MANUAL WIND ENERGY LAB

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# **Wind energy for youngsters**

Wind Energy Lab is a **portable educational installation** designed to give youngsters of different ages an understanding of **how a wind turbine and wind energy work**. It includes **educational activities** which can be carried out using the installation.

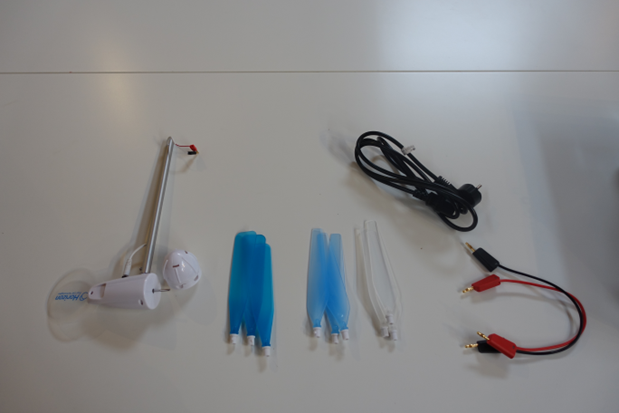
The **many possible configurations** of the turbine and the **four power loads** that can be switched in various ways allow you to study the workings of a wind turbine in greater depth. To do this, you can study the **measurements on the display**.

This educational installation was developed by **Schokarts** on behalf of **Het Beroepenhuis** as part of the **Erasmus+ Alpha Skills project.**

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# **Contents of the installation**

* Power cord
* Red and black banana cables
* 3 x set of 3 rotor blades
* Wind turbine



Always store **cables, wind turbine and rotor blades in the net attached to the lid.**

# **Setup**



* At the top, a **socket** for inserting the **wind turbine,**
* Connections with 2 mm-banana plugs for connecting the turbine (see also video).
* **Four possible loads** that can be switched on and off via selector switches. Each load has the same power consumption.

## **3.1 Choose your rotor blades**

You can equip the turbine with **3 different types of rotor blades**. There are 3 blades of each type in the case.  
Choose **1, 2 or 3 rotor blades** (or even 4, 5 or 6, although you will need to use different types of blades). If you have 2 installations available, you can install up to 6 identical rotor blades.

You can also change the pitch of the rotor blades in **three different positions**. Do this **very carefully!**

# **Creating wind**

Then there is the wind. This is simulated by **a fan**. Various settings are possible: **from gentle to very strong winds**. Study the **effect at different wind speeds**! The display shows the **voltage, current and power** generated at any given moment.

## **4.1 Beware of overvoltage!**

During testing we measured **5 volts** as the highest voltage. With a very powerful fan, the **voltage generated could be higher**.The voltage may rise to a **maximum of 10V**! If the voltage measured on the reaches **10V**, do **not allow** the fan to run **any faster or closer to the turbine**!

# **Turbine assembly**

* Choose the **type and number of rotor blades** that you want to use for the activity or test.
* Place the selected rotor blades **in their holders**. (See video)
* **Carefully place the assembled rotor blades onto the turbine shaft**. Hold the turbine firmly with one hand and push the rotor blades onto the shaft until **you hear a click**. The rotor blades are now correctly mounted and the test can begin.

# **Operation of the installation**

## **6.1 Wind turbine**

This wind turbine has a number of **rotor blades** that convert **wind energy in a rotating motion**. The **electric generator** converts the rotating motion into **electricity**.   
*The generator is of the BLDC type. Its operation is not covered in this manual. For more information contact Schokarts (contact details can be found at the end of this manual).*

More or less wind will be converted into electricity depending on **wind force**, **number of rotor blades**, **type of rotor blades** and **pitch** .

The wind turbine **initially** produces a certain **open circuit voltage**: voltage without any load connected.

## **6.2 Switching electrical loads**

You can then start **switching loads** by flipping the switch next to each load/consumer. Depending on the **size of the load** and all **other parameters** described above, **more or less energy** will be generated.   
**When you switch on the loads**, you will see the **current rise**, the **voltage drops and the power increases.**   
Deze opeenvolging van **oorzaak-gevolg** kan je uitvoerig bestuderen door verschillende belastingen te schakelen.   
 In addition to the above, heavier loads will also reduce the **rotational speed of the turbine**. If you overload it heavily, the turbine will even come to a standstill.

## **6.3 Electrical loads: power consumption**

The loads are **switched electronically** on the turbine. The switches provide the electronics with information about how much load is required. The LEDs are therefore not directly connected to the wind turbine, as is the case with the SUN ENERGY LAB. This small wind turbine **would not generate enough energy** with a simple fan to power the LED’s brightly, so it was decided to do this via the electronics so that more simple tests can be carried out. However, the **measurement shown on the display** is taken at the **output of the wind turbine**, so voltage, current and power are what the wind turbine delivers.

## **6.4 Types of rotor blades & possibilities**

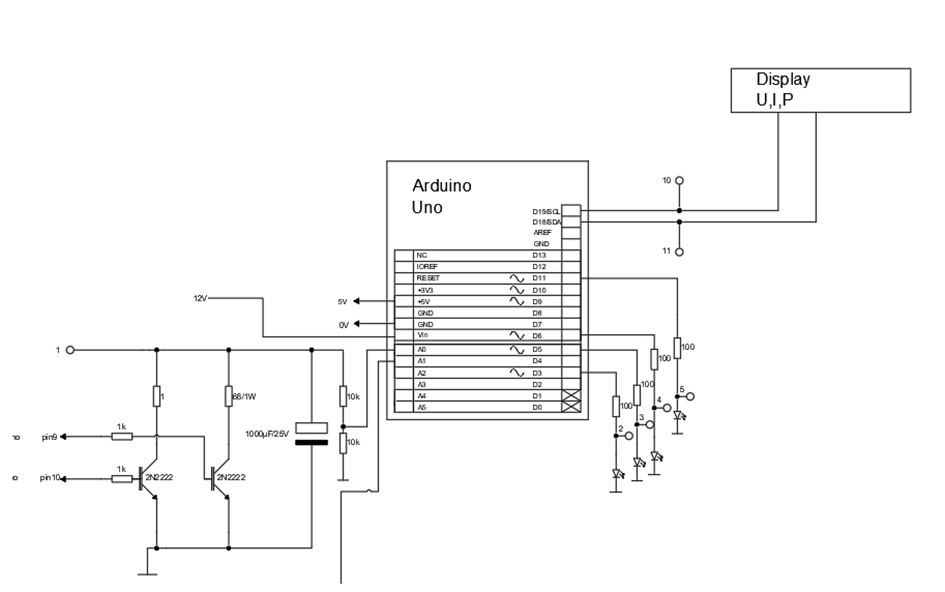
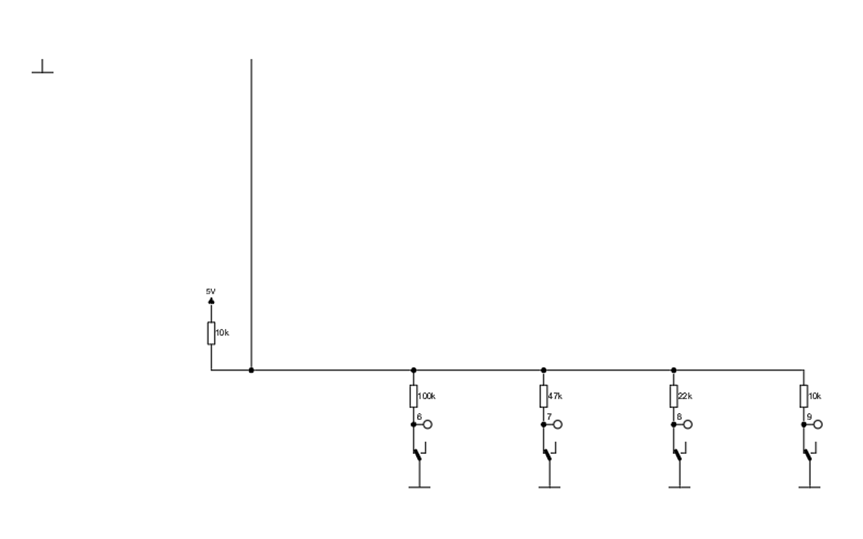
There are **three types of rotor blades**: **flat rotor blades** and **two types of profiled** rotor blades. Each type has a different colour, making them easy to distinguish.

The **flat rotor blades** have a simple, flat shape and are **less efficient** at converting wind energy. They are most useful for demonstrating the basic principles of wind energy.

The **profiled rotor blades** are **aerodynamic** and utilize the airflow much better.   
There are two variants.

* The first type is **less profiled** and therefore less efficient, but still better than flat rotor blades.
* The second type has a **stronger aerodynamic profile**, making it the most efficient type and achieving the highest yield from the available wind.

# **Circuit diagram**



# **More information**

Want to know more about the technology of the Wind Energy Lab? Contact Schokarts bv.

* mail: [Ben@schokarts.be](mailto:Ben@schokarts.be)
* phone: 0032 474/974230
* Code: [Github](https://github.com/Het-Beroepenhuis/wind-energy-lab)

Want to know more about the activity cards that are part of Wind Energy Lab?

* Visit <https://www.alphafutureskills.eu/>
* Contact Iris via e-mail: iris@beroepenhuis.be