Electrification of transport

New demand for wind and renewable power

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Electrification of transport

Why does it matter and what does it mean?
Meeting our ambitions and targets on decarbonization

Electrification of industrial and transport sectors offer great opportunities to do just that.

**EU mandate for 33% renewable energy calls for changing the way we use energy in our daily life.**

**51% of transport infrastructure could be electrified to help us meet our ambitions.**

Source: Breaking new ground. Wind Energy and the Electrification of Europe's Energy System. WindEurope, September 2018
Electrification of transport
What are we talking about

Cars: 11 – 350 kW
Buses: 100 – 600+ kW
Trucks: 350 – 600+ kW
Ships: 1 – 24 MVA
Railway: Scalable unlimited
Aviation: Scalable unlimited
Wind power will play a significant role in Europe to fuel a clean electrical transport.
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Can we actually deliver it?
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Charging use cases and solutions

Central generation

Distributed generation

End consumers

HV line
HV/MV
MV line
MV/LV
LV line

Ultra-fast charging 350-500 kW
Fast charging 50-350 kW

3-7 kW
10-20 kW
Isolated 3-350 kW

Building blocks for delivery are available.
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Will distribution networks become the bottleneck?

Digitalization of distribution networks is the key for electrification of individual transport.

Digitalization of distribution networks is the key for electrification of individual transport.

Building blocks for grid integration of EV charging

<table>
<thead>
<tr>
<th>Passive</th>
<th>Active</th>
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<tbody>
<tr>
<td>Transformer overloading¹</td>
<td>OLTC²</td>
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<tr>
<td>Transformer upgrade</td>
<td>VAR control</td>
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<tr>
<td>Limit charger rating</td>
<td>Energy storage</td>
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<td>Smart charging</td>
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Measure to increase EV hosting capacity of distribution networks
- Temporary overloading of assets
- More precise monitoring and control
- Smart (controlled) charging

¹ controlled
² OLTC: on-load tap changer
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Key solutions to enable the proper development of it

Long term generation adequacy
Short term generation adequacy
Generation flexibility (start, ramping, stop)
T&D grid hosting capacity (thermal)
T&D grid hosting capacity (voltage)
Power Quality

Impact on:

Grid reinforcement, long duration storage, flexible energy sources
HV grid connection
Intelligent charging (energy management)
Onload Tap Changer, Line Voltage Regulator
Distributed FACTS, MV/LV DC, Active Filters
BESS (buffer storage)
Advanced Distribution Grid Management (ADMS)

Benefits of V2G:

Restoration and black start
Grid stabilization
Asset loading, voltage control

Uncontrollable EV charging challenges
Impact mitigation alternatives
Vehicle to grid (V2G) applications
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Examples where wind and transport come together
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Fast charging network in a country with high wind potential

Netherlands deploy country wide charging infrastructure

The need:
- Deployment of country wide charging infrastructure in NL
- Promote green charging – Fastned runs a network of charging infrastructure which uses 100% renewable power

The solution:
- Fastned selected ABB to provide 200+ fast DC chargers
  - 15 – 30 minutes charge time
  - All fast charging with standard plugs
  - All charges connected and monitored in the cloud
- Similar projects in:
  - Estonia, Hungary
  - Denmark, Norway
  - Germany, UK
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(Internally) electrified ships – a first step for more?

Wind of Change – Wind farm operations service vessel
State-of-the-art Wind Farm Service Operation Vessel including the newest ABB technology achieving greater efficiency and precision.

DC grid inside the vessel
Energy Storage: 2 x 203,5 kWh

NKT Victoria – Cable layer vessel
Custom built according to NKT’s specifications, it will enhance the capacity of NKT submersible cable operations while delivering optimum efficiency and accuracy.

DC grid inside the vessel
Energy Storage: 1 x 156 kWh
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Summary
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Summary

Enable a market for electric transport
- One of our opportunities to advance the decarbonization of the energy sector
- Policy efforts in place, more should be added
- Industry started to prepare the value chain (batteries, EV models, charging infrastructure, etc.)

Powering it up
- Wind will play a significant role to power the electric transport
- Technologies have been developed, to kickstart the adoption of electrical transport
- More solutions and infrastructure is necessary to reach our goals

We are key
- As drivers and passengers, we have great power to select the ways we move around
- Go for a clean transportation path
- Support our goals and ambitions