SMS group Latest Development in its Thin Slab Technology

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Today’s and future requirements on successful steel plants

Environmental compatibility
Reduction of emissions
Sustainability

Demanding products
Advanced steel grades
Challenging dimensions

Digitalization
Quality, Asset Monitoring, Availability and Continuous Improvement

Market competitiveness
Efficiency, flexibility and promptness

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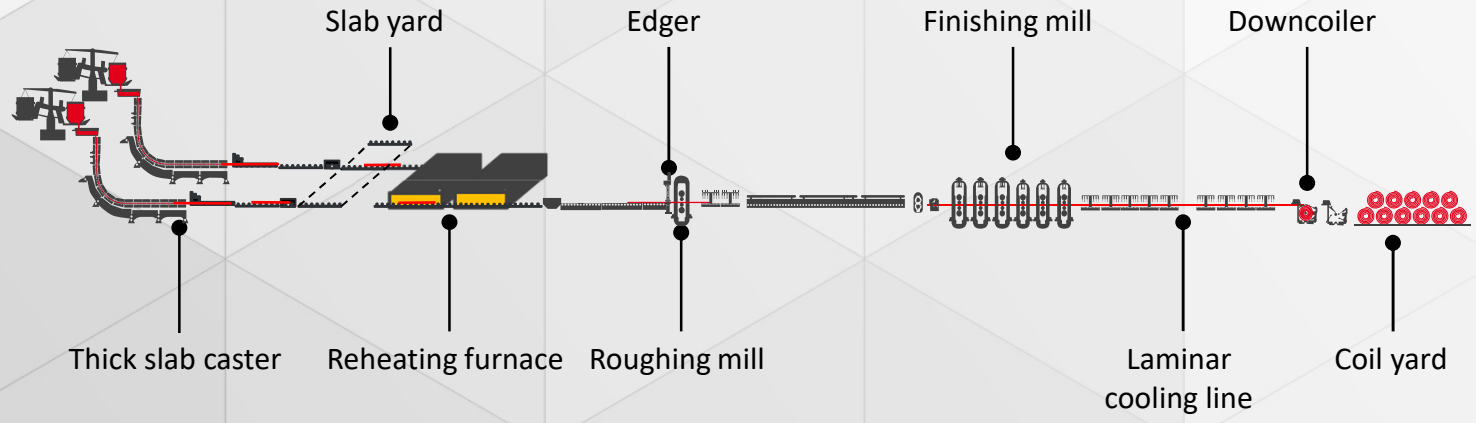
Flat strip production plants

Conventional

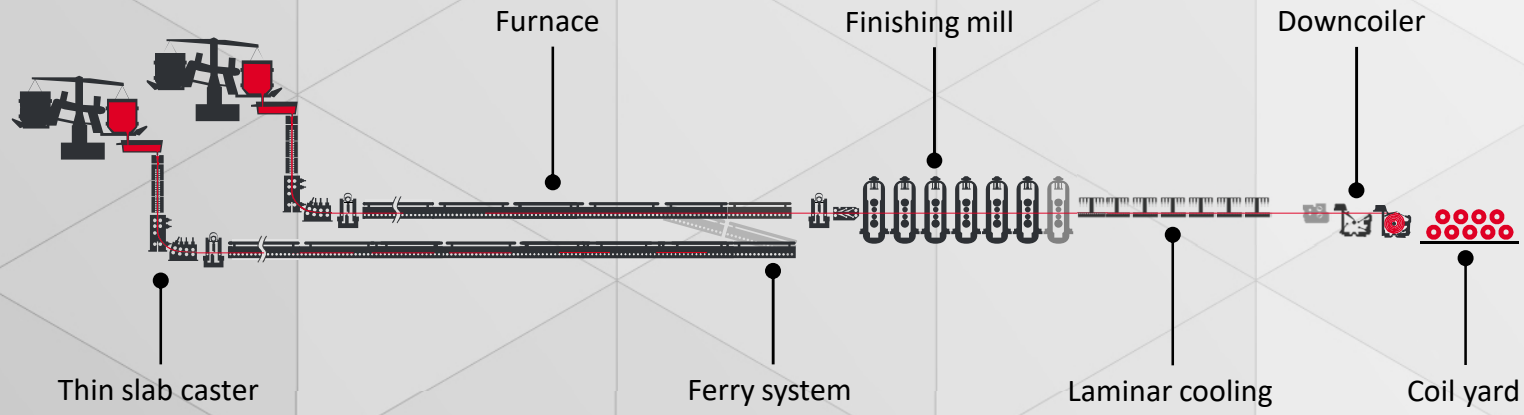
- 1936
- HSM, Dinslaken, Germany
- 47 plants



- High productivity and flexibility in production scheduling
- High process flexibility due to decoupled process route
- All steel grades possible
- High quality products

CSP® Plant

- 1989
- Nucor Steel, Crawfordsville, USA
- 29 plants



- Minimized conversion costs and CO_2 emission
- Homogenized temperature and product properties
- Lower CAPEX and smaller layout footprint
- All steel grades possible
- Thin gauge products

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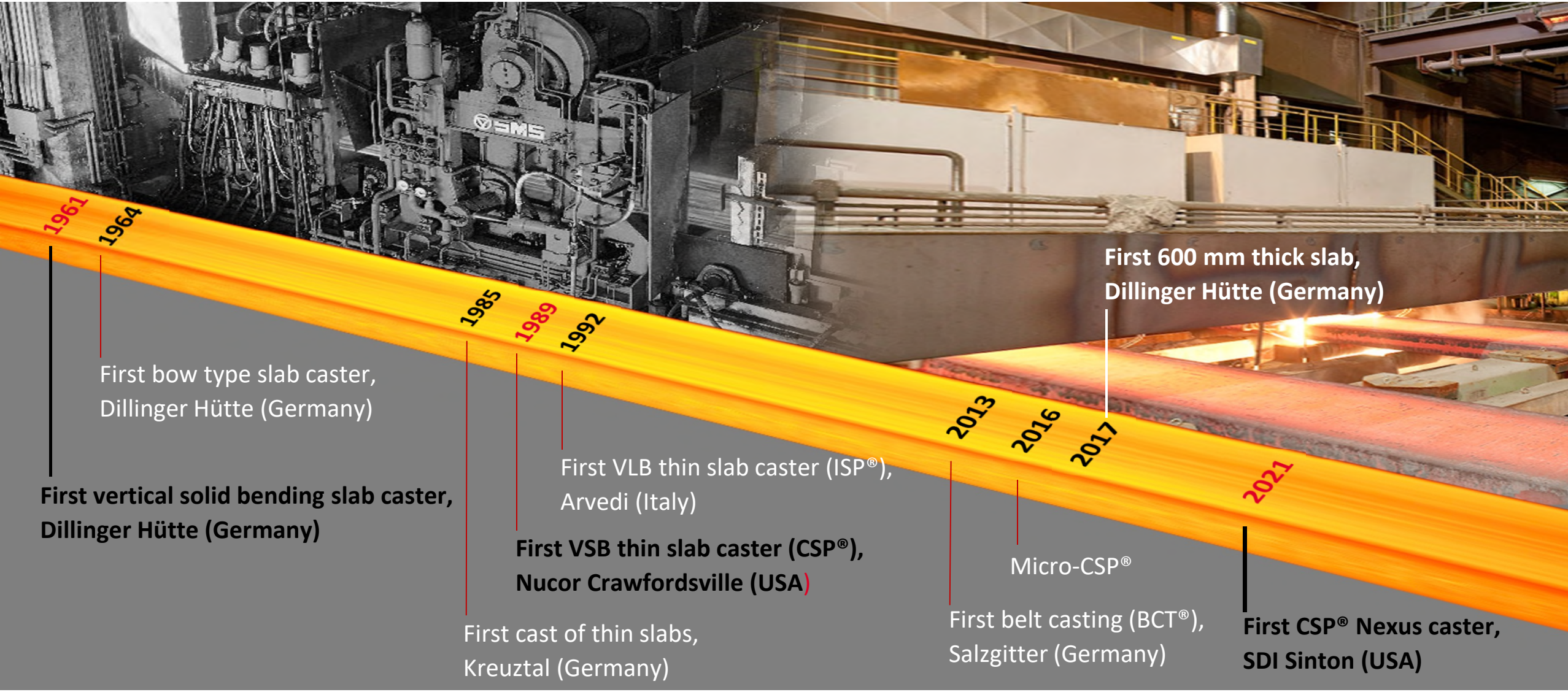
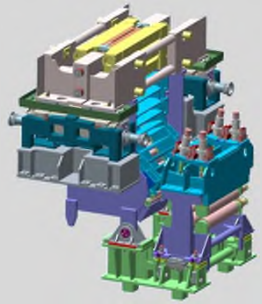
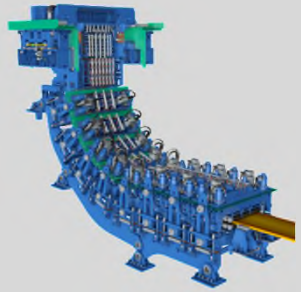
Leadership in continuous casting

Milestones and Success Story 60+ Years



CSP® Caster Concepts

	Micro	Vertical	Nexus
			
Capacity per strand	0.5 - 0.7 mtpa	0.7 - 1.5 mtpa	**≥ 1.5 mtpa**
Metallurgical length	3.9 m	5.4 - 10.3 m	**≥ 12.0 m**
Thickness range	45 mm	50 - 90 mm	**≥ 110 mm (160 mm)**
No. of segments	1	2 - 5	**≥ 7**
Steel grades	LC, MC	LC, MC, HC, HSLA, Si, API ≤ 16 mm	ULC, LC, MC, HC, HSLA, Si, API > 16 mm
Characteristics	♦ Easy handling ♦ Low budget ♦ Limited product mix	♦ Easy handling ♦ Vertical solidification ♦ No bending / unbending	♦ High production ♦ Extended product mix ♦ Enables endless process

CSP® Nexus for most efficient casting and rolling

Key facts

Production:	2.0 – 3.0 Mtpy ≤ 5,5 mtpa with 2nd strand
Strip width:	up to 2,250 mm
Strip thickness:	1.2 (0.8) mm – 25.4 mm
Plant length:	320 m – 340 m (1 strand) 400 m (with 2nd Strand)
Rolling modes:	Batch / Endless

Key advantages

- High productivity, excellent product quality
- Entirely homogeneous temperature distribution (properties)
- Full flexibility for adjustment of the rolling strategy (independent rolling groups) to comply with all process and metallurgical requirements
- Utilization of the heat content of the liquid steel (minimum energy consumption)
- Extended product mix portfolio (e.g. Peritectic grades, thick API, etc.)
- Low OPEX

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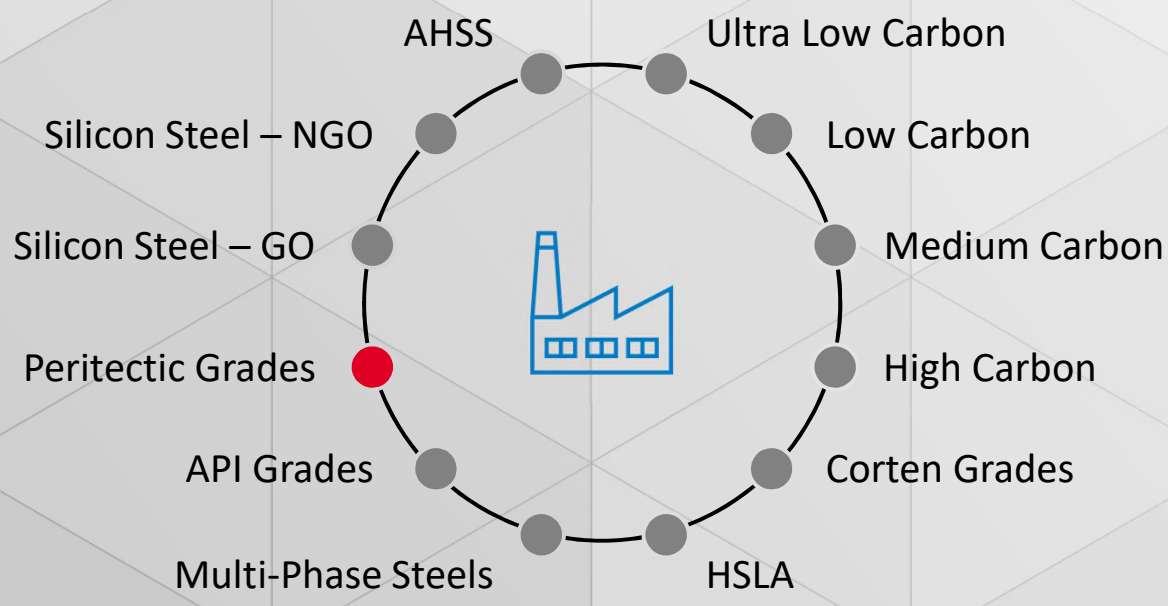
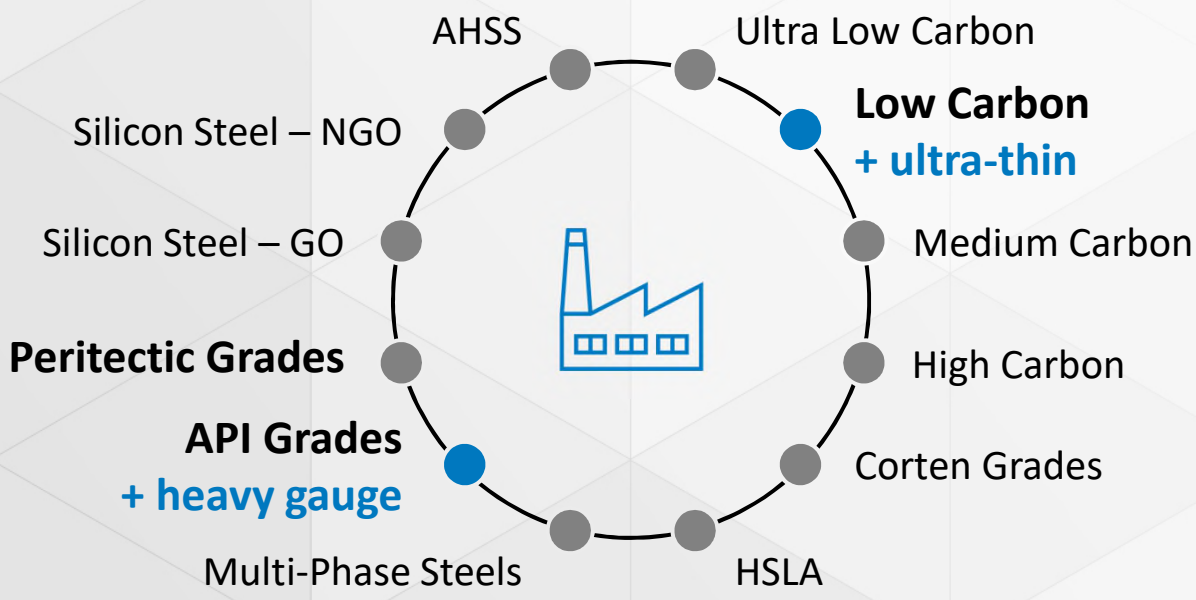
Extended product mix portfolio with CSP® Nexus

CSP®



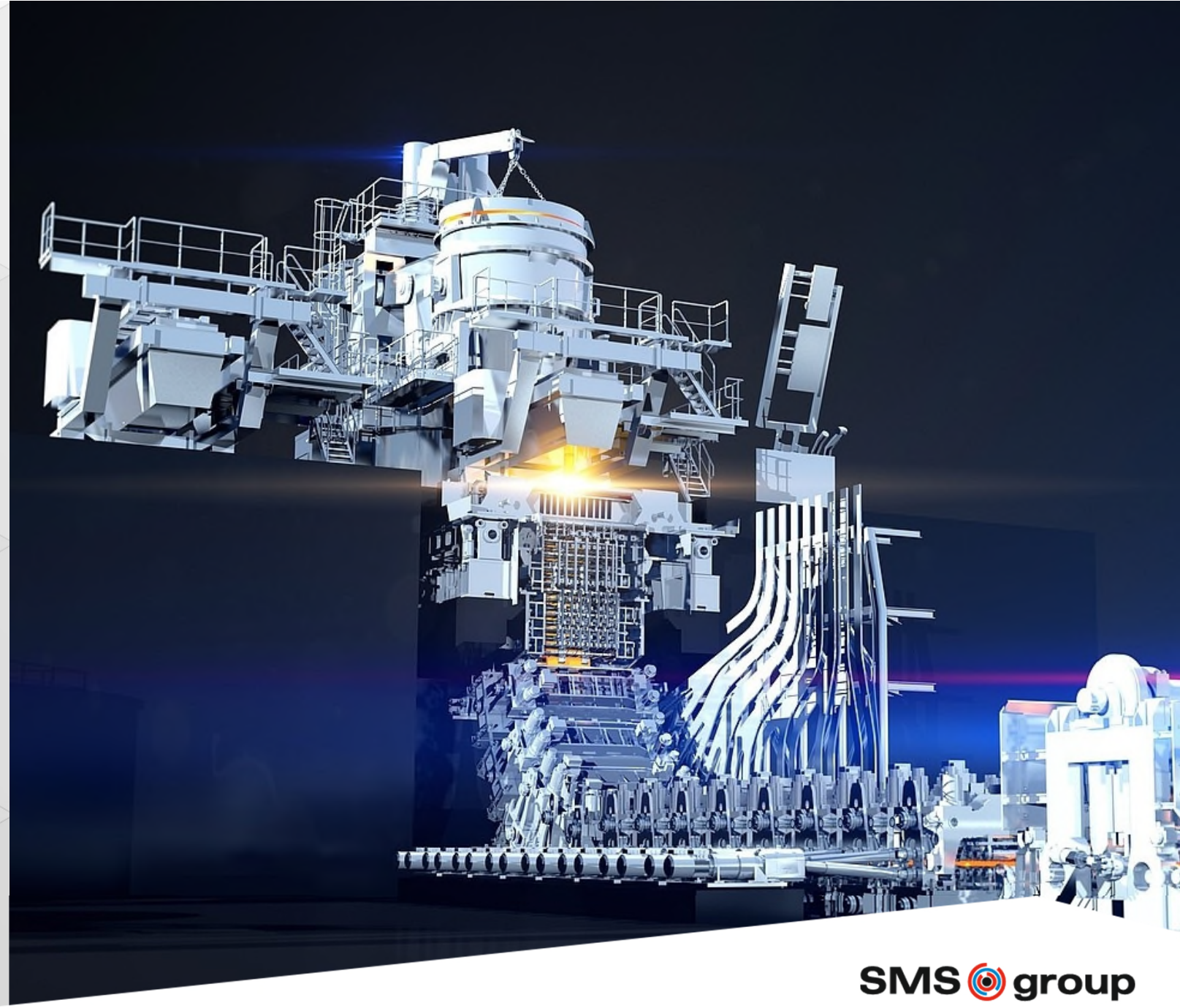
NEXUS



CSP® Nexus
Casting Machine

Designed for high productivity

- Bow-type caster
- 110 – 130 (160) mm casting thickness
- Up to 6 m/min casting speed
- Up to 2250 mm casting width
- High steel mass flow



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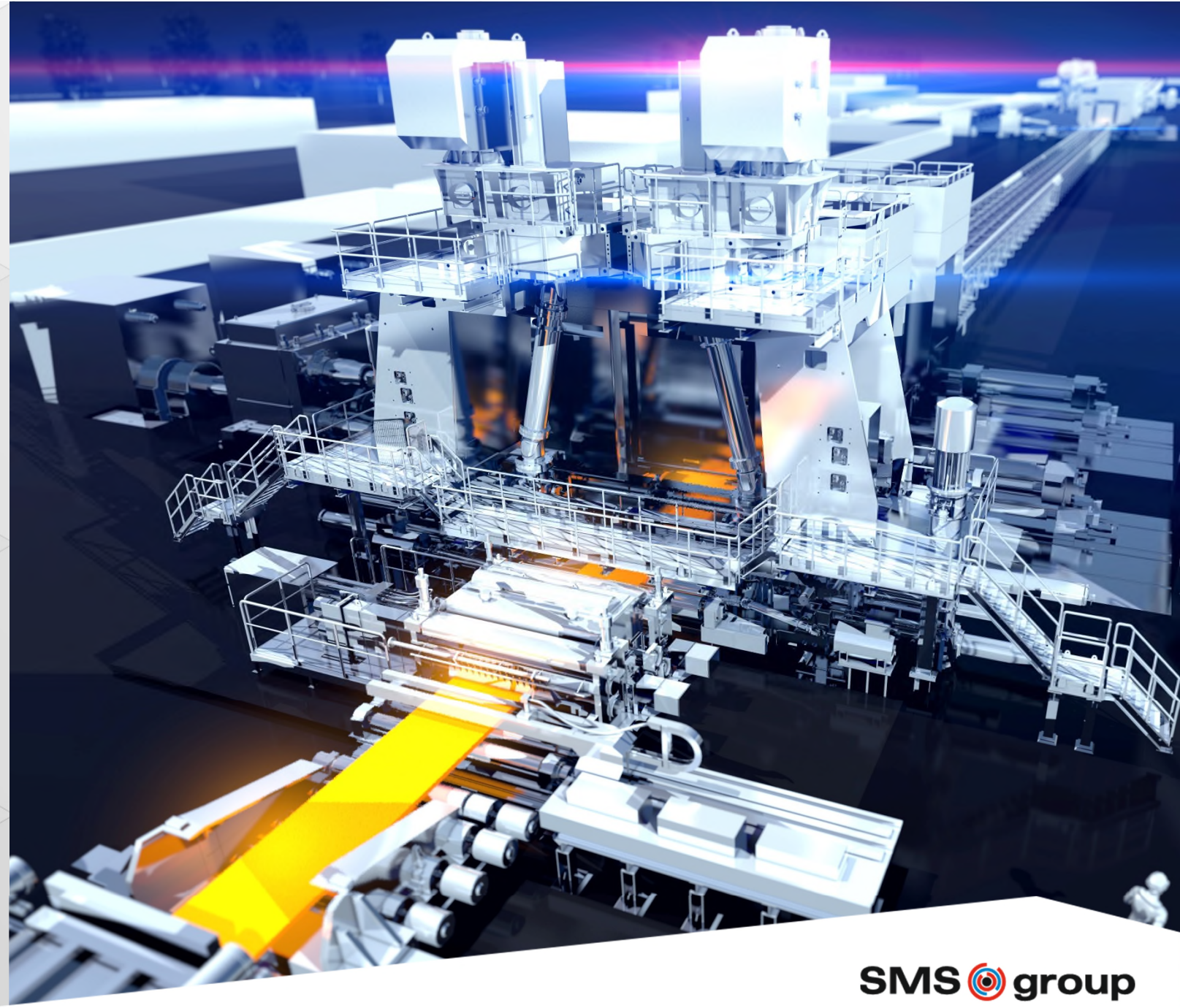
CSP® Nexus
Roughing Mill

High reduction capability

- High reduction of slabs
- Allows high production and temperature from Casting Machine, casting always in optimum thickness range
- Serves the optimum incoming thickness into the Finishing Mill
- Optional Edger to increase the plant productivity and yield even more



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CSP® Nexus

Finishing Mill

Designed for high product quality

- **6 to 7 mill stands**, depending on target product mix and desired strip dimensions
- Advanced guiding system for centered feeding of transfer bar into rolling mill
- Highly dynamic thickness control and rolling temperature control
- **CVC®plus**, the profile and flatness control system based on roll grinding and roll shifting for excellent strip profile, contour and flatness

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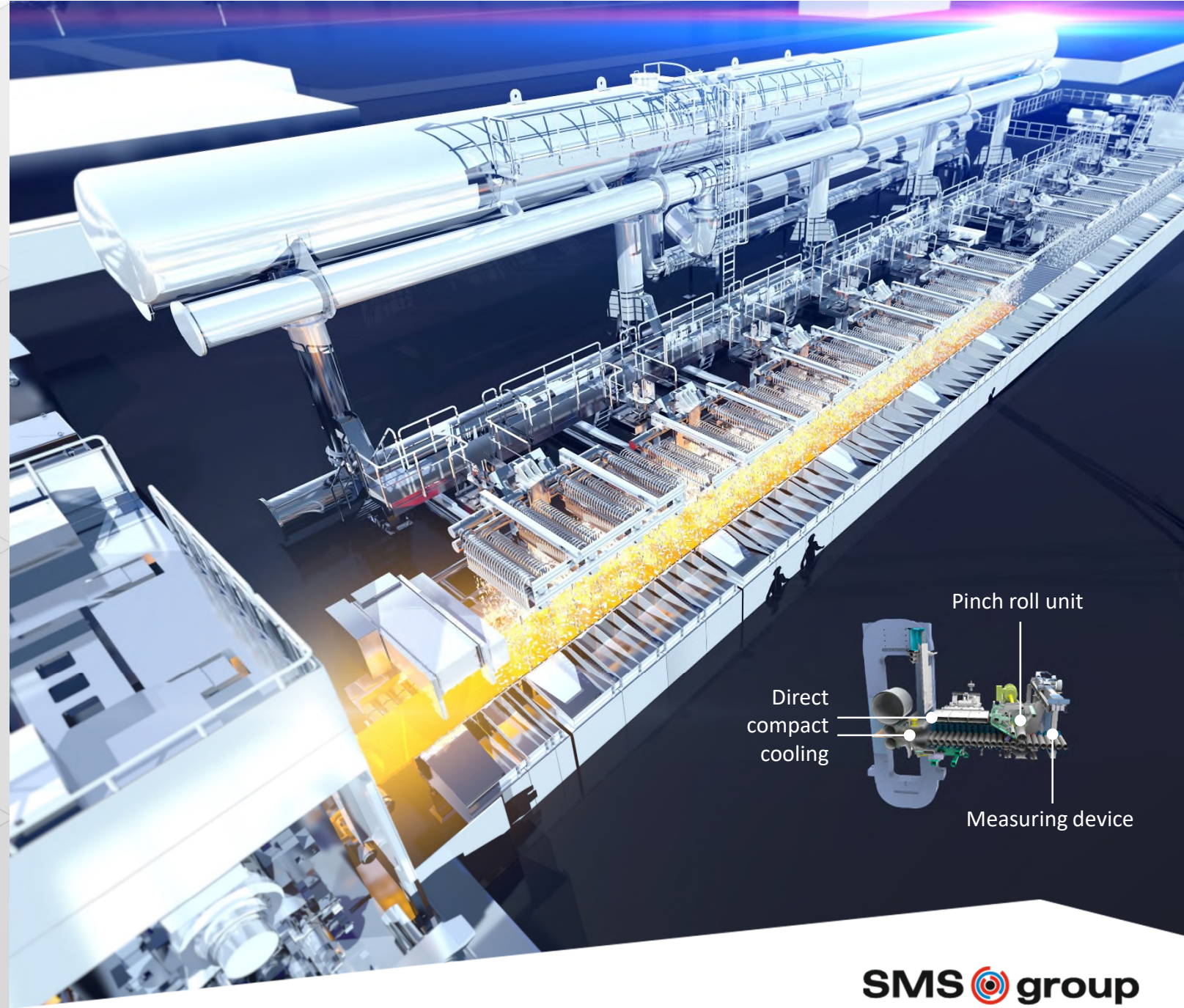
CSP® Nexus

Laminar Cooling Line

State-of-the-art strip cooling

- Latest strip cooling technology with high cooling rate flexibility
- Model-based consideration of product microstructure to achieve desired material properties
- **Option: Direct Compact Cooling**
  - Improve strength and toughness
  - Higher strength allows significant alloy cost reduction
  - Lighter chemistry is beneficial for casting and rolling process



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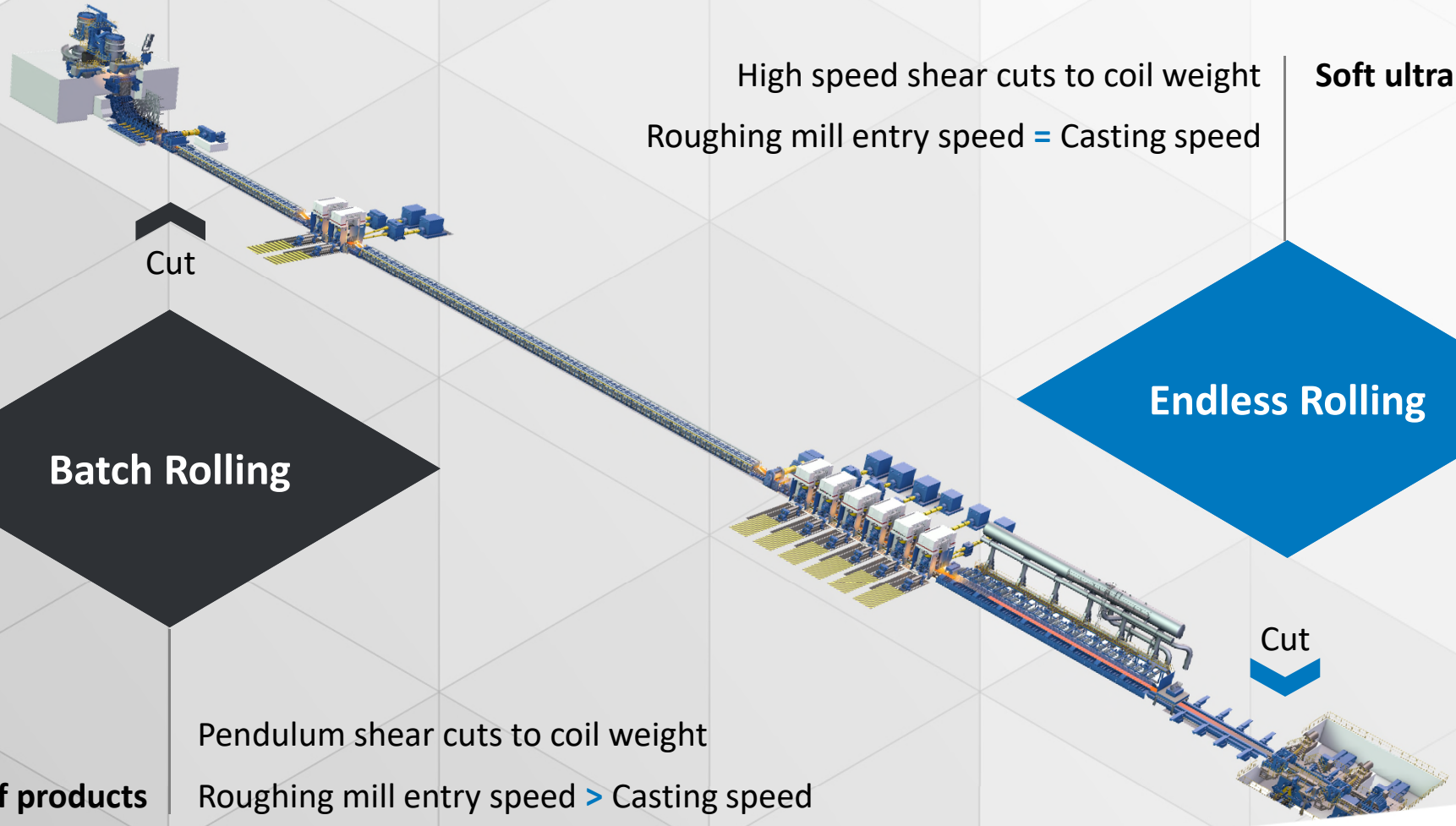
Maximum Flexibility with CSP® Nexus

Operation modes



Batch Rolling

Majority of products

Pendulum shear cuts to coil weight

Roughing mill entry speed > Casting speed

Endless Rolling

Soft ultra thin grades

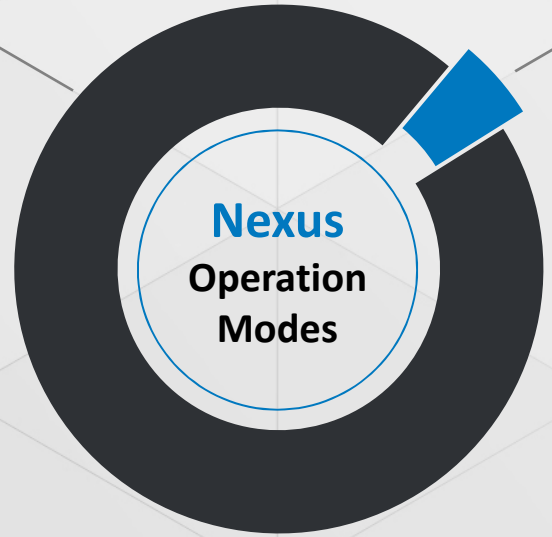
High speed shear cuts to coil weight

Roughing mill entry speed = Casting speed

Flexible production with CSP® Nexus

Batch Mode (Coil-to-Coil)

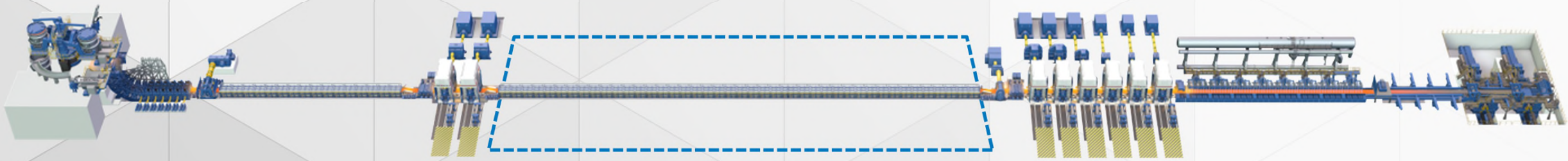
- Energy efficient operation due to independent casting & rolling process
- Final rolling temperature can be easily met by adapting the rolling speed
- Simple sequence start and buffer time for work roll change
- Homogeneous slab and transfer bar temperature by the two heated roller tables
- Flexible adjustment of strip width and thickness



Endless Mode (Continuous)

- Higher rolling stability for ultra-thin gauges < 1.2 mm
- Tighter tolerances for ultra-thin gauge
- Economic production without massive inductive heating power compared to other endless plants
- Homogeneous slab and transfer bar temperature by heated roller tables

Advantages of decoupled roughing and finishing rolling for CSP® Nexus



- Higher process speed in R1 & R2 reduces significantly the slab temperature losses
- Higher speed ensures higher edge temperature and thus reduces risk of corner cracks, especially for crack-sensitive grades (e.g. HSLA, AHSS)
- Homogeneous temperature profile → homogeneous product properties
- Most favorable practice for thermomechanical rolling (micro alloyed steel grades like HSLA and API)
- Independent control of final rolling conditions (temperature, speed)

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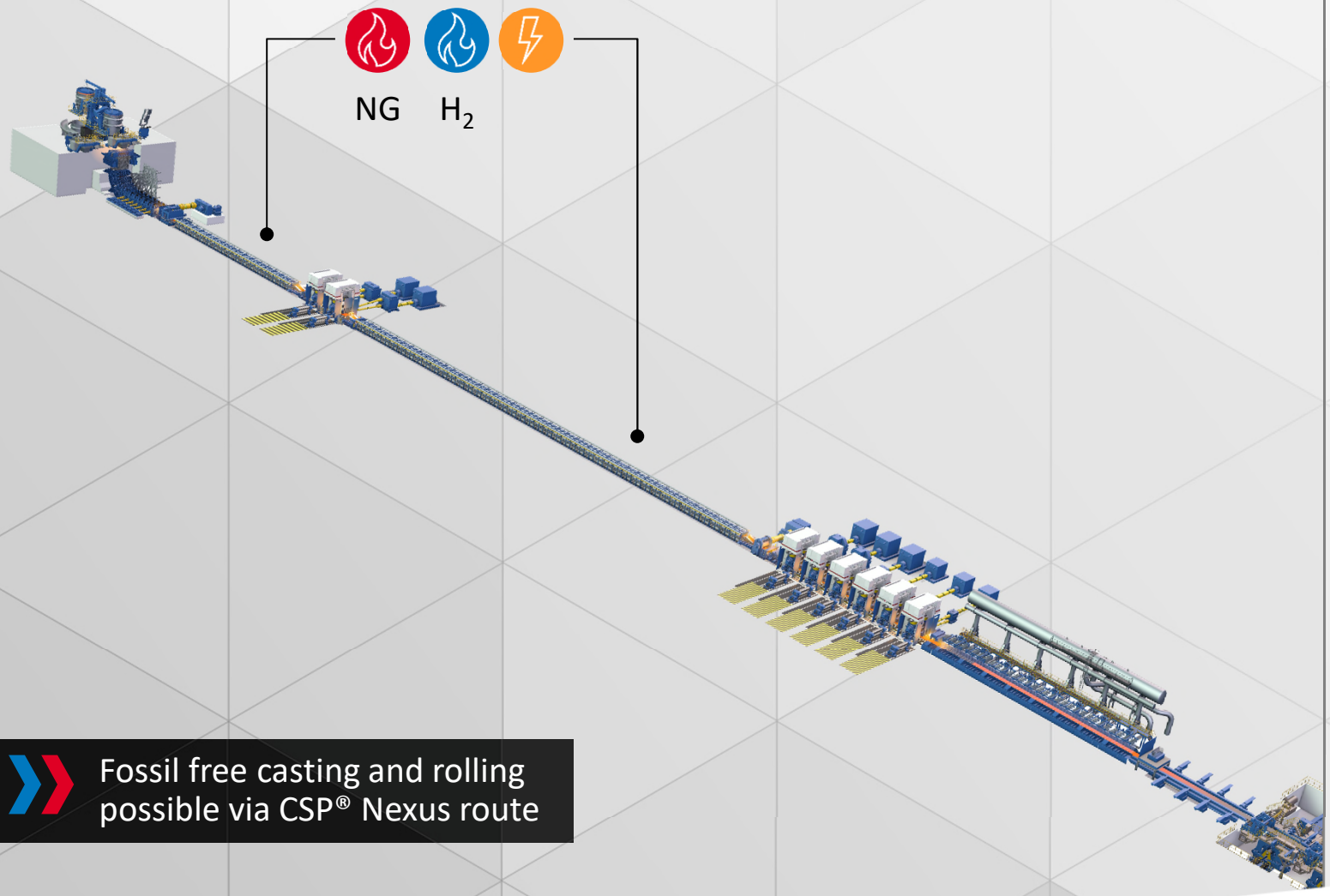
Emission free Casting and Rolling via CSP® Nexus



Fossil free casting and rolling possible via CSP® Nexus route

Key Factor: Hybrid heating solutions

NG	+	H_2
NG	+	Inductive
H_2	+	Inductive
Conductive	+	Inductive

Alternative heating solutions

- Electrical heating solutions
  - Inductive
  - Conductive
- Hydrogen

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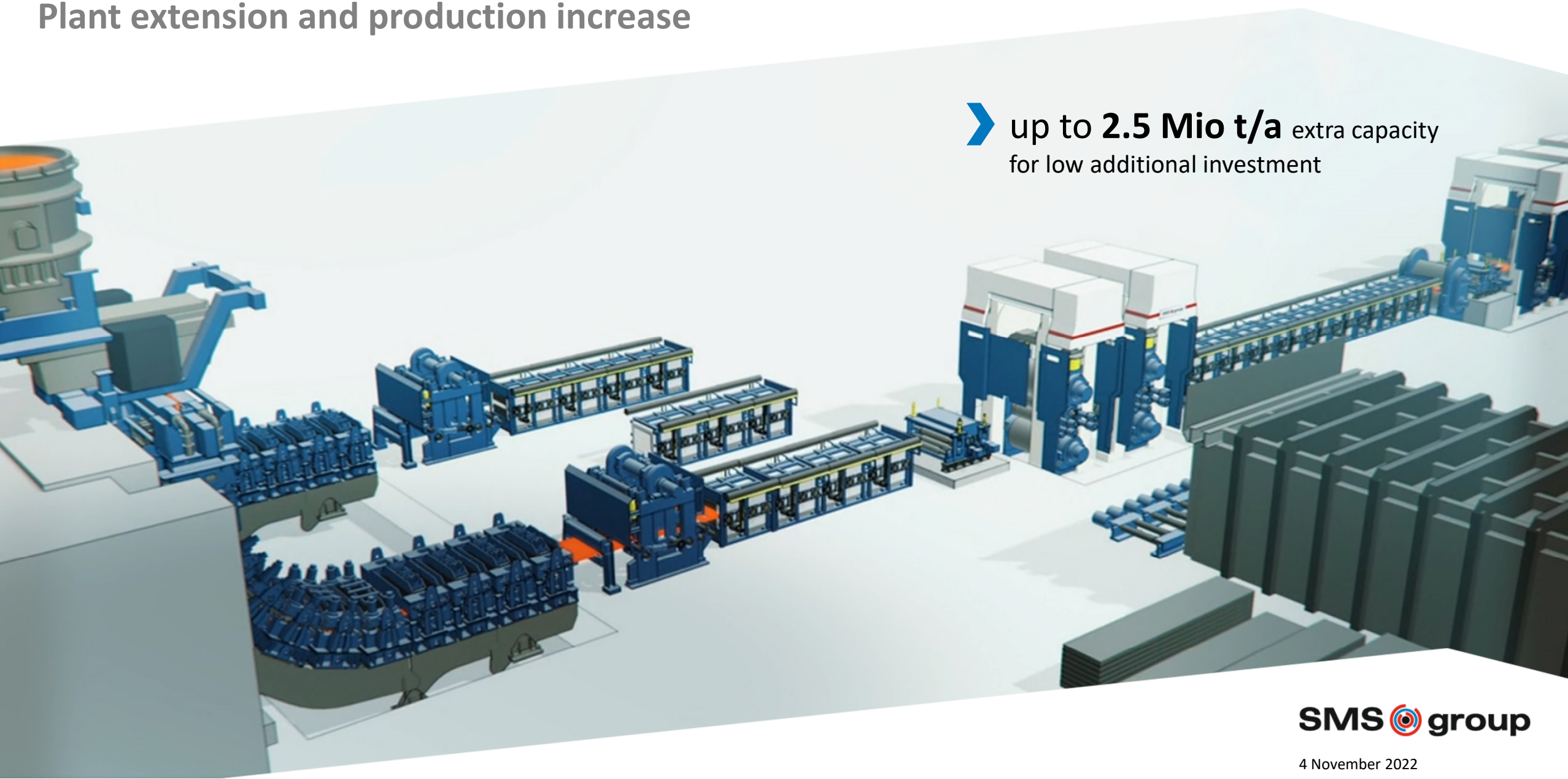
Maximum future flexibility

Plant extension and production increase



- up to **2.5 Mio t/a** extra capacity for low additional investment

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Nexus

The First Reference

Steel Dynamics, Inc.

SDI Sinton, Texas, USA

- Annual production: 2.7 Mio. t/y
- Provision for second strand
- Max. strip width: 2134 mm (84”)
- Min. strip thickness: 1.2 mm
- API grades up to 25.4 mm (1”)
- **Melt Shop,**
  CSP® Nexus,
  Pickling Line,
  Cold Mill, Temper Mill and
  Galvanizing Line

Supplied by SMS

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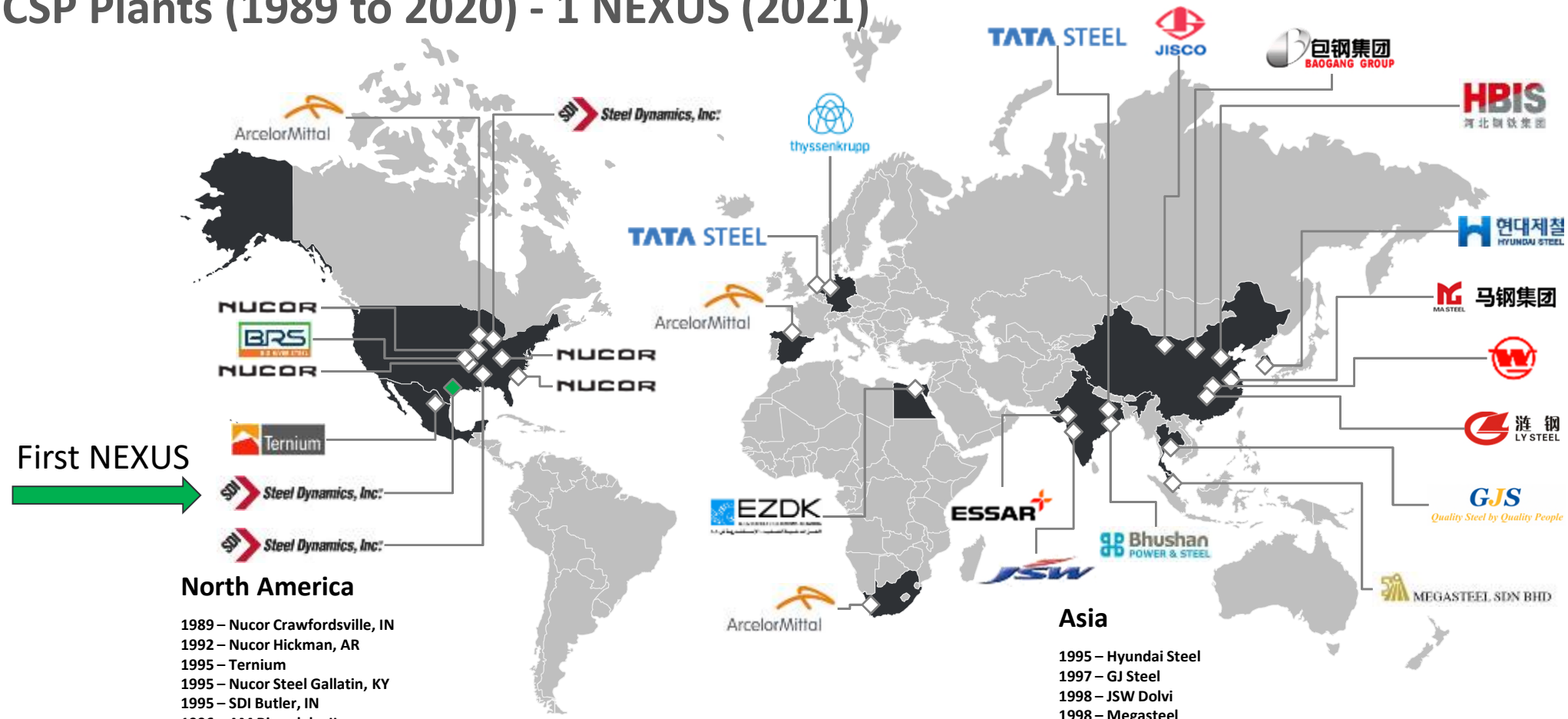
CSP® Technology – global overview

28 CSP Plants (1989 to 2020) - 1 NEXUS (2021)



North America

1989 – Nucor Crawfordsville, IN
1992 – Nucor Hickman, AR
1995 – Ternium
1995 – Nucor Steel Gallatin, KY
1995 – SDI Butler, IN
1996 – AM Riverdale, IL
1996 – Nucor Berkeley, SC
2007 – SDI Columbus, MS
2016 – Big River Steel, AR
2021 – SDI Sinton, TX

Europe

1996 – AM Sestao
1999 – thyssenkrupp Steel Europe
2000 – Tata IJmuiden

MENA & Africa

1998 – AM Saldanha
1999 – Al-Ezz Dekheila Steel

Asia

1995 – Hyundai Steel
1997 – GJ Steel
1998 – JSW Dolvi
1998 – Megasteel
1999 – Hebei Steel Handan
2001 – Baotou Iron & Steel
2003 – Maanshan Iron & Steel
2004 – Lianyuan Iron & Steel
2005 – Jiuquan Iron & Steel
2007 – Bhushan Power & Steel
2009 – Wuhan Iron & Steel
2011 – Essar Hazira
2012 – Tata Jamshedpur

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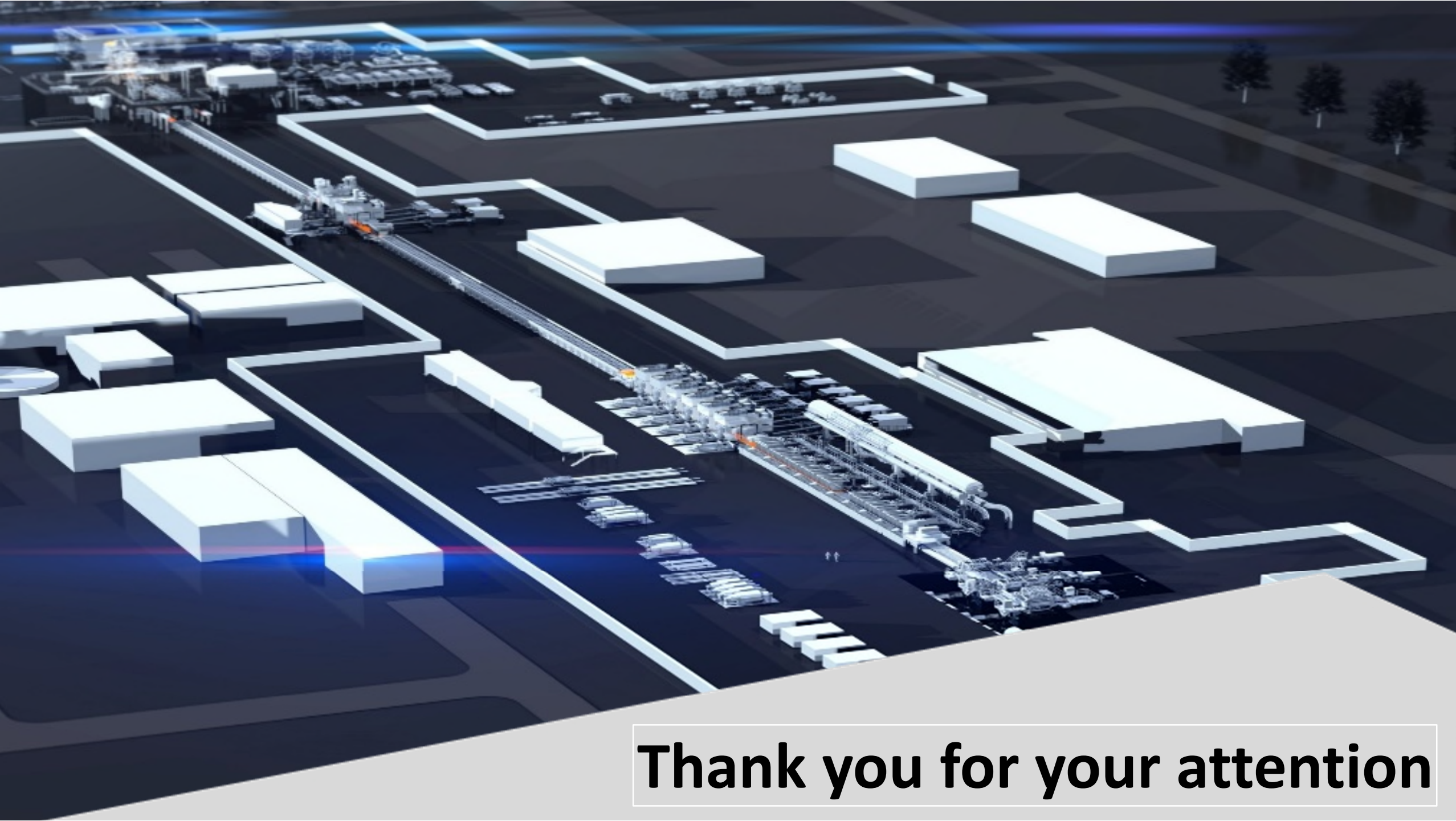

Thank you for your attention