EWS

Economic Wind power Solutions

Wind measurements

From the green field to wind power generation

Dr. Sabine Zerobin

Agenda

_ Short presentation of EWS

_ Wind energy in Austria

_ Measurement technique

_ Important steps in project development and the significance of wind measurements

_ Summary

EWS – Economic Wind Power Solutions

_ Company with head office in Munderfing (Upper Austria)
_ Technical services in the field of renewable energies

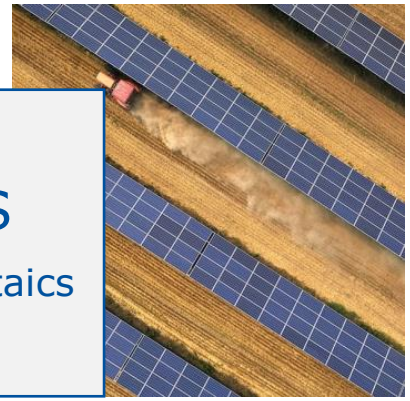
EWS Wind

EWS Mobility

EWS DeCarb

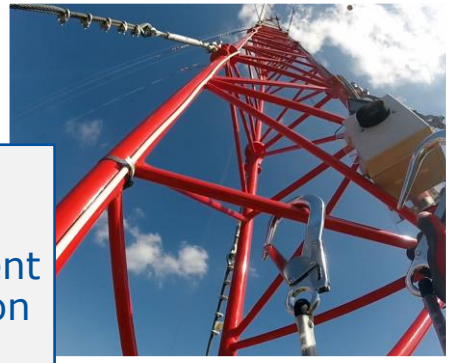
New:

EWS Photovoltaics



EWS Wind

Measurement & Evaluation



Planning

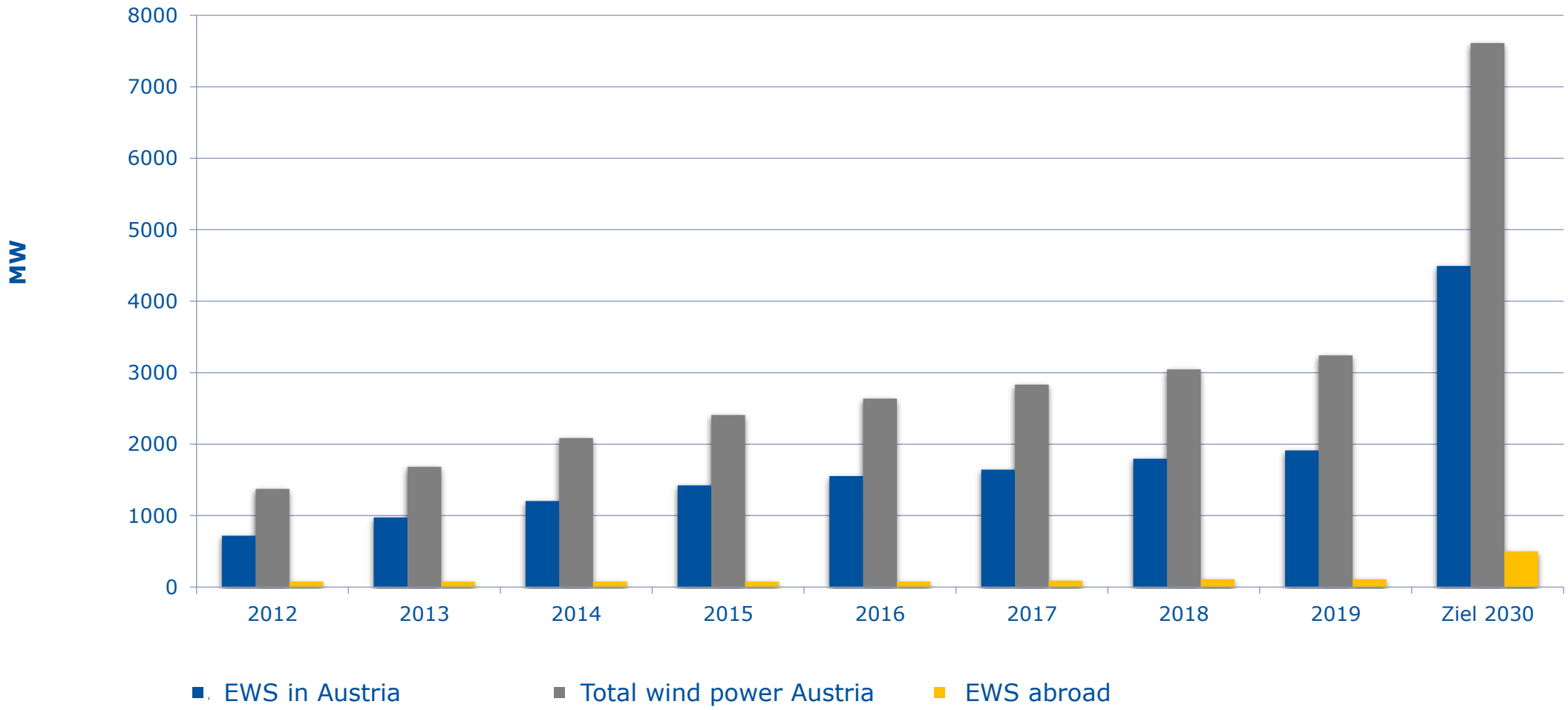
Electrical & Power Systems Engineering

Construction

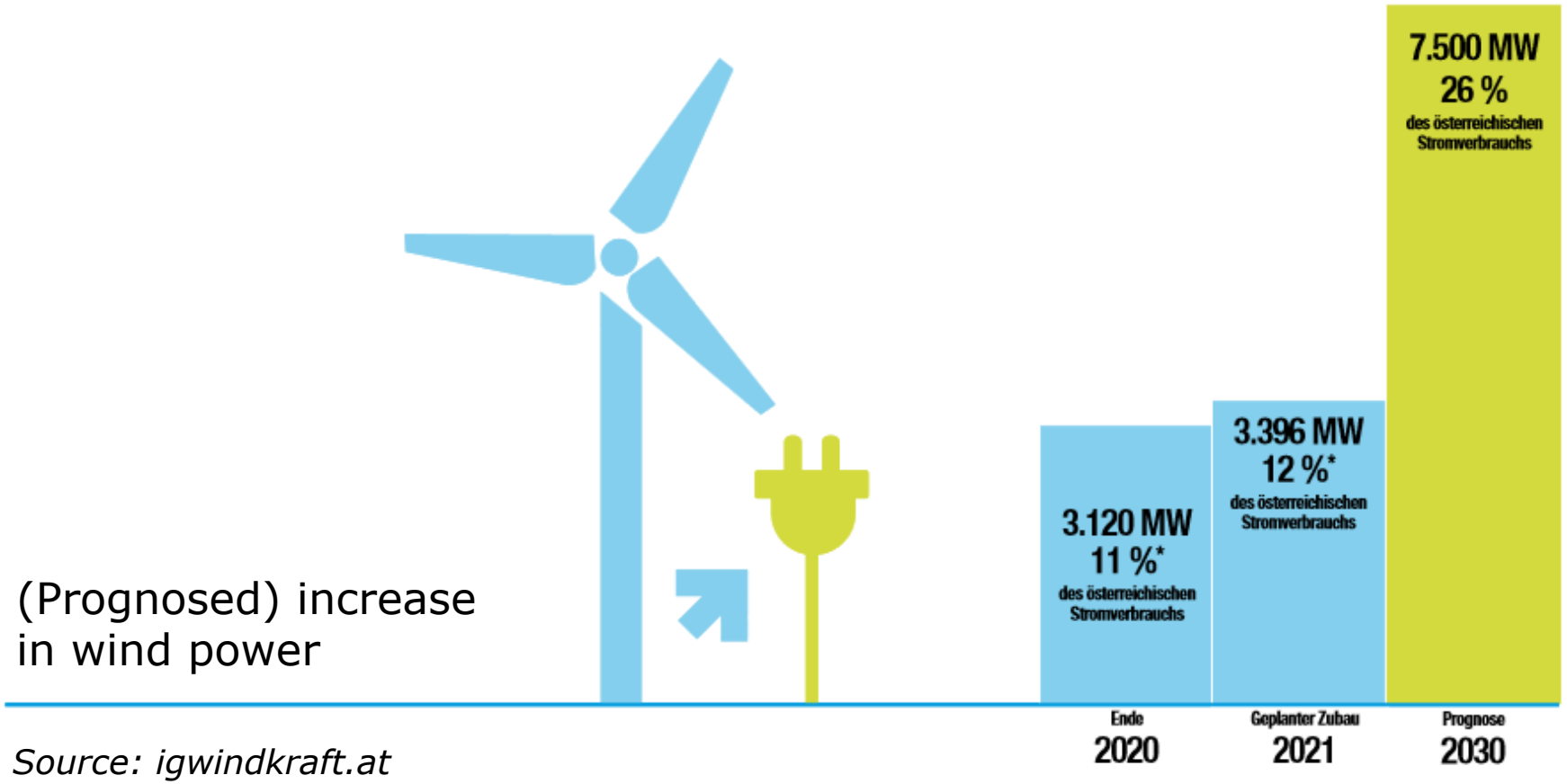
Biology & Ecology

Techn. Operation Management

EWS Wind


MW
8000
7000
6000
5000
4000
3000
2000
1000
0
2012
2013
2014
2015
2016
2017
2018
2019
Ziel 2030
EWS in Austria
Total wind power Austria
EWS abroad

Wind Energy in Austria

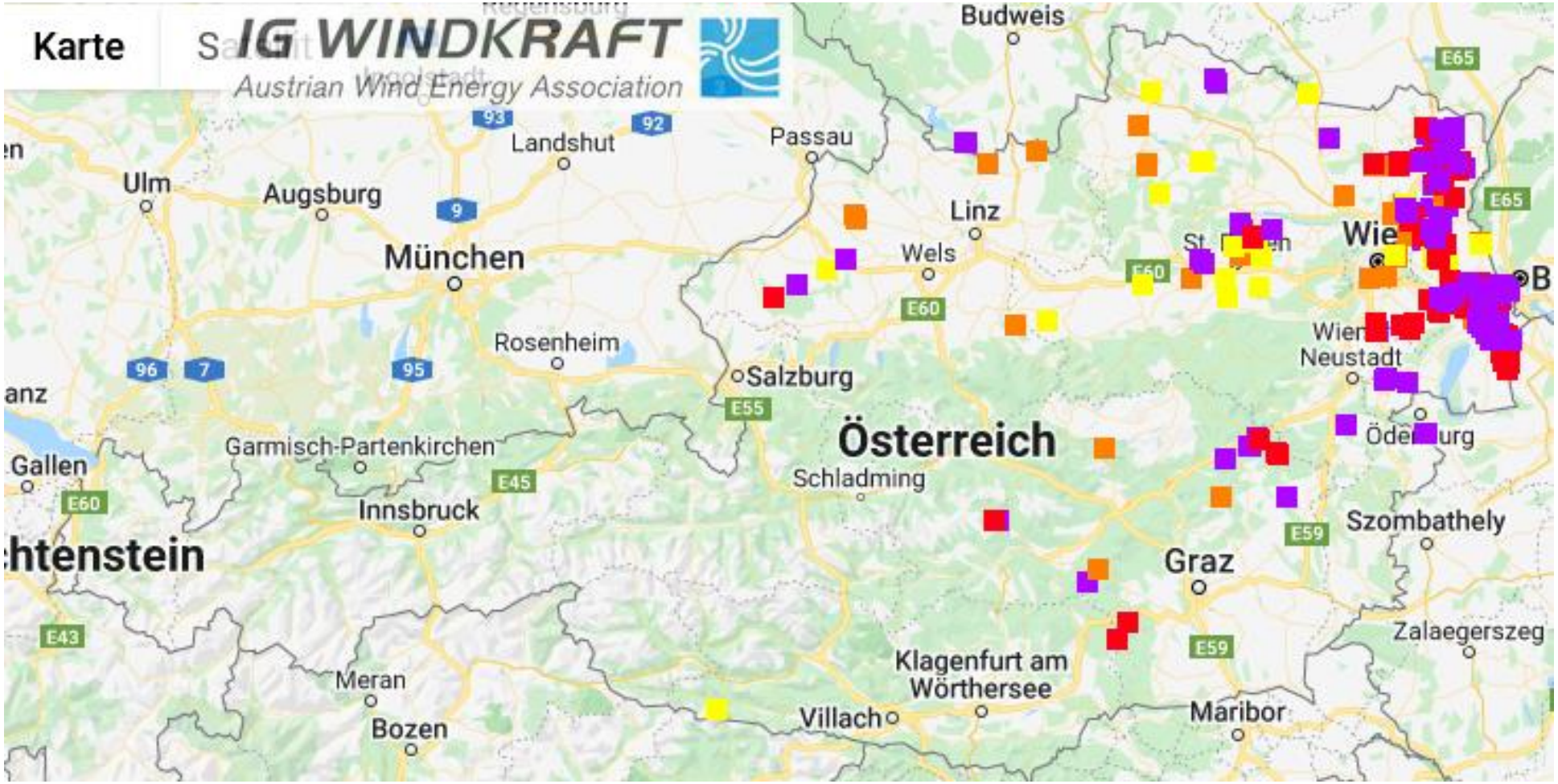


(Prognosed) increase in wind power

Source: igwindkraft.at

Until 2030: 120 WTG per year

Wind Energy in Austria

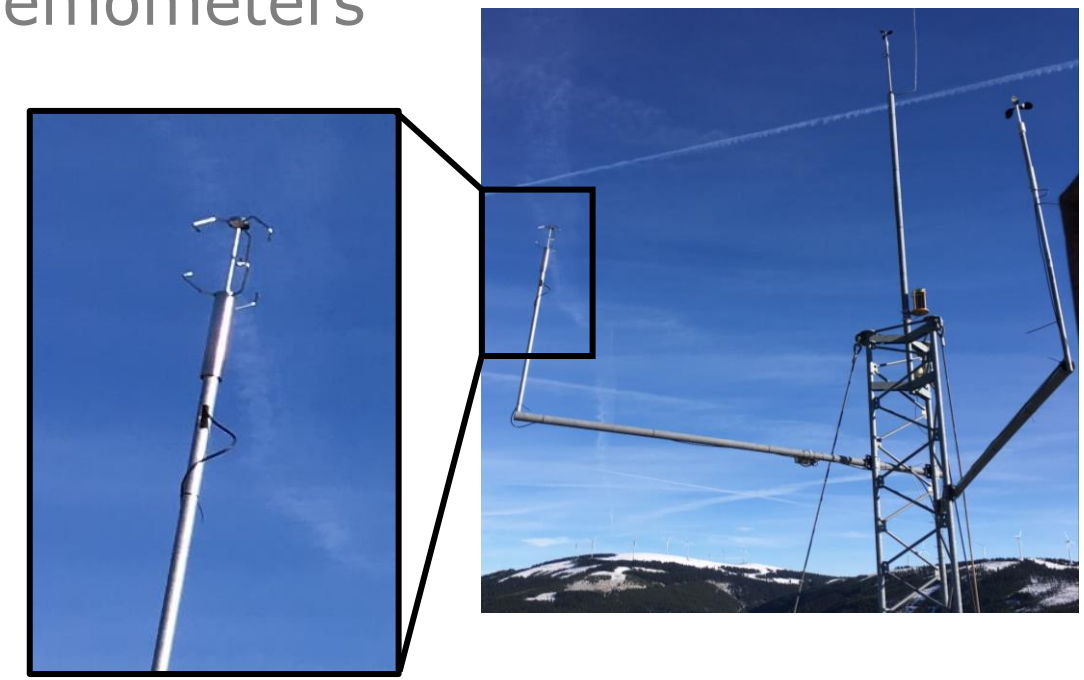


Source: igwindkraft.at

Measurement Technique

- Cup anemometers and wind vanes
  - Anemometers: Thies First Class Advanced (X)
  - Wind vanes: Thies First Class

- Ultrasonic anemometers
  - 2D and 3D
  - heated



Measurement Technique

- LiDAR devices
  - Leosphere Windcube V2/V2.1
- SoDAR devices
  - AQSystems AQ510 Windfinder

- Both of them can be used with a power trailer for autonomous power supply during the measurement (EWS Power Trailer for LiDAR)

Measurement Technique

PROs and CONs

Met mast

+ can be realised fully compliant to technical standards, well established
+ other devices e.g. for bat/bird detection can be mounted
- installation in complex areas can be tricky
- increasing hub heights are challenging

Remote Sensing Devices

+ easier installation in complex areas
+ autonomous operation can be realised relatively easy
- problems with data availability, especially in mountain areas (clean sky)
- combination with met mast recommended

Important Steps in Project Development

Pre-planning

- **Analysis of potential areas and feasibility study**
  - spatial analyses based on wind field models (sometimes measurements)
  - already include additional criteria like infrastructure, biological/ecological aspects, zoning etc.

Planning phase I

- **Wind farm layout and measurement campaign**
  - definition of WTG sites and types (manufacturer, machine type, hub height, power)
  - execution of precise measurements on-site

Planning phase II

- **Wind potential and energy yield calculations, site compliance**
  - these analyses and calculations are based on reliable wind measurements
  - the „better" the measurement the lower the uncertainties of yield and site-specific wind conditions

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Important Steps in Project Development

The interaction between layout and measurement concept

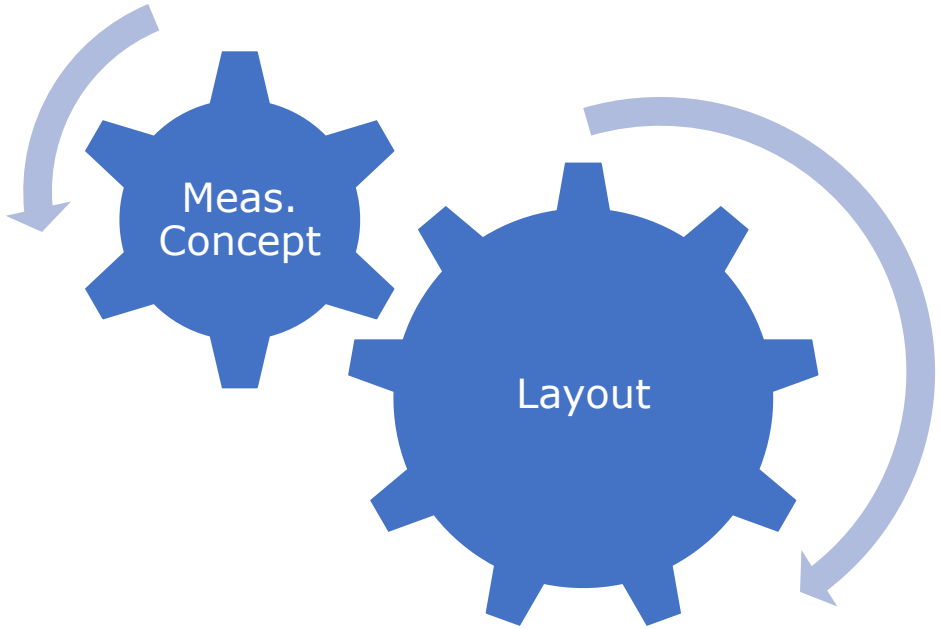
- Wind measurements in the context of wind farm design are subject to several technical standards
- E.g. IEC 61400-12-1 Ed.2

Some of the most important criteria:

- Measuring period of at least 12 months with data availability of >80%
- RSD is recommended in combination with met mast, verification of RSD is mandatory
- Met mast: top anemometer has to be at least 2/3 of planned hub height
- Representativity: 2 km around measurement location at complex sites, 10 km at non-complex sites

Important Steps in Project Development

The interaction between layout and measurement concept



- Changes in layout can lead to the necessity to adjust the measurement concept (e.g. more measurement locations)
- The measurement concept can reveal that an adjustment of the layout is necessary (e.g. larger hub heights)

Important Steps in Project Development

The interaction between layout and measurement concept

It is not always that simple…

Constraints due to:

- Access roads
- Type of terrain
- Landed property
- Municipality borders
- Etc.

Important Steps in Project Development

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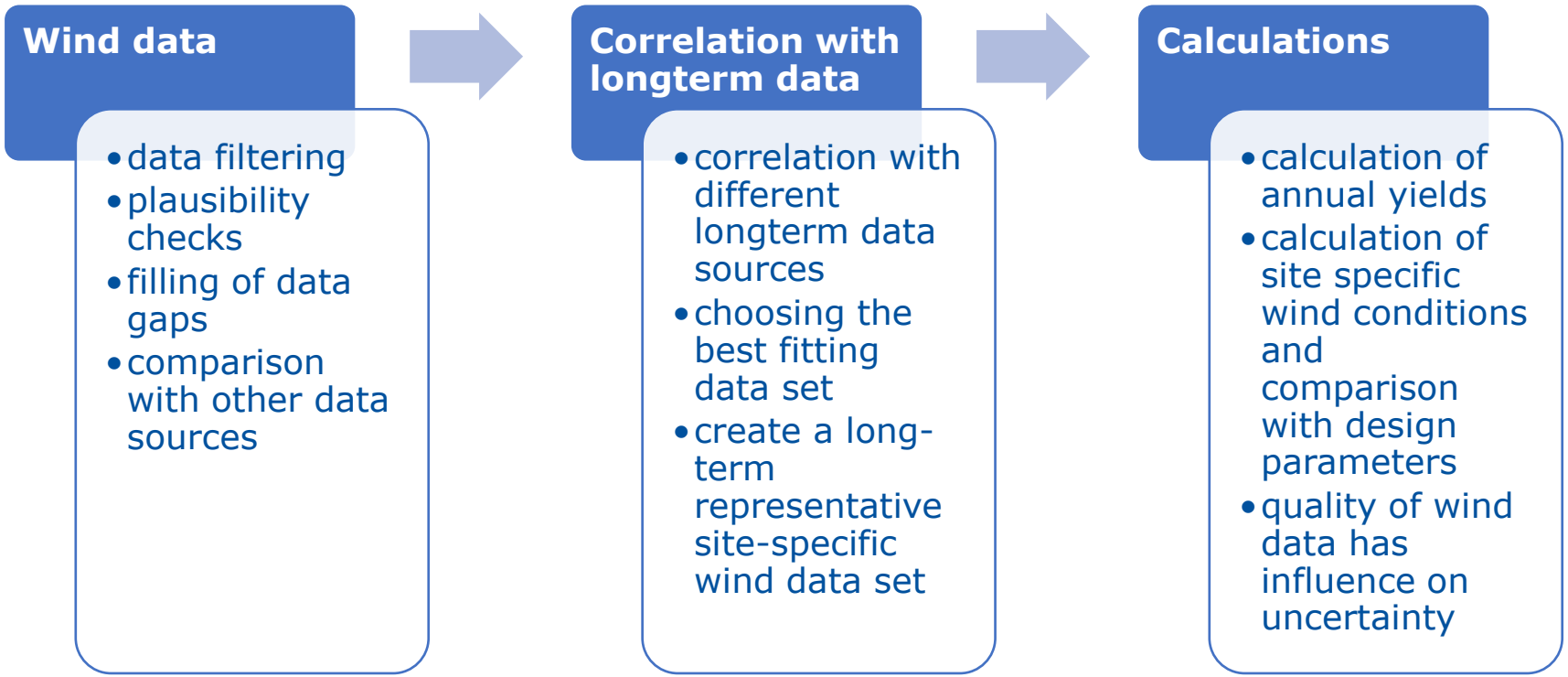
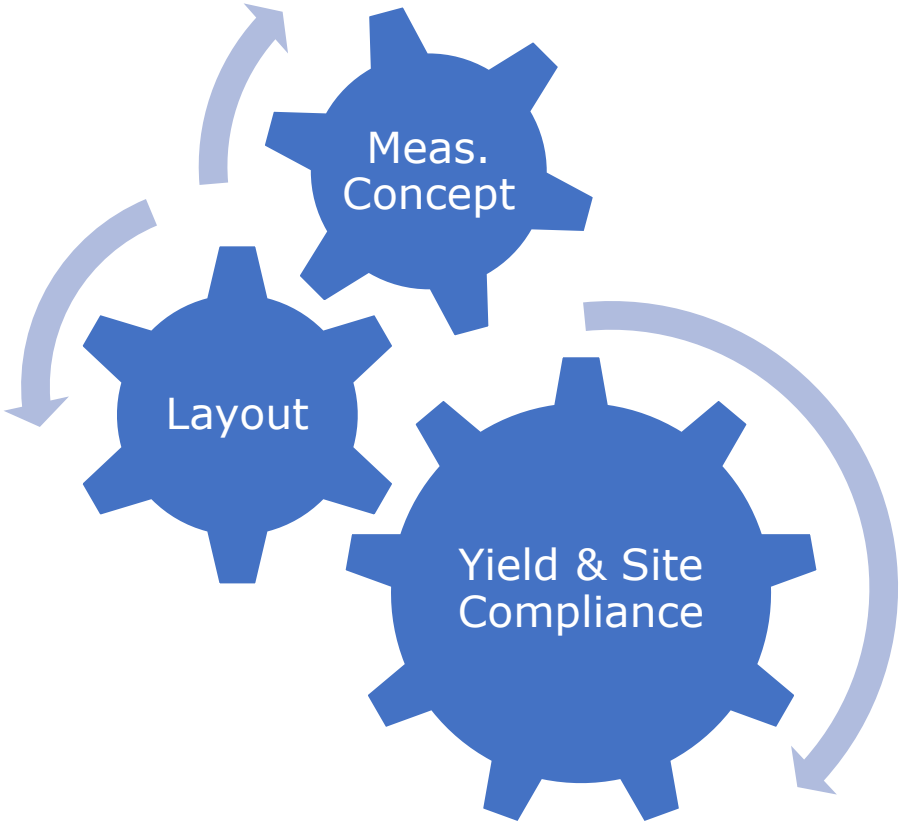
Important Steps in Project Development

Procedure for yield calculations and site compliance



Important Steps in Project Development

The interaction between layout, measurement concept and calculations



- Yield and site compliance calculations can reveal that an adjustment of the layout is necessary
- Can have an influence on the measurement concept
- Iterative process

Important Steps in Project Development

Preparatory works

- Tendering
- Construction planning
- Infrastructure, Balance of Plant, access routes

Construction

- Construction management and monitoring
- WTG commissioning
- WTG test operation and plant take-over

Operation

- Faultless power production
- Maintenance and repair works
- Under-performance and trouble-shooting

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Important Steps in Project Development

Underperformance and trouble-shooting

Three steps upon suspicion of underperformance during operation:

Step 1: Analysis of operational data

Step 2: Power curve and performance check using LiDAR

- Quick and cheap solution, no influence on operation

Step 3: Power curve and performance check using a met mast

- Accredited service according to technical standards
- Very high data quality, but more complex solution

Summary

- To reach the 2030 goal of 100% electricity from renewable energies (26% wind) reliable wind measurements are inevitable

- Wind measurements are crucial in several phases during project development and realisation:
  - Planning phase, possible interaction with wind farm layout (WTG location, type and hub height)
  - Basis for yield prediction and evaluation of technical feasibility
  - Important analysis tool when it comes to underperformance during operation

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Thank you for your attention.

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