



Floating wind

Mooring line capability

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BRIDON · BEKAERT
THE ROPES GROUP

Bridon-Bekaert, part of Bekaert



Founded in 1880 by Leo Leander Bekaert



No1 in steel wire and rope manufacture



Serving customers in 120 countries through our 29 000 employees worldwide



€ 4.3 billion sales in 2018



Listed on Euronext® Brussels

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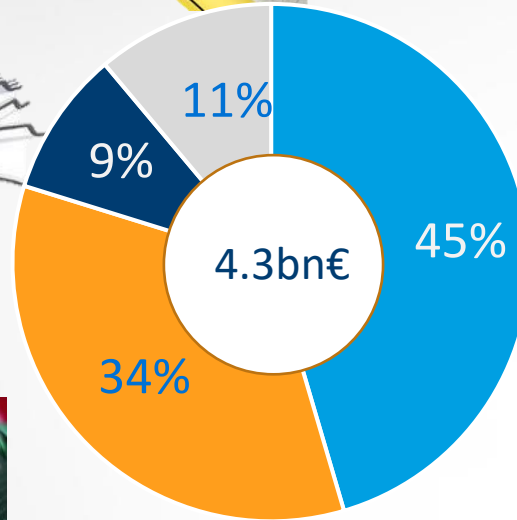
Bridon-Bekaert, part of Bekaert



Specialty Business



Steel wire
Solutions



Rubber Reinforcement



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Bekaert: committed to floating wind

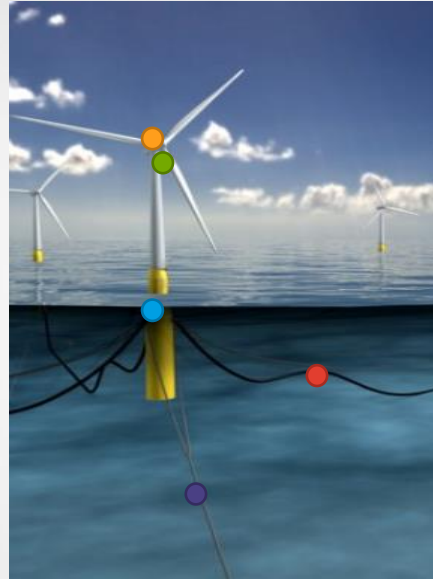
Advanced
concrete
reinforcement



Armouring
solutions for
dynamic power
cables



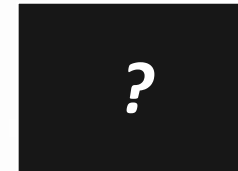
Mooring lines
for station
keeping



Timing belt for blade
pitch adjustment



Superconductor for
compact 10MW
turbine generators

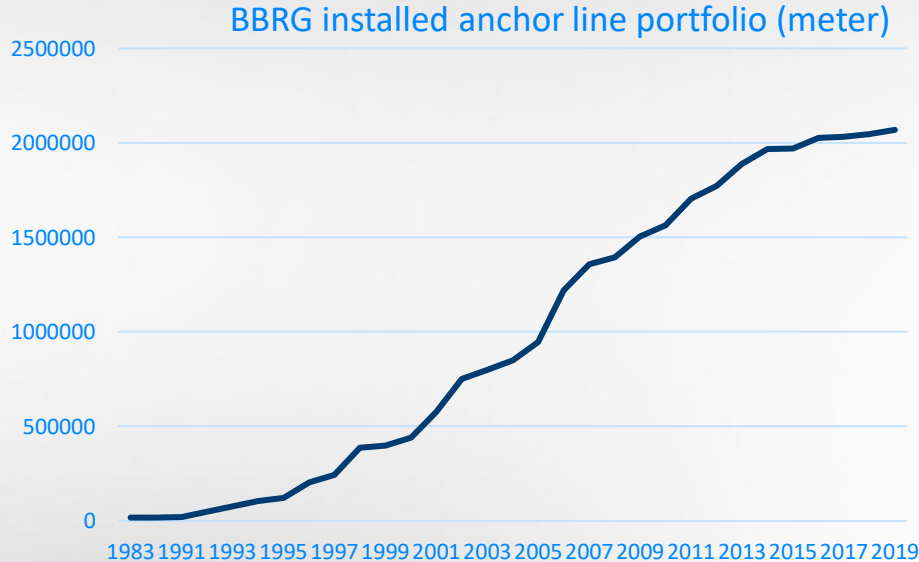


Who knows
what's next

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Bridon-Bekaert

Unrivaled track record in offshore mooring



- Both steel & fibre solutions in portfolio
- Building on the learnings from all 172 completed projects
- With a tradition to push the boundaries
 - BP Mad Dog - First synthetic truss spar
 - Shell Prelude - First FLNG, steel
 - Shell Perdido – Deepest spar, fibre
 - SHI Egina - Longest steel lines
 - Subsea7 Guara Lula – Largest SCR tether

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Floating wind mooring mission requirements: Not a copy past from O&G

	O&G Mooring	FWT Mooring
Operating life	Up to 25 years	At least 25 years
Water depths	>500m (synthetic fibre)	50-250m
Motion characteristics	Wave & low frequency	Wave & vibrations
Expected marine fouling	Low	High
(Re)tensioning on board	Normally possible	Not normally possible
Lines per project	25-75	150-300
Pre-tension	>10% MBL	<10% MBL
System redundancy	High	Low
Failure consequence	High	Low(er)



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BBRG unique through its access to the full suite of mooring products

	CHAIN 	STEEL SPIRAL 	POLYESTER 	NYLON 	HIGH MODULUS SYNTHETICS 	INNOVATIVE CONCEPTS 
Track record	<ul style="list-style-type: none"> Shallow water O&G All FOW demos 	<ul style="list-style-type: none"> Medium water O&G 	<ul style="list-style-type: none"> Deepwater O&G FOW demos 	<ul style="list-style-type: none"> General shipping FOW demos 	<ul style="list-style-type: none"> LNG mooring FOW demos FOW Kincardine 	<ul style="list-style-type: none"> -
Strength	<ul style="list-style-type: none"> Catenary in shallow water Combines with cheap anchors 	<ul style="list-style-type: none"> Compact Robust & reliable 	<ul style="list-style-type: none"> Low cost feedstock 	<ul style="list-style-type: none"> Fit for shallow 	<ul style="list-style-type: none"> High strength 	<ul style="list-style-type: none"> Fit for purpose
Challenge	<ul style="list-style-type: none"> Becomes bulky Reliability Cost 	<ul style="list-style-type: none"> Too light for effective catenary in shallow water 	<ul style="list-style-type: none"> Compliance 	<ul style="list-style-type: none"> Fatigue life Rawmat cost 	<ul style="list-style-type: none"> Feedstock cost Stiffness Creep 	<ul style="list-style-type: none"> Approval & gaining confidence
Expected field of play	<ul style="list-style-type: none"> Pilots & small farms 	<ul style="list-style-type: none"> TLP tendon Midwater catenary 	<ul style="list-style-type: none"> Deepwater farms (e.g. US) 	<ul style="list-style-type: none"> Mainstream contender for shallow water 	<ul style="list-style-type: none"> Insert for chain 	<ul style="list-style-type: none"> Innovators

BBRG as development partner

Bridon-Bekaert – Innovation in close collaboration with lead users is in our DNA



€ 65 million
in-house R&D in 2018



International **R&D** teams in
Belgium – China – India



About **1700**
patent rights



“Innovative Mooring” JIP



MooringSense

Durability & design optimisation



Ready to co-innovate together

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A team dedicated to mooring solutions



**Greg
Mozsgai**

Business Development
Manager Renewables
UK/USA



**Timothy
Hunter**

Technology Lead –
Mooring Solutions
UK



**Simon
Frost**

Global Commercial
Manager Mooring
UK



**Steve
Willis**

Global Project Director
UK



**Christof
Dewijngaert**

Global Segment Lead
Belgium



**Matthew
Davies**

Project technical
specialist
UK



**Emma
Stevenson**

Project Manager
UK



**Michelle
Latta**

Engineering Lead
Synthetic Solutions
UK



**Michael
Kent**

New Product
Design Engineer
UK

Bridon-Bekaert: EMEA manufacturing facilities dedicated to mooring today

Coatbridge, UK, Main hub for Bridon-Bekaert fibre rope activities



- Multi-purpose fibre facility
- Versatile manufacturing processes

Grangemouth, UK, Quayside facility focused on larger fibre rope



- Purpose built new quayside facility
- Further expansion possibility

Newcastle, UK, Quayside facility for steel mooring solutions



Flagship steel mooring facility



Doncaster, vertically integrated steel wire supply

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Bridon-Bekaert's take on floating wind fibre solutions

Compliance

Nylon- PET alike stiffness, quantified and proven

+

Sea bed contact

Occasional dynamic sea bed contact

+

Marine fouling

Remove need for buoyancy!

+

Buoyancy

Integrated and external buoyancy systems

+

Cut resistance

Improved resistance to e.g. trawling

+

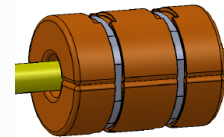
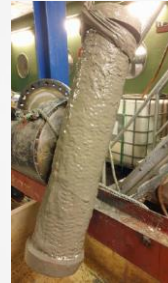
Tensioning

Reduce the need for re-tension

+

Deployment

Safe and fast deployment from simple small vessels



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In a nutshell

- Floating wind mooring \neq Oil & gas mooring \Rightarrow co-development needed
- Start with industrialization in mind
- If you have an exciting mooring challenge, get in touch
 - Greg.Mozsgai@bridon-bekaert.com
 - Payam.pourmand@bridon-bekaert.com

A close-up, high-angle photograph of several thick, braided steel ropes. The ropes are arranged in a series of parallel lines that recede into the distance, creating a strong sense of depth and perspective. The lighting is dramatic, highlighting the metallic sheen and the intricate texture of the individual strands. A semi-transparent white rectangular box is centered horizontally across the middle of the image, containing the company name and tagline.

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