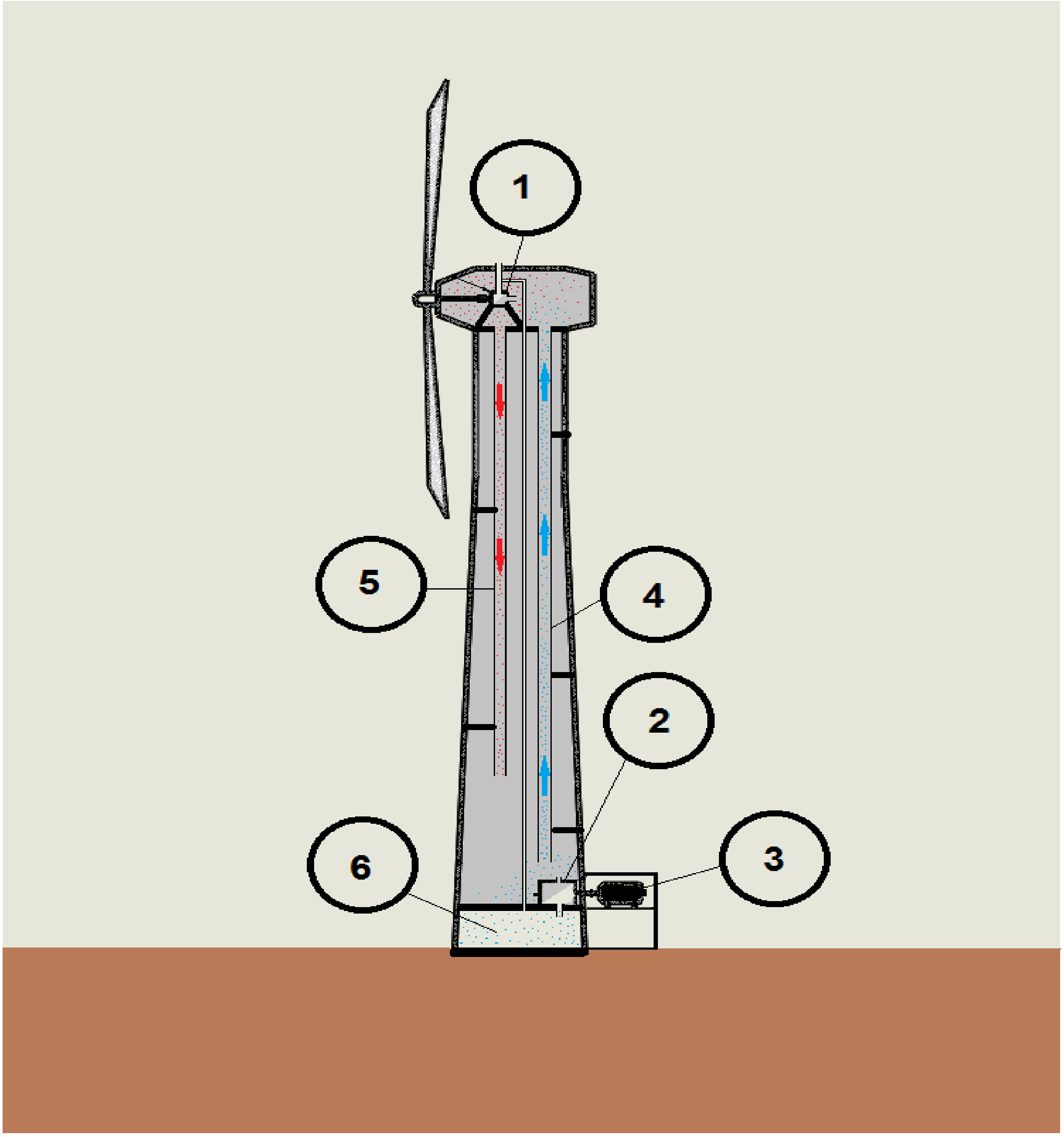
Calculation example

Wind turbine rated power 1MW with two Zired-motors



Specifications upper Zired-motor -1-

1. Masses: B = 816 mm, H = 816 mm, T = 816 mm
2. Weight: about 640 Kg stainless steel / aluminum. Around 840 kg only stainless steel
3. revolutions per minute: 1 - 600
4. Flow rate liters per revolution: around 86 liters / rev
5. Maximum pressure: 80 bar (design-related)

The upper Zired engine in compressor operation

Such a wind turbine with 14 rotor revolutions per minute and with a gear 1:20 provides a rated torque to the shaft of the Zired-motor, which is around 31847 Nm:

$$M = \frac{P}{n} \cdot \frac{30}{\pi} = \frac{1000000W}{300} \cdot \frac{30}{\pi} = 31847{,}13 \text{ Nm}$$

The Zired engine (efficiency 0.9 theoretical) can use this torque (from the first revolution) to compress the air to about 25 bar. (forces couple: M = F • a p = F / A). However, the same Zired engine can easily achieve higher pressure if the wind turbine rotor can deliver even higher torque (slip clutch required). At 300 rpm, the Zired engine (compressor operation) can fill a tank (the tower itself serves as a tank) from 2000 m3 to 25 bar pressure within around 32 hours of continuous operation. The torque is directly proportional to the pressure. That means you only need the biggest torque if you want to reach the pressure of 25 bars.

Specifications of the lower Zired motor -2-

1. Masses: B = 680 mm, H = 680 mm, T = 680 mm
2. Weight: about 460 Kg stainless steel / aluminum. Approximately 660 kg only stainless steel
3. Revolutions per minute: 1 - 600
4. Flow rate liters per revolution: approx. 49 liters / rev
5. Maximum pressure: 80 bar (design-related)

The lower Zired engine in air motor mode

Such a compressed air motor can operate a standard 1 MW generator with 9 bar operating pressure from the tank and the 6369 torques generated from it (from the first revolution) and with 30 revolutions (with gear 1:50 to 1500 rpm).

$$M = \frac{P}{n} \cdot \frac{30}{\pi} = \frac{1000000W}{1500} \cdot \frac{30}{\pi} = 6369{,}42 \text{ Nm}$$

When the tank is full, it will be enough to run the generator with the maximum power of 1MW for about 29 hours. That ist he case, when the tank has reached a pressure of 25 bar. That means the generator can deliver the largest power of

1MW for 29 hours without the wind blowing. These 29 hours can be doubled if you do not constantly demand the full power. If you expand the tank in this example and optimize the power consumption, then you can reach a self-sufficient level, as far as the power supply concerned.

If the 32 hours which it takes to bring the tank full to 25 bar and the 29 hours of 1MW lasting power gets divided then the result give us the efficiency of 0.9 for the whole system (theoretical).

For more information please write to info@optimetron.com