

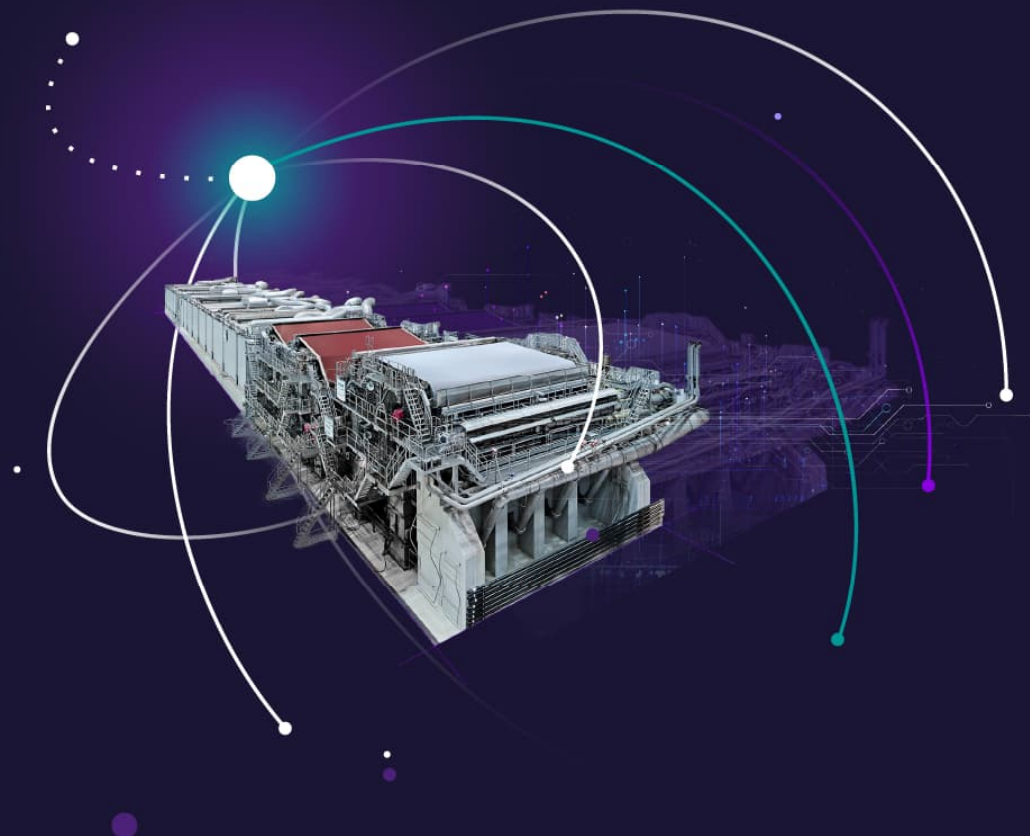
Industria Papelera y Energía

Mesa redonda II:

Descarbonización y competitividad en la industria del papel y el cartón

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Pulp & Paper Industry

- 4th most energy-intensive industry
- ~2% of global GHG emissions


Market Segments

Tissue & Special Paper Mills		Pulp Mills	
Green Solutions beyond Pulp & Paper		Board Mills	

Major CO2 emission routes

- Direct emissions^{1,2,3,4}
- Purchased electricity
- Transportation

+ 7% pulp, paper, board production
- 21% energy usage (total energy mix)
- 75% CO2 emissions (- 37Mt CO2)

 2015-2050
PATHWAYS FOR DECARBONISATION

Regulatory drivers for decarbonization








- Increasing CO2 penalties and decarb funding
- Demand for CO2 free products from off-takers / consumers (Amazon, Coca-Cola, Maersk ...)
- Investor / shareholder push for responsible sourcing by mill owners

Pulp & Paper Industry has already commenced their decarbonization journey

Europe's pulp and paper industry has reduced its CO₂ emissions* by -50% in the last three decades
*per tonne of product

Decarbonization potentials (direct emissions), use-cases

<p>1 Efficiency increase</p> <p>30%</p>	<ul style="list-style-type: none"> • energy-efficient components and system design (gearless, electric drive trains ...) • Measures to lift operational uptime • process and control (closed cycles, waste-heat-recovery, economy of scale ...) 	 
<p>2 Fuel shift</p> <p>35%</p>	<ul style="list-style-type: none"> • steam generation with low carbon boilers (multifuel, biogas, electric ...) • integrated CHP power plants w/ flex-fuel turbines • waste incineration power plants (Biomass, residual wood, rejects, municipal waste ...) 	 
<p>3 Demand side flexibility</p> <p>10%</p>	<ul style="list-style-type: none"> • flexible operations, providing grid control • peak-shaving through storage (electric, thermal, mechanical, chemical ...) and temporary generation (gas motors, gas turbines) • sector coupling, district heating 	
<p>4 Emerging & breakthrough technologies</p> <p>25%</p>	<ul style="list-style-type: none"> • process knowhow for commercial scale (220ktpy) non-fossil biochemicals production (BioMEG, BioMPG, RFF, industrial sugars) • industrial integration of eFuel production, made from renewable energy, water and biogenic CO₂ 	 

 % contribution to decarb targets



Pathways for the decarbonization of Pulp & Paper Industry



Low carbon energy

Highly efficient and reliable provision of heat and power

Combined heat & power

Zero carbon power for industry

Modernization and upgrades



Heat integration

Enhanced heat production and utilization

Heat production

Waste heat utilization

Thermal storage



Electrification

Electrification along the industrial value chain

Electrification of drives

Electrical heating

Microgrid*



Power to X

Solutions for the hydrogen infrastructure

Hydrogen production

E-fuel production

Gas compression & handling



Residuals and fugitive emissions

Utilization and reduction

Monitor & detect

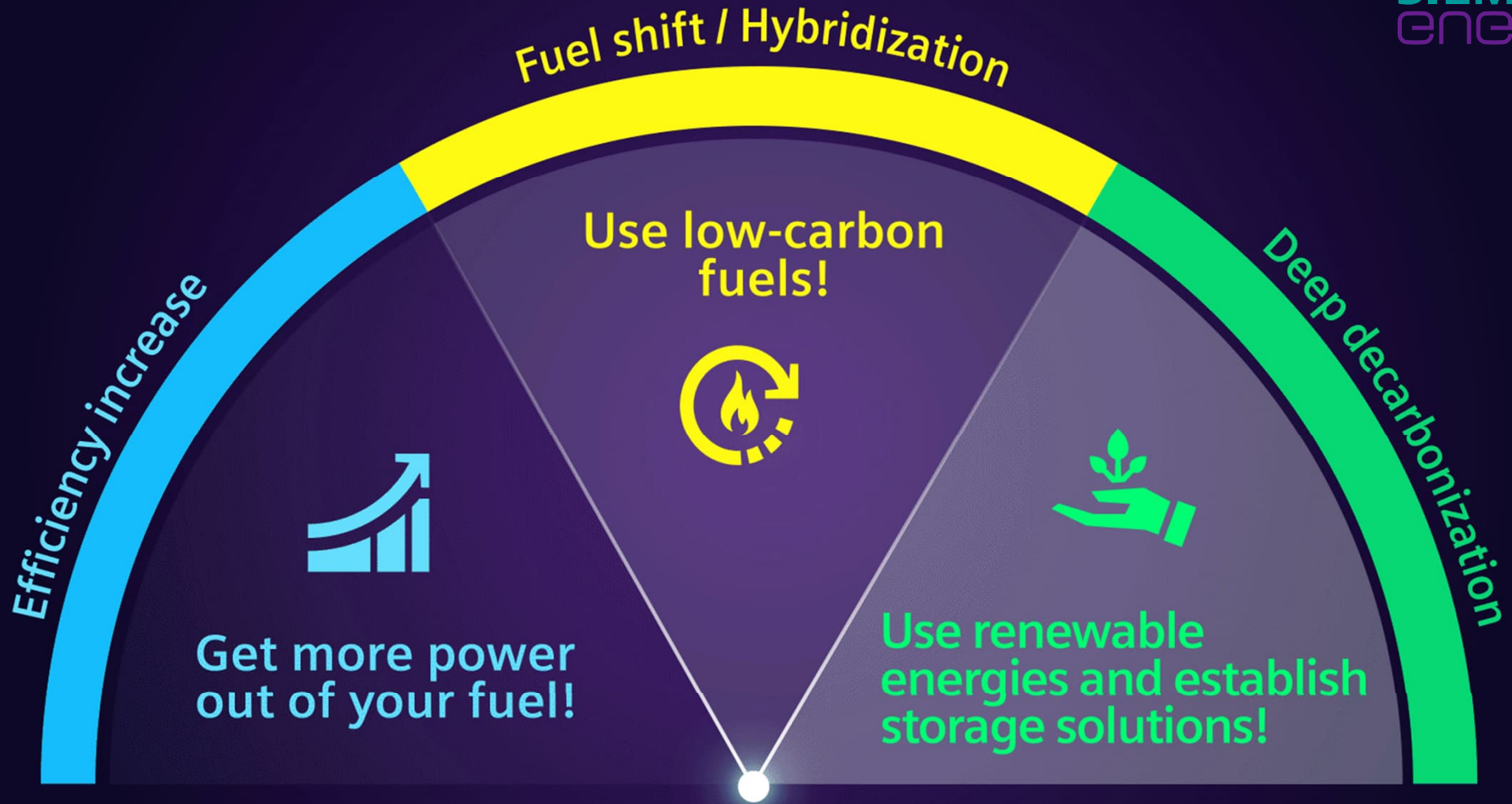
Residual utilization

Fugitive emission reduction

Process decarbonization

- Olefine production
- E-fuel production
- Steam & autothermal reforming
- Ammonia production
- Carbon Capture processes
- Fuel receiving terminals
- **Pulp & Paper**
- Steel production

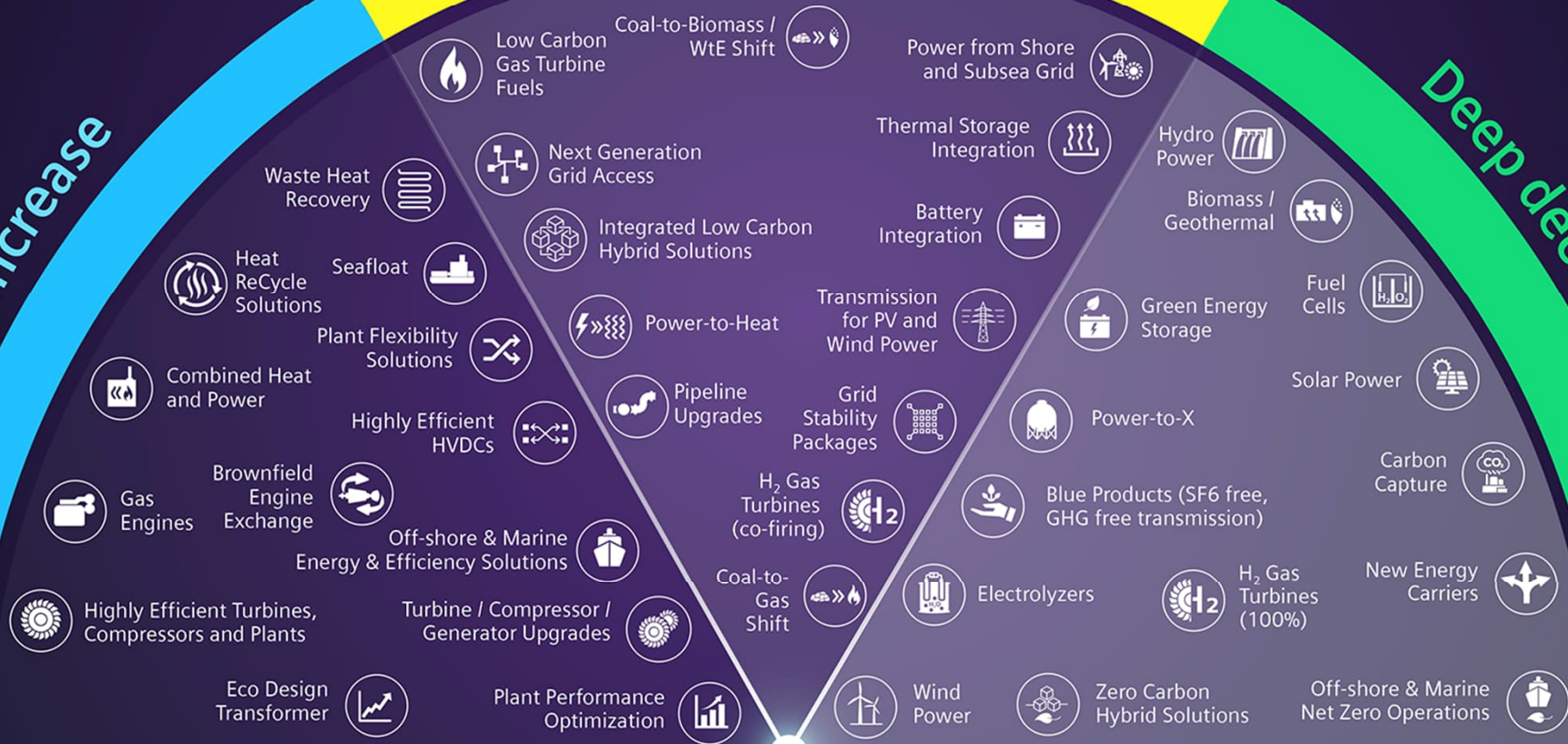
Use cases



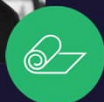
Fuel shift/Hybridization

Efficiency increase

Deep decarbonization



Contact



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