
# ENERCON

## Nature inclusive wind farm development

**Nature inclusive wind farm development, 05.11.2021**

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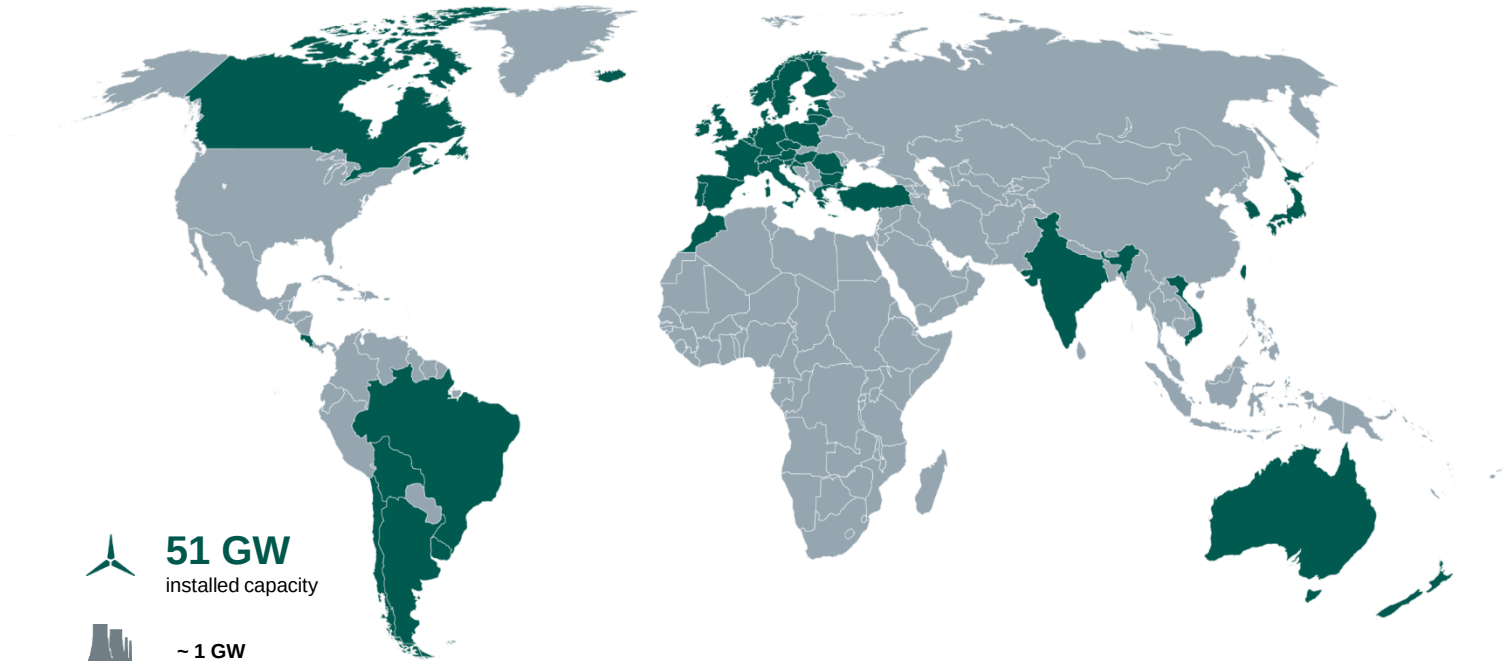
ENERCON
ENERGY FOR THE WORLD

# FACTS & FIGURES

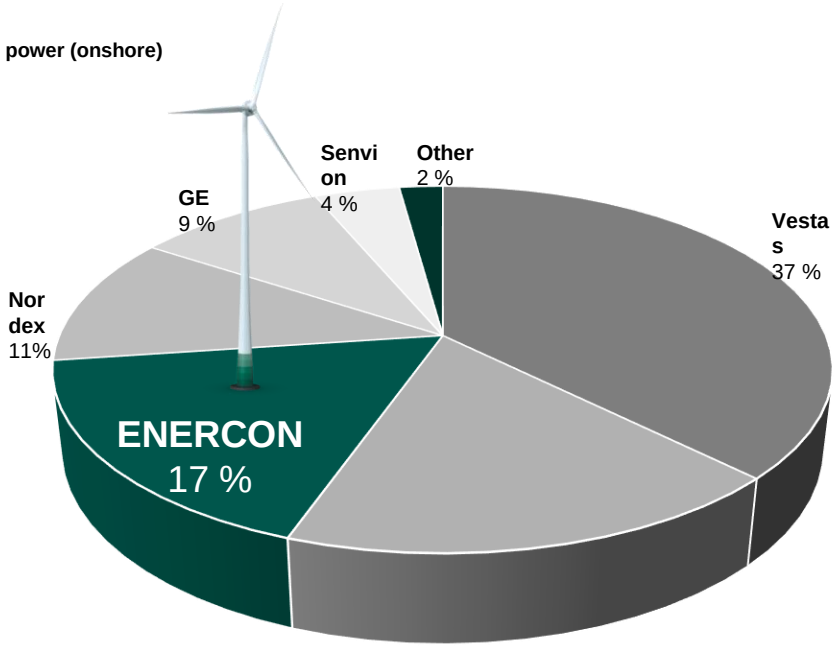
- **COMPANY HEADQUARTERS:** Aurich
- **SALES:** 11 national and 30 international sales offices
- **SERVICE:** Global Service network with over 360 Service stations
- **LOGISTICS:** Customised logistics solutions
  - E-Ship 1
  - e.g.o.o. Eisenbahngesellschaft Ostfriesland Oldenburg mbH
  - Mobile cranes up to 1,600 t
  - Numerous Service vehicles and special transport vehicles for towers and rotor blades
- **PRODUCTION SITES FOR ENERCON WEC COMPONENTS**
  - GERMANY: Aurich, Emden, Magdeburg, Georgsheil
  - WORLDWIDE: Turkey, Portugal, Canada, France, Poland

# ACTIVE MARKETS



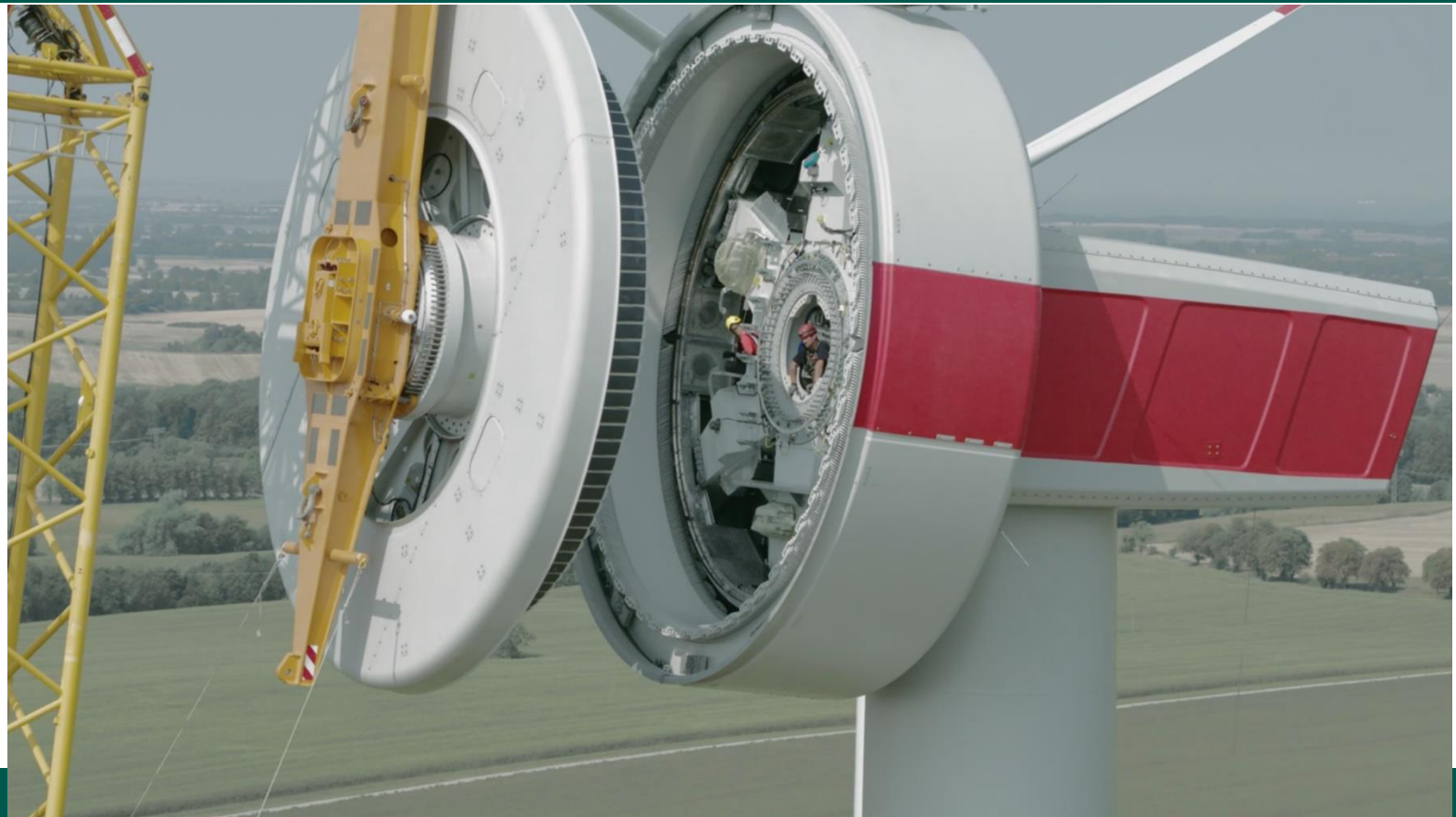
# MARKET SHARE EUROPE 2019*

*** based on new installed power (onshore)**




Quellen: Bloomberg „2019 Global Wind Turbine Market Shares“ (02/20), Wind Europe: “Wind energy in Europe in 2019” (02/20)

# GENERATOR – INSTALLATION (E-126 EP3 / Kirch Mulsow)



# ROTOR BLADE TRANSPORT – SPECIAL EQUIPMENT

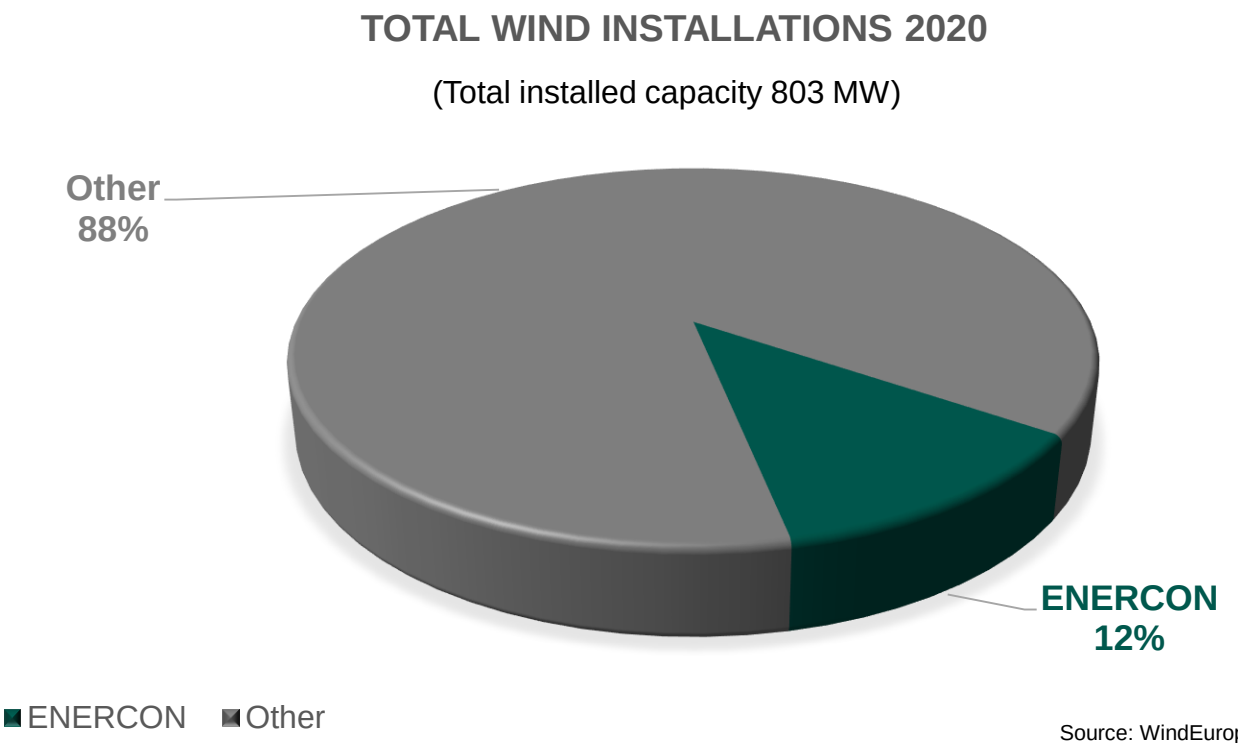
# ROTOR BLADE INSTALLATION (E-126 EP3 / Kirch Mulsow)

# ENERCON Installed capacity

- ENERCON active since 2006
- ENERCON installations 112,8 MW

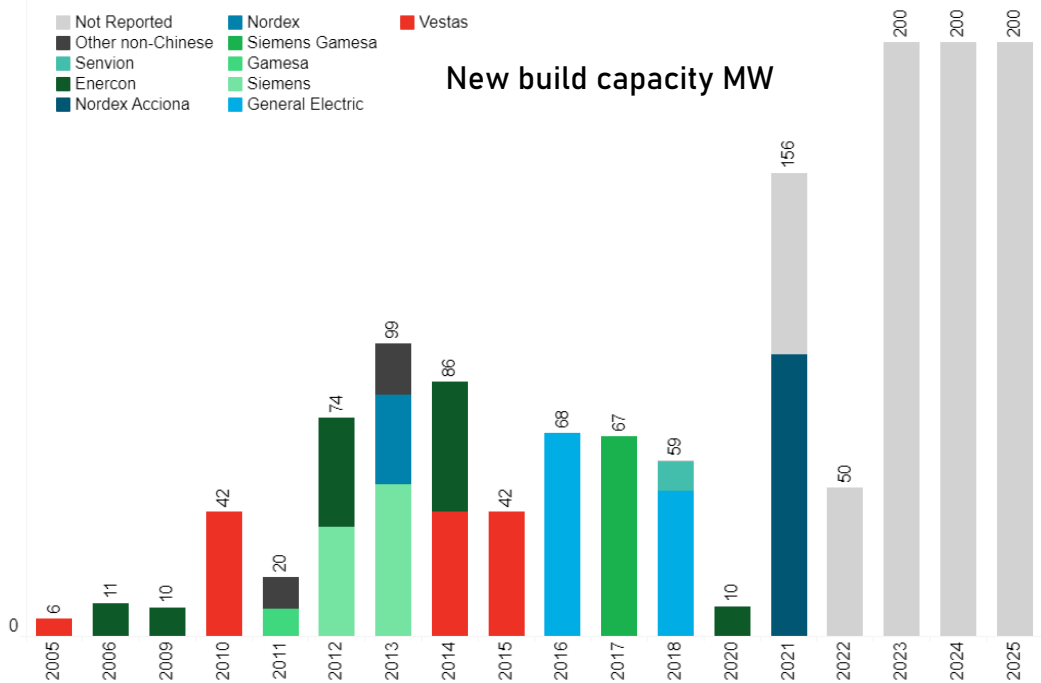
| WEC Type | Number |
|---|---|
| E-44 | 8 |
| E-48 | 17 |
| E-70 | 21 |
| E-82 | 19 |

# Market share




Source: WindEurope, ENERCON

# Market Outlook




Source: Bloomberg

- Croatia aims to increase its wind energy capacities by a factor of three in the next 10 years.
- With wind and other renewable energy sources, Croatia will achieve the renewables share in gross energy consumption of 32% by 2030 and at least 56% by 2050.

Source: https://balkangreenenergynews.com/croatia-aims-to-triple-wind-boost-solar-energy-capacities-20-times-in-next-10-years/

# COMPANY PRINCIPLES & CLAIM TO PERFORMANCE

RESPONSIBILITY

INDEPENDENCE

LONGEVITY

TECHNOLOGY LEADERSHIP

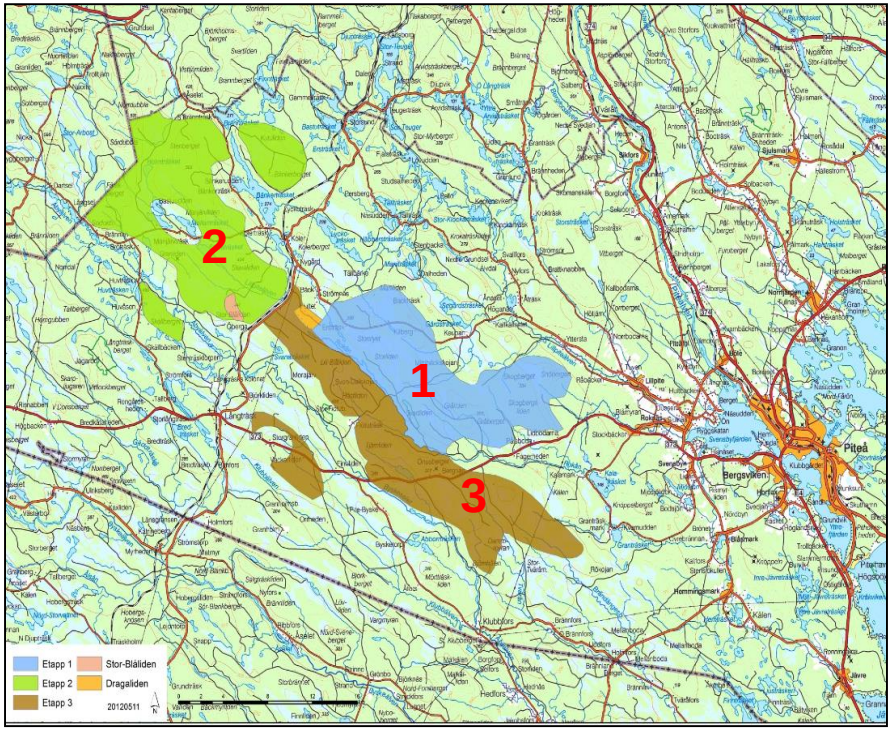
QUALITY LEADERSHIP

# Case study Markbygden


## Croatia

# Markbygden windfarm

- 1 101 turbines
- Area covering 450 km²
- Currently over 1000 MW installed capacity
- Once fully constructed Markbygden will produce about 8% of Sweden's total electricity demand
- Government permissibility granted 2010
- Divided into three phases for the Environmental permits



# Hierarchy

- Mitigation hierarchy
  1. Avoid impact
  2. Reduce impact
  3. Compensate impact
  4. Accept impact

- Coordinate with authorities
  - Regular site visit!
  - What impact will be caused
  - What mitigation is needed

- Example
  1. Don’t interfere with a creek with migration fish
  2. Place a culvert in the creek
  3. Construct a new creek
  4. Accept the conflict

# Considerations

- All mitigations come with a cost
  - Increased investment cost
  - Increased production cost
  - Reduced availability
  - Reduced production
  - Secondary impact

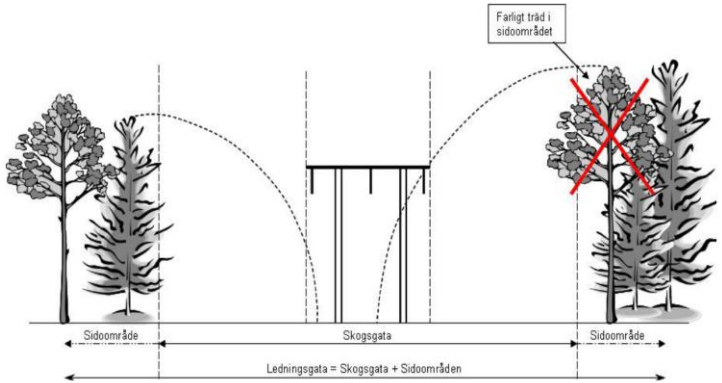
- To consider
  - Is the mitigation relevant?
  - Will the mitigation significantly reduce the impact?
  - Is the mitigation worth the cost?
  - Will the mitigation cause other disadvantages?

# Examples of different mitigation and their impact

- Location and design
  - Wind farm layout
    - Reduce visual impact
  - Dimension of turbines
    - Avoid bird collision
- Physical measures
  - Fencing
    - Avoid accidents
  - Culvert
    - Maintain water flow, migration
- Time
  - Avoid work during certain dates
    - Birds breeding
  - Avoid production during certain conditions
    - Bats and birds migrations
- Compensation
  - Economic
    - Balance loss of income
  - Physical
    - Create new habitats

# Tree cutting

- Limit the width of cuttings
  - Better micro climate
  - Less impact on the environment
  - Restore

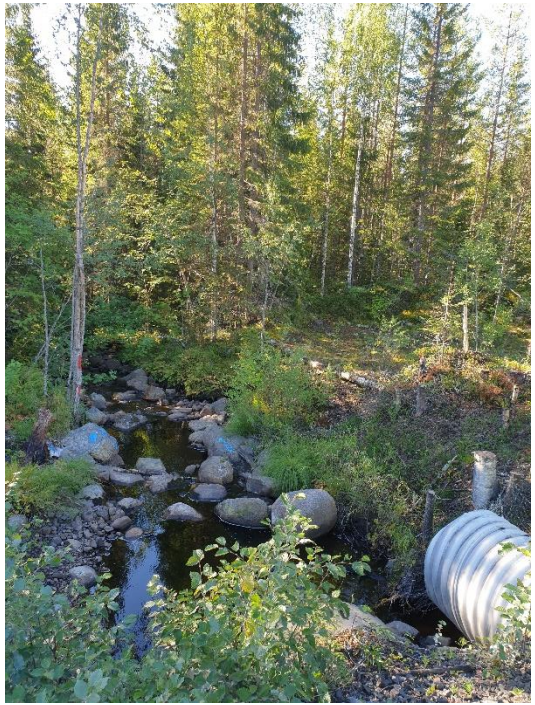



# Breeding birds

- Onsite field inventory
- Avoid noisy installation work close to breeding sites
- Additional feeding

# Fish migration

- Maintain existing waterways
- Culvert road crossing
- Avoid draining
- Protect from sediment spill
- Fish implantation



# Bear

- Avoid creating barriers
- Additional feeding
- Careful approach (female bear and cub!)
- Make sure the bear is aware of you
- Avoid simultaneous construction work all over the area

# Domestic mammals

- Additional winter feeding
- Fencing
- Give the animals time to adapt
- Transport of migrating reindeers

# Follow up impact and mitigation

- Monthly meetings with authorities
  - Also on site
- Control program/monitoring
  - Conditions set by consent
  - Impact on animals, flora and fauna
  - Noise
- Environmental report
  - Yearly
  - Subject to approval by the authorities

# Bat & Bird protection

Mitigation measures operational phase

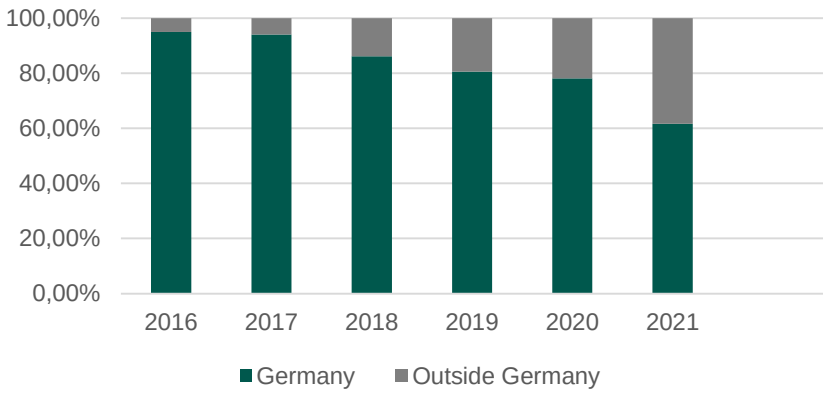
Bat friendly operating algorithms

Bird protection for breeding and migrating birds

~ Start/Stop algorithms in operational phase > 4.000 ENERCON WEC's

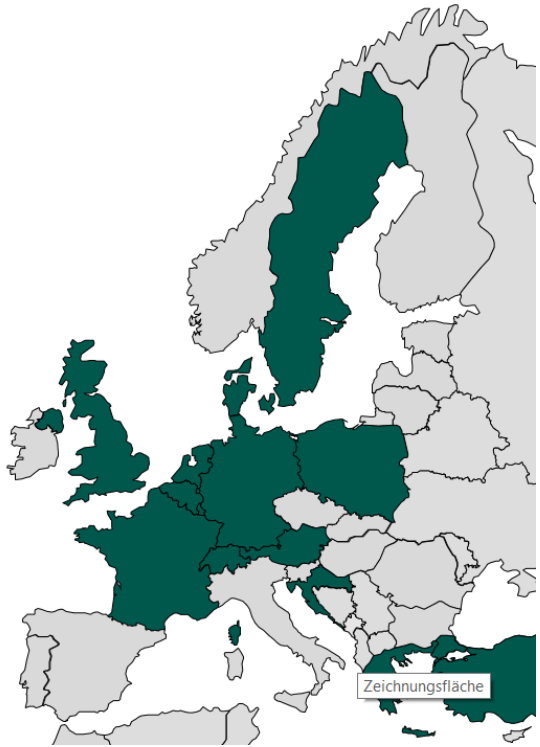
# Distribution of bat friendly algorithms

- In the beginning main distribution in Germany




Project numbers bat protection, source: ENERCON

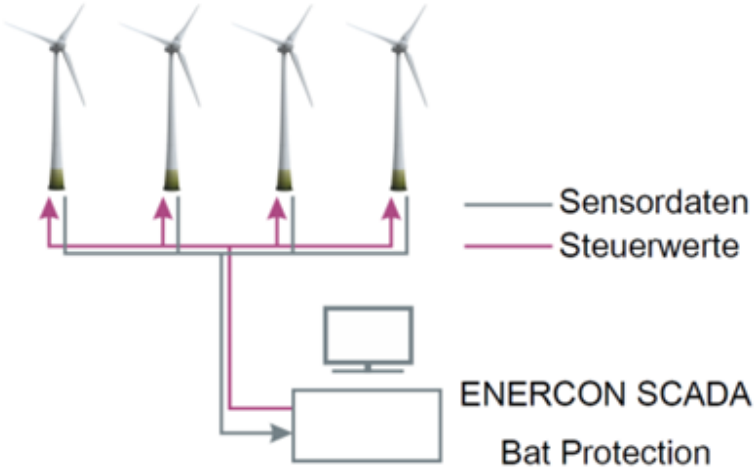
- Now standard in many European countries
- Internationally also used in Turkey and Canada
  - Future projects in Japan and Finland




Eurpean countries bat protection is active, source: ENERCON

# Function

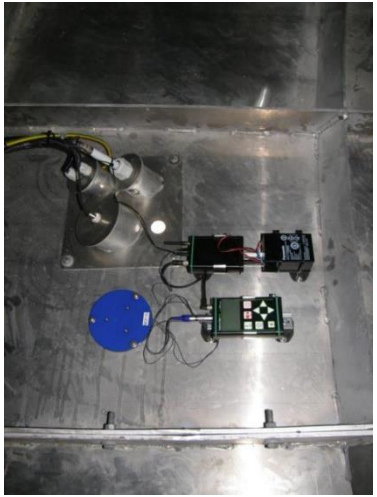
- Start/stop function to protect bats in flight times
- Parameters used for bat friendly algorithm
  - Date range
  - Time of day / night
  - Wind speed [m/s]
  - Temperature [°C]
  - Precipitation intensity [mm/min]
- Log data available

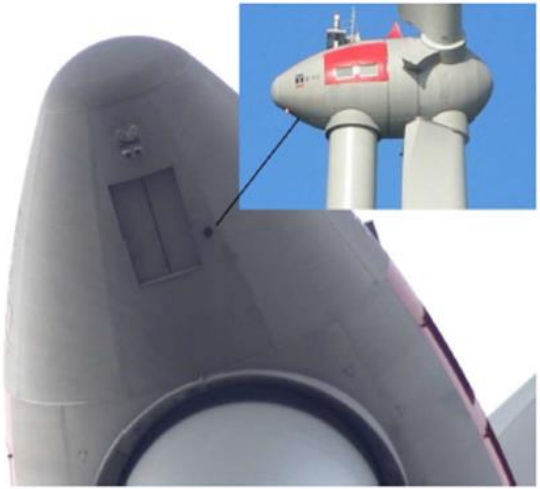



Integration of software module and sensor data, source: ENERCON

# Bat monitoring

- Ultrasonic bat monitoring in narcelle
  - Optimization and control of parameters
  - Adaptation site and species specific

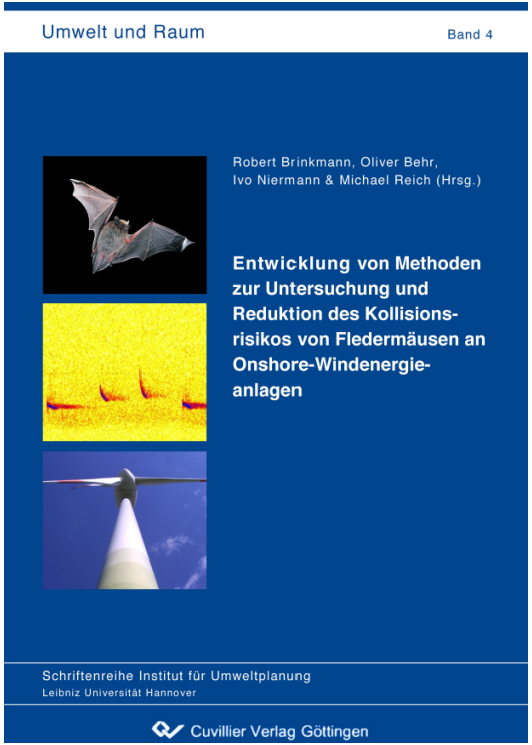




Ultrasonic microphone for bat monitoring in narcelle, source: ENERCON

# Cooperation

- Authorities and experts
  - Implementation and confirmation of shutdowns included in permission
- Third party systems
  - Integration and support
- Research and validation
  - Projects and development




Research project RENEBAT I, 2011

# THANK YOU FOR YOUR ATTENTION

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