

MATERIALDURCHSATZ BEIM BESCHICHTEN UND LÖSEMITTELRÜCKGEWINNUNG - AUSWIRKUNGEN AUF PILOT- UND MASSENFERTIGUNG VON BATTERIEELEKTRODEN

Andreas Keil, Director Business Development , Dürr MEGTEC

München 6 Juni

DÜRR GROUP: 3 GLOBAL BRANDS



Dürr AG

Dürr Systems AG



Carl Schenck AG



HOMAG Group AG



DÜRR GROUP: 5 GLOBAL DIVISIONS



Sales 2017: € 3.7 billion, employees 2017: approx. 15,000

Paint and Final Assembly Systems	Application Technology	Clean Technology Systems	Measuring and Process Systems	Woodworking Machinery and Systems
<ul style="list-style-type: none"> Paint and final assembly systems <p>€ 1.2 billion 3,500</p>	<ul style="list-style-type: none"> Paint application, glueing and seam sealing technology; products for industrial painting <p>€ 0.6 billion 2,100</p>	<ul style="list-style-type: none"> Air pollution control and noise abatement systems <p>€ 0.2 billion (0.4 billion)* 600 (1.600)*</p>	<ul style="list-style-type: none"> Balancing, assembly, testing and filling technology <p>€ 0.5 billion 2,300</p>	<ul style="list-style-type: none"> Machinery and plants for woodworking <p>€ 1.2 billion 6,400</p>

* Since October 2018

Employees Sales

TECHNOLOGIE ZUR HERSTELLUNG VON LI-IONEN ZELLEN

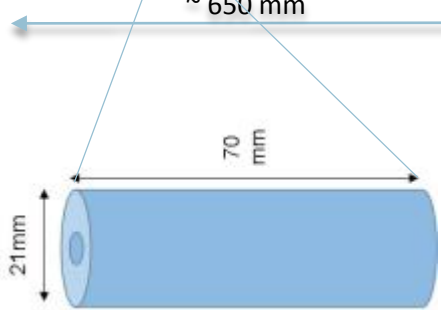
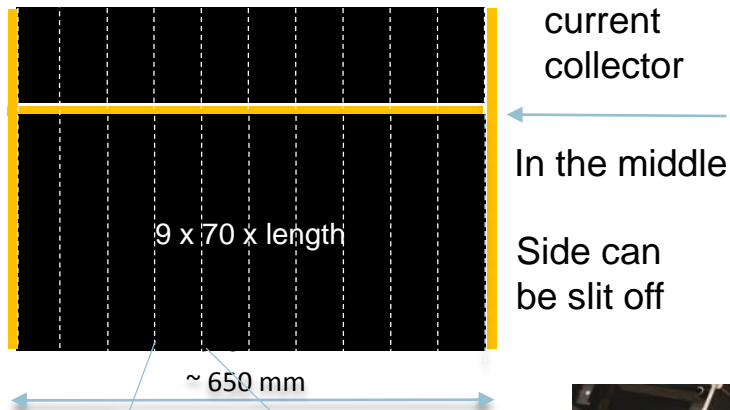
Zellproduktion



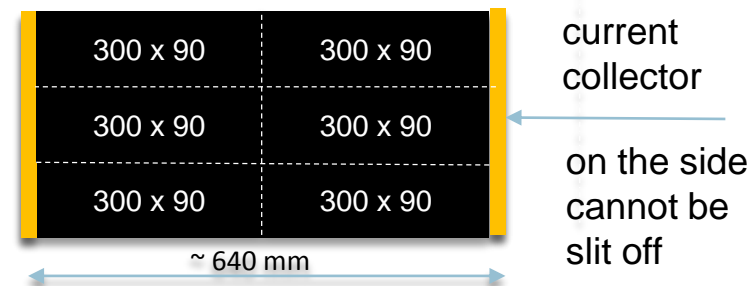
ACTUAL CELL DESIGNS

Cylindrical, Pouch and Prismatic

Cylindrical Cell
requires Intermittent coating

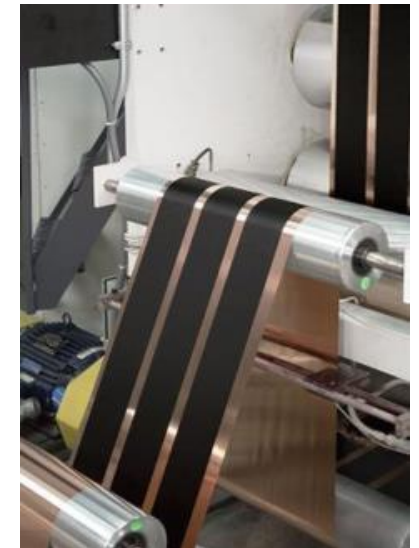


Pouch Cell with
continuous coating



Cell can be 300 -500 mm wide and 70 – 100 mm high to fit in car floor

Prismatic Cell with
continuous coating



Electrode can be 12-14 m long

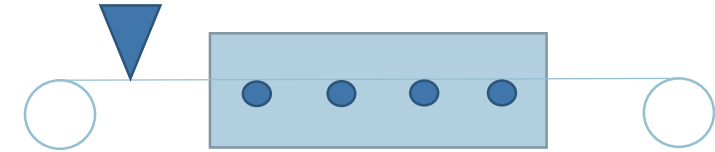
BESCHICHTUNGSTECHNOLOGIE FÜR LI-IONEN ELEKTRODEN

Konfigurationen Beschichter

Einseitige Beschichter – 2 Durchläufe

Beschichten Seite A; Trocknen; Aufwickeln

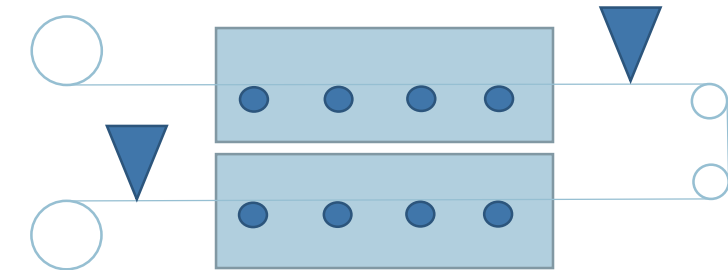
Dann Beschichten Seite B; Trocknen; Aufwickeln



Tandem Beschichter – 1 Durchlauf für beide Seiten

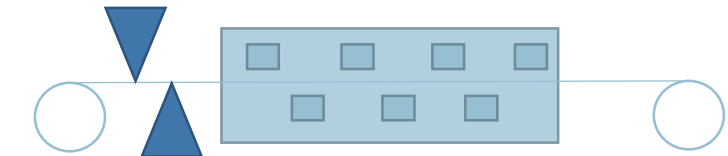
Beschichten Seite A; Trocknen; Wenden

Beschichten Seite B; Trocknen; Aufwickeln



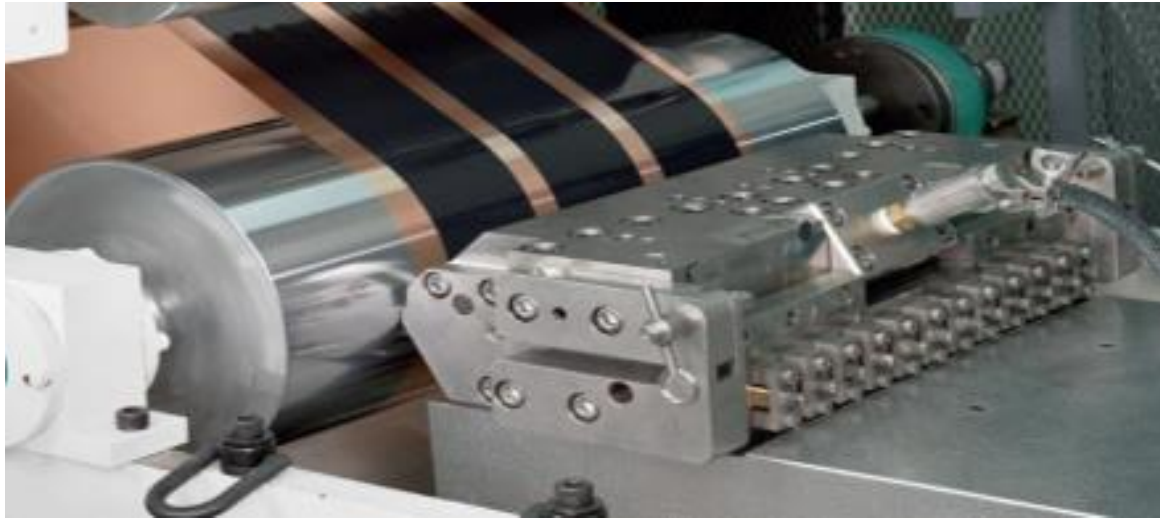
Simultan 2-Seitige Beschichtung

Beschichten Seite A; Beschichten Seite B; Trocknen; Aufwickeln



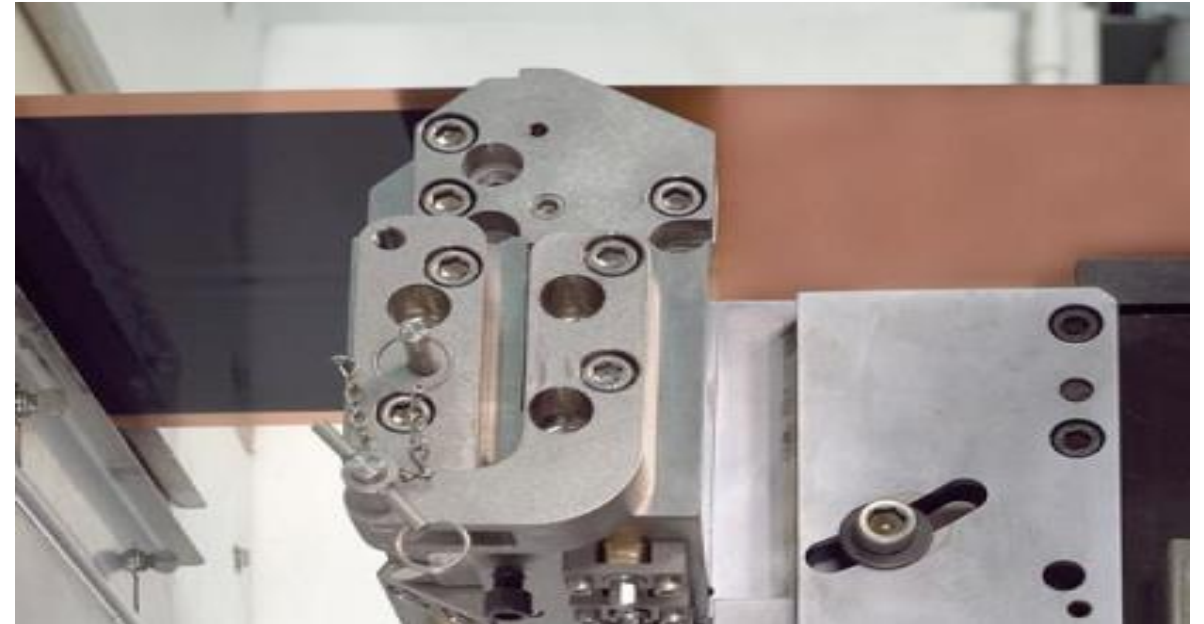
BESCHICHTUNGSTECHNOLOGIE FÜR LI-IONEN ELEKTRODEN

Innovation in LIB – Elektroden Fertigung



Standard Konfiguration:
Schlitzdüse an Beschichtungswalze
Hohe Beschichtungspräzision

Dürr MEGTEC Entwicklung:
Tensioned-Web Schlitzdüsenbeschichtung
um beide Seiten simultan zu beschichten



BESCHICHTUNGSTECHNOLOGIE FÜR LI-IONEN ELEKTRODEN

Heißluftschwebetrockner



Ermöglicht simultan beidseitige Beschichtung in einem Durchlauf

Gleiche Trocknung beider Seiten

Bessere Produktqualität insbesondere bei dicken Beschichtungen

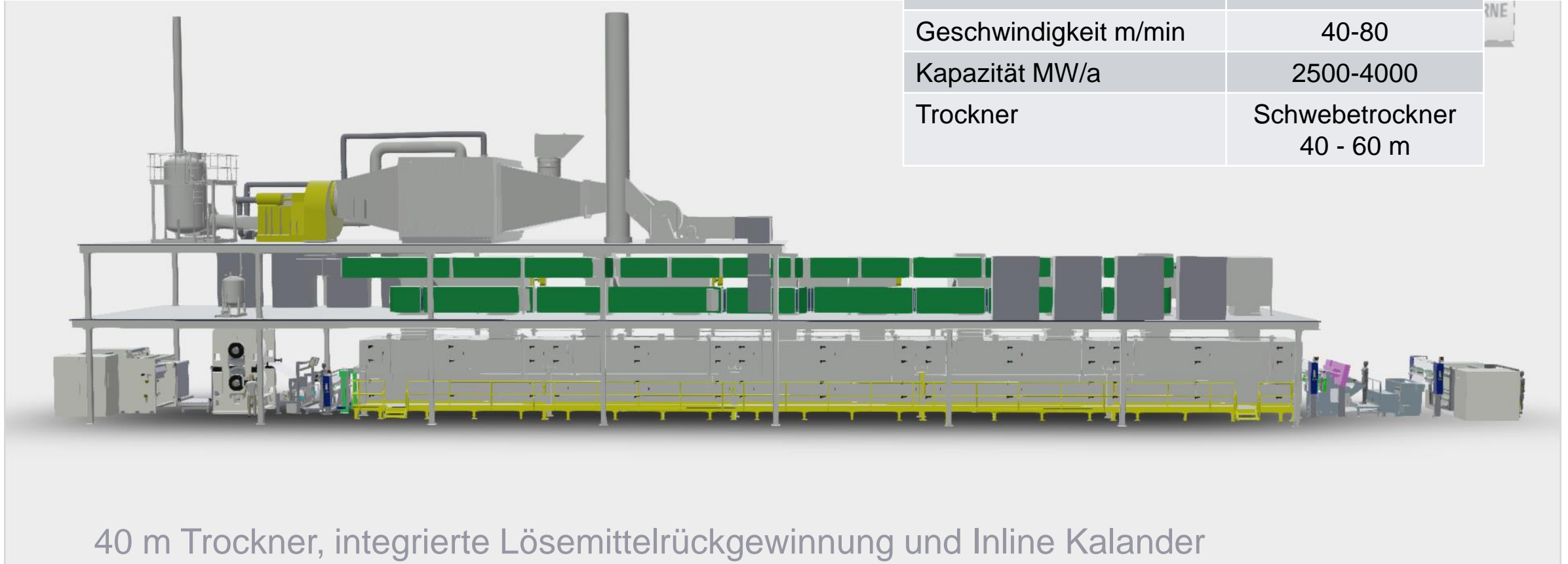
Reduzierte Anlagenkosten– doppelter Durchsatz

MEGTEC hat >10.000 Schwebetrockner seit 1969 für die verschiedensten Anwendungen geliefert (Druck, Papier, Coating, Coil Coating)

GIGACOATER™

Für Massenfertigung in Giga Factories

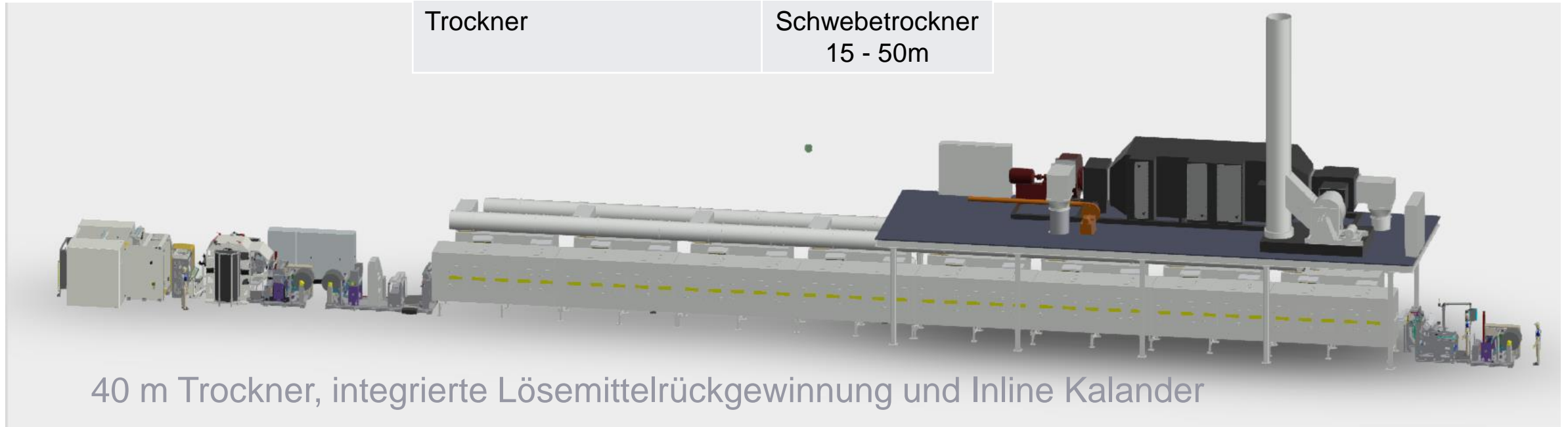
	GigaCoater
Folienbreite mm	1400
Geschwindigkeit m/min	40-80
Kapazität MW/a	2500-4000
Trockner	Schwebetrockner 40 - 60 m



PROCOATER

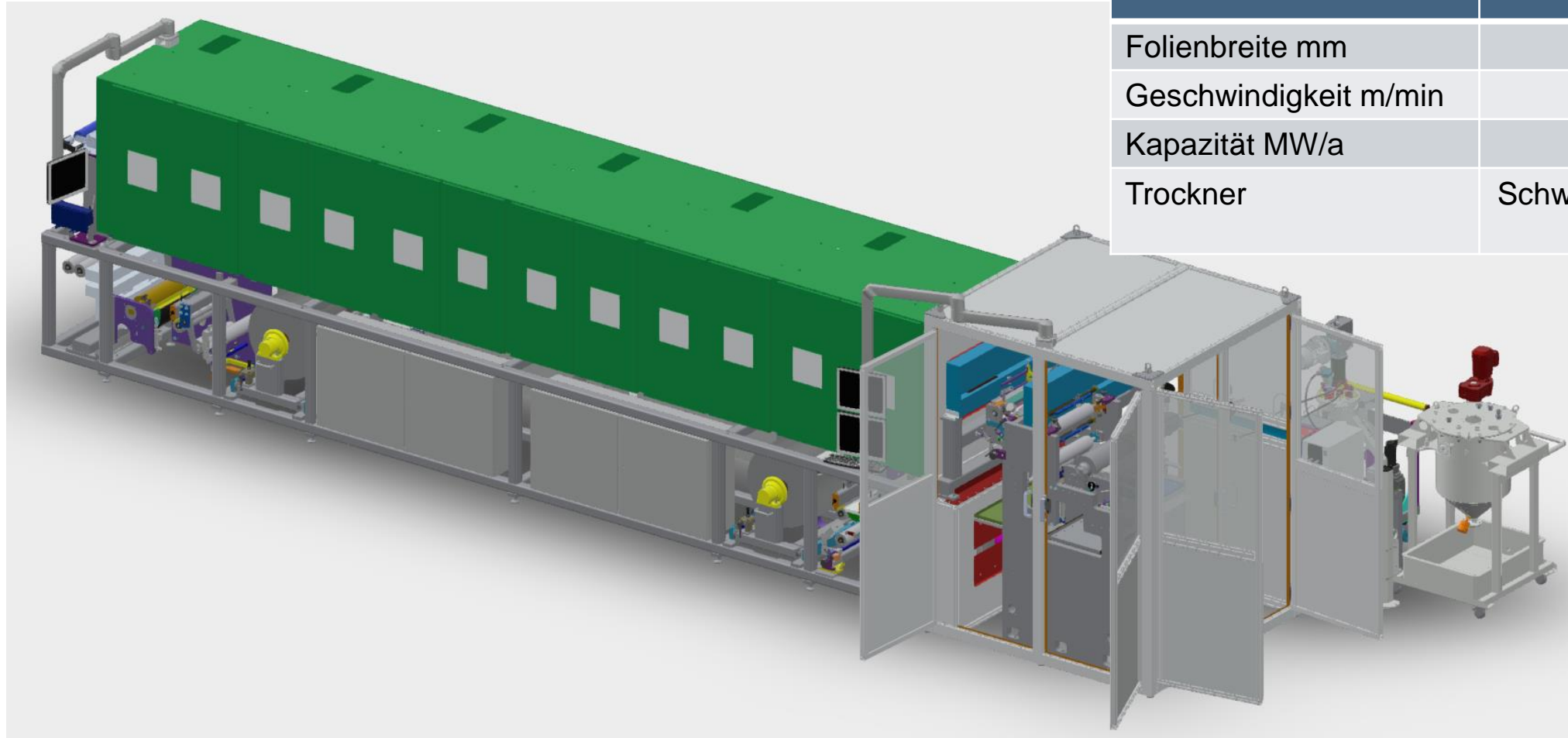
Für Flexible Kleinproduktion bis zur Massenfertigung

	ProCoater
Folienbreite mm	700
Geschwindigkeit m/min	20-80
Kapazität MW/a	500-1000
Trockner	Schwebetrockner 15 - 50m



PILOTCOATER

Für Pilotproduktion und Prozessentwicklung



	PilotCoater
Folienbreite mm	350
Geschwindigkeit m/min	10
Kapazität MW/a	50-100
Trockner	Schwebetrockner 6 m

MATERIAL COST

	PilotCoater	ProCoater	GigaCoater
Dryer	6	40	56m
Coating Speed	7	48	67m/min
Foil Width	350	700	1400mm
Coated Width	320	640	1280mm
Coat Weight Dry Per Side	200	200	200g/m ²
Solid Content in Coating	70%	70%	70%
Coat Weight Wet Per Side	286	286	286g/m ²
Foil Consumption	147	2016	5628m ² /h
Coating Consumption	84	1152	3216kg/h
NMC Consumption	59	806	2251kg/h
NMP Solvent Consumption	25	346	965kg/h
NMC Price	40	40	40€/kg
NMC Cost/hour	2.352	32.256	90.048€/h
NMP Solvent Price	3	3	3€/kg
NMP Cost/h	75,6	1036,8	2894,4€/h

FUNCTION INTEGRATION & DATA TRACKING

Inline calender

- » Opportunity to test different process configuration.
- » The calenders can be designed to operate inline and offline



Inline coat-weight measurement

- » Wet and dry ultrasonic measurement of coatweight traversing or 100%



Optical Inspection

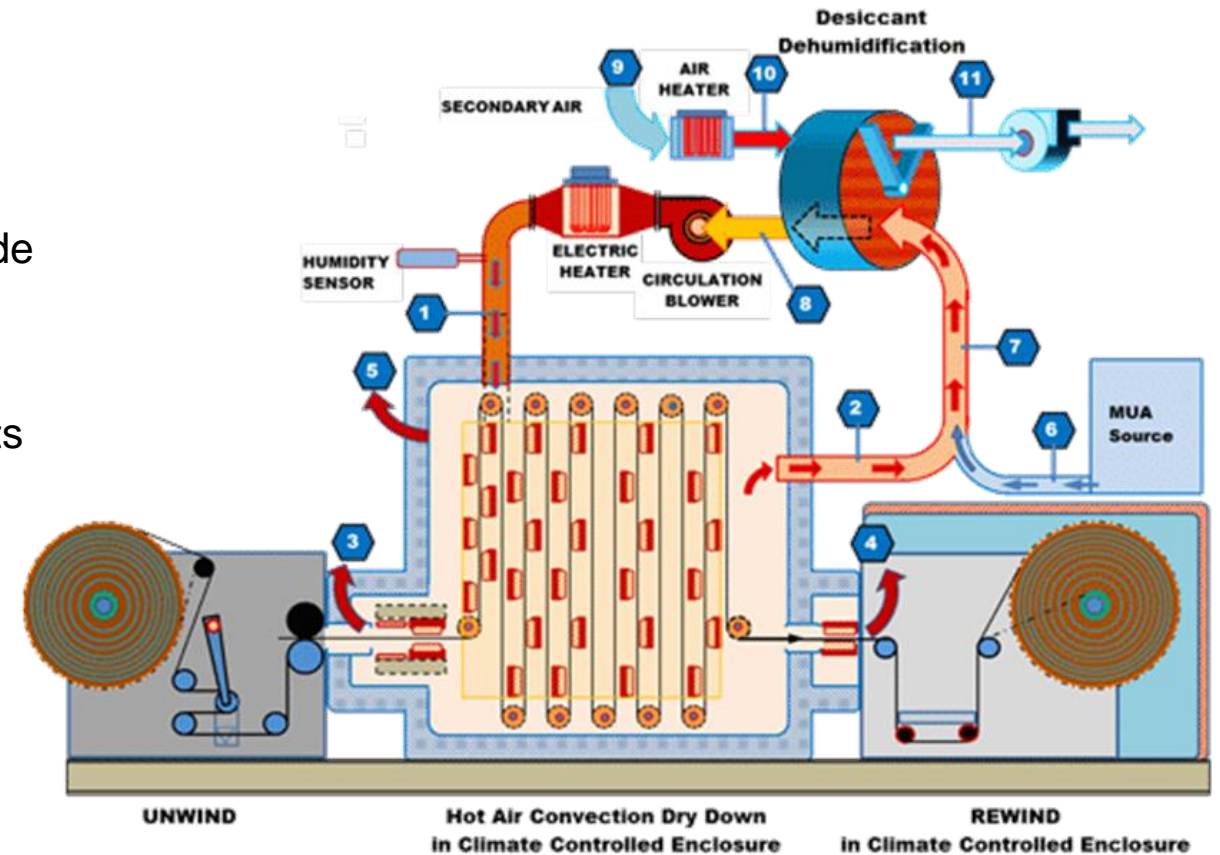
- » 100% inspection of the electrode and alignment control



ROLL-TO-ROLL SECONDARY DRYING

Improved quality and reduced cost

- » Eliminates the bottleneck of vacuum oven drying step
- » Provides higher product consistency and quality
- » Can be stand-alone or integrated inline
- » Can be designed to match the line speed of other electrode unit operations
- » Can be tailored to specific chemistry
- » Custom engineered to facility and application requirements
- » Dürr MEGTEC will introduce in 2019

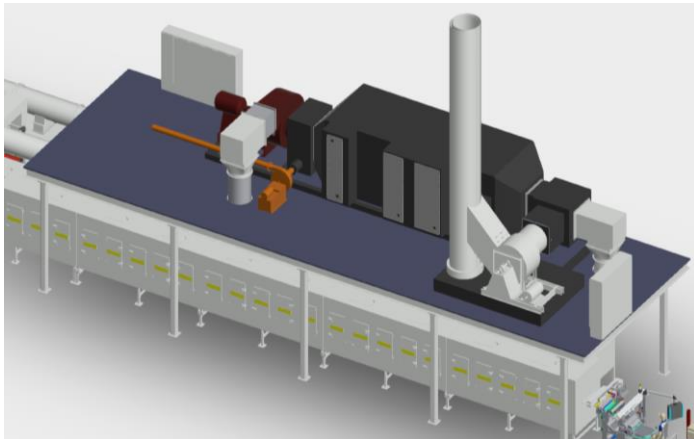


PRODUCT RANGE

Recover NMP and clean exhaust air



Condenser



Condenser above dryer



Carbon bed

Dürr MEGTEC developed a multi stages solution with lowest OPEX and CAPEX

- » Stage 1: Condenser < 50-150 ppm recover most of the solvent by condensation
- » Stage 2: Exhaust air cleaning by Carbon filter < 2 mg/Nm³ lowest emission to meet strictest regulations
- » Recovery of NMP > 99.9%
- » Refining and Reuse on site in next process step available

PRODUCT RANGE

Closed-loop reuse of NMP in production scale

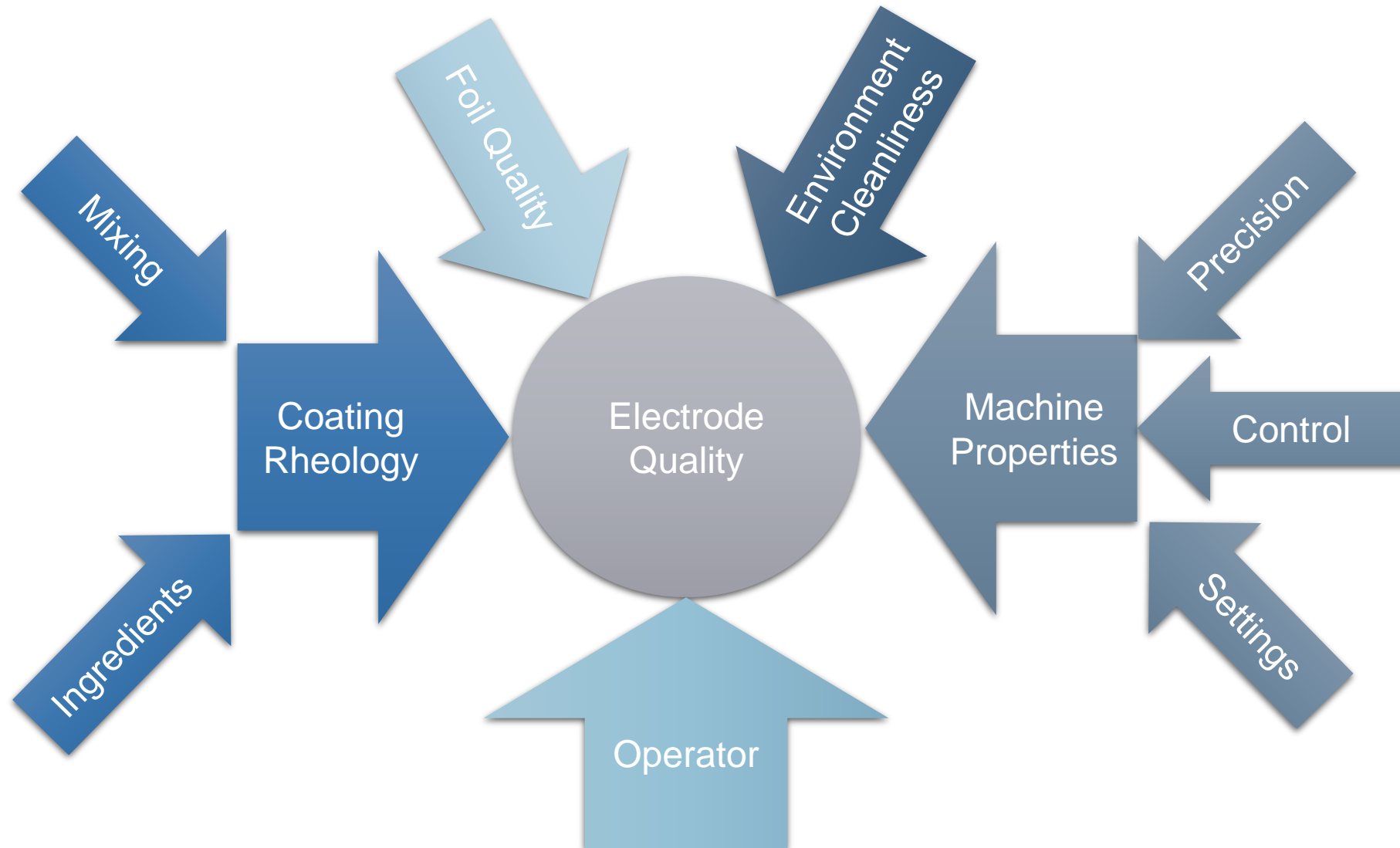
- » Distillation onsite
- » Achievable quality is “electronic/battery grade”
- » High reuse rate
- » Payback typically < 1 year
- » Connection of tank system to mixer plant



NMP SOLVENT RECYCLING

	ProCoater	GigaCoater	
Coating Lines	8	8	
NMP recovery rate	99%	99%	
Production hours/day	20	20 hours	
NMP Solvent recovered	54,7	152,8m ³ /day	
Autonomy	3	3 days	
Storage Volume	164,2	458,5m ³	
Tank Size	70	70m ³	
Number of tanks recovered	2,3	6,5	
Refining rate	95%	95%	
Number of tanks refined	2,2	6,2	
Total storage tanks	6	14	
Fresh NMP tanks	1	1	
Bottoms tanks	1	1	
Waste water tanks	1	1-2	

QUALITY: MULTIPLE IMPACT FACTORS



ALL factors must be aligned to achieve optimal performance!

WAS IST WICHTIG?

- » Beste Beschichtungstechnologie
- » Qualität von Folie und Coating
- » Richtige Größe des/der Beschichter
- » Entscheidung für oder gegen Integration von Prozessschritten
- » Keine Kompromisse beim Umweltschutz
- » Gut ausgebildete Bediener

Andy Keil, Director Business Development, Dürr MEGTEC LLC

Address: MEGTEC Systems SAS
32, rue des Malines
91090 Lisses, France

Phone: +49 (0) 89 35 65 47 18

Email: Andreas.keil@megtec.fr

Web: www.megtec.com

THANK YOU

“Subject to change. The information in this presentation contains only general descriptions or performance characteristics, which may vary in different cases. The requested performance characteristics are only binding if they are expressly agreed in the contract.”