

## Long term evaluation

The long-term evaluation offers the possibility to test a small wind turbine over a longer period of time (at least 1 year) and to determine yield values. In the course of the evaluation, the availability of the turbine or failures and malfunctions can be analysed.

For this purpose, the turbine, including all turbine components required for the functioning of the turbine to be measured (e.g. inverter, control unit, control and data lines), is mounted on an existing mast or on a mast erected by the client. The wind conditions are recorded on site using anemometers at 19 m and 15 m and the yield is measured using electricity meters of accuracy class 1.

### NOTE:

The duration of the measurement is agreed with a minimum of 12 months, an extension of the duration is possible at any time. The data obtained will be evaluated and summarised in a written report and handed over to the contractual partner.

### Services of the JV

The long-term evaluation comprises the following individual or partial services:

- The construction of the small wind turbine to be measured, including the necessary components on the infrastructure, is carried out together with representatives of JV energy research park Lichtenegg.
- JV energy research park Lichtenegg shall ensure the connection of the plant to the regional electricity distribution grid. JV accepts no liability for downtimes or damage to the system due to grid interruptions or due to other external influences (e.g. ice build-up).
- JV energy research park Lichtenegg shall also be responsible for obtaining the permits required for the construction and operation of the wind turbine, whereby the contractual partner shall provide JV with all documents and declarations required for this purpose (e.g. structural analysis report).
- JV energy research park Lichtenegg shall provide the necessary wind and energy measurement data, as well as the required mast infrastructure including foundations and a container to house the inverter.
- The measurement data will be processed and made available for the duration of the long-term evaluation either in a password-protected area on the website of JV energy research park Lichtenegg or sent to the contractual partner by e-mail.

In addition, the contractor receives the following services:

- Monthly report of quarter-hourly yield values and wind measurement data.
- Final report at the end of the long-term evaluation (availability, yield, key figures e.g. full load hours, specific yields).

## Power curve assessment according to IEC 61400-12

The power curve measurement shows the specified electrical active power as a function of the wind speed up to a minimum of 14 m/s.

For this purpose, the system including all necessary system components (e.g. inverter, control unit, control and data lines) is mounted on a specially erected 19 m high test mast. The wind conditions on site (wind speed, wind direction) are permanently recorded by 2 anemometers, which are mounted on a mast at 17 m and 19 m as standard.

### NOTE:

The duration of the measurement is about 3 months and depends on the occurring wind speeds. Due to the naturally lower wind supply in the summer months, the power curve measurement may take longer during this period.

### Services of the JV

The power curve measurement comprises the following individual or partial services:

- The installation of the small wind turbine to be measured, including the necessary components on the infrastructure, is carried out together with representatives of JV energy research park Lichtenegg.
- JV energy research park Lichtenegg shall ensure the connection of the plant to the regional electricity distribution grid. ARGE accepts no liability for downtimes or damage to the system due to grid interruptions or due to other external influences (e.g. ice build-up).
- JV energy research park Lichtenegg shall also be responsible for obtaining the permits required for the construction and operation of the wind turbine, whereby the contractual partner shall provide JV with all documents and declarations required for this purpose (e.g. structural analysis report).
- JV energy research park Lichtenegg shall provide the necessary wind and active power measurement, as well as the required mast infrastructure including foundations and a container to house the inverter.
- The measurement data can be retrieved remotely, are processed and made available as a power curve report and as tabular data at the end of the testing service.
- The report of a power curve assessment includes the following sub-items:
  - Description of the small wind turbine (manufacturer's data, plant control, plant data, photos).
  - Description of the measurement site (topography, measurement sector, site plan, photos)
  - Description of the measurement and data preparation (general description of the procedure, wind measurement data and technical data, data filtering)
  - BIN-averaged power curve for the reference air density of 1.225 kg/m<sup>3</sup>
  - Annual energy yield (AEP) for the air density 1.225kg/m<sup>3</sup>

## Sound measurement according to IEC 61400-11

The sound measurement provides the sound emissions to the corresponding wind speed up to at least 11 m/s at a certain distance and variable distance in the form of a sound map.

For this purpose, the turbine, including all turbine components required for the functioning of the turbine to be measured (e.g. inverter, control unit, control and data lines), is mounted on a 15 m high test mast at a distance of 500 m from the energy research park. The wind conditions on site (wind speed, wind direction) are permanently recorded by 1 anemometer, which is installed at a distance of approx. 12 m on an 11 m high mast.

### NOTE:

The duration of the sound measurement is 1 to 2 days and depends on the occurring wind speeds. The measurement consists of total noise measurement (small wind turbine + ambient noise) and ambient noise measurement, which is subtracted from the total noise. Since the time range for high winds is limited, an ambient noise measurement may consist of historical measurements due to time constraints. In summer, measurement is not possible due to ambient noise (insects, birds, high grain) and low wind speeds in June, July and August. Several months may pass before optimal wind conditions for measurement prevail. To avoid additional noise caused by resonances in the mast, a vibration decoupling between mast and turbine is recommended. Deviating from the standard, the frequency spectrum is examined in a simplified way for certain wind speeds.

### Services of the JV

The sound measurement comprises the following individual or partial services:

- The installation of the small wind turbine to be measured, including the necessary components on the infrastructure, is carried out together with representatives of JV energy research park Lichtenegg.
- JV energy research park Lichtenegg shall ensure the connection of the plant to the regional electricity distribution grid. ARGE accepts no liability for downtimes or damage to the system due to grid interruptions or due to other external influences (e.g. ice build-up).
- JV energy research park Lichtenegg shall also be responsible for obtaining the permits required for the construction and operation of the wind turbine, whereby the contractual partner shall provide JV with all documents and declarations required for this purpose (e.g. structural analysis report).
- JV energy research park Lichtenegg shall provide the necessary wind and sound measurements, as well as the required mast infrastructure including foundations and a location (building of the Kornfell family) to house the inverter.
- The measurement data cannot be retrieved remotely due to the short measurement period.
- The report of a sound measurement includes the following sub-items:
  - Description of the small wind turbine (manufacturer's details, system control, system data, photos).
  - Description of the measurement site (topography, measurement sector, site plan, photos)
  - Description of the measurement and data preparation (general description of the procedure, wind measurement data and technical data, data filtering)
  - BIN-averaged sound emission curve up to at least 11 m/s.
  - Sound map up to 100 m distance.
  - Simplified frequency spectrum of the investigated installation.

## Vibration measurement according to IEC 61400-2

The vibration measurement reproduces resonance events at certain speeds in the form of a Campbell diagram and provides conclusions about critical speeds and material loads.

For this purpose, the system is optionally installed on (including all system components required for the functioning of the system to be measured e.g. inverter, control unit, control and data lines):

- a separate mast (recommended variant, as the vibration behaviour depends strongly on the mast construction and dimensions).
- an existing mast in the research park. Pipe masts and lattice masts are available for this purpose.

### NOTE:

Typically, a vibration measurement takes less than 1 day, but depends on the prevailing wind conditions. In summer, a measurement is difficult to implement due to low wind speeds, as the entire speed range must be covered several times. By default, the speed is determined via the generator pole number and the generator frequency. If this is not possible for technical reasons, the client must find an alternative technical solution in consultation with representatives of the consortium.

### Services of the JV

The vibration measurement comprises the following individual or partial services:

- The installation of the small wind turbine to be measured, including the necessary components on the infrastructure, is carried out together with representatives of JV energy research park Lichtenegg.
- JV energy research park Lichtenegg shall ensure the connection of the plant to the regional electricity distribution grid. ARGE accepts no liability for downtimes or damage to the system due to grid interruptions or due to other external influences (e.g. ice build-up).
- JV energy research park Lichtenegg shall also be responsible for obtaining the permits required for the construction and operation of the wind turbine, whereby the contractual partner shall provide JV with all documents and declarations required for this purpose (e.g. structural analysis report).
- JV energy research park Lichtenegg shall provide the necessary wind, speed and vibration measurements, as well as the required mast infrastructure including foundations and a container to house the inverter.
- The measurement data cannot be retrieved remotely due to the short measurement duration.
- The report of a vibration measurement includes the following sub-items:
  - Description of the small wind turbine (manufacturer's details, system control, system data, photos).
  - Description of the measurement site (topography, measurement sector, site plan, photos)
  - Description of the measurement and data preparation (general description of the procedure, wind measurement data and technical data, data filtering)
  - Campbell diagram near the generator.
  - Campbell diagram at the foundation.

## Services of the contracting party

The contractual partner shall provide the wind turbine to be measured free of charge for the duration of the service used and shall also be responsible for the delivery and removal of the wind turbine to and from the measurement site. The contractual partner shall deliver the wind turbine subject to the contract to the installation site (postcode 2813, Rotte Pesendorf, location of the large wind turbine) free of charge and shall also transport it away from there.

The contractual partner shall also bear the costs for the crane or other necessary lifting equipment for the installation of the small wind turbine on the mast. The contractual partner may choose whether to mount its turbine on a mast provided by the consortium or to bring its own mast. In the latter case, the contractual partner must provide static proof for the mast and submit it at least 15 working days before the agreed installation date.

At least 15 working days before the agreed installation date, the contractual partner shall provide all necessary documents free of charge (control lines, control pulses, block diagrams and other existing technical documents such as data sheets, expert reports, etc.) as well as a proof of the installation of tested components.

Furthermore, the contractual partner shall provide proof of the existence of a valid liability insurance for the entire duration of the measurement.

During assembly and disassembly, a competent representative of the manufacturer shall always be provided. Assembly and disassembly shall be carried out at a prior arranged appointment.

Delays after completion of the test or measurement service, which are caused by the manufacturer and thus require a longer contract period, will be invoiced in advance with a further month's rent in each case. Otherwise, JV energy research park Lichtenegg will carry out a substitute performance or disassemble the system. The contract partner shall bear the costs of the necessary disassembly.

If the contractual partner makes technical changes to the system or a system component (e.g. control system or inverter) during the measurement period, JV energy research park Lichtenegg must be informed of these changes at least 2 working days in advance. Subsequently, the changes made must be reported immediately in writing and, if required, the necessary documents must be made available.

If the contractual partner engages any sub-partners during the performance of the testing or measurement service used, they shall be agreed with JV energy research park Lichtenegg in advance or, in any case, announced by name prior to the signing of the contract.

The contractual partner shall be obliged to carry out any maintenance and servicing work during the performance of the long-term evaluation, as well as repairs to the wind turbine, at its own expense. Insofar as necessary for the fulfilment of the contract - in particular for the aforementioned work - the contractual partner shall be granted access to the wind turbine by JV-Lichtenegg in consultation with the JV contact person.

## Public relations

In addition to various measuring and testing services, the Lichtenegg Energy Research Park consortium offers anyone interested the opportunity to find out about the topic of small wind power on site and gain an insight into the technology and operation of various small wind turbines. A special highlight is the opportunity to visit the viewing platform of the over 60 m high wind turbine.

With the exception of a short winter closure, the tours are offered on selected Thursdays from March to November and last approx. 1 hour. Advance booking is required and can be made online at [www.energieforschungspark.at](http://www.energieforschungspark.at). If required, individual guided tours can also be arranged outside of the offered dates. For general questions about the tours or individual tours outside the offered dates, please contact [fuehrungen@energieforschungspark.at](mailto:fuehrungen@energieforschungspark.at).



Figure 1: Energy Research Park Lichtenegg