ESTEP 2025 Poster Session Debate

Forging Sustainable European Steel: Decarbonization, Digitalization & Circularity

Moderator: Prof. Fabio Miani

University of Udine, Italy

October 30, 2025

17 Presenters 90 Minutes

Udine, Italy

Overview

Debate Format

1. **Opening (5 min)**
   Moderator introduces themes and ground rules
2. **Theme 1: Decarbonization Pathways (25 min)**
   6 presenters $\times$ 2 min + 13 min debate
3. **Theme 2: Digital & AI Transformation (25 min)**
   5 presenters $\times$ 2 min + 15 min debate
4. **Theme 3: Process Innovation & Circularity (25 min)**
   6 presenters $\times$ 2 min + 13 min debate
5. **Cross-Theme Integration (10 min)**
   Integration questions across all themes

Moderator Guidelines

Key Responsibilities

- Keep 2-min presentations sharp - use bell/timer
- Encourage disagreement and constructive tension
- Draw connections between technologies
- Push for specifics: costs, timelines, TRL levels

Time Management

- 2 min per presenter (strict)
- 13-15 min structured debate per theme
- Use visual timer or bell at 1:30 mark

Theme 1: Decarbonization Pathways

25 Minutes Total

6 Presenters $\times$ 2 min + 13 min debate

Presenters:

- **Dr. Annelies Malfliet** (KU Leuven) - Hydrogen in Stainless Steel
- **Mikhail Lukin & Dr. Joachim von Scheele** (Linde) - H_2-Oxyfuel REBOX
- **Thomas Bräck** (Meva Energy) - Renewable Biosyngas
- **Dr. Tova Jarnerud Örell** (SWERIM) - Biocarbon 418t Trial
- **Paulina Copik** (GIT-Lukasiewicz) - Biomass in Sintering
- **Dirk Rabelink** (ULC-Energy) - Nuclear Hydrogen

Theme 1: Key Debate Questions

Q1: Scalability Race

Which pathway offers **fastest industrial scalability**: H_2, biocarbon, or nuclear?

Q2: Energy Intermittency

How do we address the tradeoff between **renewable intermittency** vs **nuclear baseload**?

Q3: Transition Fuels

Can REBOX achieve **100% H_2** or will we always need transition fuels?

Push For:

Specific costs (€/ton steel), deployment timelines (2030/2040), TRL levels

Theme 2: Digital & AI Transformation

25 Minutes Total

5 Presenters $\times$ 2 min + 15 min debate

Presenters:

- **Vikas Goel** (Tvarit) - Hybrid AI, 50% Scrap Reduction
- **Nikolaos Matskanis** (CETIC) - Edge AI Framework
- **Gunnar Mathiason** (University of Skövde) - ProcTwin Distributed AI
- **Francesca Motta** (Danieli Automation) - AI Dimensional Control
- **Maryam Baniasadi** (SMS Group) - FOAK Decarbonization Tech

Theme 2: Key Debate Questions

Q1: Edge vs Cloud

Edge AI vs Cloud: What's optimal for harsh steel environments?

Q2: Data Silos

How do we overcome **data silos** between competing steel plants?

Q3: Zero-Scrap Manufacturing

Can AI achieve **true zero-scrap manufacturing** or are we hitting physical limits?

Push For:

Real performance metrics, data sharing models, cybersecurity concerns

Theme 3: Process Innovation & Circularity

25 Minutes Total

6 Presenters $\times$ 2 min + 13 min debate

Presenters:

- **Dr. Hadi Barati** (K1-MET) - Nozzle Clogging CFD
- **Dr. Markus Fürhrer** (TU Wien) - CALPHAD Thermokinetics
- **Antoine Marsigny** (Université Lorraine) - H_2 DRI Optimization
- **Mauro Scocco** (Acciaierie Bertoli Safau) - Steel Slag Construction
- **Jaume Pujante Agudo** (EURECAT) - CiSMA Circular Steel
- **Jean Borlée** (CRM Group) - Pilot-Scale Upscaling

Theme 3: Key Debate Questions

Q1: Pilot to Industrial

Are we ready to scale from **pilot (CRM)** to **full industrial deployment**?

Q2: Residual Elements

How do **residual elements in recycled steel** affect mass-market applications?

Q3: True Circularity

Can we achieve **true circularity** or will we always need virgin materials?

Push For:

Upscaling challenges, economics of slag valorization, market acceptance

Cross-Theme Integration Questions

Decarbonization ↔ Digitalization

Can **Tvarit's AI** optimize **Meva's biosyngas** injection or **ULC's nuclear H_2** production scheduling?

Digitalization ↔ Circularity

How can **ProcTwin digital twins** help **EURECAT's CiSMA** project handle variable scrap quality?

Circularity ↔ Decarbonization

Does **100% EAF scrap (CiSMA)** + **renewable H_2 (ULC/Linde)** achieve true net-zero steel?

Provocative Closing Questions

€ Cost Reality

Who can give a **€/ton steel price** for their technology in 2030?

TRL Gap

Which presenter is **closest to commercial deployment TODAY**?

EU Policy

What **single policy change** would accelerate your tech most?

Collaboration

Which **two presenters should work together** but aren't yet?

Thank You!

Questions & Discussion

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