



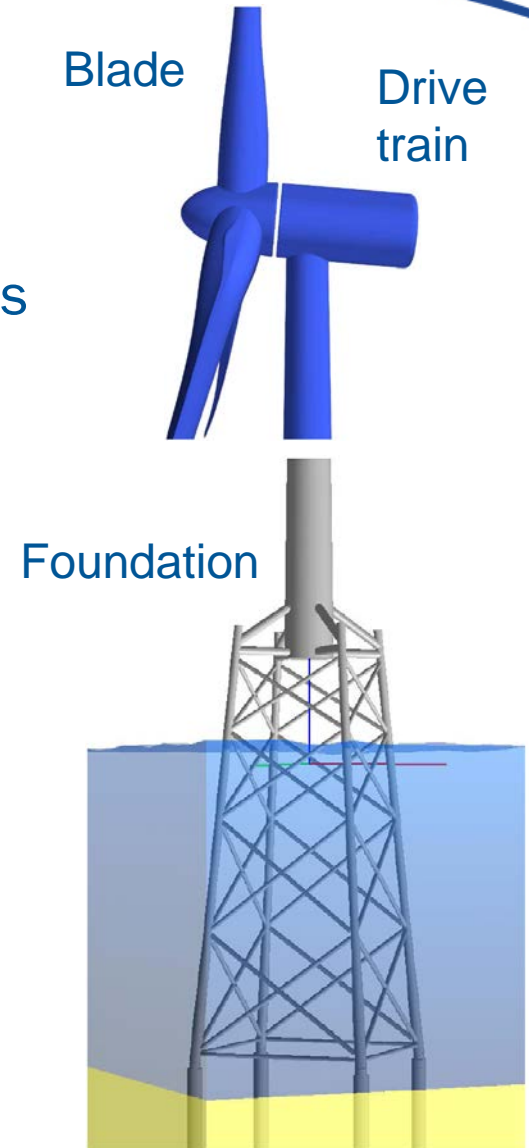
Drivetrain structures for 10 MW - 20 MW wind turbines

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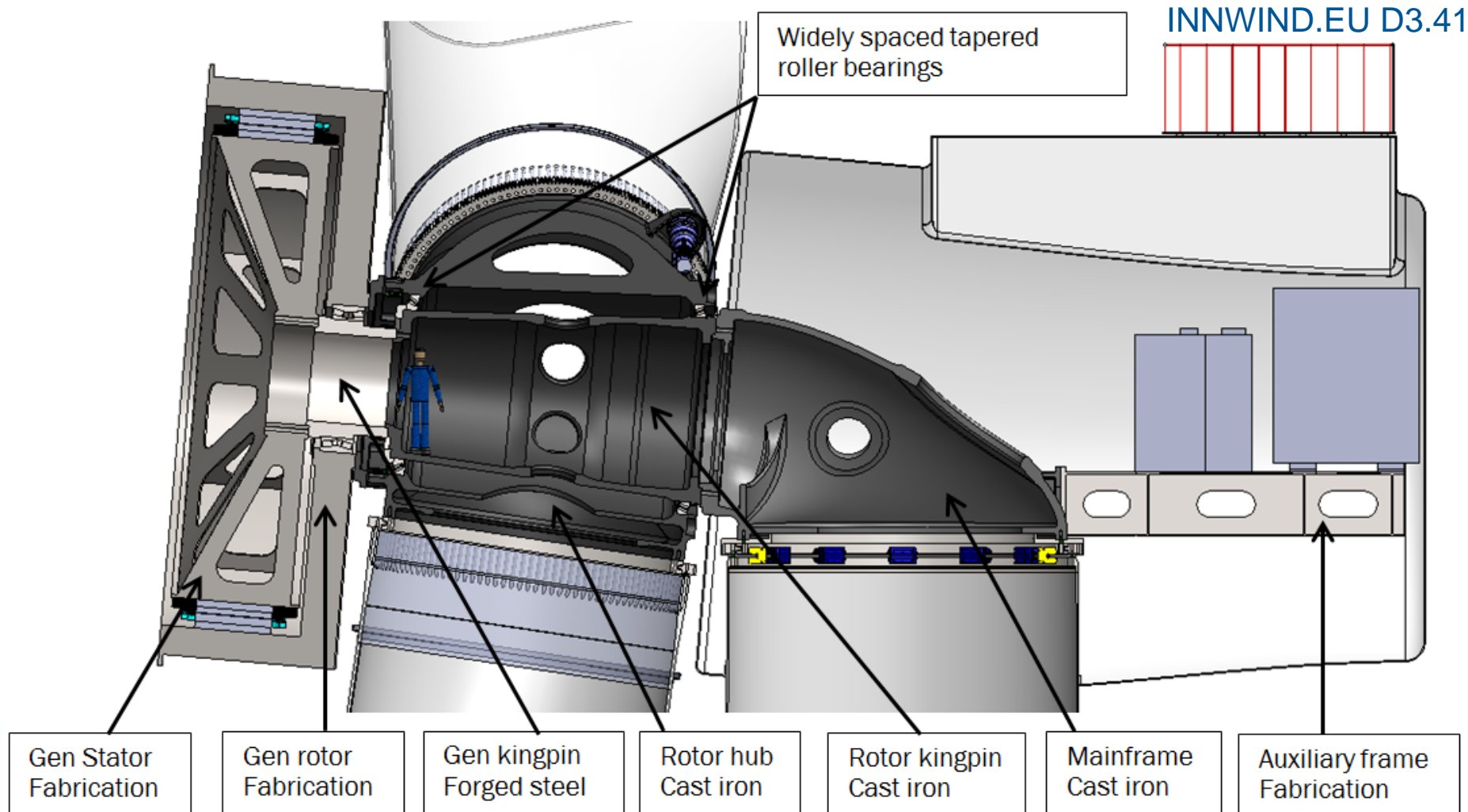
Associate Professor Delft University of Technology

- King-pin Nacelle Layout
- Non-contact drive trains
 - Superconducting direct drive generators
 - Pseudo Direct Drive generator
- Key performance indicators
 - Mass scaling 10 – 20 MW
 - Efficiency
 - Levelized Cost of Energy (LCoE)
- Conclusion

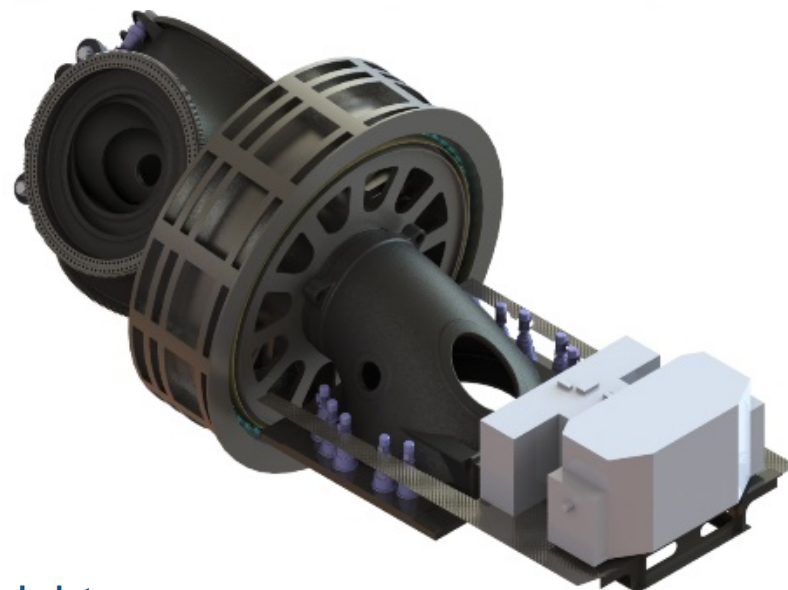
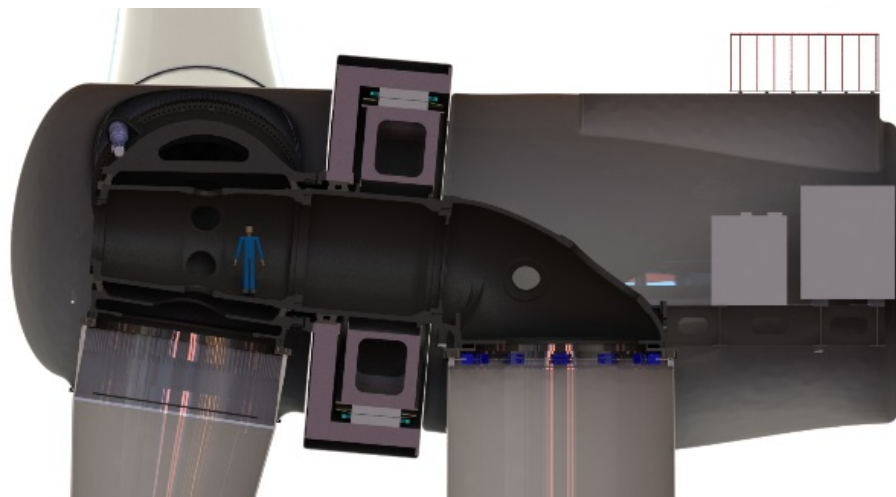
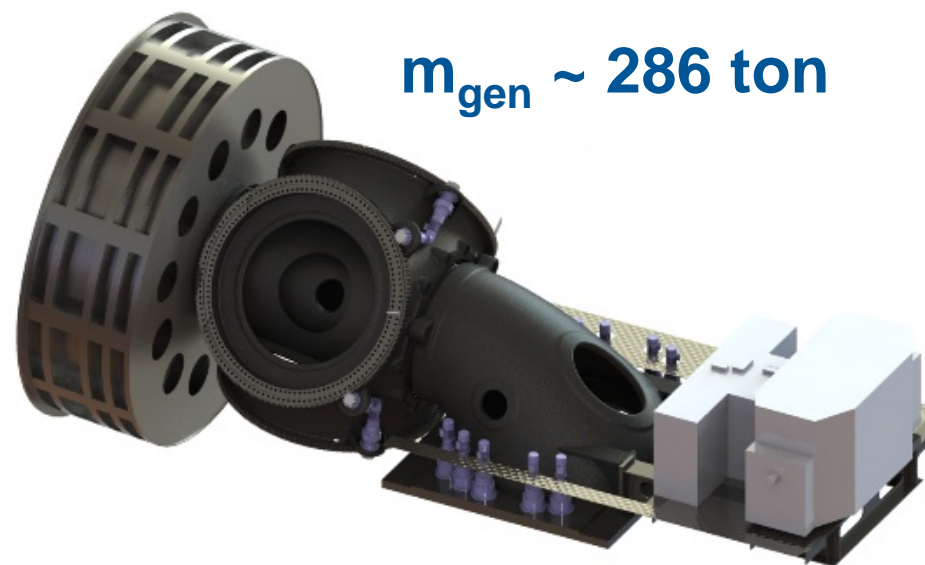
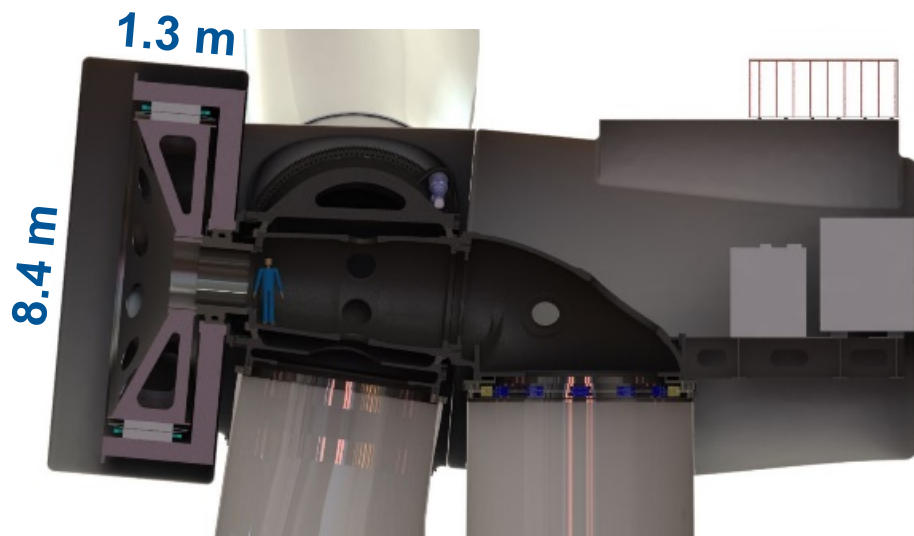


Integration of generators in King-pin nacelle

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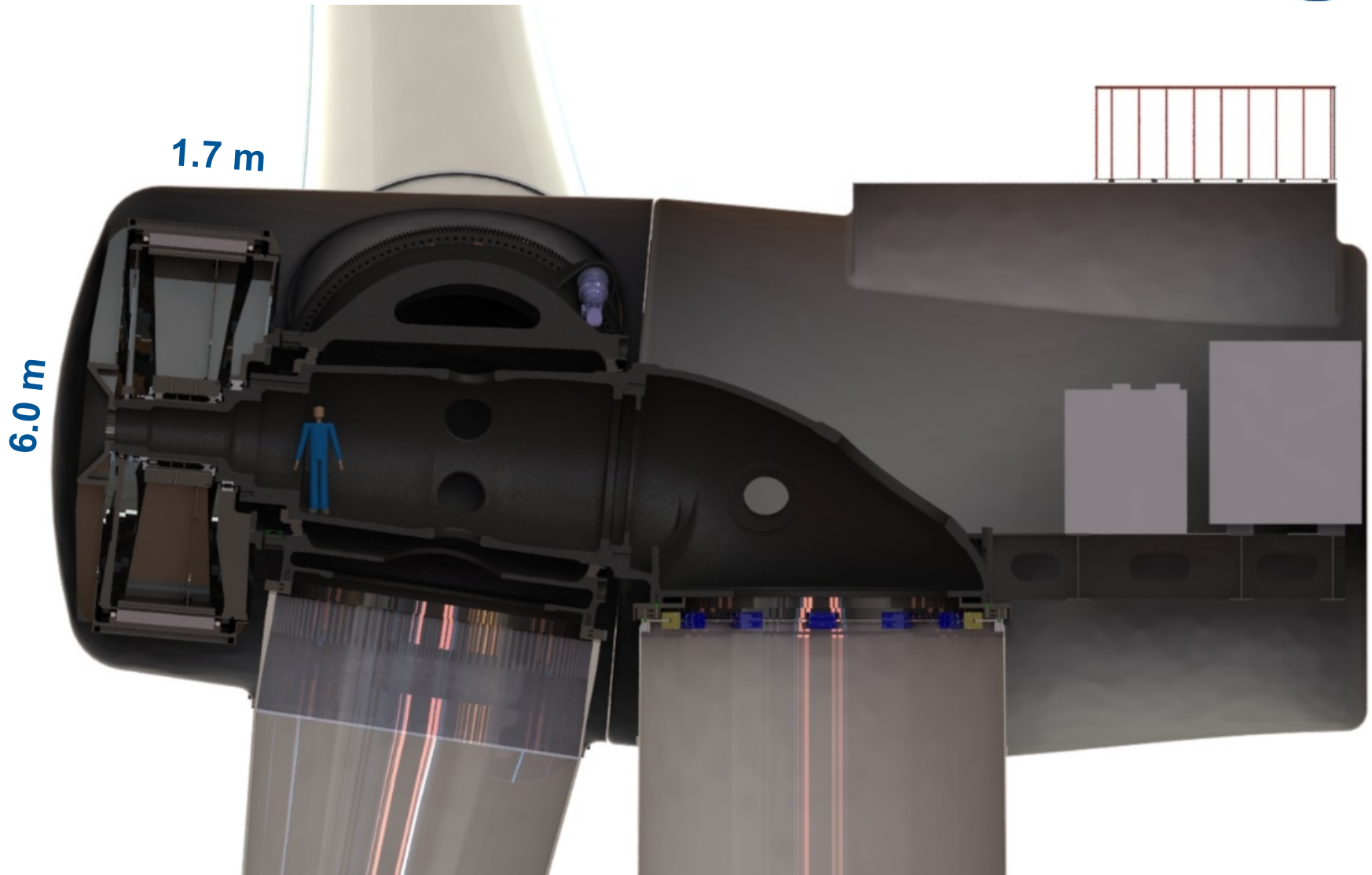
Superconducting direct drive generators @ 10 MW



Front and back mounted have approximately the same nacelle weight



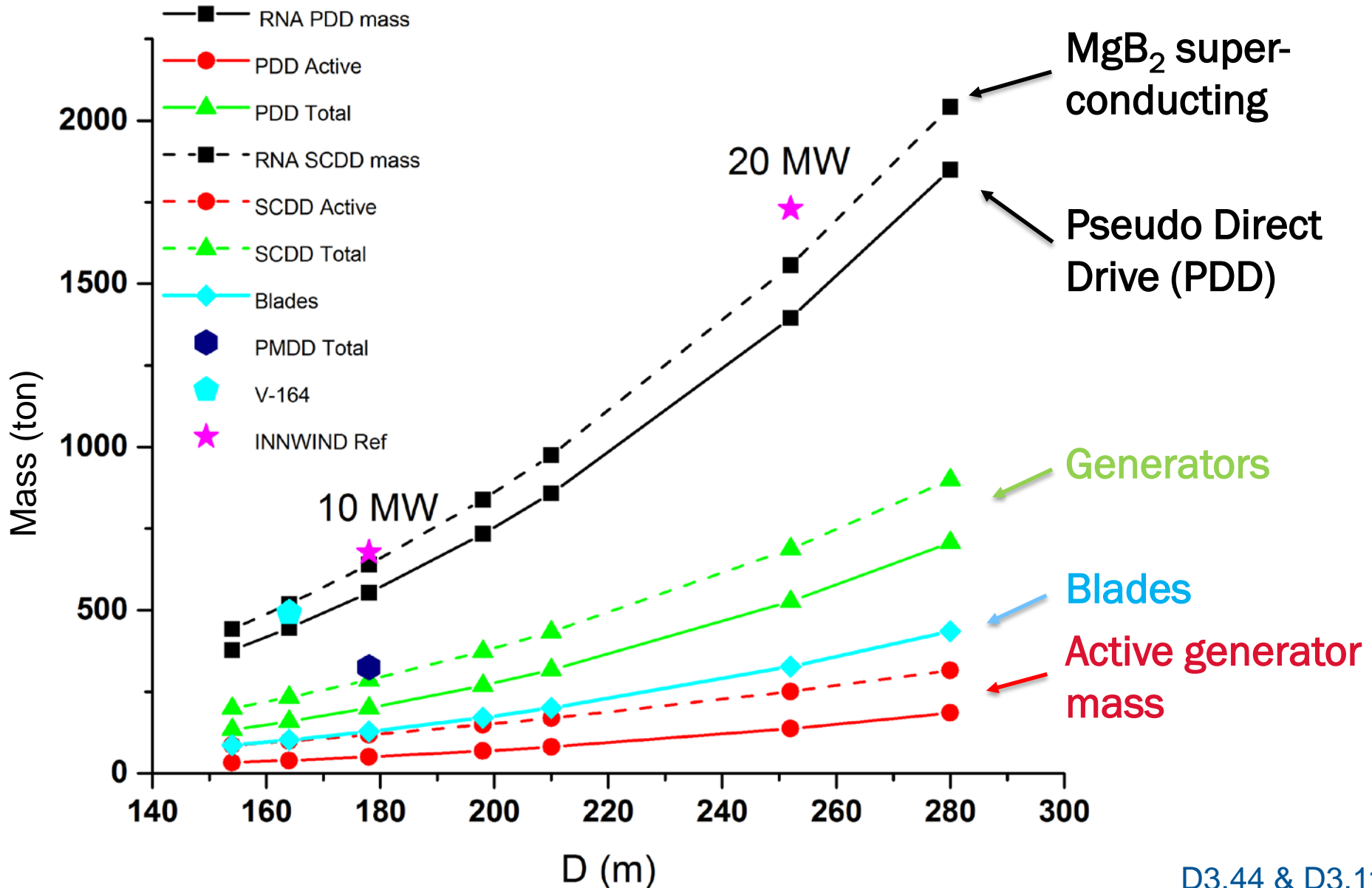
Front-mounted Pseudo Direct Drive (PDD) @ 10 MW



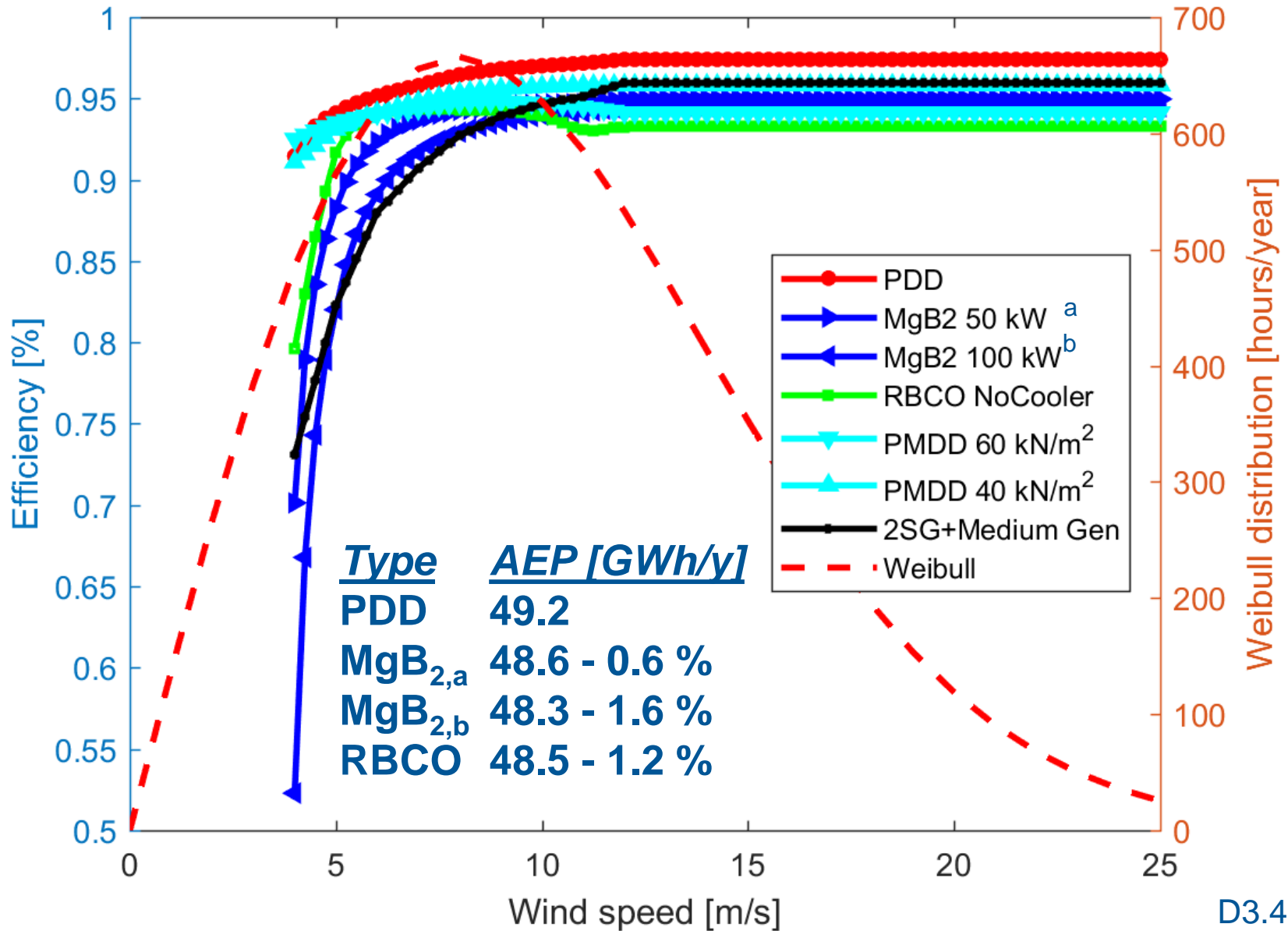
$m_{gen} \sim 150 \text{ ton}$



Rotor Nacelle Assembly mass scaling 10-20 MW



Efficiency @ 10 MW



Conclusions



- Integration of drive trains into king-pin nacelle
- Scalable 10 MW – 20 MW
 - Component not available at 20 MW
- Superconducting direct drive (SCDD) can be more compact and efficient than Permanent Magnet Direct Drive (PMDD)
- Minimum LCoE of SCDD → Iron cored topology
 - Heavier than PMDD and Pseudo Direct Drive (PDD)
 - More expensive than PMDD and PDD
- Magnetic Pseudo Direct Drive
 - Smaller and more efficient than PMDD

$\Delta\text{LCoE} \sim - 1.9 \%$

Pseudo Direct Drive

$\Delta\text{LCoE} \sim + 0.5 \%$ (- 0.2 %) MgB_2 superconducting direct drive

$\Delta\text{LCoE} \sim 0.0 \%$

2 stage gear + medium speed generator

