the Southern Hemisphere turn to the left. The effect is zero at the equator.

Surface Roughness

Rough landscape surfaces tend to slow wind speeds, while smooth surfaces allow for higher wind speeds. For instance, a forested area creates more friction for moving air, resulting in slower wind speeds than a prairie. This is called surface roughness and can be defined according to different classes. An open sea provides very little friction for air and would be a class 0, whereas a large city with skyscrapers is a class 4. When siting a wind farm, it's important to look at the surrounding area to determine how the surface roughness will alter the local wind speeds.



Topography

Topography can impact wind speeds in two ways. First, land masses tend to heat up more quickly than oceans during the day. This results in warm air above the land rising and cooler air from the water blowing toward the land, creating "ocean breezes." A second impact of topography is natural or manmade obstacles that can block air movement. For example, a mountain range is an obstacle that winds have to move around. This can increase the wind speed in some areas while reducing it in others. Obstacles can also create turbulence in the air movement. Turbulence happens when the air moves irregularly, which creates the bumps you sometimes experience on an airplane flying over a thunderstorm or mountain.

Elevation

Wind speeds generally increase with elevation. As elevation increases, there are typically fewer obstacles, allowing wind to blow at faster speeds. Also, the friction with the Earth is reduced higher above the ground, so wind moves faster. Over time, engineers have designed turbines to be taller so that they can capture these faster winds.

CAREER PROFILE: ROLF MILLER, TECHNICAL CONSULTING SERVICES MANAGER

I am a Technical Consulting Services Manager for a wind resource assessment and wind energy forecasting company. We provide wind farm developers, financiers, and utilities with highly accurate estimates of how much clean, renewable energy a wind farm will produce. In this role, I work with a team of meteorologists and analysts to gather data from a variety of sources and help our customers understand how the weather will affect their wind farm.

As with many in the wind industry, I did not start out here. My undergraduate degree is in geology. At school, I wanted to meld the power of computers with studying natural systems. Geology had the irresistible appeal of working outdoors and a wide variety of things to study—fossils, plate tectonics, and mineral structures. For my senior thesis, I compiled a database of rock samples and mapped them with some of the earliest versions of geographic information system (GIS) software. I still use GIS software on a regular basis.

After school, I worked as a groundwater scientist for a consulting company, where I compiled one of the largest groundwater chemistry databases of its kind at the time. I also became interested in groundwater modeling, which uses computers to simulate the flow of water in the ground. It can predict where contaminants in the groundwater are likely to flow. I liked it so much that I enrolled in graduate school, where I studied groundwater flow.

Over time, I have held many jobs for the company, including research scientist, software designer, programmer, manager, and salesperson. My current job is exciting because I can help our customers solve challenging problems that also have significant financial impacts. My motivation is providing customers with valuable information that results in well-designed and efficient wind farms.