2025 Green Steel World conference

Green Steel Strategy & Circular Economy Insights from Swiss Steel Group

Bernhard Rischka, Corporate Technology May, 2025





The race to Net-Zero Emissions is both, ambitious and unequal

Global Roadmap to Net-Zero Emissions

WORLD COUNTRIES' CARBON NEUTRALITY TIMELINE

To limit climate change, countries of all sizes the world over have committed to achieving net zero emissions before the end of this century. While most are aiming for the Paris Agreement's 2050 target, a few are significantly ahead, and others have yet to agree on a concrete target date for reaching carbon neutrality.



The steel industry remains a significant contributor to greenhouse gases CO₂-emissions by industrial sector



Worldwide CO₂-emissions, in total and by industry

Direct CO₂-equivalent-emissions in EU by sector (2015, millions metric tons)



Data source: World Steel: Sustainability performance of the steel industry 2003-2021, December 2022; Institute for European Studies – Industrial Value Chain: A Bridge towards a Carbon Neutral Europe, September 2018



Swiss Steel Group is one of the world's leading providers of individual solutions of special long steel – globally active, but local at your doorstep



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Special steel producers face additional decarbonization challenges Major process steps of specialty steel makers





Dependent on low-CO₂ electrical energy

Mainly Scope 1 emissions SSG operates >150 furnaces



Swiss Steel considers various levers for its decarbonization roadmap Categories of opportunities to reduce our CO₂ footprint





- Scrap Al
- Production planning systems
- Power management
- Furnace heat models



Electrification

- Heat treatment furnaces
- Rolling mill
- furnaces
- Forge furnaces



Process improvement

- Yield
- Energy efficiency
- Quality increase
- Weighing points
- Technology



Recycling

- Scrap (for ore)
- Aluminium cans
- Slag (for construction)
- Scale (for counterweights)
- Dust, sludges for alloys
- Refractory



Substitution

- Biogas (for CH4)
- Alloyed scrap for alloys
- Hydrogen (for CH4)
- Biomass (for coal)
- Oxygen (for air)



The EAF combines both circularity and decarbonization technique

Global share of steelmaking technology







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Circularity opportunities



We add value by turning scrap into new special steel products Life cycle assessment of steel scrap



Source: Worldsteel nagelsky.de/produkte/stahlschrott - https://www.werner-winter-gmbh.de/de/leistungen/stahlschrott

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Sorting of obsolete scrap will increase its usage for special steel Modern shredder with LIBS technology screens and purifies end-of-life scrap





Main benefits:

- ✓ Less scrap export
- ✓ Higher scrap ratio (less scrap substitutes)
- ✓ Higher scrap yield



Alloys substitution opportunity

Scrap sorting is driven by alloy hedging and by tramp elements Scrap box allocation at Finkl Chicago





Primary alloys: Production and Carbon footprint

Source: Swiss Steel Group; constructionweekonline.in; miningweekly.com; totalmateria.com; worldsteel

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UgiRing converts end-of-life materials and process by-products into primary alloys Process chart of by-product recycling



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Electrification opportunity

Green electrical energy is key for a successful decarbonization Electrical CO₂ emission factors per MWh of various countries / region Electrification (Québec) 5% 11% 25% 34% 43% 41% 50% 58% 61% 7% 64% 100% Fossil Nuclear Renewable 381 56 < 10 < 10 582 kg CO₂ per MWh (2023)



Our energy intensive process calls for renewable power

Seasonal and daily fluctuation of renewable energy and, thus prices



Avg price €/MWh	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
00:00	98	117	99	107	96	108	103	98	95	78	73	55
01:00	88	113	92	102	92	103	94	94	91	72	68	53
02:00	83	109	86	95	85	95	84	88	86	65	63	50
03:00	81	107	86	94	82	91	77	84	83	59	60	48
04:00	75	106	83	92	81	89	72	82	82	57	57	45
05:00	77	107	83	92	83	89	72	83	84	58	58	45
06:00	84	114	90	97	89	95	77	89	90	66	66	49
07:00	109	131	108	113	101	112	89	107	115	88	85	58
08:00	129	148	124	127	106	118	97	119	138	109	103	70
09:00	144	157	127	128	101	110	93	111	122	114	110	81
10:00	145	143	112	111	84	94	78	97	103	103	104	82
11:00	138	130	99	94	69	78	64	84	82	86	97	79
12:00	134	121	91	83	57	69	53	75	71	76	94	76
13:00	128	116	83	74	46	63	41	67	62	67	91	74
14:00	125	110	79	67	34	55	30	58	55	62	91	72
15:00	127	112	80	64	30	53	21	56	56	64	97	75
16:00	132	122	85	67	36	61	29	63	69	75	108	79
17:00	137	134	95	76	55	70	50	73	82	93	116	85
18:00	149	154	119	94	78	88	67	94	110	117	129	92
19:00	151	165	139	118	97	108	90	114	149	138	128	90
20:00	139	158	145	138	116	129	114	141	201	146	116	82
21:00	127	143	131	139	124	141	127	145	161	117	101	74
22:00	116	134	116	129	115	133	125	129	123	97	89	67
23:00	112	130	109	118	105	121	115	113	107	93	85	65

Monthly electricity spot prices, Germany



Hourly electricity spot prices, Germany



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Green Hydrogen hypothesis

In Europe, Hydrogen may serve as reduction agent rather than fuel



Evaluation chart for potential Hydrogen supply countries

Countries (incl. RES source)	1. LCOEs ¹	2. Production capacity	3.Subsidies for H ₂	4. Political stability	
Norway 🖒 🔿	4	3	4	4	
Portugal 💧 🔿 🌞	4	2	4	4	
Spain 💧 🔿 🌞	3	3	3	4	
Iceland 🖒 🔿 🗳	4	2	2	4	
Morocco 🖒 🔿 🌞	3	3	3	2	
Algeria 🥚	3	2	0	2	
Saudi Arabia	3	3	2	3	
UAE	3	2	0	3	
Iraq 🔿 🧕	3	2	0	1	
Australia 💧 🔿 🏓	3	4	4	4	
Chile 💧 📿 😐	3	3	1	3	
South Africa 💧 📿 🌞	3	3	2	3	



 \bigcirc = very good \bigcirc = good \bigcirc = medium \bigcirc = medium-low \bigcirc = low \bigcirc = none

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The conversion of natural gas-fired furnaces to alternative fuels is a central pillar of our decarbonization roadmap

Electrification	 At the steel plant in Sorel, Canada, we already operate electric heat treatment furnaces Conversion of forge furnaces planned
Hydrogen	 Multi-year EU research project HYDREAMS that focuses on hydrogen and oxycombustion Pilot hydrogen electrolyzer planned in Ugine
Hybrid solutions	 Hybrid solutions for combustion applications increase flexibility Hybrid rolling mill furnace planned in Ugine (electrical, oxy-combustion, hydrogen)



Hydreams annealing furnace



SSG's push for green steel has been rewarded

Use of renewable energy and high amount of scrap







WINNER

In order to transform our industry, multiple tailwinds are needed

Economic conditions where Europe underperforms





Thank you!

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