



Lake State TAPPI

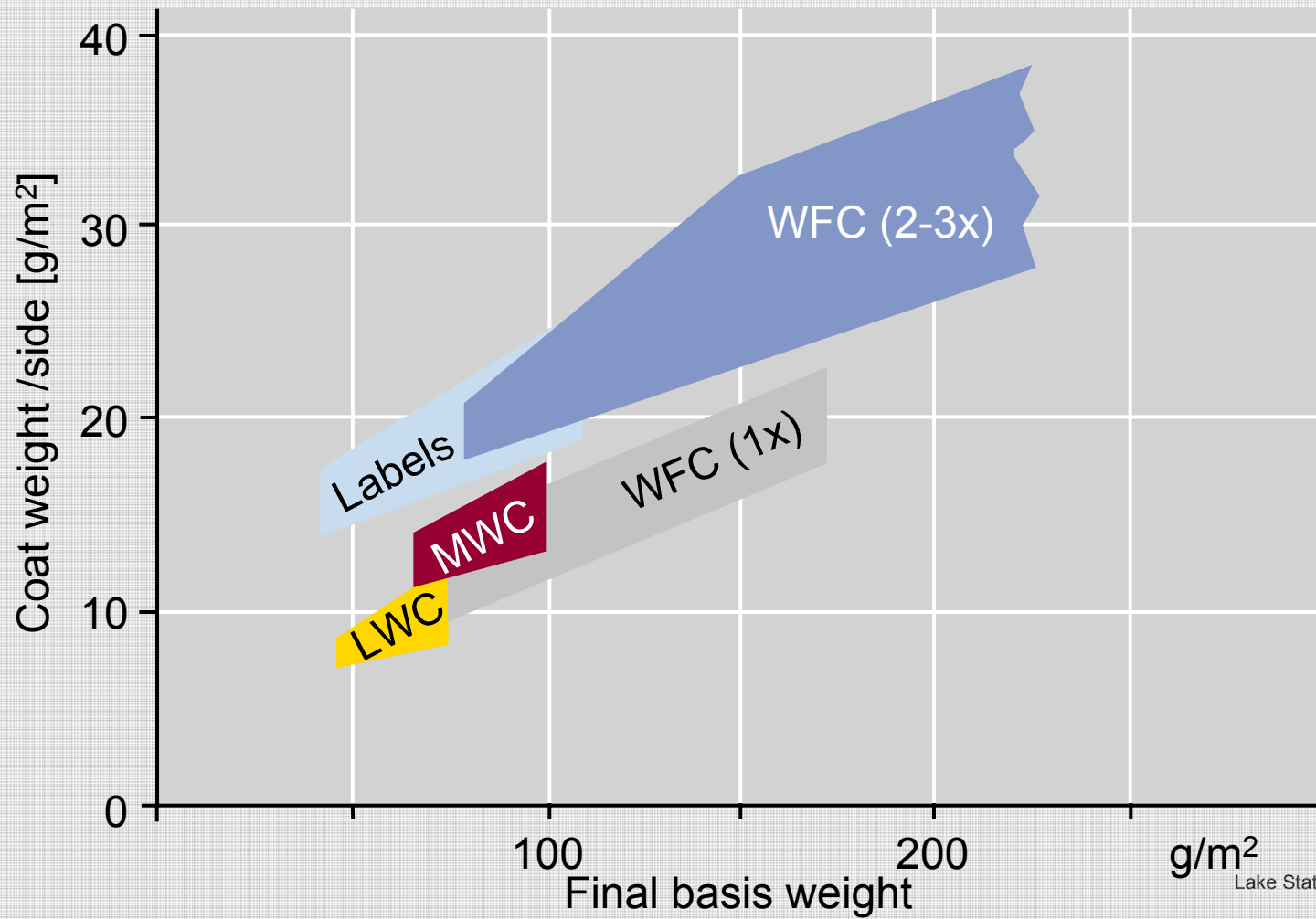
New Coating Concepts and their Potential for Efficient Production

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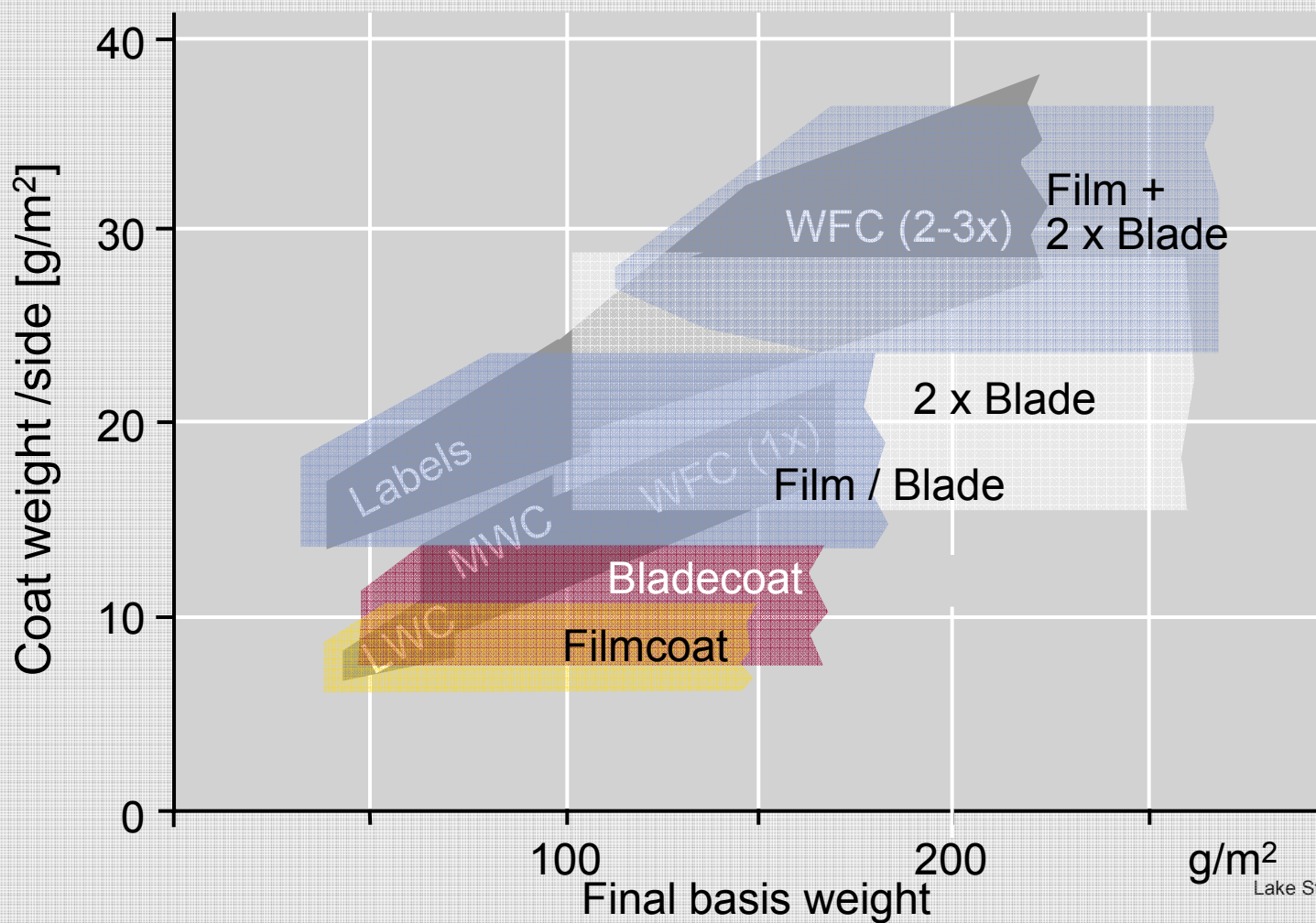
New coating concepts and their potential for efficient production

- 1.** Paper grades and typical machine concepts.
- 2.** Performance of today's production lines.
- 3.** Which alternative concepts are available?
- 4.** Two examples for alternative concepts.
- 5.** Energy efficient drying concepts

Overview of coated paper grades

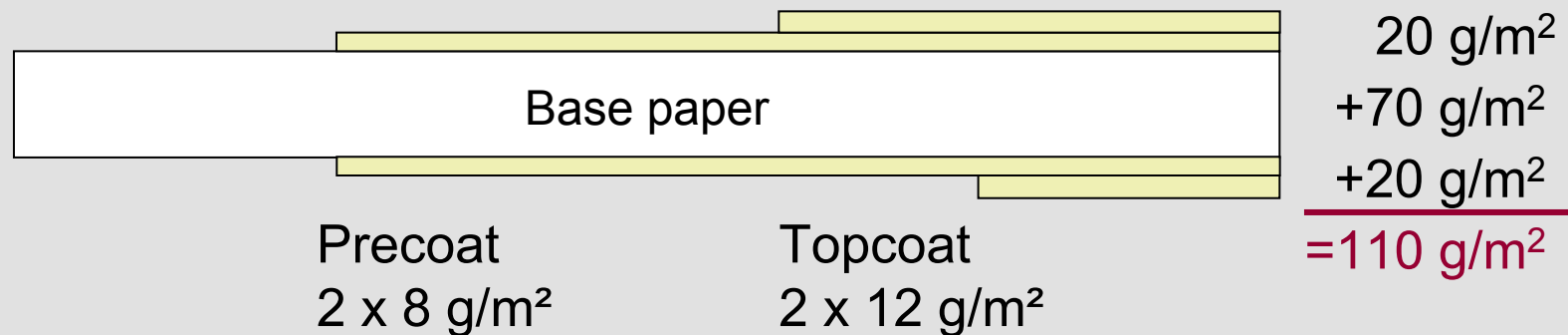


Typical machine concepts for coated paper



Performance of today's production lines

Example WFC 80 -128 g/m²



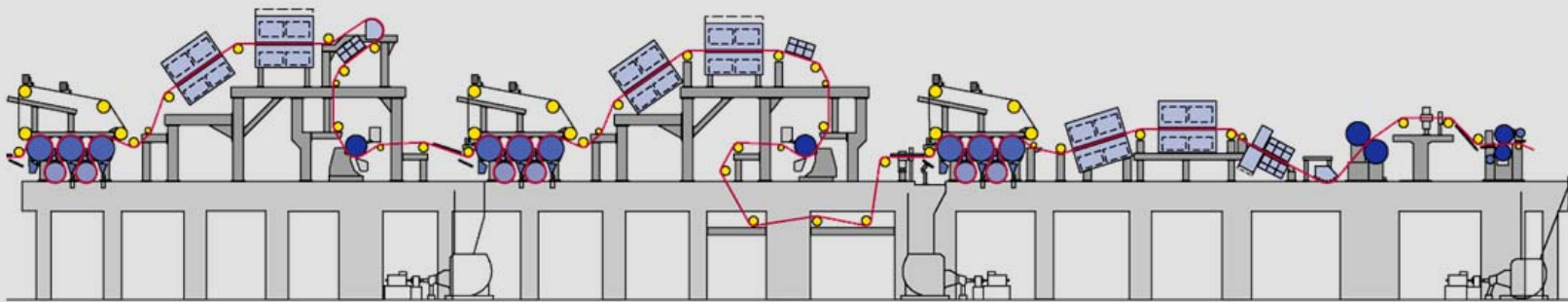
"Classic" concept: Film - Precoat + Blade - Topcoat
 (6-10 g/m²) (9-14 g/m²)

Performance of today's production lines

Example: WFC 80-128 g/m²

Top coat

Pre coat

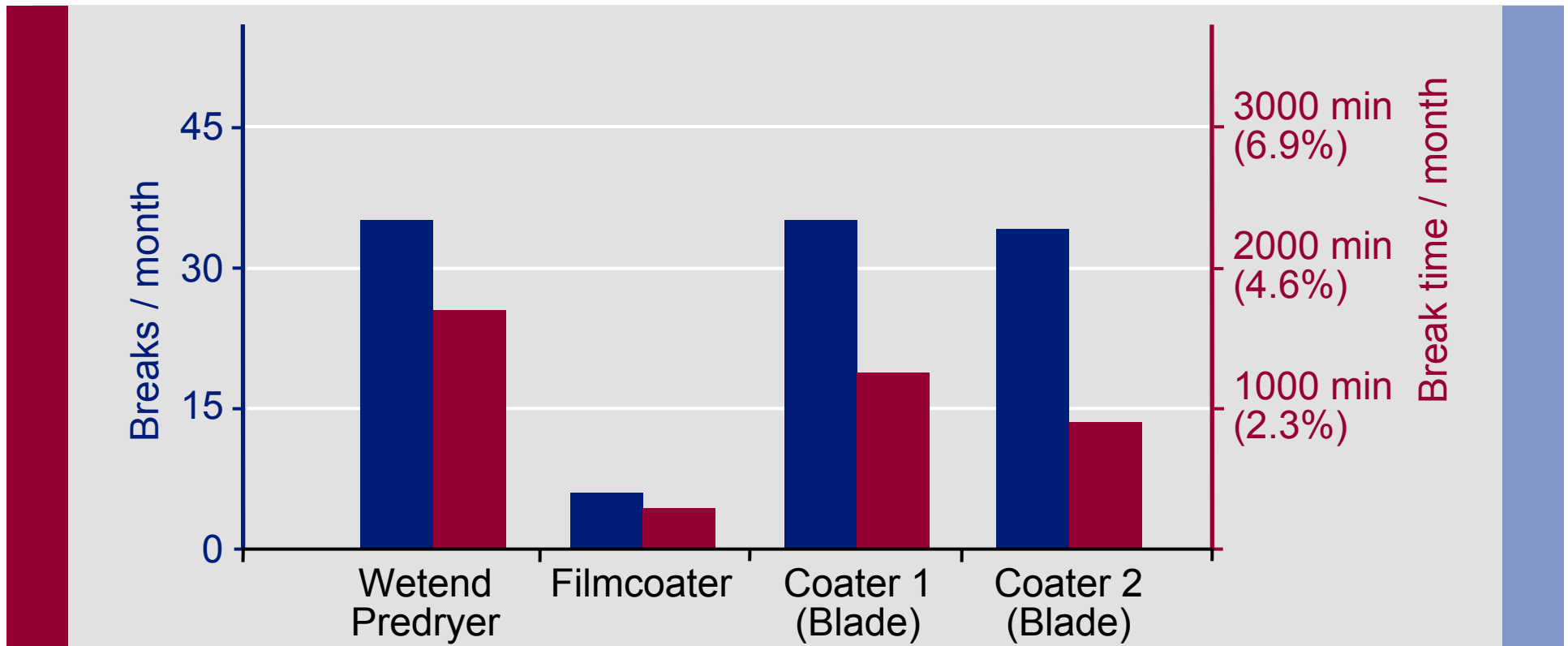


Startup = May 2005

Web width = 9770 mm

$V_{\max.}$ Prod. = 1770 m/min (Oct 2008)

Performance of today's production lines month x / 2006, Film/Blade concept



Alternative concepts: What is required for more efficient machine concepts ?

- Reduced investment
- Increased line efficiency
- Reduced operating costs
- Standard quality

Less coating stations for the same product

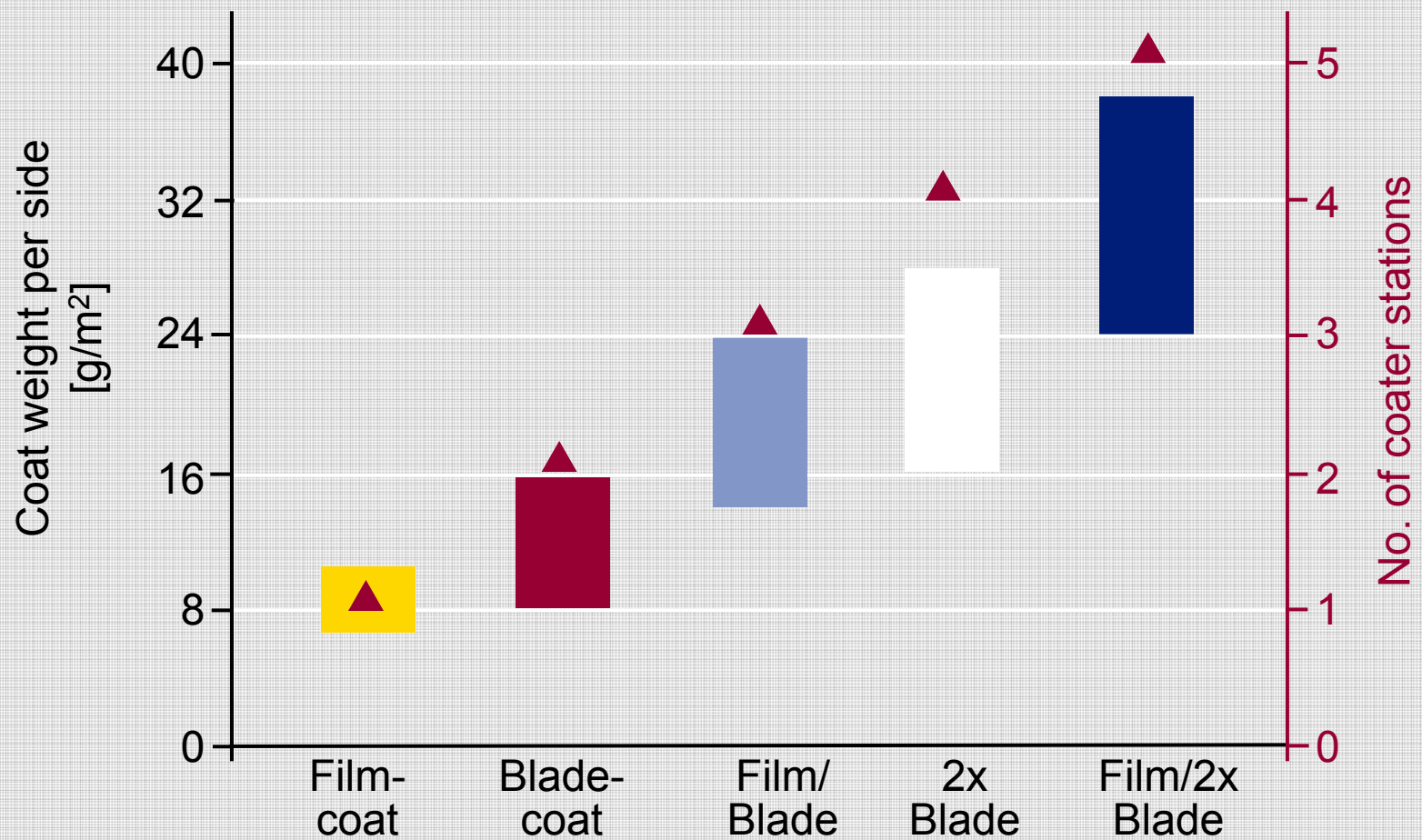
Example: LWC (50 - 70 g/m²) offset

2 Blade coaters 1990



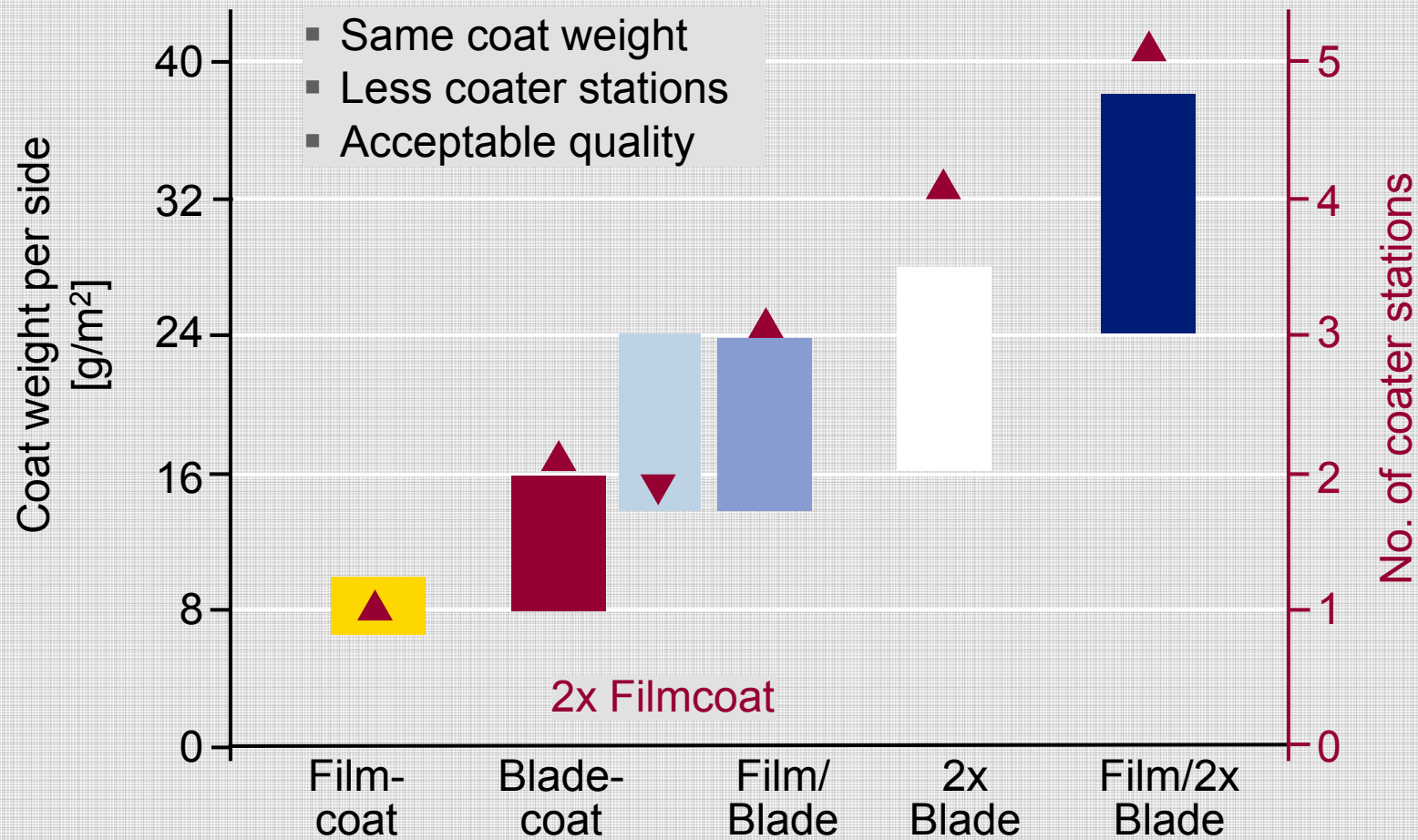
1 Filmcoater 2000

Typical machine concepts: Coat weight vs no. of coater stations



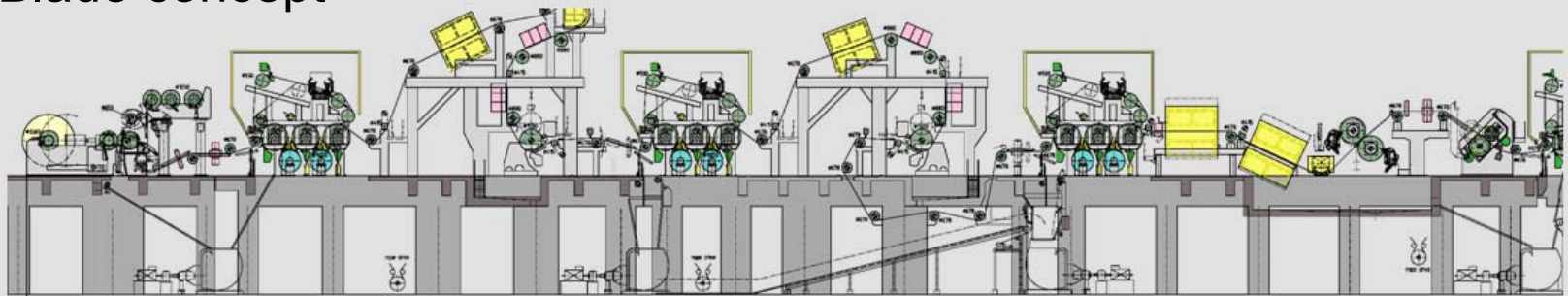
Alternative concepts: 2x Filmcoat

Coat weight vs no. of coater stations

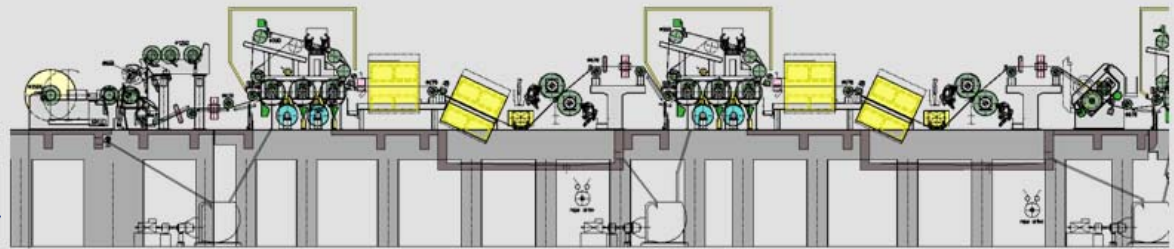


2x Filmcoat vs. "classic" Film/Blade concept. Comparison 70-100 g/m² MWC, Layout speed = 1800 m/min

Film/Blade concept



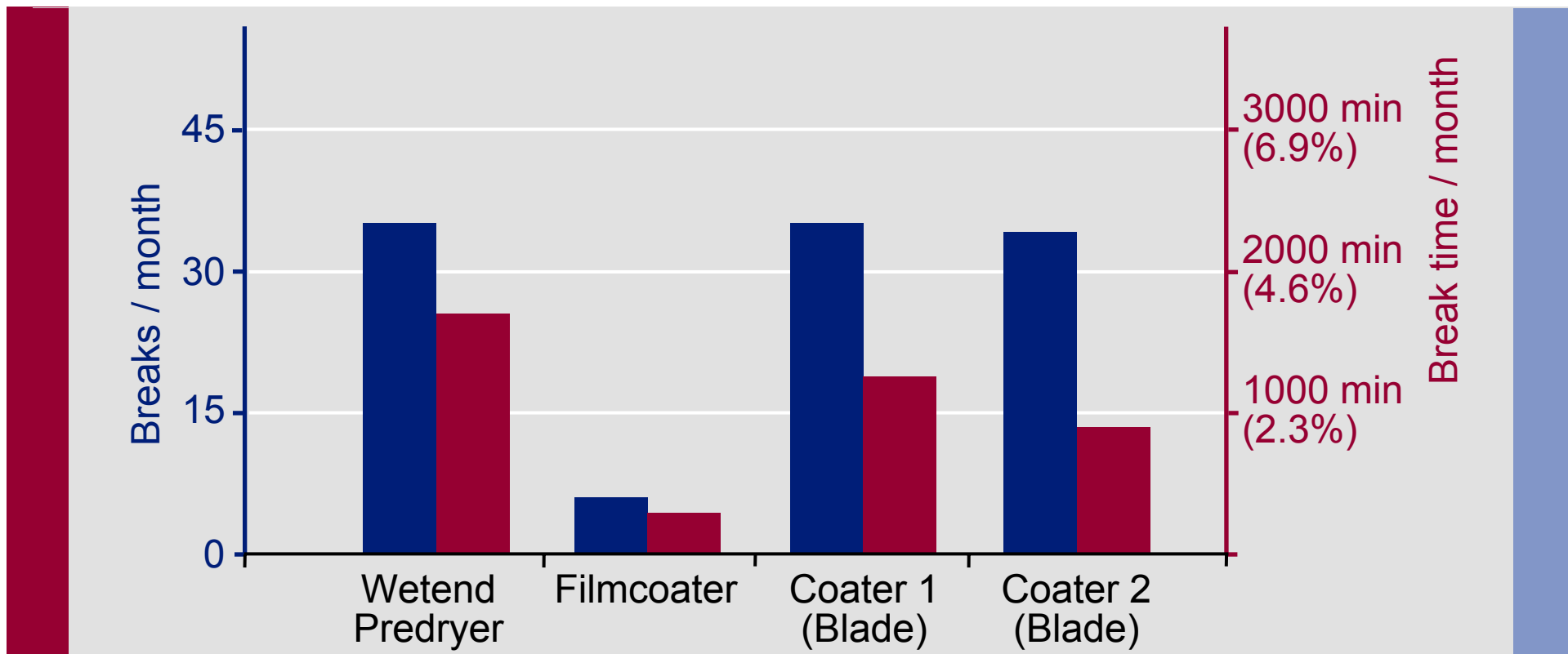
Film/Film concept



Length ~ 25 m less

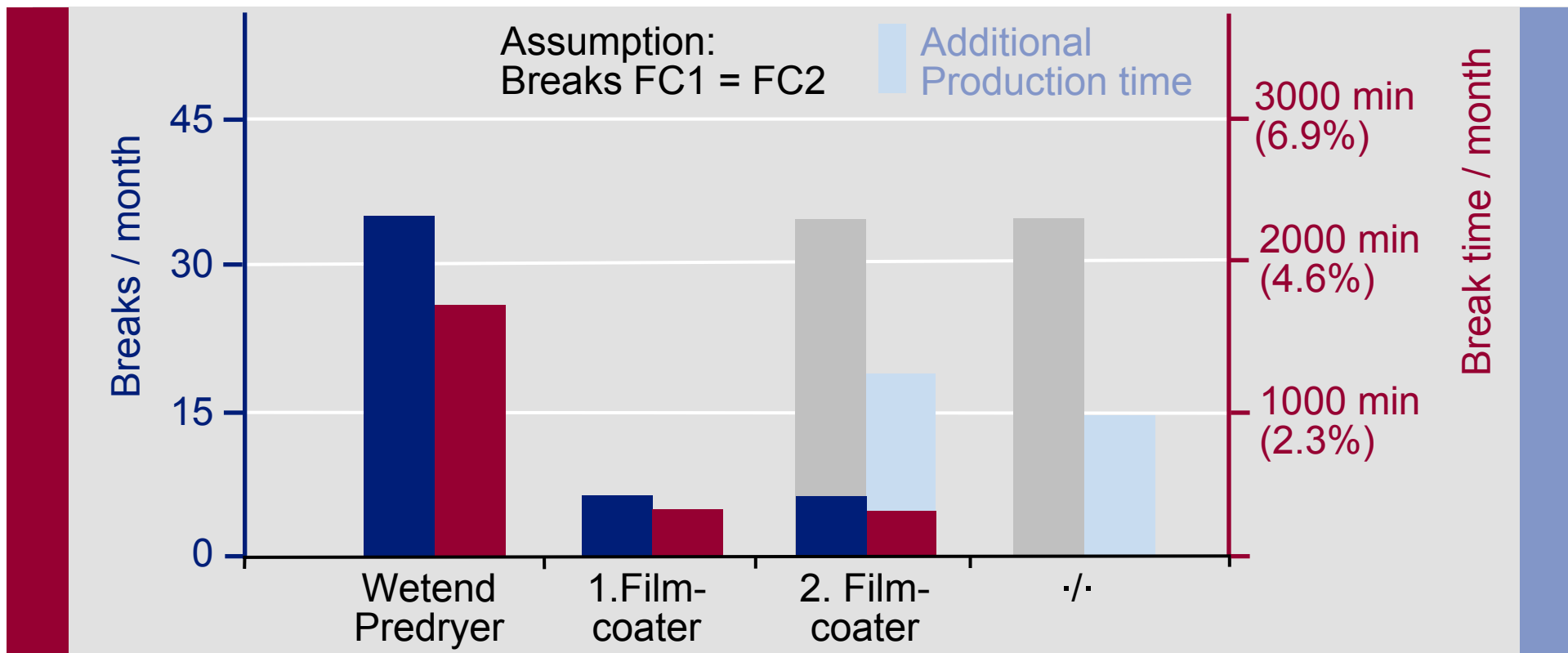
Eff. ~ 4 % greater

Performance of today's production lines month x / 2006, Film/Blade concept



Efficiency improvement

2x Filmcoat vs. "classic" Film/Blade concept

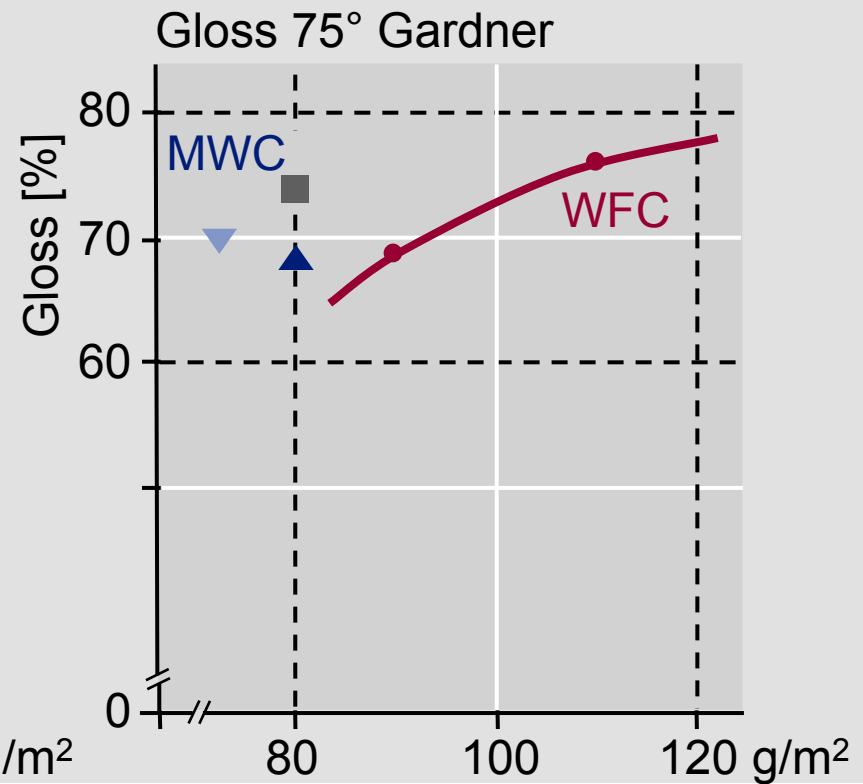
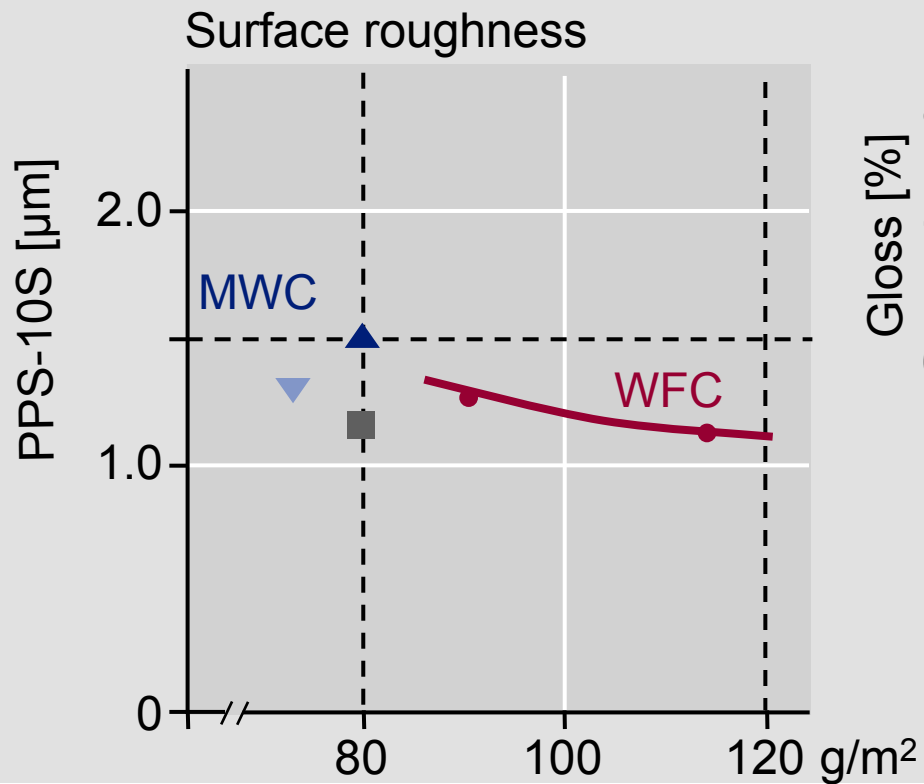


2x Filmcoat vs. "classic" Film/Blade concept

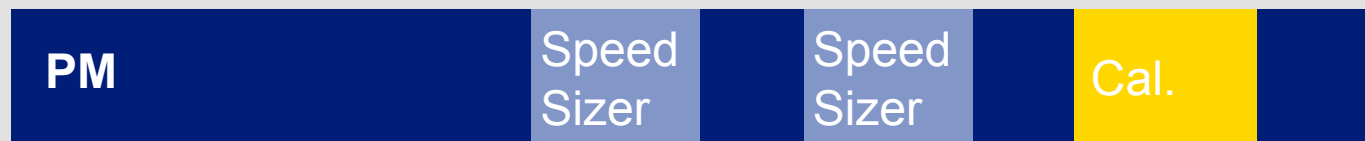
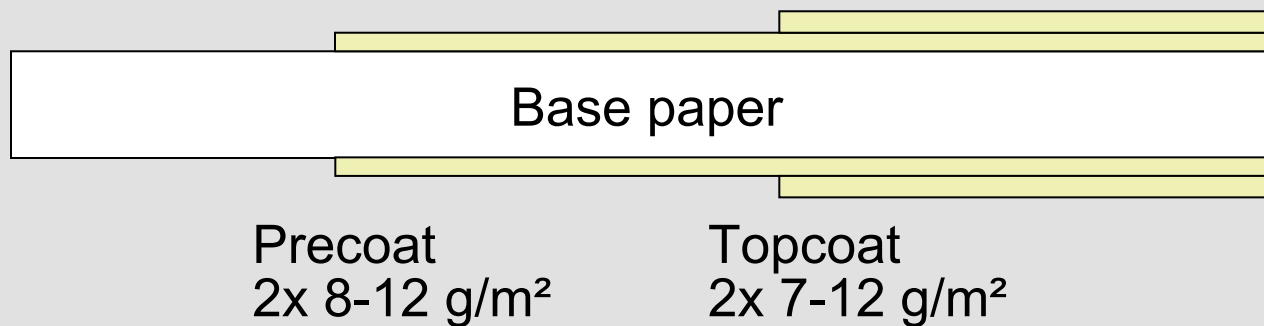
Time efficiency and additional production

	Film /Blade	2 x Filmcoat	Δ Performance
Speed	constant	constant	constant
Breaks/ day @ coater	2.5	0.4	- 2.1 break/ day
Lost time/ day	82'	20'	- 62 min/ day
η / month	83.3%	87.6%	+4.3%
tons / day	100%	105%	+5%
	Data from "live" - example	Incl. worst case assumptions	

Quality potential for 2 x Filmcoat 80 - 120 g/m² (pilot trial results)



Alternative machine concept Film/Film for basis weights between 80 – 120 g/m²



Total coat weight: 15 - 24 g/m² per side

Summary 2 x Filmcoat vs. Film / Blade concept

- Less equipment (2 stations vs. 3), reduced investment
- Higher efficiency due to elimination of blades
- Higher efficiency due to less machine sections (threading)
- Gloss and printability equal to blade coat
- Surface roughness limited in certain cases (base sheet, calender)



Alternative coating concepts

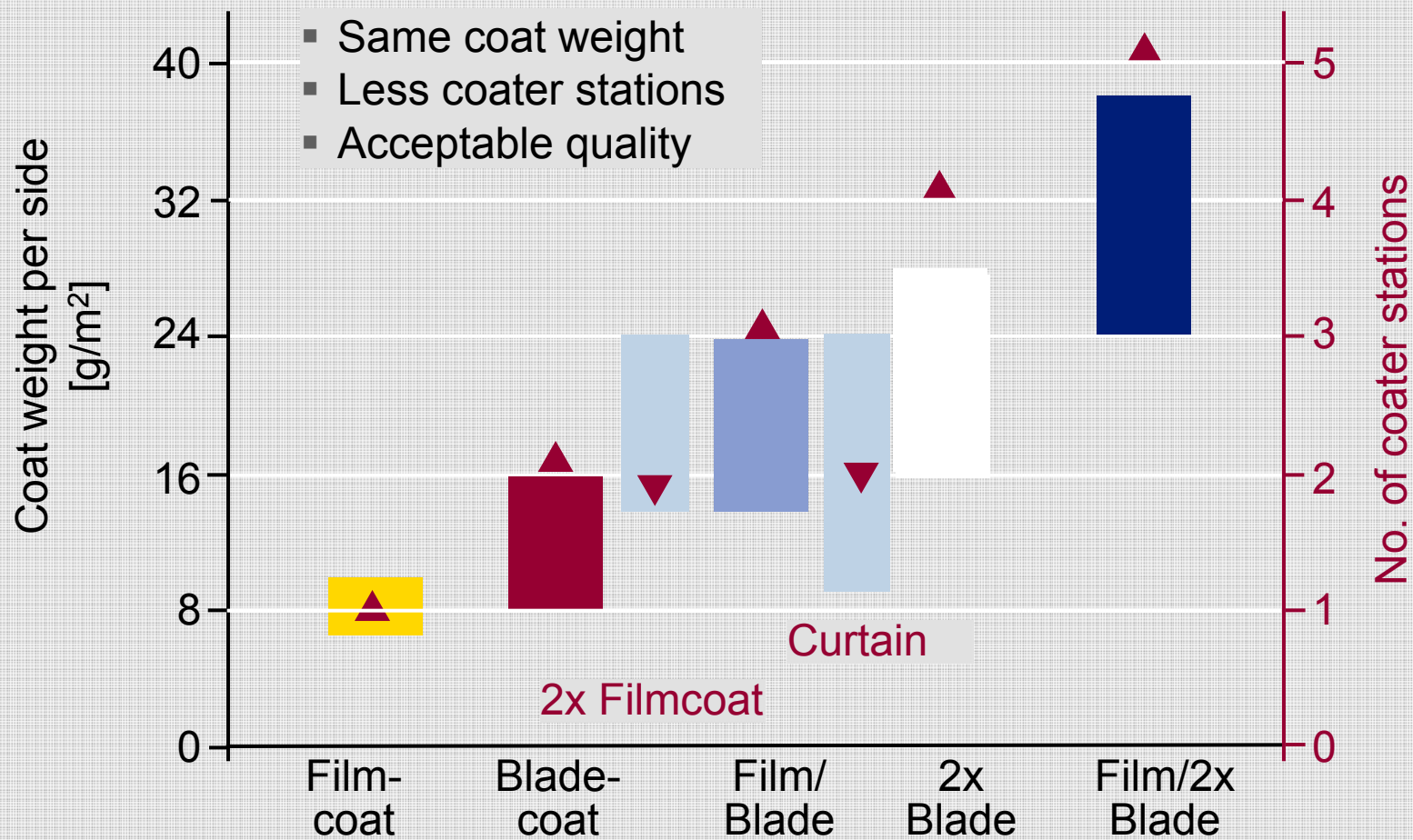
Combination of existing techniques
➔ 2 x Filmcoat

- Standard market quality with optimization of base sheet surface and coating formulation
- Increased efficiency

New techniques
➔ Contactless / Curtain Coating

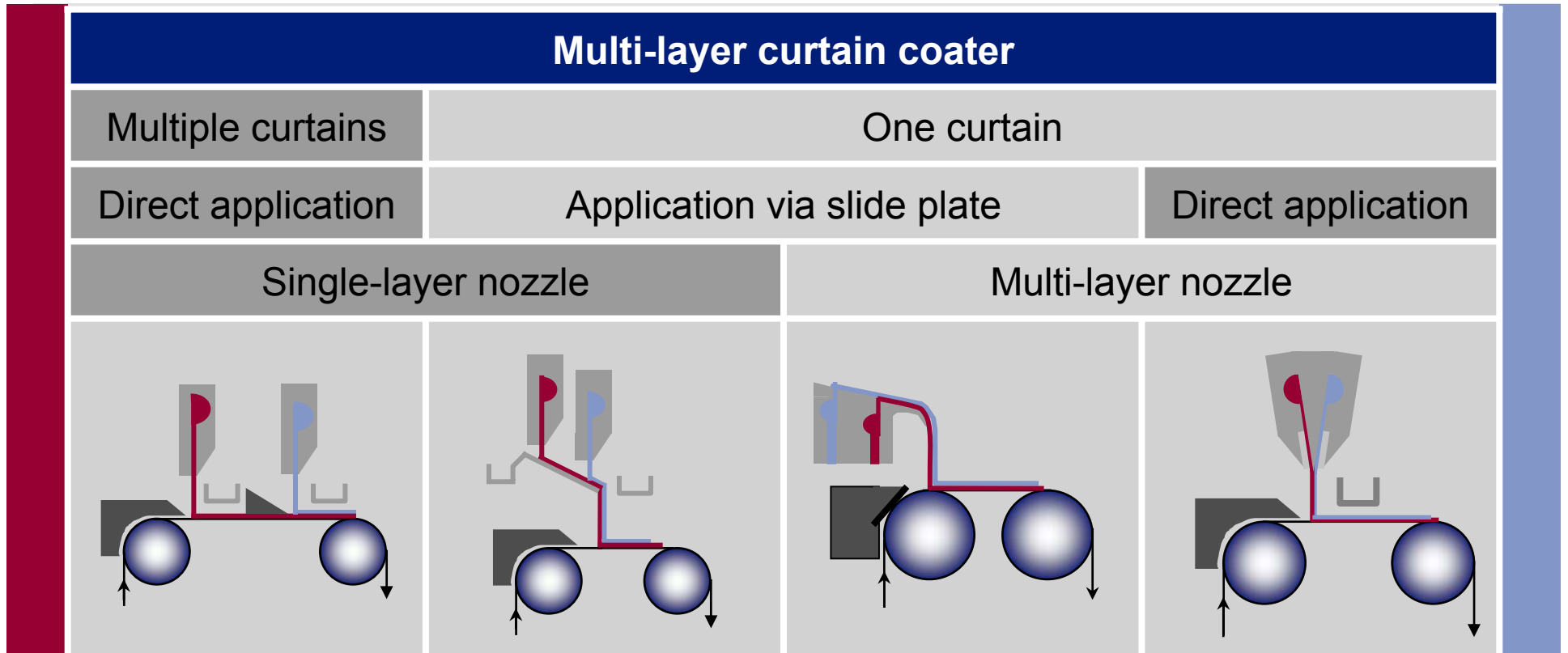
- In competition to existing techniques
- Best suitable for
 - high coat weights ($\geq 20 \text{ g/m}^2$)
 - high surface quality

Alternative concepts: 2x Filmcoat and Curtain Coater

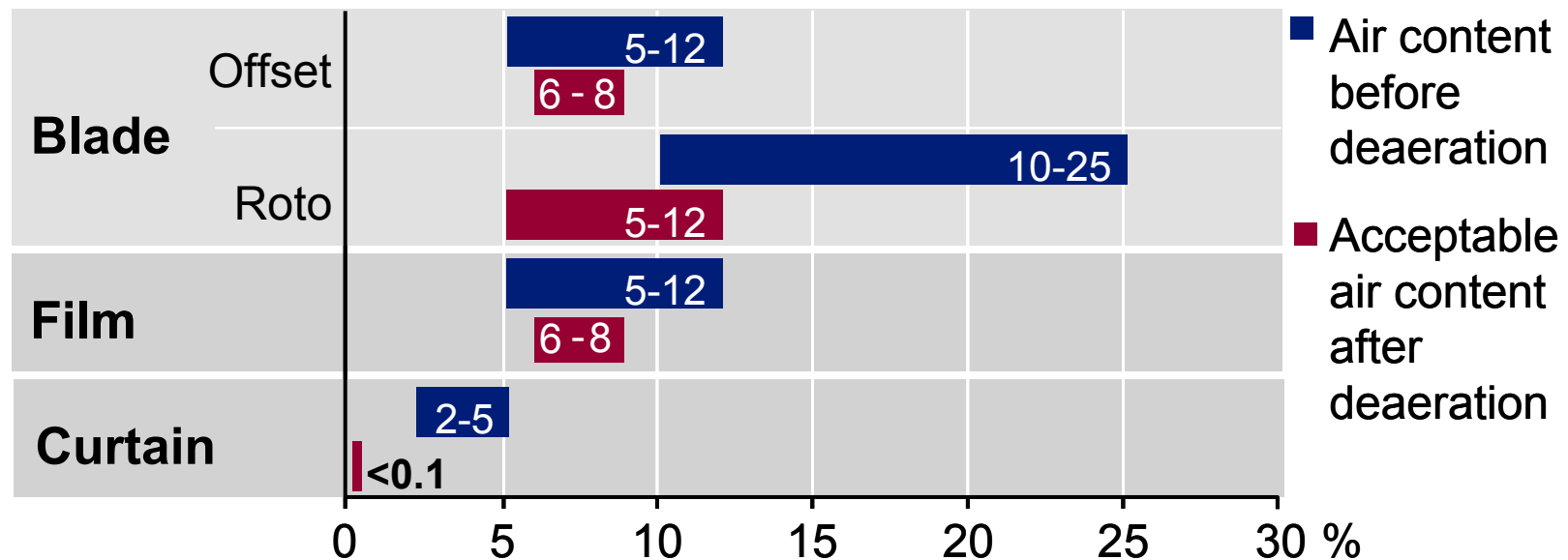


Multi-layer Curtain Coating

Different concepts



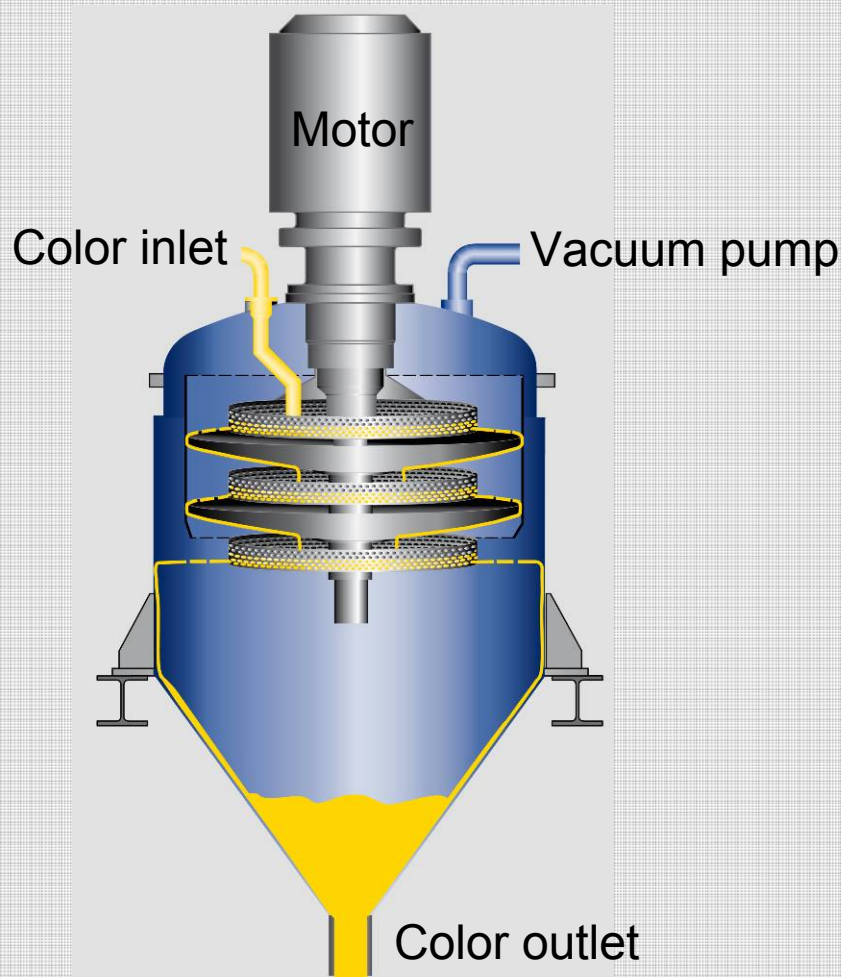
Typical air content Comparison Blade, Film and Curtain



- ➔ Only very low air contents are acceptable in curtain coating
- ➔ Voith has developed its own vacuum deaeration device (rotating disk type), due to quality & capacity requirements

AirEx AT-V

Vacuum deaerator for Curtain Coaters



Cascade principle:

3 x more surface at similar
outer dimensions compared
to competition

Summary: Potential of Curtain Coater and preferred application range

Comparison with Film- or Blade coating

- Higher coat weights without operational problems
- Optimum coverage
- Higher efficiency
- Surface roughness depending on base sheet

Preferred range of application

- “Heavy weights”, high surface quality (WFC, Labels, Board)
- Solids cont. & viscosity: No limitations
- < 500 m/min certain limits
>1500 m/min with Rheology adjustments

Outlook: For which paper grades are alternative concepts a realistic option?

LWC (coated mechanical), $\leq 70\text{g/m}^2$	Filmcoater already most economic solution
MWC (coated mech.) 70-100 g/m ² Light weight woodfree, 80-120 g/m ²	2x Filmcoat more economic than Bladecoat
Heavy weight woodfree, 135-250 g/m ²	Curtain Coater attractive. Replacing one Blade, higher coat weight
Labels & Flex. Packaging:	Curtain Coater very attractive, Potential for efficiency & quality
Coated Board:	Curtain Coater has high potential for replacement of airknife coaters



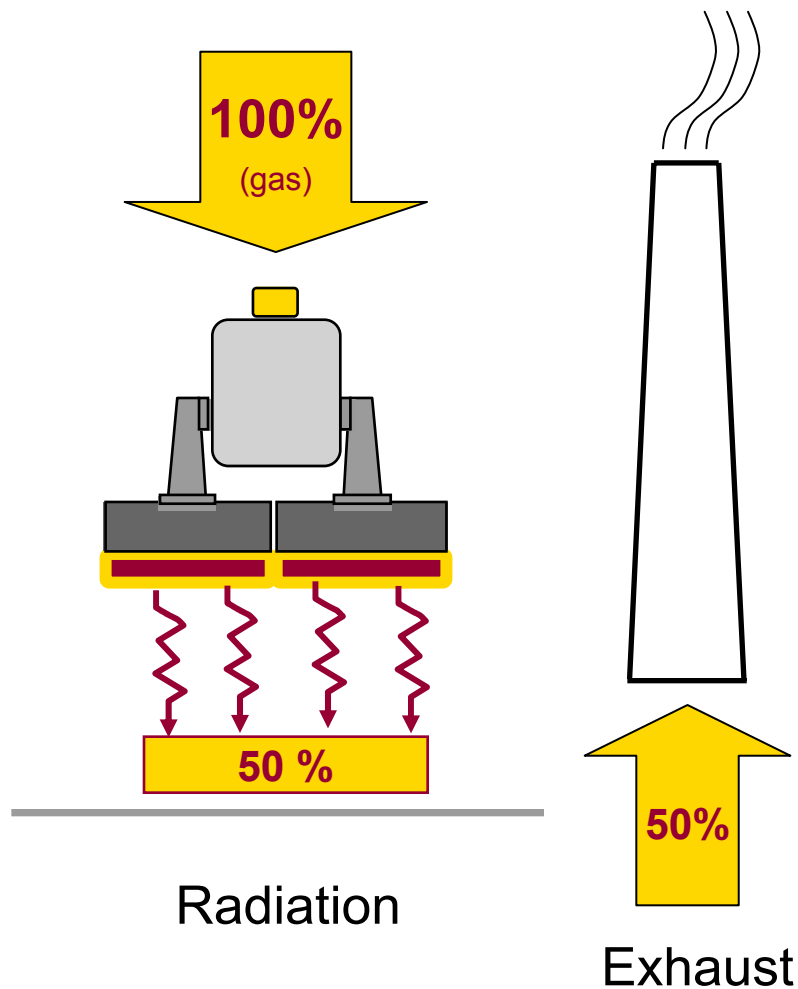
Energy Efficient Drying Concepts



Available drying methods for coated paper

	Operating cost	Remarks
Electric IR	Very high	Profiling ++
Gas fired IR	High	Profiling +
Air flotation drying	Medium	Gas or steam heated
Dryer cans	Low	Not suitable directly after coater

Efficiency of standard IR systems



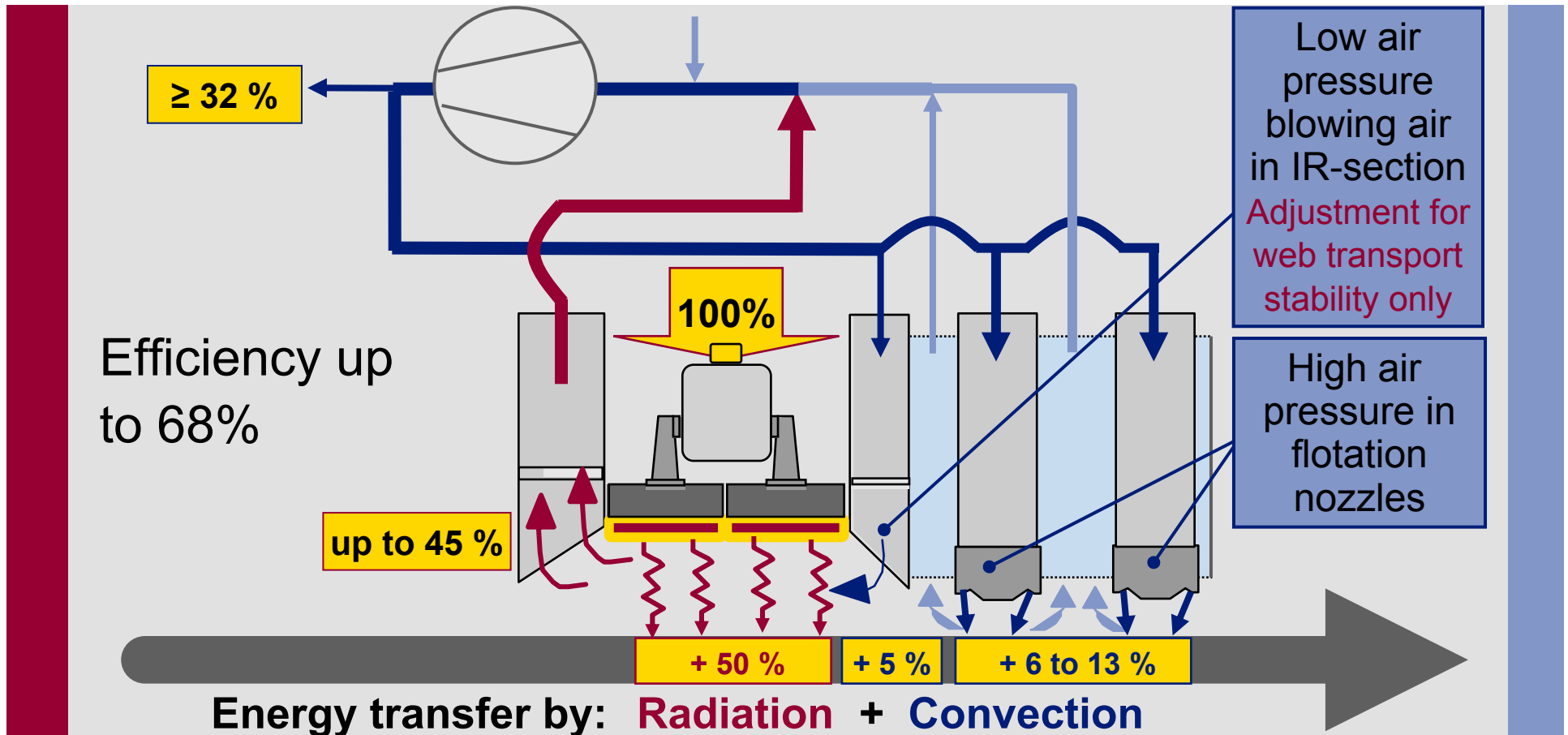
Infrared systems with simple exhaust air systems reach thermal efficiencies (by radiation only) of **max. 48-50%**, provided a suitable emitter type is installed.

→ 50 % of the energy is lost

➔ What can be done?

IntegratedDryer

Improved efficiency by reusing IR exhaust gases



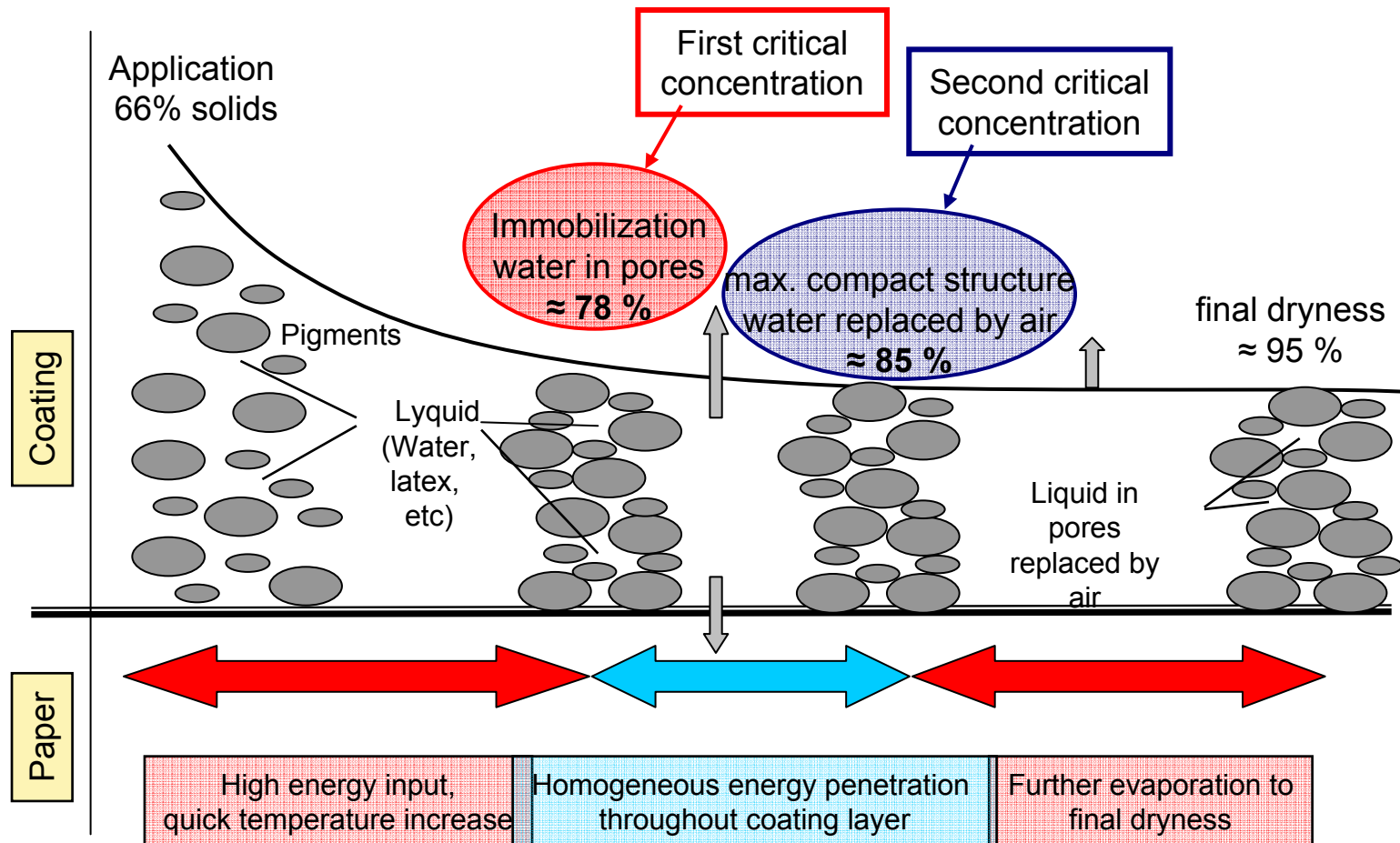
IntegratedDryer – Additional benefits

Reduction of risk of mottling

- 15% moisture level or lower required to restrict movement in coating layer
- Curing temperature of binder (approx. 72°C to 75°C) needs to be reached quickly
- Almost all current WFC installations globally (regardless of equipment supplier) rely heavily on IR for drying due to quality requirements
- Typical process guideline for drying capacity process would be 40% IR, 40% air drying, 20% cylinder drying

Integrated Dryer – Additional benefits

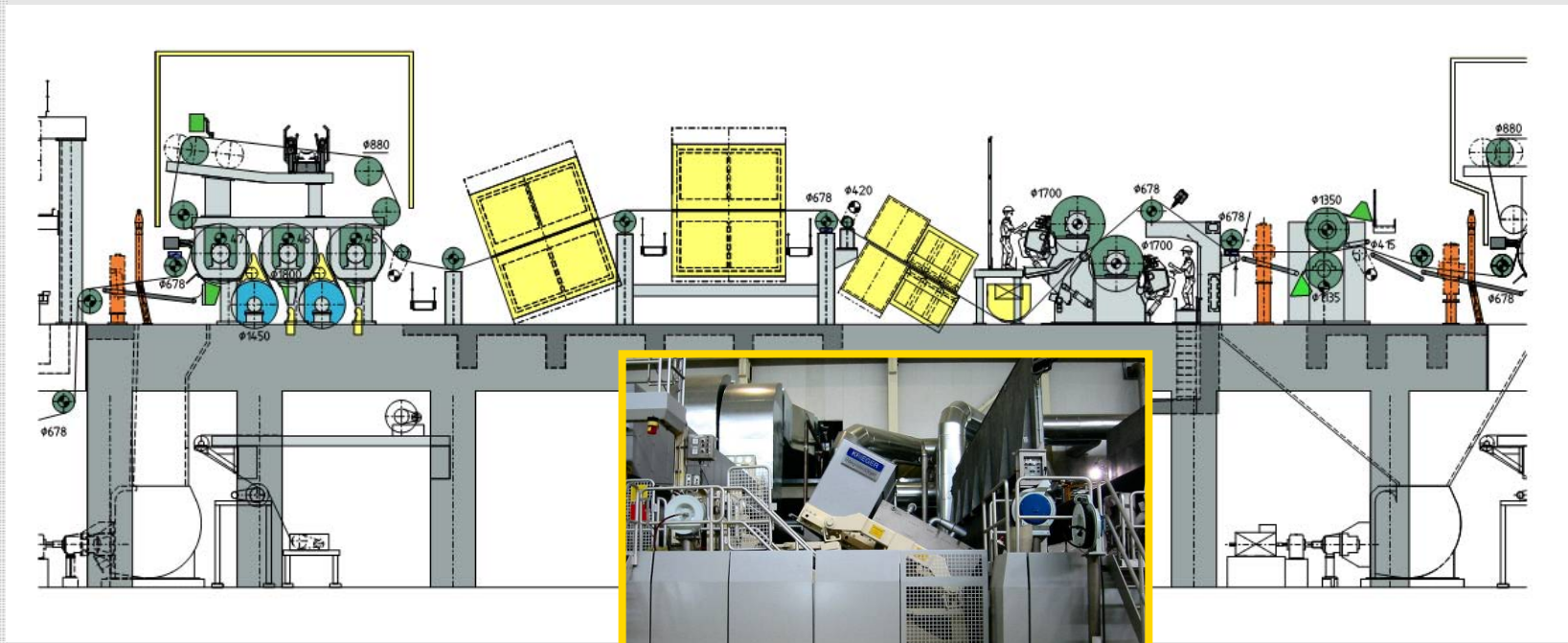
Reduction of risk of mottling



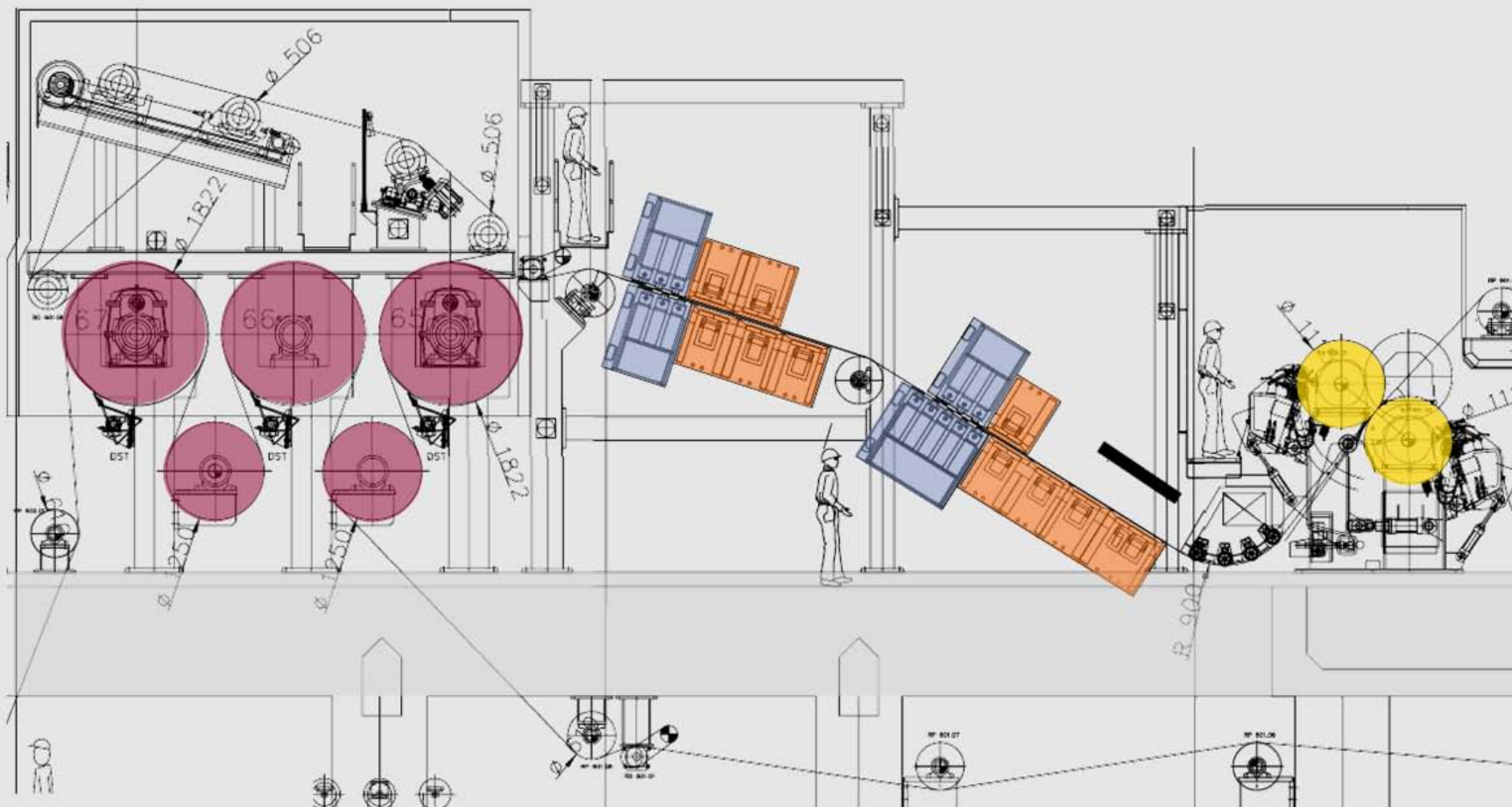
Integrated Dryer Dagang PM3

	Machine speed m/min	Web width in mm	Paper grades	Basis weights g/m ²	Start up
APP Gold East Paper (Jiangsu) PM 3 (PRC)	1650-1800	9770	woodfree coated	55-128	05-03

Pre-Coat



Integrated Dryer Klabin BM9





VOITH
Engineered reliability.