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Offshore charging

Initial technical considerations of integrating an offshore charging device into the grid of an offshore wind farm.

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Operational scenarios for connecting a vessel to power from an offshore wind farm

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Various methods for connecting an offshore charging device to the infrastructure of an offshore wind farm can be envisioned:

1A Charging a vessel (of all size, shapes and functions) directly from a wind turbine

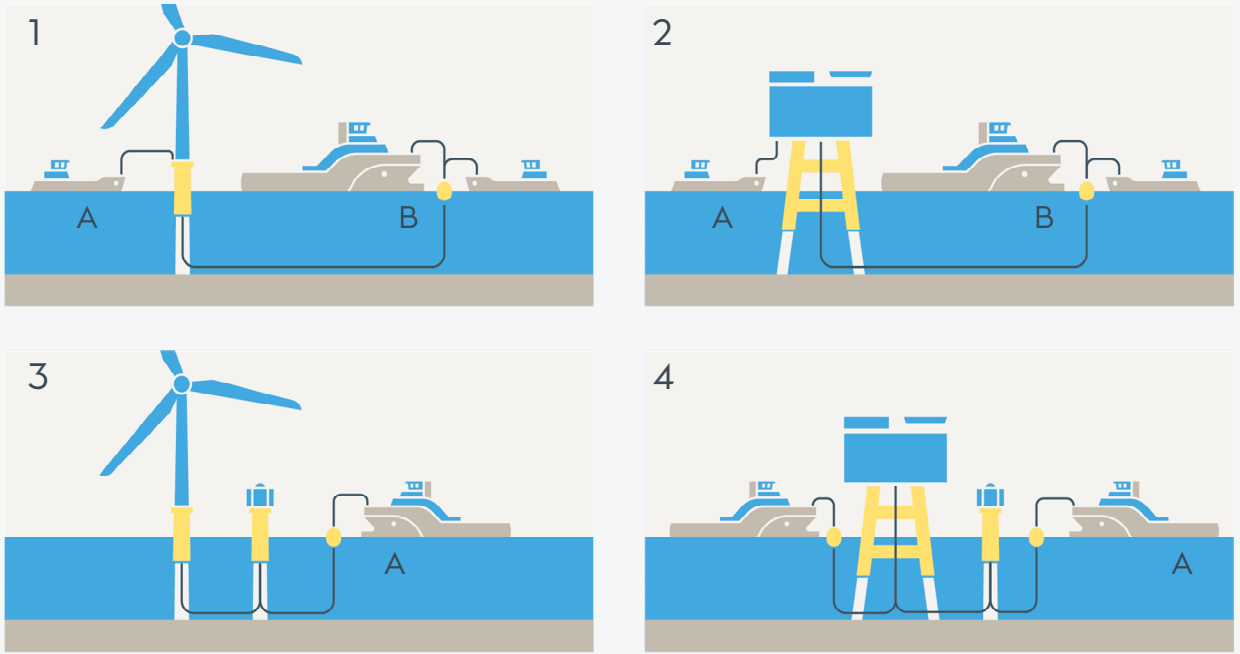
1B Charging a vessel (of all size, shapes and functions) from a charging buoy, connected directly to a wind turbine.
This is the option being trialled in collaboration with Maersk Supply Service

2A Charging a vessel (of all size, shapes and functions) directly from an offshore substation

2B Charging a vessel (of all size, shapes and functions) from a charging buoy, connected directly to an offshore substation

3A Charging a vessel (of all size, shapes and functions) directly from a separate transformer connected to the wind turbine, located either on the wind turbine or on a separate foundation

4A Charging a vessel (of all size, shapes and functions) directly from a separate transformer connected to the substation, located either on the sub station or on a separate foundation



WTG: Wind turbine generator
OSS: Offshore sub-station

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Connection to an offshore wind turbine

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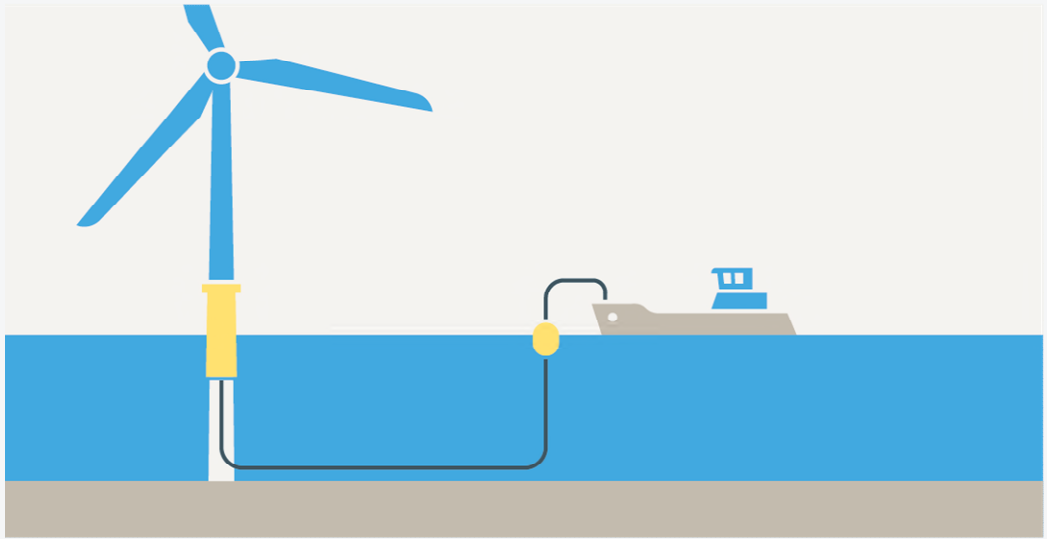

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Option: Wind turbine (WTG) LV/MV connection

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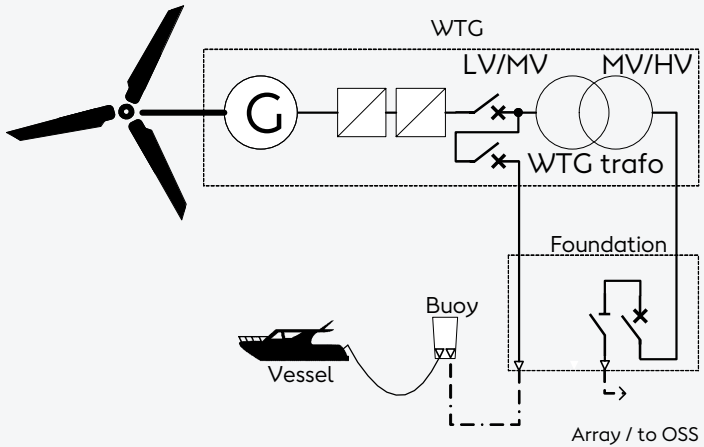
The buoy can be connected to WTG LV/MV system either inside the WTG or in the foundation. The voltage levels inside the WTG and foundation could possibly be somewhere between 110V and 11kV.



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Option: Wind turbine (WTG) MV/HV connection

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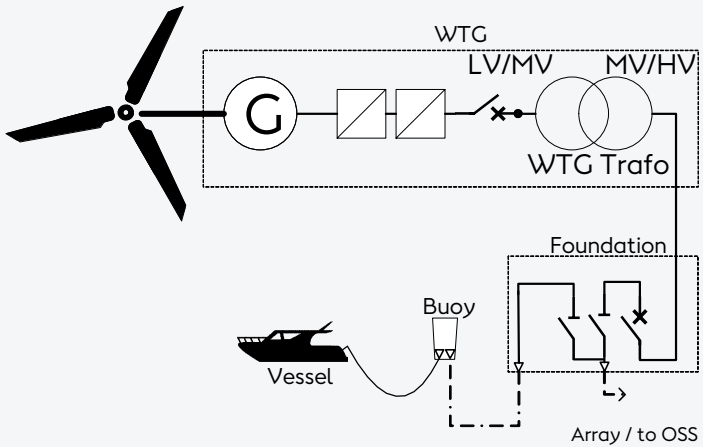
The buoy can be connected to the MV/HV system, either by a direct connection to the array cable system (with or without a specific MV/HV breaker) or to the wind turbine side of the MV/HV breaker in the turbine foundation.

The voltage level could be somewhere between 11kV and 132kV (or higher in future WTG designs).



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Option: Wind turbine (WTG) MV/HV connection with a transformer

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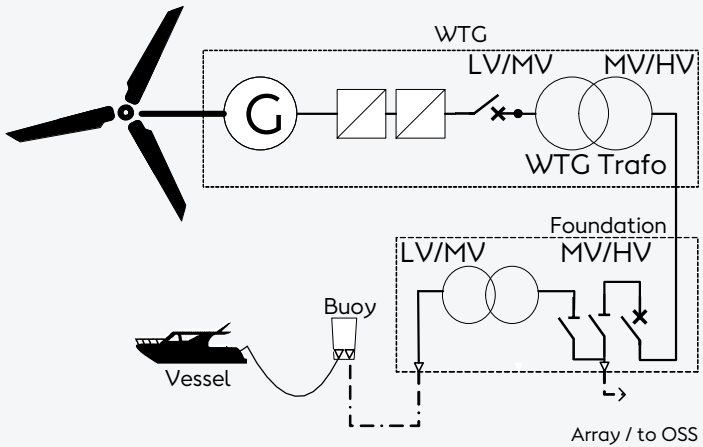
The buoy can be connected to the MV/HV system, either by a direct connection to the array cable system (with or without a specific MV/HV breaker) or to the wind turbine side of the MV/ HV breaker in the turbine or foundation. A transformer and possibly a converter/inverter could be placed in the turbine or foundation for the connection on the buoy.

The voltage level of the buoy connection could be somewhere between 110V and 11kV. If an converter/inverter is placed in the turbine or foundation a DC connection is made possible for the buoy connection.



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Option: Wind turbine (WTG) DC connection

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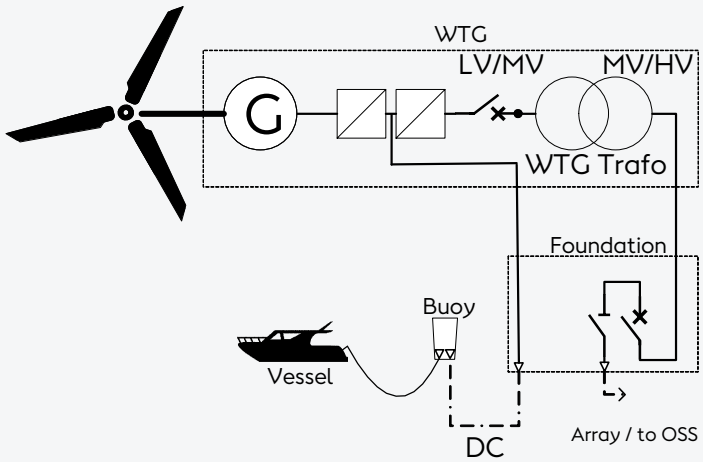
The buoy can be connected to the DC link inside the WTG.



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Connection to an offshore sub-station

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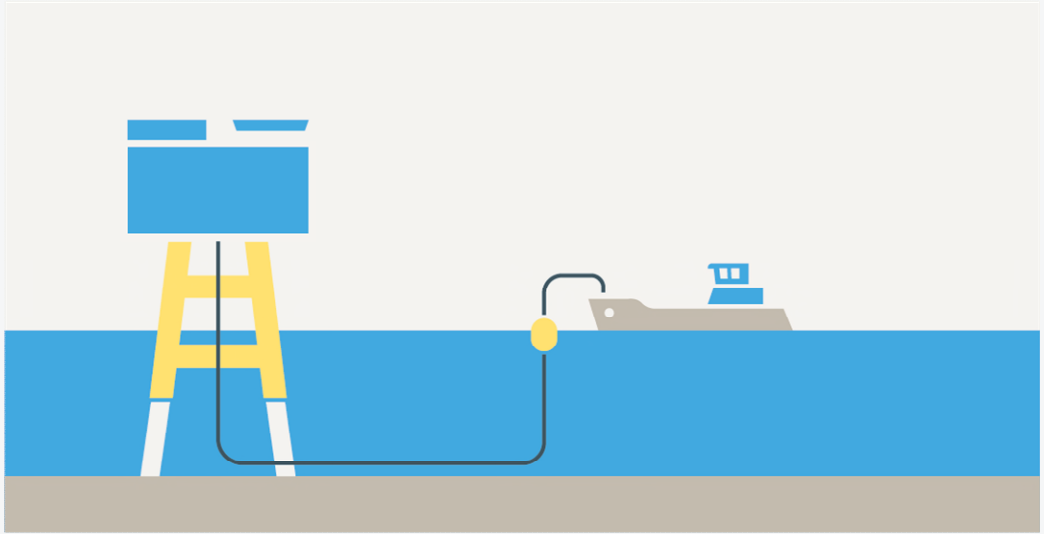

WTG: Wind turbine generator
OSS: Offshore sub-station

Option: Offshore sub-station (OSS) LV/MV connection

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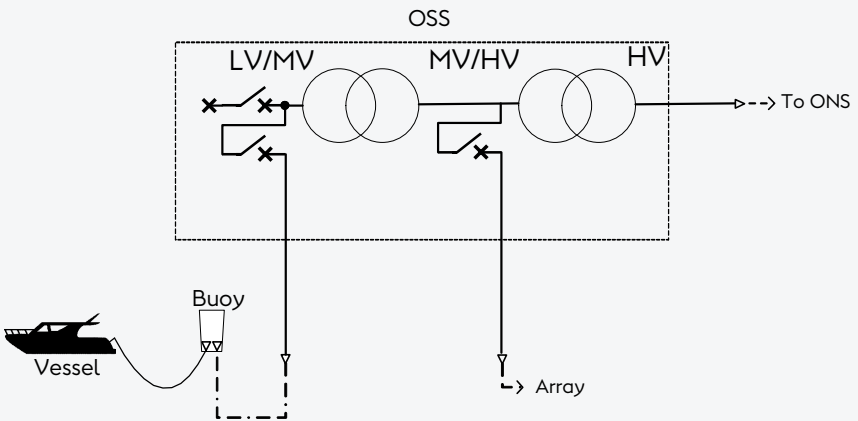
The buoy can be connected to LV/MV system on the OSS. The voltage level of the buoy connection could be somewhere between 110V and 11kV.

If a HVDC substation is available, the buoy could possibly be connected to the DC part of the substation. A converter/inverter can also be placed on the OSS to allow for a DC connection of the buoy.



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Option: Offshore sub-station (OSS) MV/HV connection

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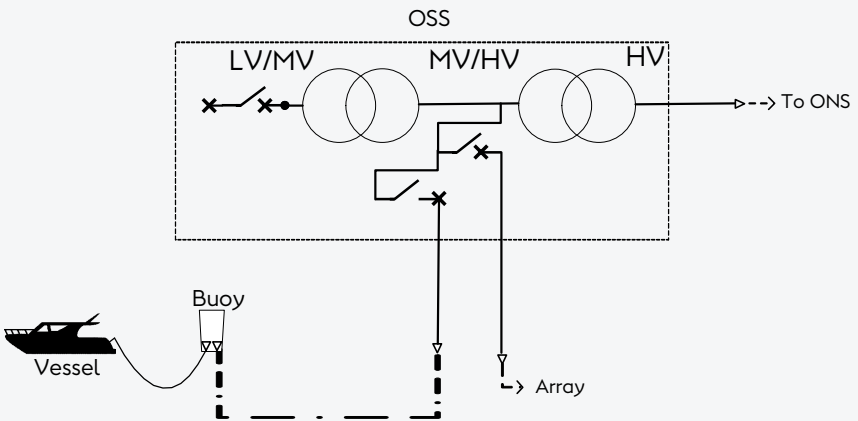
The buoy can be connected to the MV/HV system, either by a direct connection to one of the array cable systems or to a specific MV/HV breaker on the OSS. The voltage level could be somewhere between 11kV and 132kV (or higher in future WTG designs).



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