



Wind Energy Institute

Grand Opening Event TWEET-IE

Improving NTUA's profile with respect to EU research needs
and services to industry

TUM success stories

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Outline



1. CL Windcon, **EU**
2. **International** collaboration - Wake interaction of wind turbines on a floating platform
3. PowerTracker, **German**

Academic Partners : Polimi, TU Delft, Cener, Uni Stuttgart, TNO, Uni Aalborg, Nrel (external advisor)

Industrial Partners GE, Ramboll, Enel, DNV GL, IK4 Ikerlan, Qi Europe, Dewi, Zabala

Project duration: 2016-2019

Funding: Eu Horizon 2020 Research and Innovation Programme

Website: www.clwindcon.eu

Publications:

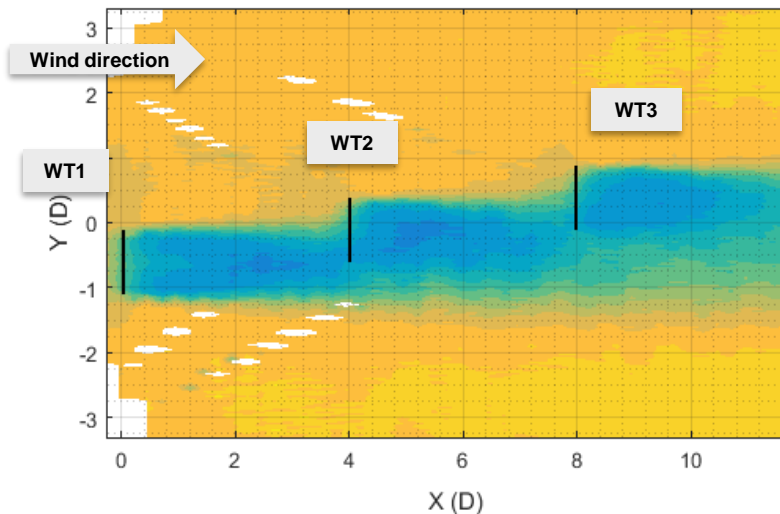
- Schreiber, Johannes; Salbert, Bastian; Bottasso, Carlo Luigi 2018 [Study of wind farm control potential based on SCADA data](#) Journal of Physics: Conference Series (JPCS).
- Schreiber, Johannes; Bottasso, Carlo Luigi 2018 [Online model updating by a wake detector for wind farm control](#) Proceedings of the American Control Conference 2018



Results: first ever experimental demonstration of closed-loop wake deflection control

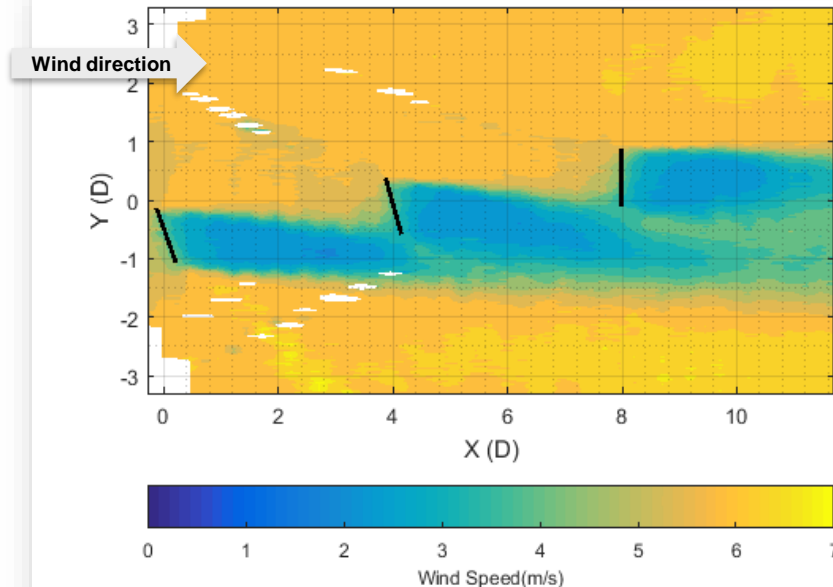


Without wind farm control



LiDAR visualization of wakes
15% wind farm power increase for this configuration

With wind farm control



Wake interaction of wind turbines on a floating platform

Academic Partners : Kangwon National University, Chuncheon, South Korea, Politecnico di Milano, Technical University of Munich

Industrial Partners -

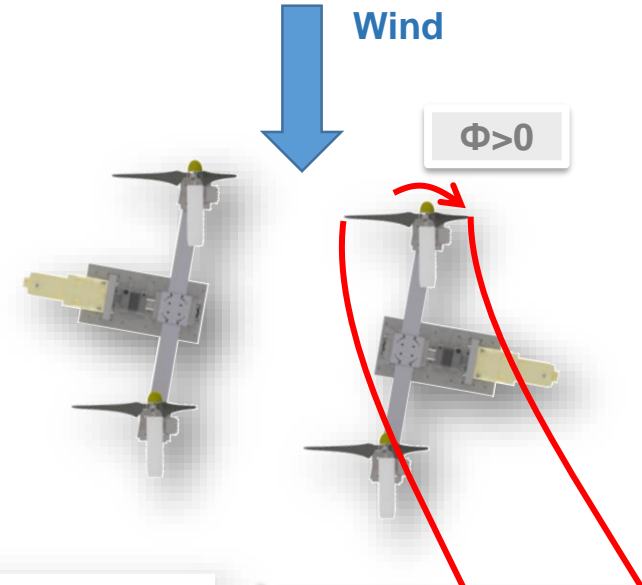
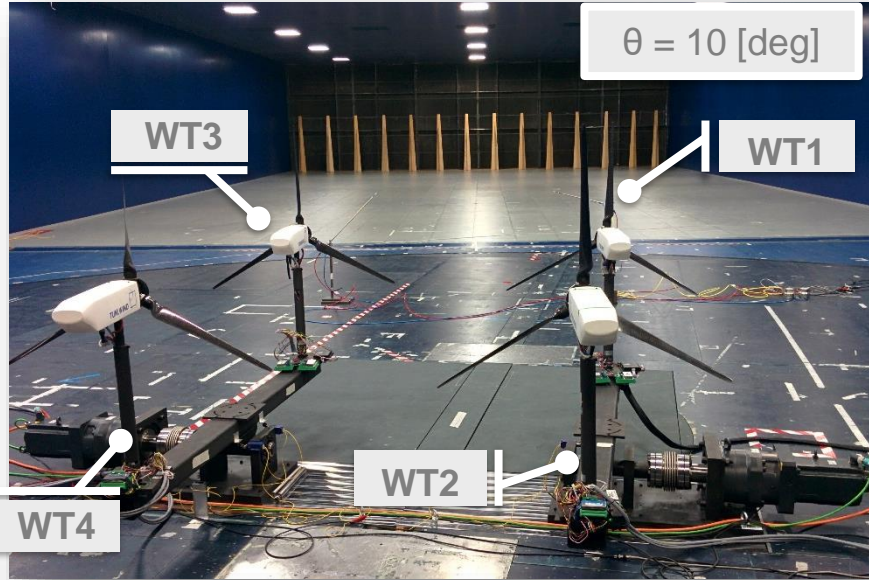
Funding: Korea Research Institute of Ships and Ocean Engineering (KRISO), South Korea

Publications:

- J Wang, C Wang, O D Castaneda, F Campagnolo, C L Bottasso, Large-eddy simulation of scaled floating wind turbines in a boundary layer wind tunnel, 2018 J. Phys.: Conf. Ser. 1037 072032



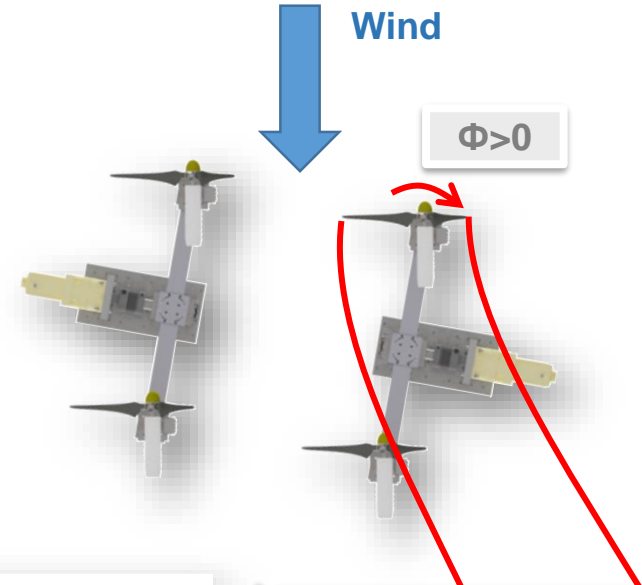
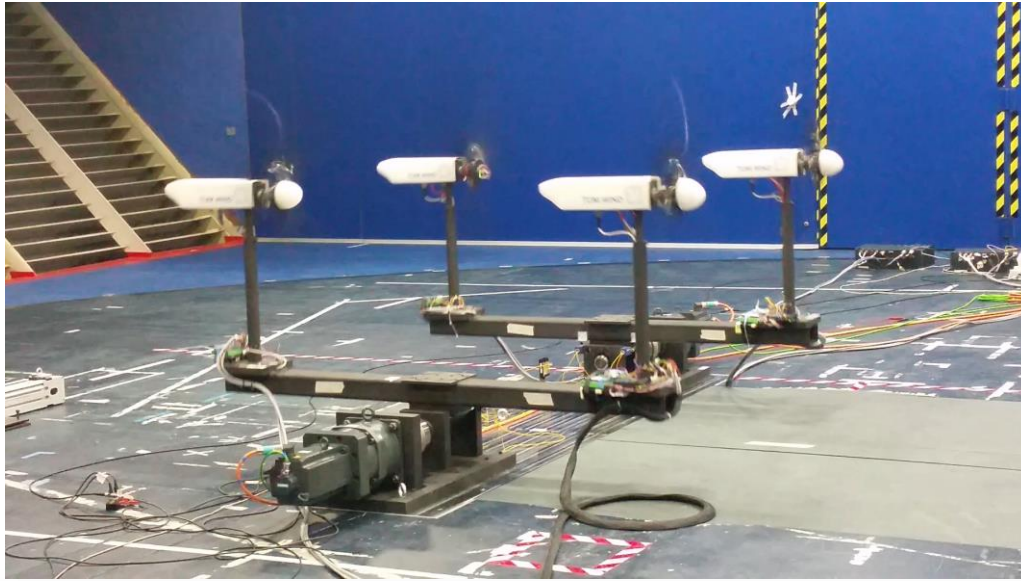
Results: Power Maximization: Wake Deflection



		WT1		WT2		WT3		WT4		WE	
		Φ^{WT1}	P	$\Delta P, \%$	P	$\Delta P, \%$	P	$\Delta P, \%$	P	$\Delta P, \%$	P
full-load	0 deg		13.0	-	8.22	-	12.35	-	9.84	-	43.41
	15 deg		11.57	-11	10.49	27.6	12.57	1.7	10.3	4.3	44.9
	25 deg		10.59	-18.5	10.98	33.6	12.64	2.3	10.42	6.0	44.6
partial-load	0 deg		23.29	-	17.82	-	23.15	-	21.08	-	85.34
	15 deg		22.75	-2.3	21.43	20.3	23.16	0.1	20.88	-0.9	88.23
	25 deg		21.03	-9.7	22.46	26.0	23.16	0.1	21.35	1.3	88.0

Potential **significant** power increase, for both **full-load** (below rated) and **partial-load** (above rated) WT operating conditions

Results: Power Maximization: Wake Deflection



	WT1			WT2			WT3			WT4			WE		
	Φ^{WT1}	P	$\Delta P, \%$	P	$\Delta P, \%$	P	$\Delta P, \%$	P	$\Delta P, \%$	P	$\Delta P, \%$	P	P	$\Delta P, \%$	
full-load	0 deg	13.0	-	8.22	-	12.35	-	9.84	-	43.41	-	43.41	-	-	
	15 deg	11.57	-11	10.49	27.6	12.57	1.7	10.3	4.3	44.9	3.4	44.9	3.4		
	25 deg	10.59	-18.5	10.98	33.6	12.64	2.3	10.42	6.0	44.64	2.8	44.64	2.8		
partial-load	0 deg	23.29	-	17.82	-	23.15	-	21.08	-	85.34	-	85.34	-	-	
	15 deg	22.75	-2.3	21.43	20.3	23.16	0.1	20.88	-0.9	88.23	3.4	88.23	3.4		
	25 deg	21.03	-9.7	22.46	26.0	23.16	0.1	21.35	1.3	88.0	3.1	88.0	3.1		

Potential **significant** power increase, for both **full-load** (below rated) and **partial-load** (above rated) WT operating conditions

PowerTracker



Academic Partners: Technical University Berlin, Politecnico di Milano, Technical University of Munich

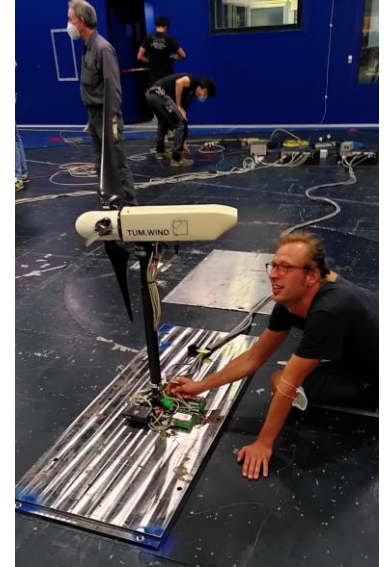
Industrial Partners: Nordex SE

Project duration: 2021-2024

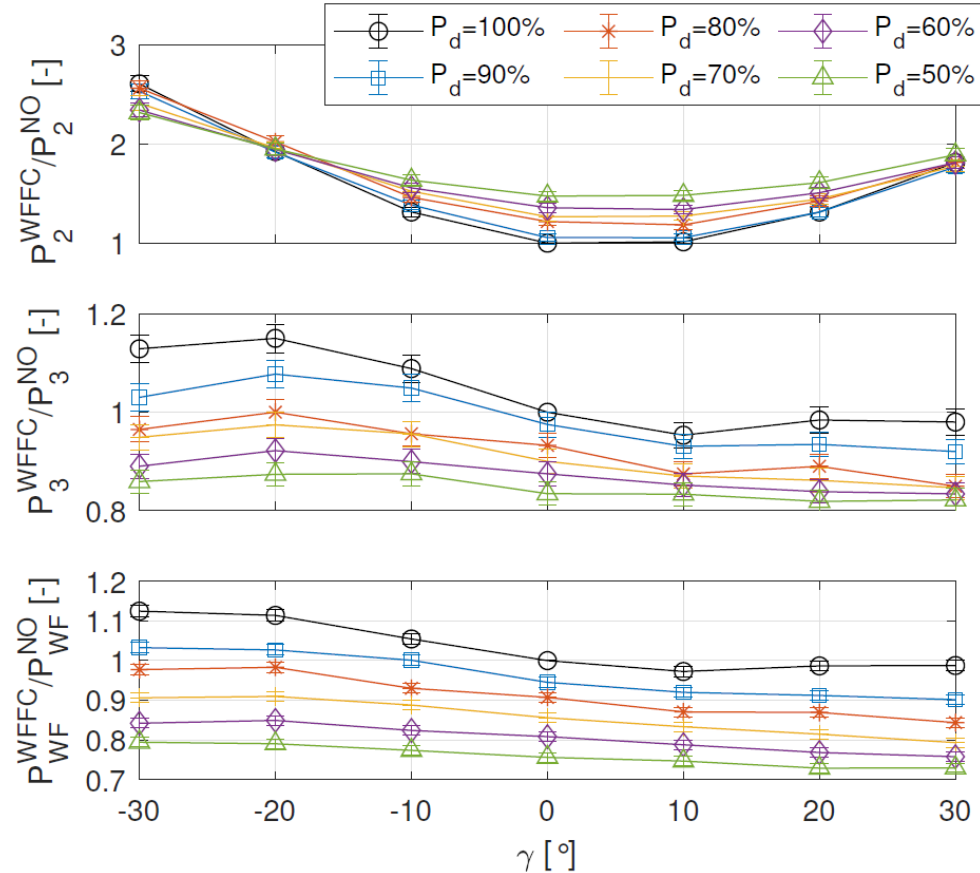
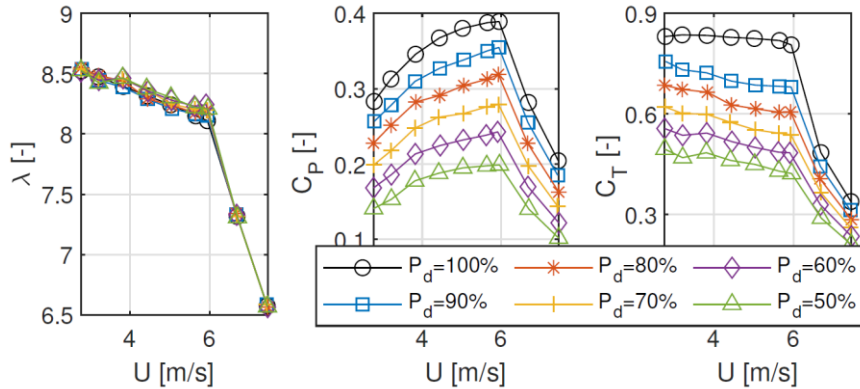
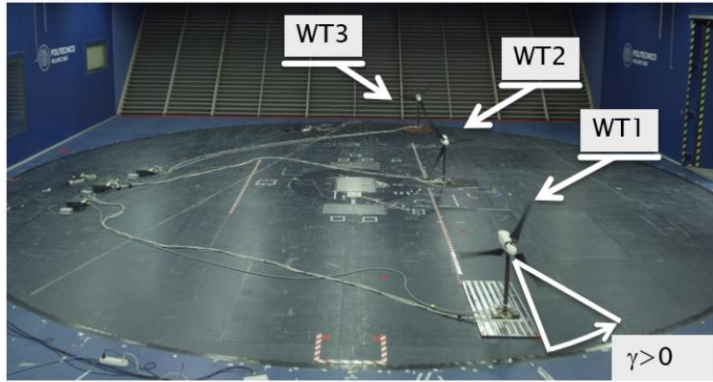
Funding: German Federal Ministry for Economic Affairs and Climate Action (BMWK)

Publications:

- F. Campagnolo, S. Tamaro, F. Muhle, Carlo L. Bottasso , Wind Tunnel Testing of Combined Derating and Wake Steering, International Federation of Automatic Control World Congress 2023, Yokohama, Japan, *under review*



Results: derating control strategies



... Tweet-IE!



Academic Partners: National Technical University of Athens, Karlsruhe Institute of Technology, Technical University Delft, Politecnico di Milano, Technical University of Munich

Funding: European Union





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Thank you for your attention!

