KidWind / Know Energy

VI. Gears
Definitions

• Torque- rotational motion
  A high torque motor generally turns with a lot of force but not much speed

• Speed-the rate at which a shaft spins
  A high speed motor generally turns with speed but not much force or torque
Definitions Continued

• Gear teeth-indentations on a gear wheel which link to the teeth on another gear wheel making that one spin also

• Gear ratios-a comparison of the two diameters of two interactive gears. A gear ratio can also be determined by comparing the number of teeth on each of two interactive gears.
Definitions Continued

• Driver gear-the gear attached directly to the motor (a.k.a. the input gear)
• Driven gear (a.k.a. the output) - the gear that is turned by the driver gear
• Gear train or gear box- a device connecting more than two gears together
Function of Gears

• Gears can be used to increase torque,
• Gears can be used to increase speed,
• Gears can be used to change the direction of rotation
Gear Math 1
Assume the larger gear is attached to a motor (driver gear)

- Calculate the gear ratio (driver/driven)
- Determine whether this system will increase the speed of the driven or output gear or the torque of the driven gear.
Gear Ratio

Number of teeth of driver gear = 12
Number of teeth of the driven gear = 8

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\text{Gear ratio (driver/driven)} = \frac{12}{8} = 1.5
\]
What does that ratio mean?

- It means that for every revolution the big gear (driver gear) makes, the smaller gear (driven gear) will make 11/2 revolutions.
- That means further, that whatever the small gear is connected to will turn faster than the large gear, but will have less torque.
Gear Math 2
Assume the smaller gear is the driver gear

- Calculate the gear ratio (driver/driven)
- Determine whether the driven gear will have more speed or more torque.
Gears in Wind Turbines

- The blades on a large wind turbine turn very slowly.
- To generate the type of electricity needed by modern homes, the generator shaft needs to spin very fast.
- A gear box is placed in the nacelle that has up to a 100:1 ratio meaning the generator shaft will turn 100 times faster than the blade shaft.
Inside a Wind Turbine
End of Part VI