

ENERGY

Modelling type B effects in the 4th Quadrant using BLADED

PCWG mtg 9, OREC, Glasgow

Richard Whiting

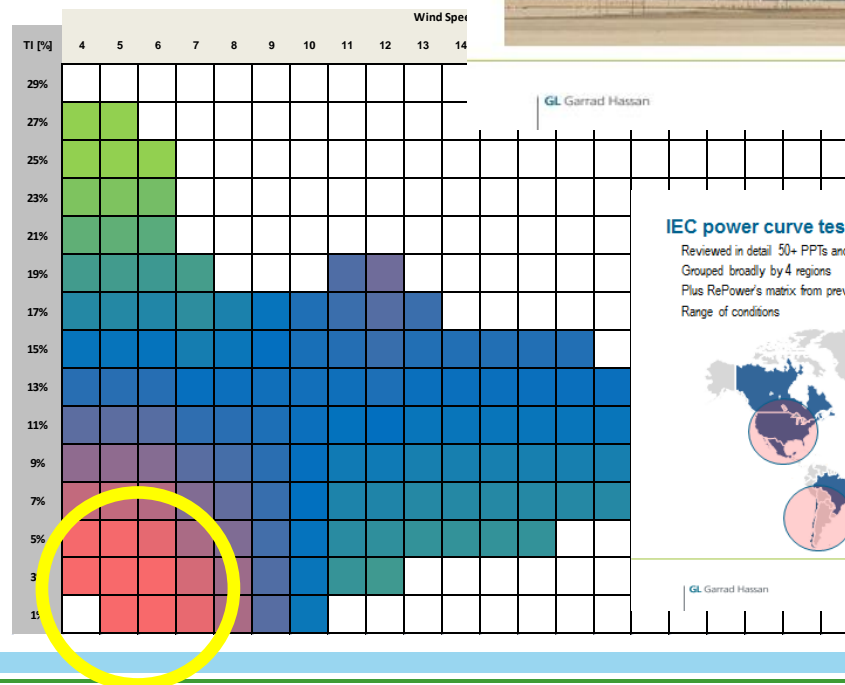
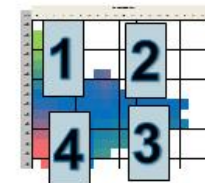
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Where to start with type B?

- Can we start to model losses beyond those implied by TI & REWS analytical models?
- First set of BLADED simulations targeted at 4th Quadrant
- Initial results look interesting

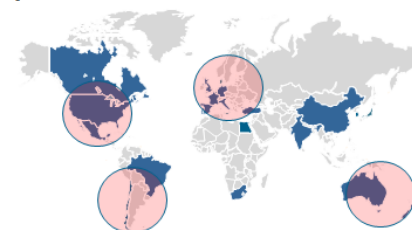
Conclusions

- Similar trends globally – but magnitude and detail of trend varies
 - Need to understand nature of data making up the matrix and adapt
- Potential in TI models to model trends quadrant 1,2,3
- Quadrant 4, low TI, low-mid ws poorly modeled
- Requires empirical approach –
 - TI most dominant metric for simple model
- Manufactures can give more insight here

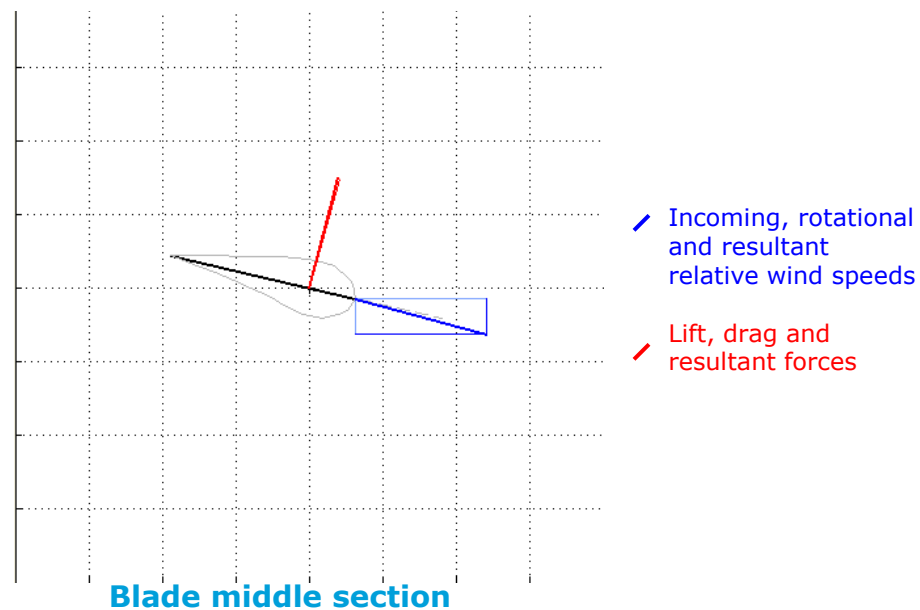
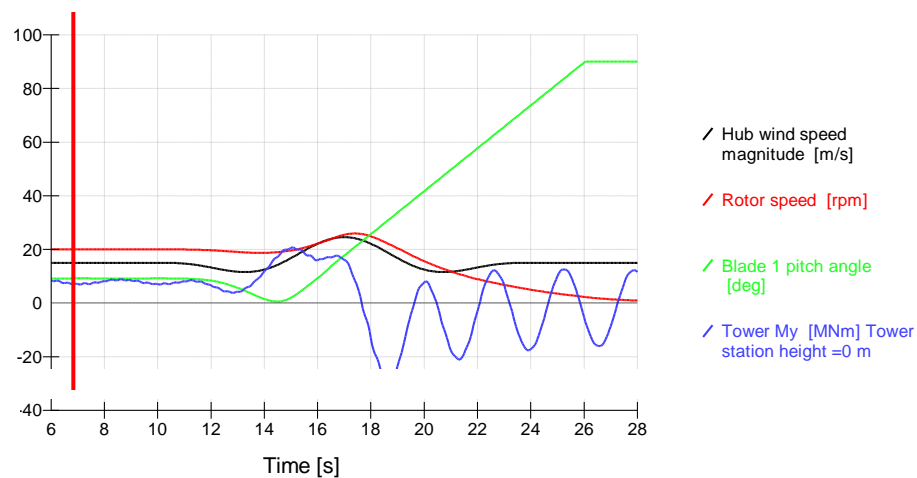
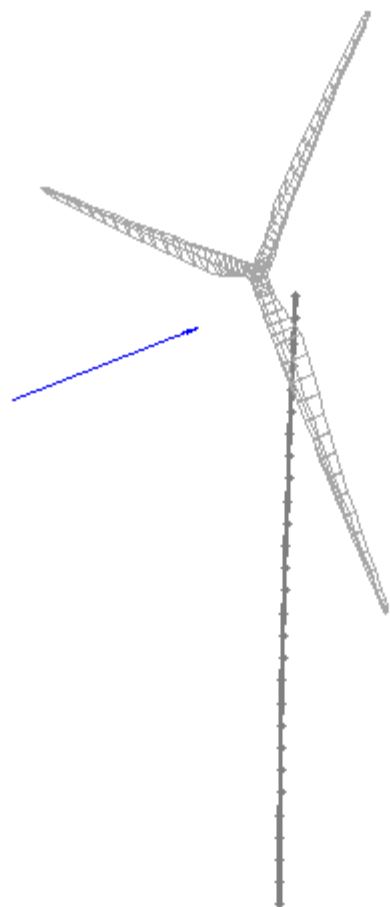


IEC power curve tests

Reviewed in detail 50+ PPTs and ws-TI matrices generated
 Grouped broadly by 4 regions
 Plus RePower's matrix from previous meetings – location unspecified
 Range of conditions

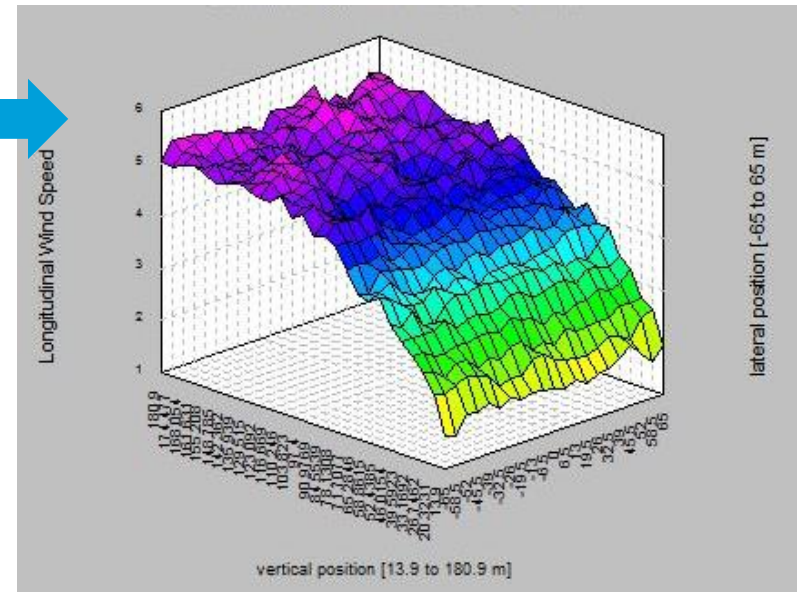
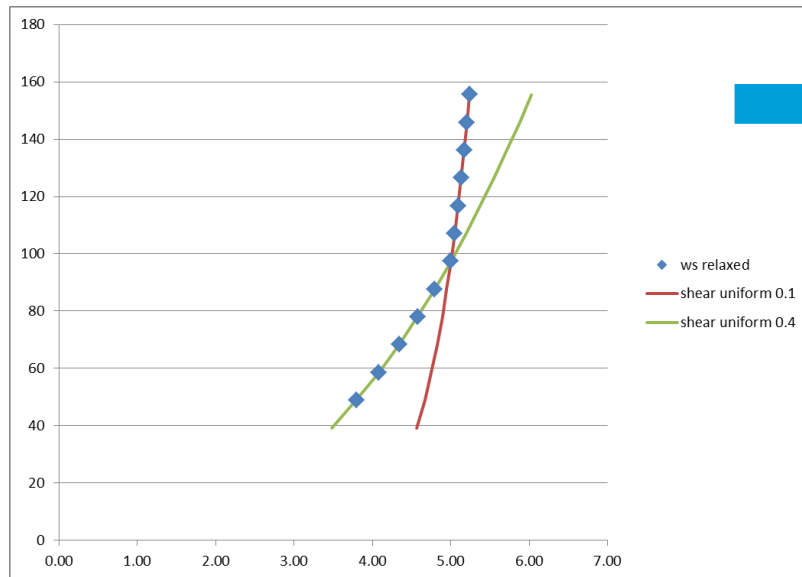


Transient loading: wind gust + turbine shutdown

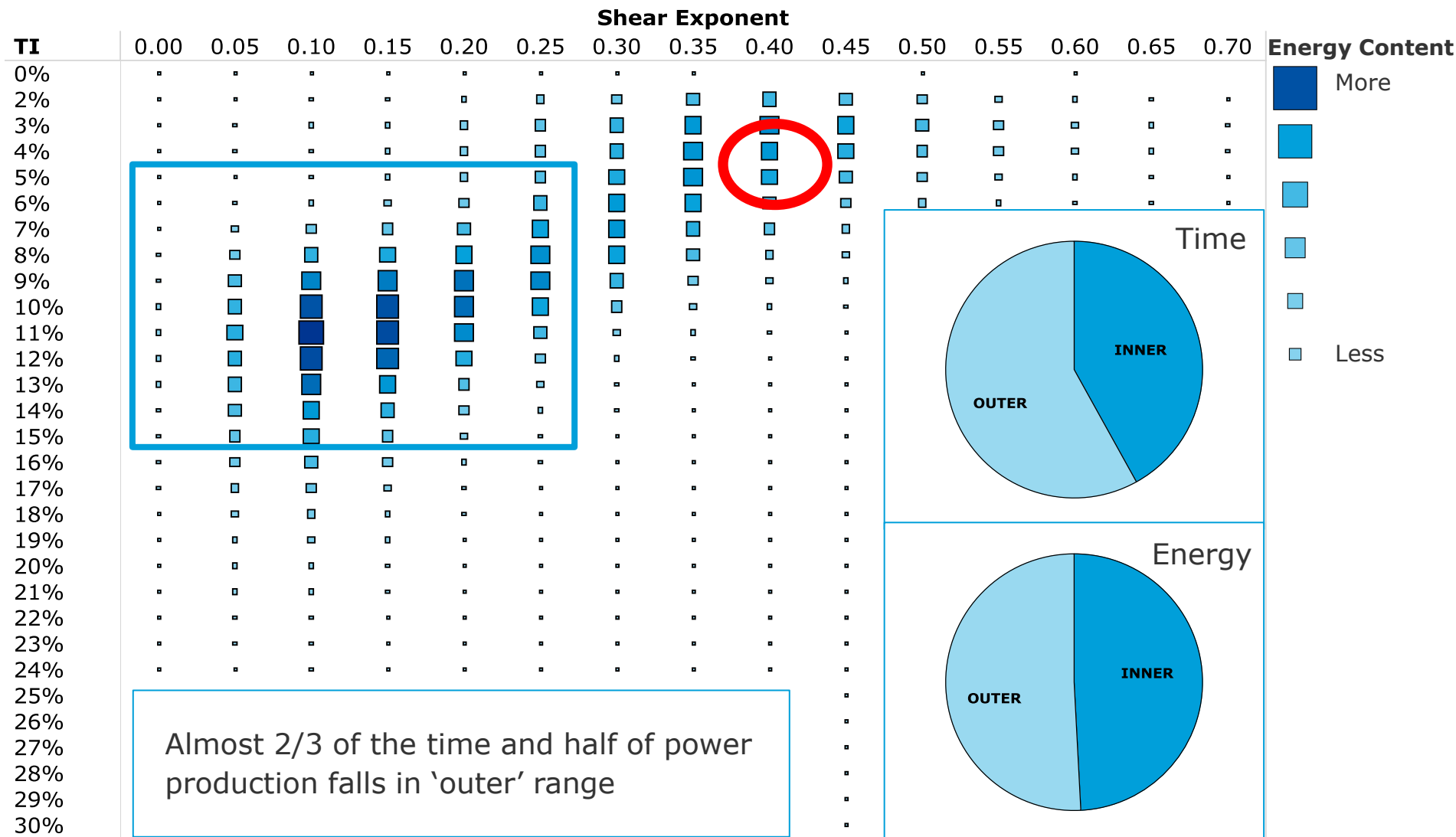


Initial cases simulated:

- Generic Multi MW turbine
- WS=5 m/s at hub height of 100m
- TI set to 5%
- Uniform shear 0.1
- Uniform shear 0.4
- Relaxed shear - 0.4 lower rotor, 0.1 above

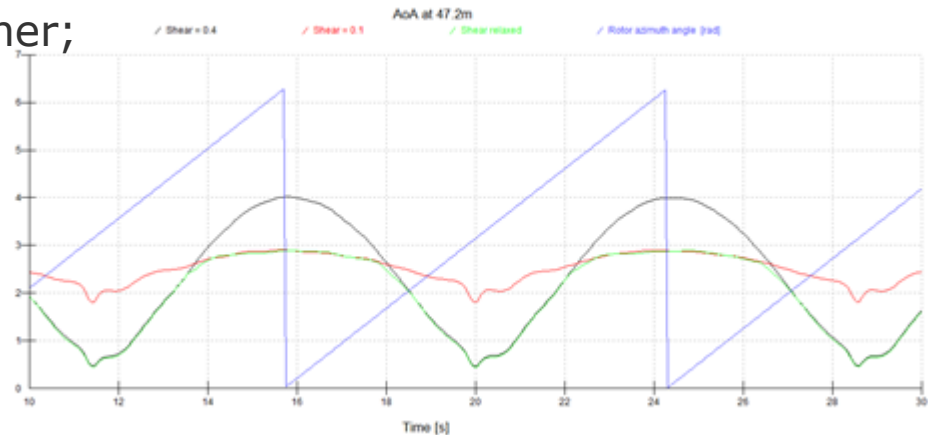


More simulations needed!



Initial Results and findings

- REWS approach would imply the relaxed shear would reduce power by 11% when c.f uniform shear 0.1 case
- BLADED simulations indicate reduction in power of 15%
- “extra 4%” from “type B?”
- Caveats: limited number of simulations, treatment of TI across rotor, realistic nature of relaxed shear case?
- Parameter sweep with shear/TI/other;
- Inflow
- Use actual measured profiles
- Generic turbine model
- Controller dynamics.....
- Turbulence length scale issues



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Discussion

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