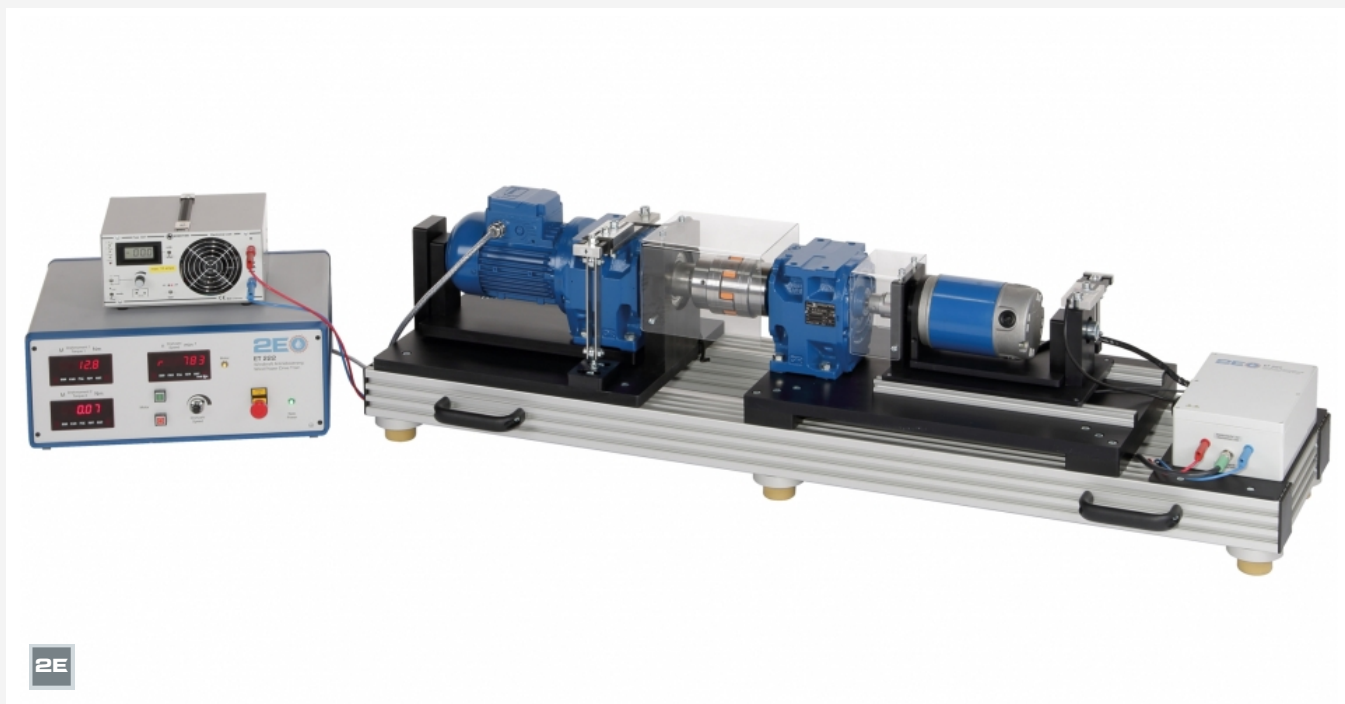


# ET 222

## Wind power drive train



### Description

- electric motor simulates wind rotor at low speed
- generator with adjustable electrical load
- torque measurements on drive and generator

Modern wind turbines should be optimally adapted to the wind available at their location and allow efficient operating conditions. In addition to the wind rotor itself, components of the drive train such as the transmission and the electric generator are crucial.

The ET 222 experimental unit contains a typical wind power drive train at laboratory scale, which is driven by an electric motor. The motor enables low speeds with high torque. This simulates a typical slowly rotating wind rotor. The speed can be adjusted.

The drive train consists of the slow-rotating drive side, the fast-rotating generator side and a three-stage spur gear between the drive and the generator. The electrical load of the generator can be varied.

The experiments with ET 222 simulate typical operating conditions of a drive train. To do this, the electrical load of the generator and the speed of the drive motor are varied. This makes it possible to approximate operating points of a typical torque characteristic. The calculated characteristic results from the mechanical power of a given wind speed.

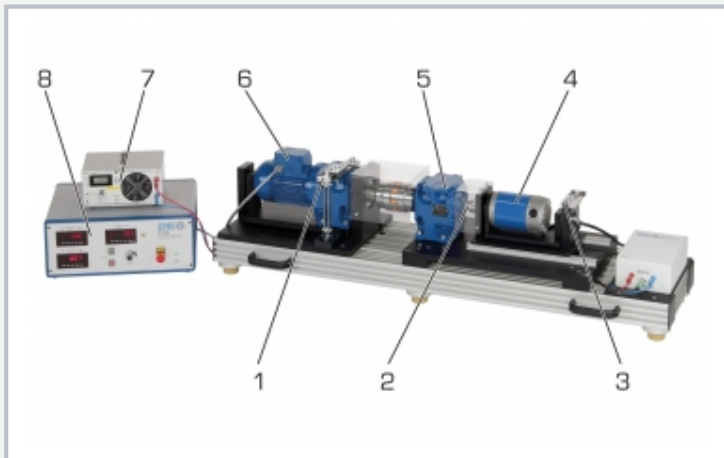
The generator speed and the torques of the drive side and generator are captured by sensors and displayed digitally on the measuring amplifier. The measured values are also available as analogue signals for optional external capture or processing.

### Learning objectives/experiments

- conversion of rotational energy into electrical energy
- influence of torque and speed on the efficiency of the transmission
- influence of torque and speed on the efficiency of the generator
- influence of the typical torque characteristic of a wind rotor on the overall efficiency of the drive train

# ET 222

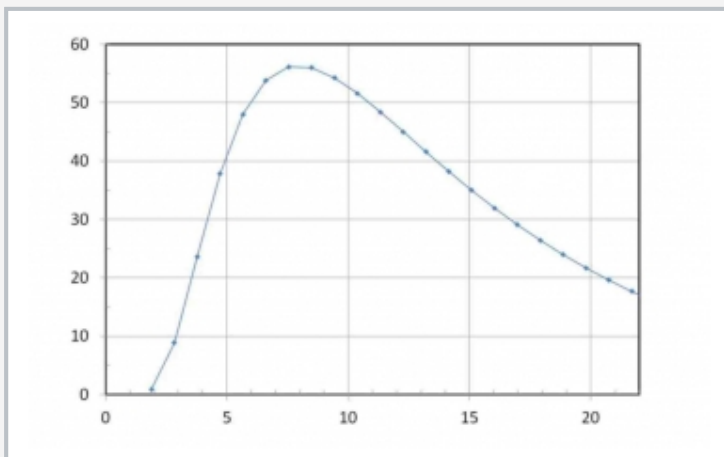
## Wind power drive train



1 drive torque sensor, 2 speed sensor, 3 generator torque sensor, 4 DC generator, 5 spur gear, 6 drive motor, 7 load, 8 measuring amplifier



measuring amplifier with digital displays and control elements



Simulated torque characteristic of a wind rotor:  
x axis: shaft speed in  $\text{min}^{-1}$  y axis: torque in Nm

### Specification

- [1] experimental unit for measurements on a wind power drive train
- [2] drive train with spur gear and DC generator
- [3] low-speed drive motor with adjustable speed simulates wind rotor
- [4] simulation of typical torque characteristics
- [5] DC generator with connections for electrical load
- [6] adjustable load with switchable display for current or voltage
- [7] sensors for generator speed and torques of the drive side and of the generator
- [8] measuring amplifier with digital displays and control elements
- [9] analogue outputs for transmitting the measured values for torque and speed

### Technical data

#### DC generator

- rated speed:  $1100\text{min}^{-1}$
- max. power: 150W
- max. current: 10A
- max. voltage: 28V

#### Spur gear

- transmission ratio: 1:53
- rated load capacity: 335Nm
- rated efficiency: 94%

#### Drive motor

- rated speed:  $22\text{min}^{-1}$
- speed range:  $3\text{...}22\text{min}^{-1}$
- rated power: 0,37kW
- max. torque: 153Nm

#### Measuring ranges

- speed:  $0\text{...}1200\text{min}^{-1}$
- torque:  $0\text{...}200\text{Nm}$
- torque:  $0\text{...}10\text{Nm}$
- current:  $0,005\text{...}25\text{A}$
- voltage:  $0\text{...}80\text{V}$

230V, 50Hz, 1 phase

120V, 60Hz, 1 phase, 230V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 1480x480x400mm

Weight: approx. 105kg

### Scope of delivery

- 1 experimental unit
- 1 electronic load
- 1 measuring amplifier
- 1 set of cables
- 1 set of instructional material