Vestas®

Wind. It means the world to us.™

Next generation of wind turbines & the future of New Zealand wind energy

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Head of Vestas Australia
and New Zealand

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Turitea: new large scale generation since 2014

Vestas to strengthen Mercury's renewable portfolio by delivering its first wind asset, Turitea Wind Farm.

The Wind Farm is the country's first large-scale generation capacity addition since 2014, after 15 years in the development pipeline.

Customer: Mercury
Location: Turitea, near Palmerston North
Wind turbine: 33 X V112-3.6 MW
Hub height: 69 meters
Total installed capacity: 119MW
Service contract: 25-year AOM 5000

New wind farm to be New Zealand's first large-scale generation since 2014

Joshua S Hill 29 March 2019 0 Comments Share

Image Source: https://www.evwind.es/2019/03/27/new-wind-farm-planned-for-mercury-new-zealand/66538

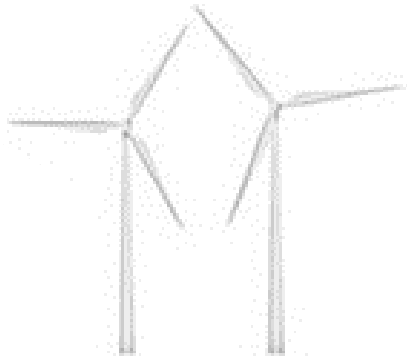
New Zealand electric utility Mercury will develop the country's first large-scale generation capacity addition since 2014 with a 119MW wind farm set to be built in the south of the North Island, a project that has been in the development pipeline for 15 years.

Mercury announced this week that it had committed to constructing the first 33 of 60 planned wind turbines for the 119MW Turitea wind farm, near Palmerston North.

Wind turbine technology update

Versatile solutions for any wind energy project

Ongoing innovation from the undisputed global wind leader



2 MW Platform

4 MW Platform

EnVentus™ Platform

PRODUCT-CAPACITY	V90-2.0 MW®	V100-2.0 MW®	V110-2.0 MW®	V116 2.1 MW™	V120 2.2 MW™	V105-3.45 MW™	V112-3.45 MW®**	V117-3.45 MW®	V117-4.2 MW™	V126-3.45 MW®	V136-3.45 MW®	V136-4.2 MW™	V150-4.2 MW™	V150-5.6 MW™	V162-5.6 MW™
YEAR OF PROTOTYPE	2004	2009	2014	2017	2018	2014	2013	2013	2018	2013	2016	2018	2018	2019	2020

Installed*
43 GW

Installed**
23 GW

* As of 31 December 2018, including V80-1.8/2.0 MW™ and V90-1.8 MW™
** As of 31 December 2018, Including V112-3.0 MW™
Not shown: V90-3.0 MW®, constituting 10 GW
Not shown: 'Other' turbine models constituting 23 GW

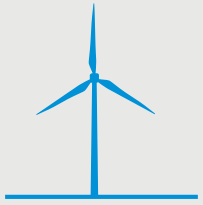
Vestas®

V136-4.2 MW™ Extreme Climate

Focused on Pad-constrained sites with the full range of average wind speeds, where high MW rating turbines **minimize LCoE by maximizing individual turbine AEP**

With full **Type Certificate** for **global applicability**, the turbine is suitable for markets prone to extreme average wind, wind gusts and severe climate events such as New Zealand, Japan, Southern China, Caribbean, and UK

Structural design accommodating site specific towers to meet market specific hub heights and transportation requirements through standard designs and proven Vestas technology



The V136-4.2 MW™ features one of our largest onshore rotors, but is strong enough to cope with extremes.

Application range of extreme climate variants

Covering all low-, medium-, and high wind speeds, specifically design to operate and withstand severe climate conditions

WIND SPEED

wind speed range: low- high = 6 m/s to 10 m/s

TURBINE TYPE	Low	Medium	High	Above 10.0 m/s
V117-4.2 MW™ IEC S-T				
V136-4.2 MW™ IEC S Extreme Climate				

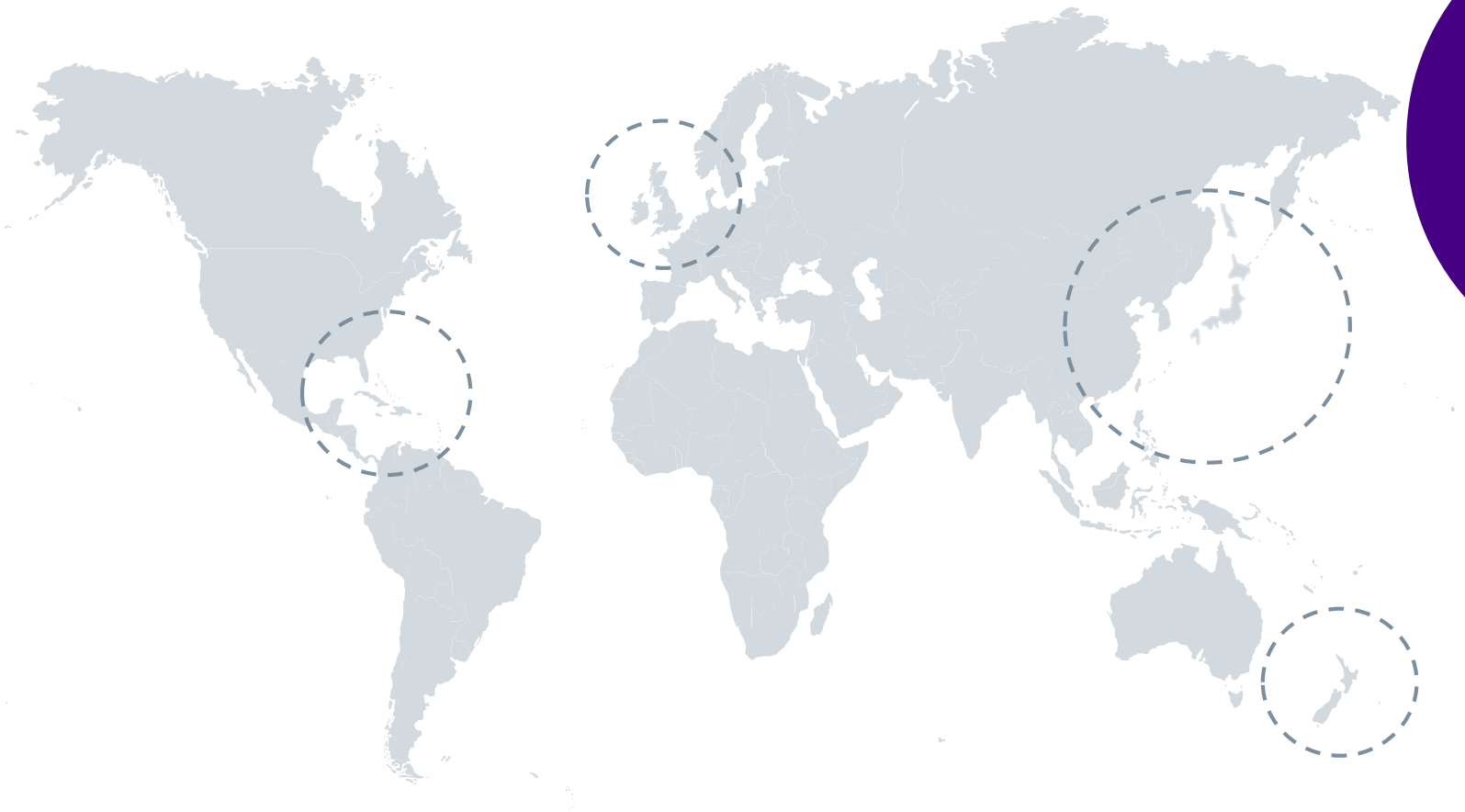
Standard wind conditions

Site dependent

Vestas

4 MW platform: strengthened offering for **extreme climate**

V136-4.2 MW™ further expands the versatility of the 4 MW platform, strengthening its competitiveness in extreme climate conditions complementing the V117-4.2 MW™ Typhoon variant



V117-4.2 MW™ Typhoon

With applicability in **IEC T** and highly aggressive wind conditions covering also high wind sites

V136-4.2 MW™ Extreme Climate

With **IEC S** class and a larger rotor size, enables **higher AEP** in less aggressive wind conditions and low to medium average wind speeds

Illustrative representation of markets covered by the extreme climate turbines

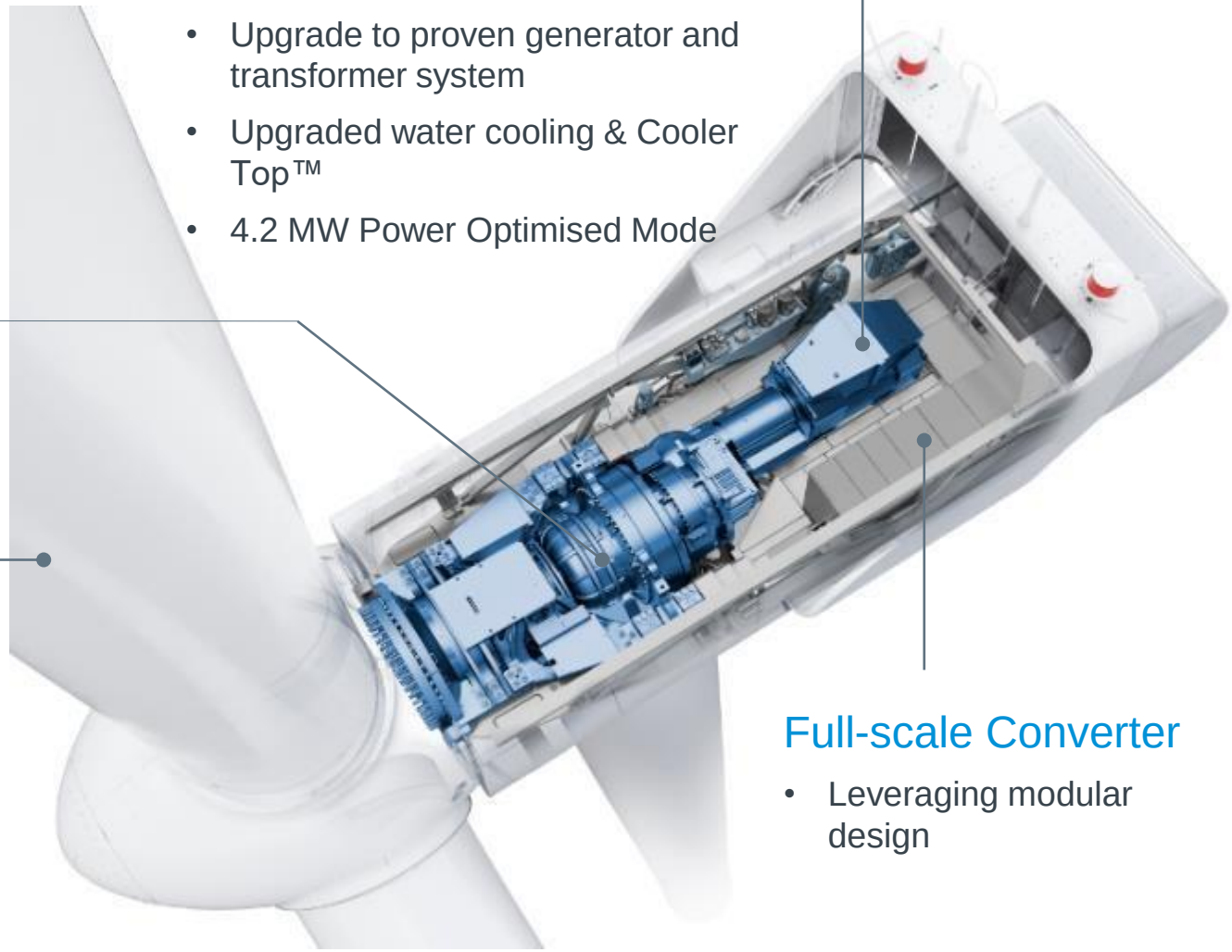
V136-4.2 MW™ Extreme Climate features the **4 MW platform**'s latest **performance upgrades**

4.0 MW nominal rating

- Upgrade to proven generator and transformer system
- Upgraded water cooling & Cooler Top™
- 4.2 MW Power Optimised Mode

More Torque

- Upgraded gearbox, same proven design. Powering V136-4.2 MW™ and V150-4.2 MW™
- Application of known gearbox in V117-4.2 MW™



Upgraded Blades & Hub

- Vestas most advanced blade design & advanced materials
- Strengthened 57.2 m (V117-4.2 MW™) blade
- Re-enforced blade bearings & pitch capacity of the V150-4.2 MW™

Full-scale Converter

- Leveraging modular design

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V136-4.2 MW™ Extreme Climate builds on the **V136-4.2 MW™**

High production at industry leading sound power levels

Segment leading low **Sound Power Level**

Proven gearbox
Same proven gearbox design powering V136-4.2 MW™ and V150-4.2 MW™, having lower rotor rotational speed and enabling enhanced project specific siteability

More Power
Upgraded generator to 4.0 MW nominal rating with 4.2 MW Power Optimised Mode

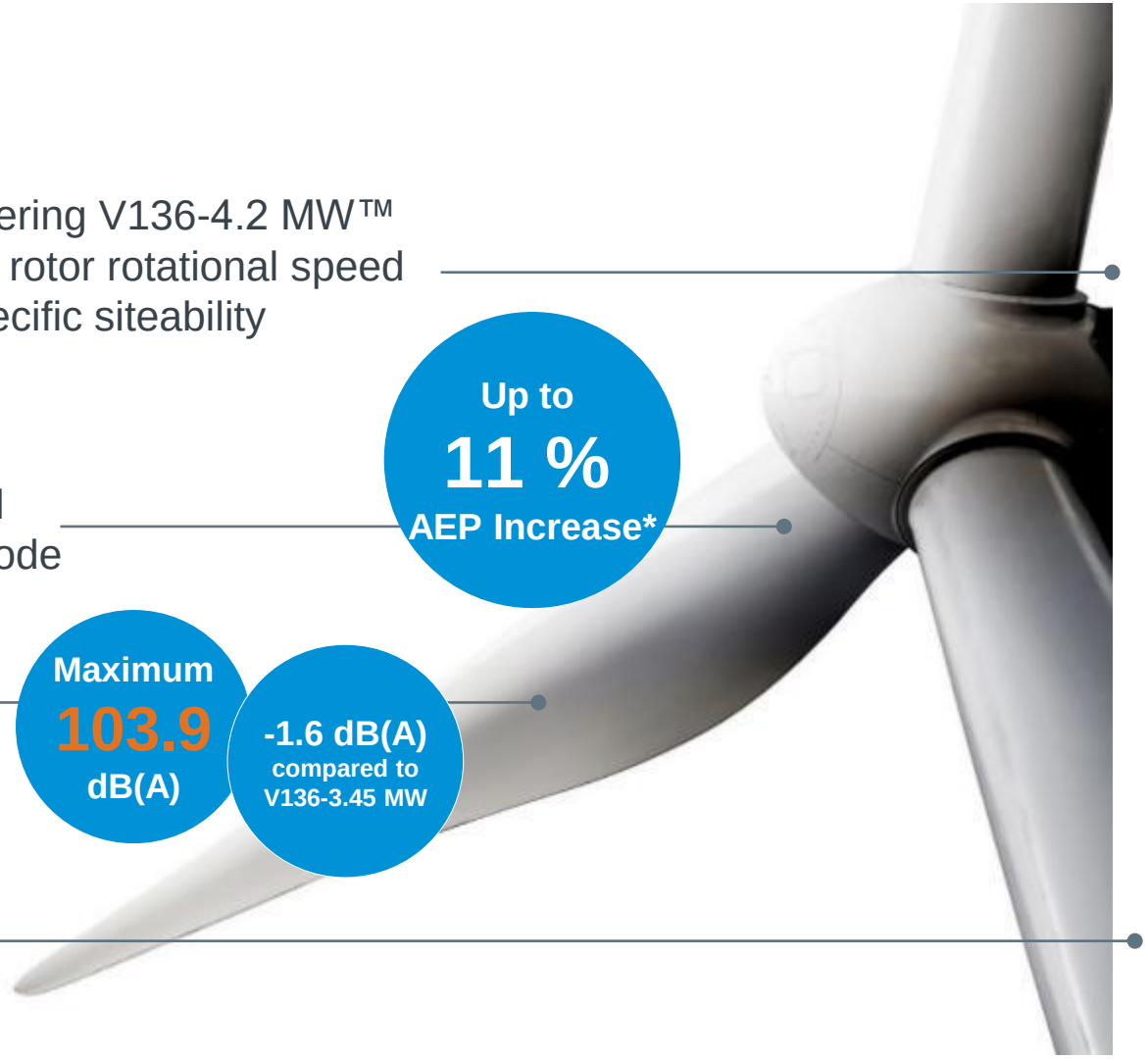
Up to 11 % AEP Increase*

Low Sound Power
Segment leading sound power level at 103.9 dB(A)

Maximum 103.9 dB(A)

-1.6 dB(A) compared to V136-3.45 MW

Tower Portfolio
Site specific towers to meet hub height and transportation requirements, accommodating up to 150-230 m tip height.



*Compared to V136-3.45 MW. Depending on wind conditions

Vestas

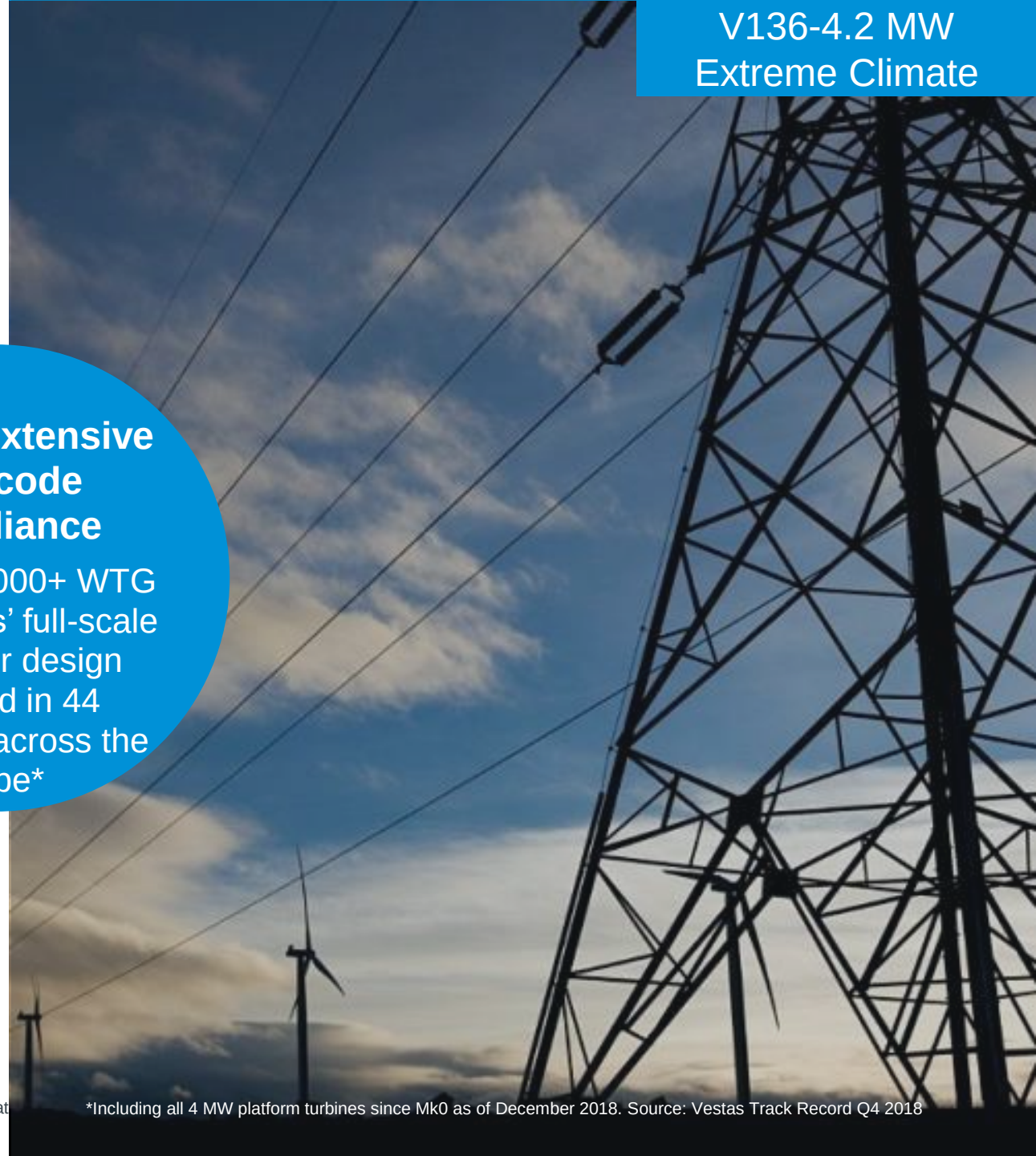
Full-scale converter enhances **grid stability** in weather event prone areas with low grid capacity

Full-scale low voltage converter

- **Superior voltage range,** enabling a better match between the power dispatched and grid load
- **Fast active and reactive** power support during dynamic frequency and voltage events
- Enhanced **protection against air humidity and pollution**

Proven extensive grid code compliance

through 7,000+ WTG with Vestas' full-scale converter design installed in 44 countries across the globe*

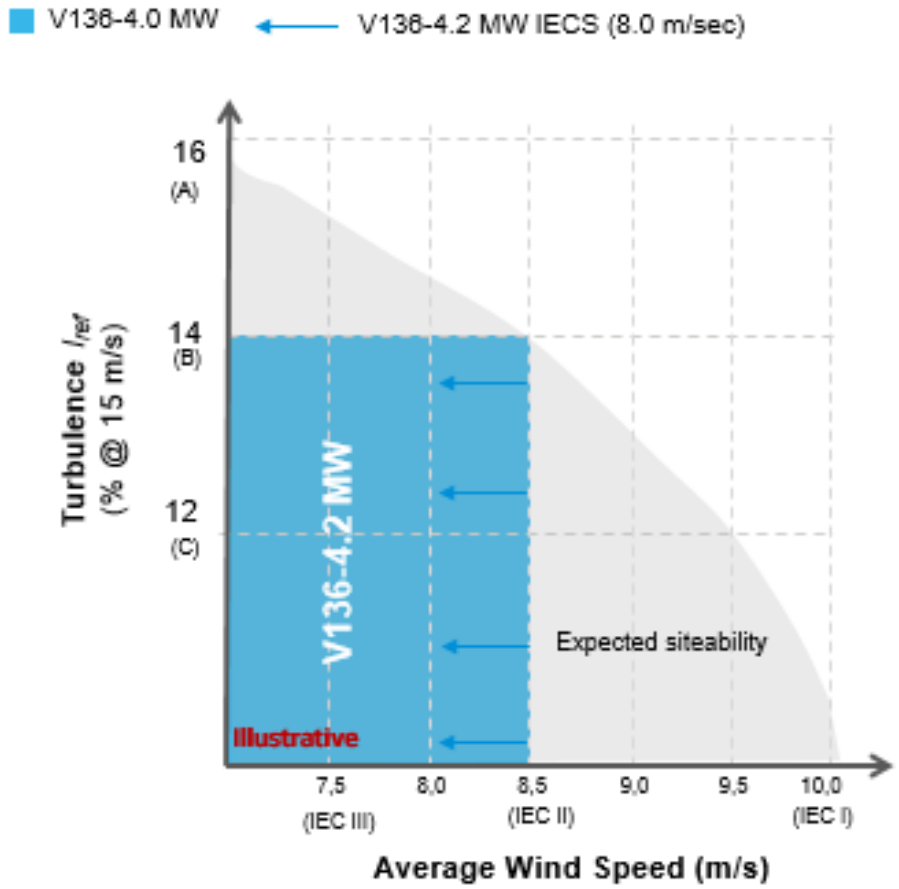


*Including all 4 MW platform turbines since Mk0 as of December 2018. Source: Vestas Track Record Q4 2018

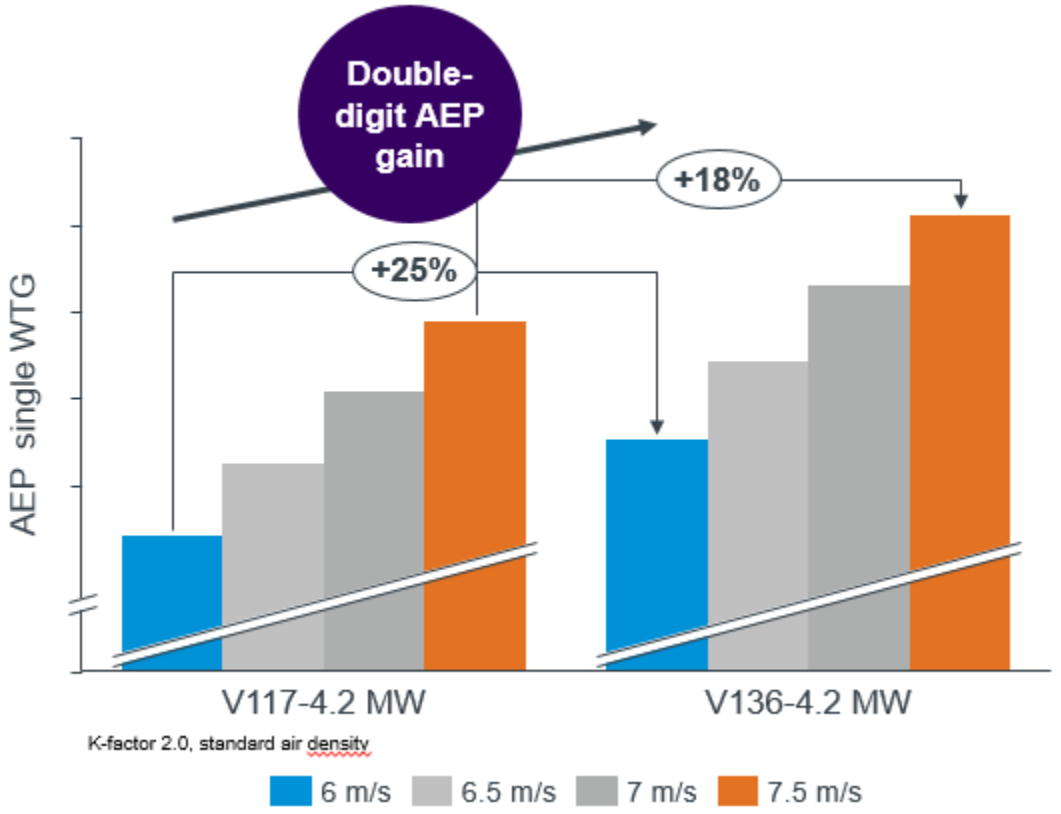
Performance development

Operating strategy for maximizing siting and power performance

Application Space



Energy Production



K-factor 2.0, standard air density

Vestas next step: Advanced modular design

Modularity enhances the flexibility of our solutions, while maintaining benefits of scale

Enabling more customised solutions to match customer needs including unique wind regimes

Expanding number of variants, lowering number of components

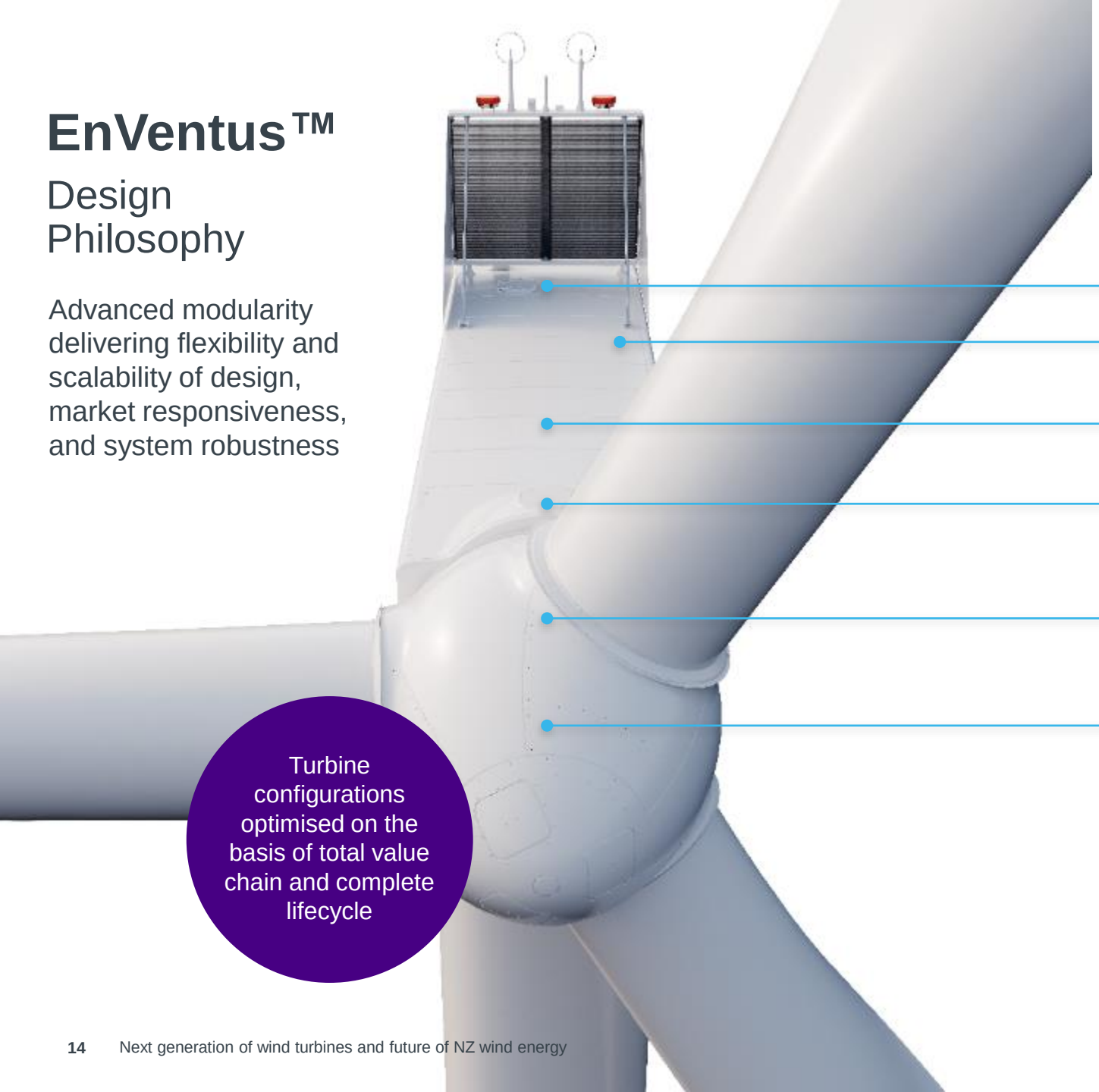
More standardised components enable efficiency and scale

Increased opportunities to build supplier partnerships

EnVentus™

Design Philosophy

Advanced modularity delivering flexibility and scalability of design, market responsiveness, and system robustness



- Non-integrated nacelle rear structure
- In-house developed modular converter
- Compact modular semi-integrated powertrain design
- Modular main shaft housing adapter flange to accommodate different gearbox sizes
- Modular hub-mounting flange to accommodate different hub sizes
- Short overhang

Turbine configurations optimised on the basis of total value chain and complete lifecycle

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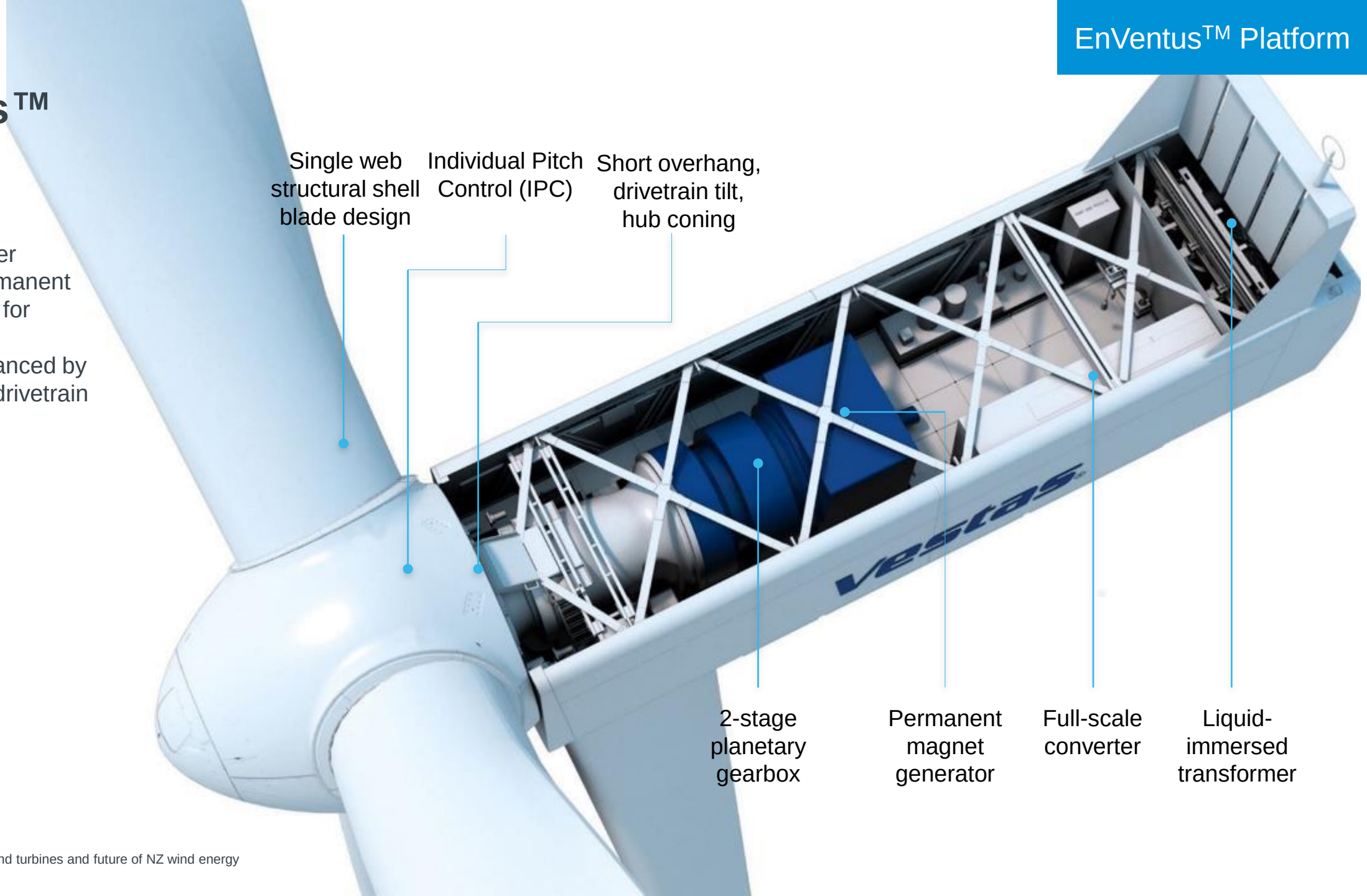
EnVentus™

Design Choices

Full-scale converter matched by a permanent magnet generator for maximum system efficiency and balanced by a medium-speed drivetrain




Future of New Zealand Wind Energy…?
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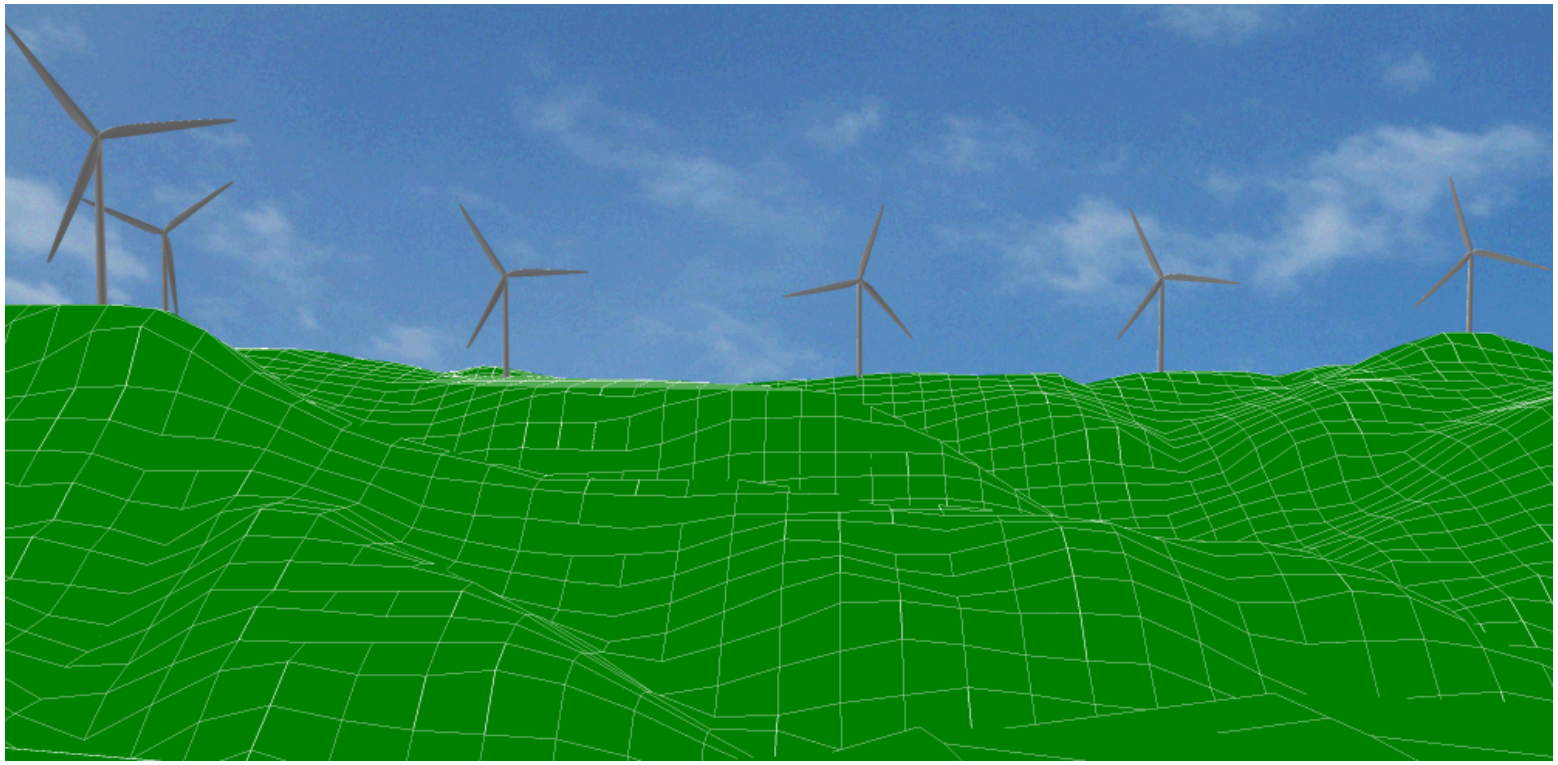
A Typical NZ Wind Regime

Today, with a 125m tip restriction

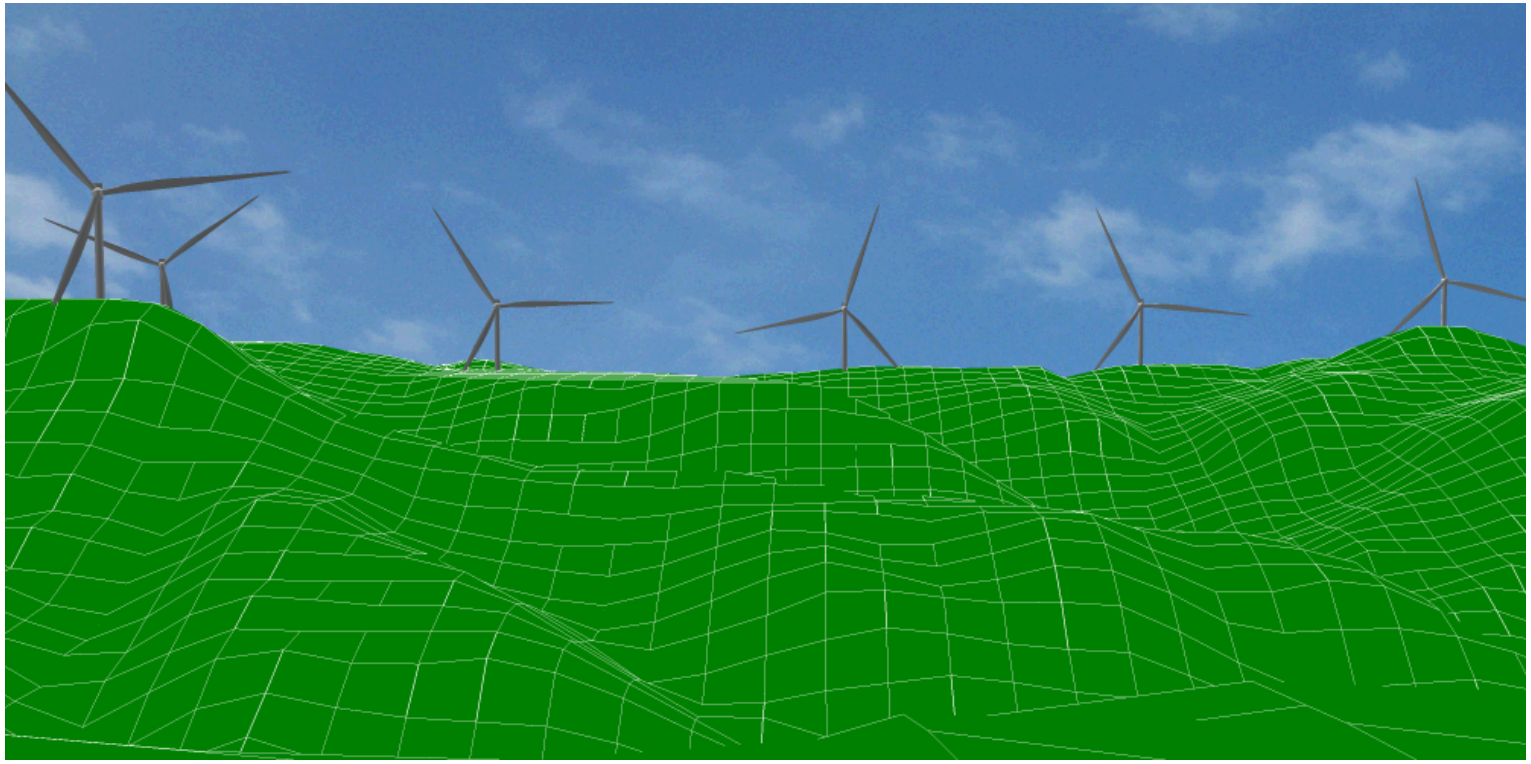
	V112	V117
Qty	6	6
WTG Capacity [MW]	3.6	4.2
Hub height [m]	69	66.5
Rotor [m]	112	117
Tip Height [m]	125	125
Wind Farm Capacity [MW]	21.6	25.2
AEP [GWh]	85.7	95.8
AEP/WTG [GWh]	**14.3**	**16.0**
Gross CF	52.9%	63.3%
Net CF	**45.3%**	**43.4%**



A Typical NZ Wind Regime

Limitation of tip height restrictions

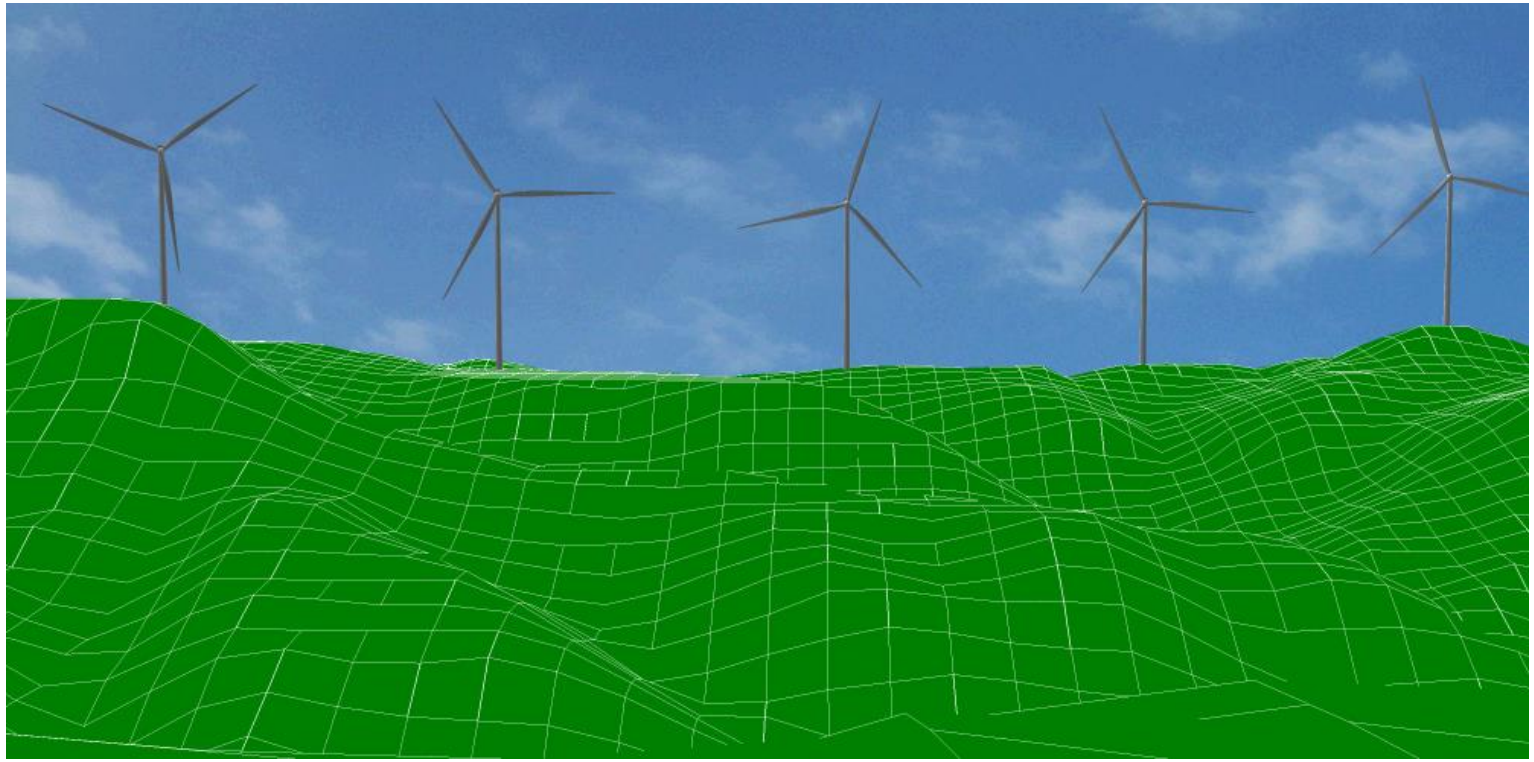
	V162
Qty	6
WTG Capacity [MW]	5.6
Hub height [m]	44
Rotor [m]	162
Tip Height [m]	125
Wind Farm Capacity [MW]	33.6
AEP [GWh]	140.3
AEP/WTG [GWh]	**23.4**
Gross CF	55.7%
Net CF	**47.7%**



A Typical NZ Wind Regime

With updated tip height constraints (200m)

	V136	V162	V162 – initial capacity
Qty	6	6	4
WTG Capacity [MW]	4.2	5.6	5.6
Hub height [m]	132	119	119
Rotor [m]	136	162	162
Tip Height [m]	200	200	200
Wind Farm Capacity [MW]	25.2	33.6	22.4
AEP [GWh]	118. 3	156.9	105.7
AEP/WTG [GWh]	**19.7**	**26.1**	**26.4**
Gross CF	64.3%	62.3%	62.3%
Net CF	**53.6%**	**53.3%**	**53.9%**



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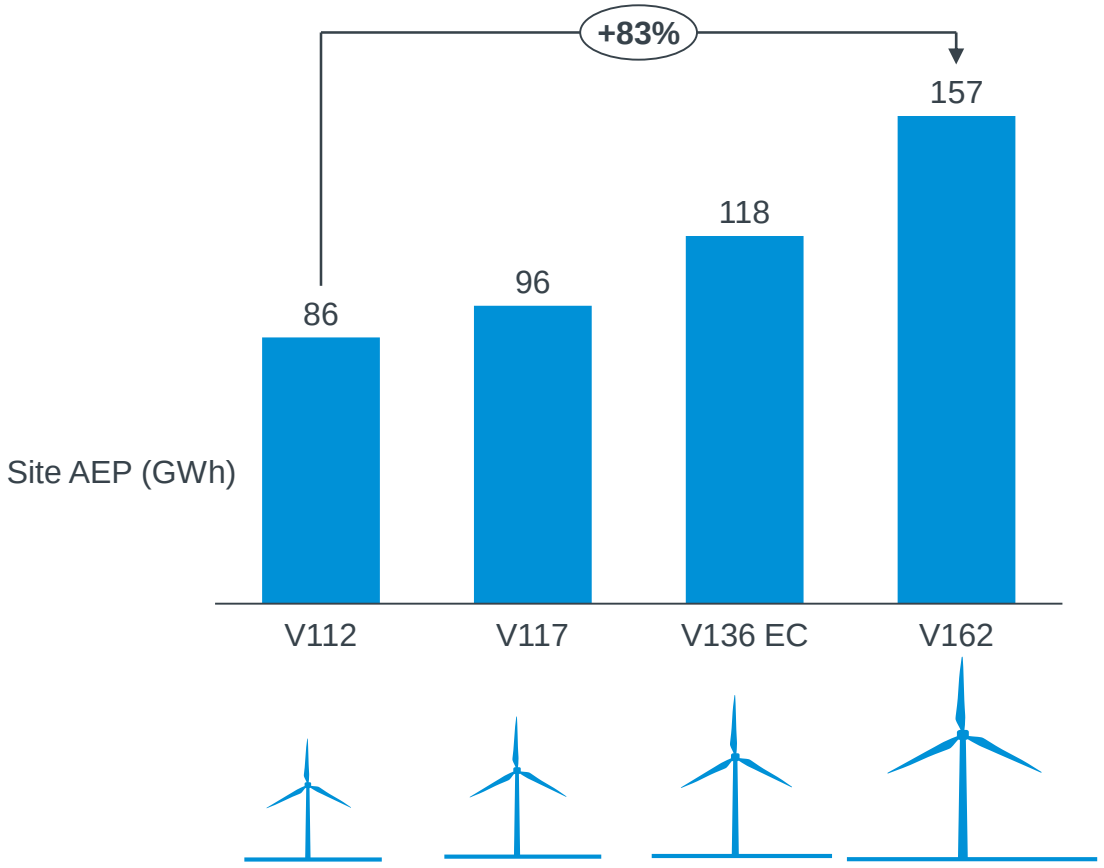
Wind. It means the world to us.™

Thank you

Releasing full wind potential in New Zealand

By utilizing latest technology and updating tip height restrictions

Example site Annual Energy Production
With today's tip height limitation vs updated tip height limitation and using latest technology



- With taller towers and more advanced turbine technologies, a typical New Zealand wind power plant may produce 83% more energy annually comparing to the current best solution.
- If power plant capacity cap is applied, less turbines are used to achieve the same capacity by using taller towers and more advanced turbine technology.

An example shows AEP differences at a site with 6 wind turbines, utilizing different Vestas turbine technologies under a typical New Zealand wind regime.
Source: Vestas Analysis

Technical data

	4MW Platform			EnVentus Platform
	V112-3.45MW™	V117-4.2MW™	V136-4.2 MW™	V162-5.6MW™
Rated Power	3,450 kW	4,000 kW/4,200 kW	4,000 kW/4,200 kW	5,600 kW
Climate Envelop	IEC IA	IEC IB/IEC IIA/IEC S	IEC IIIB/IEC S	IEC S
Sound Power Level	Max. 105.4 dB(A)	Max. 106 dB(A)	Max. 104.9 dB(A)	Max. 104dB(A)
Towers	69 m (IEC IA) and 94 m (IEC IA)	91.5 m (IEC IB) 84 m (IEC IIA)	Site and country specific	119m (IEC S/DIBt S), 125m (IEC S), 148m (DIBt S), 149m (IEC S), 166m (DIBt S)
Rotor diameter	112 m	117m	136m	162m
Blade length	54.7 m	57.2 m	66.7 m	
Operating Temperature	-20°C-+45°C (derating above 30 ºC)	-20°C-+45°C (derating above 30 ºC)	-20°C-+45°C (derating above 30 ºC)	-20°C-+45°C