



Patented Synchronous Power-train:

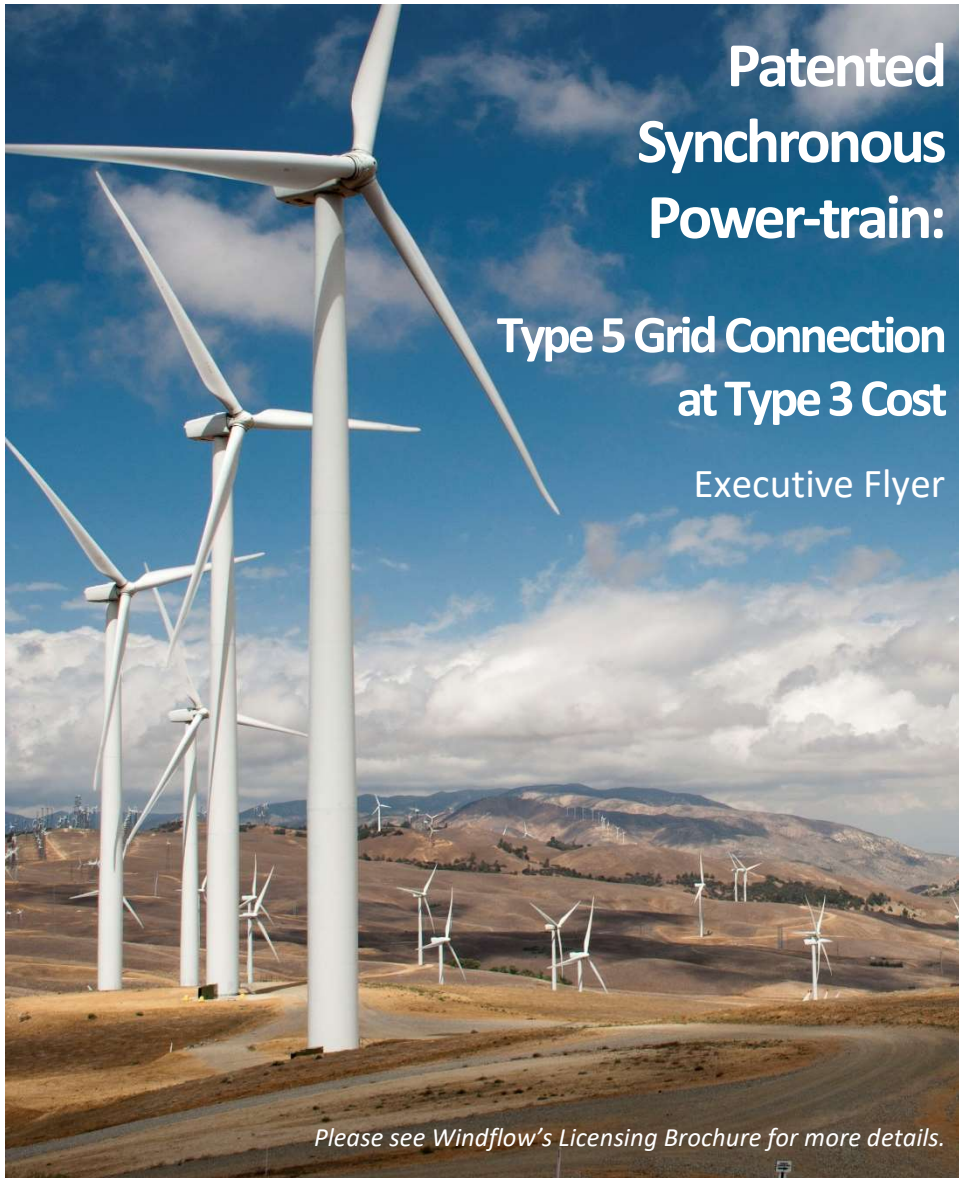
Type 5 Grid Connection at Type 3 Cost

Executive Flyer

Synchronous generation improves system stability in voltage faults and provides inertia, essential in frequency faults.

Partner with Windflow Technology:

- ✓ Synchronous wind turbines are trusted and understood by electricity system operators.
- ✓ “Type 0” in power industry = Type 5 in wind industry (more grid-friendly than Type 4).
- ✓ Avoid the prospect of future constraints by electricity system operators.
- ✓ Avoid costs and well-known reliability issues of power electronic converters (PECs).



Please see Windflow's Licensing Brochure for more details.

- **Patented Technology**

Multiple countries, recent patents, IEC-certified technology

- **950 turbine year track-record**

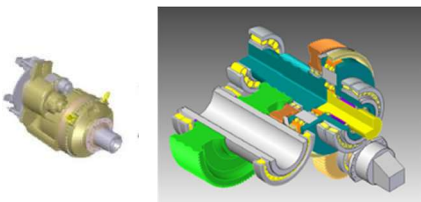
All synchronous and directly grid-connected, including 48 MW wind farm generating 10% of NZ's wind power, and boosting system strength

- **Low cost – less than a Type 3 turbine**

Additional hydraulic system handles only 5% of rated power, loses less than 1%, keeps capital and O&M cost down, easily replaced up-tower

- **No power electronics (PEC)**

- **Scalable to 2 MW, 5 MW, 10 MW, and above.**

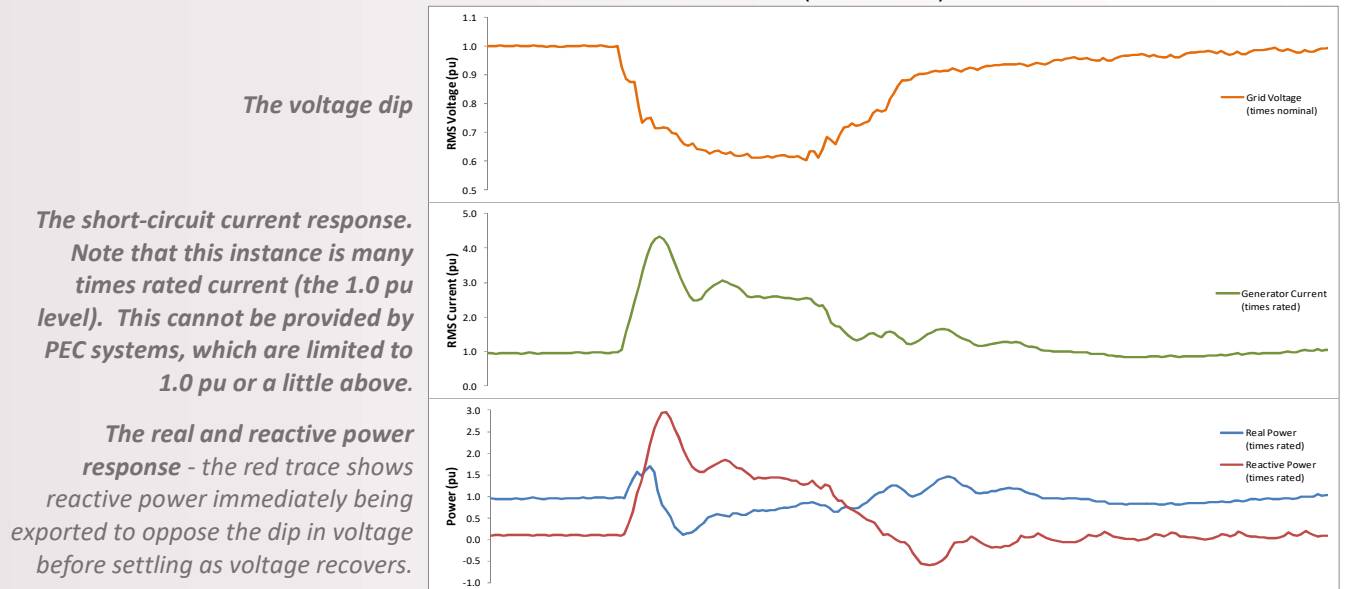


Advantages of Windflow's Synchronous Power-train:

- **Solution to gearbox reliability problems:** Torque Limiting Gearbox (TLG)
- **Full synchronous capabilities will lift barriers to renewable future:**

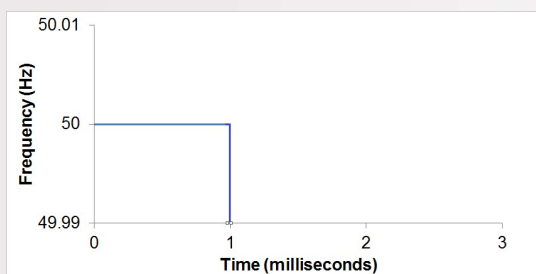
- **System strength:** Voltage stability with short-circuit current available to 1000% rated

Figure 1 - Example of fault contribution & ride-through: A system voltage dip to 60% of normal voltage that lasted around 100 ms (0.1 seconds).

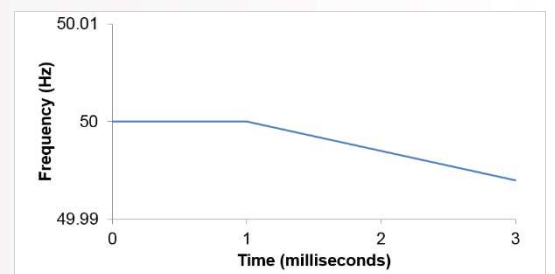


- **Reactive power capabilities:** 100% kVAr continuous rating
- **Generator is a synchronous condenser:** Can run with no wind (if small motor added)
- **Physical inertia:** Frequency stability due to generator inertias being synchronously tied

Figure 2 - The basic principles of physical inertia: Fundamental PEC versus Synchronous generator frequency response



PEC generator has no inertia so frequency could change abruptly on a millisecond timescale, destabilising grid.



Synchronous generators contribute at distance to stability by electro-magnetic sharing of inertia.

- **Very fast frequency response (FFR):** When in FFR/load-following mode, the total measurement-controller-actuator time is a few tenths of a second, uses turbine inertia.

- **Excellent low wind performance:** Typically 5% higher AEP and 4 m/s cut-in suits low wind sites (class 3&4). Patented low variable-speed (LVS) system enables broad-band variable wind turbine speed. (Generator speed stays constant, synchronised with grid).

Proven in New Zealand and Scotland.

We are looking for partners
to take this global.



© Windflow Technology Ltd

Christchurch, New Zealand

phone: +64 3 365 8960

info@Windflow.co.nz

www.Windflow.com