

# Academia-Industry Collaboration for Decarbonisation of Steelmaking in Net Zero Transition of the Electricity Sector

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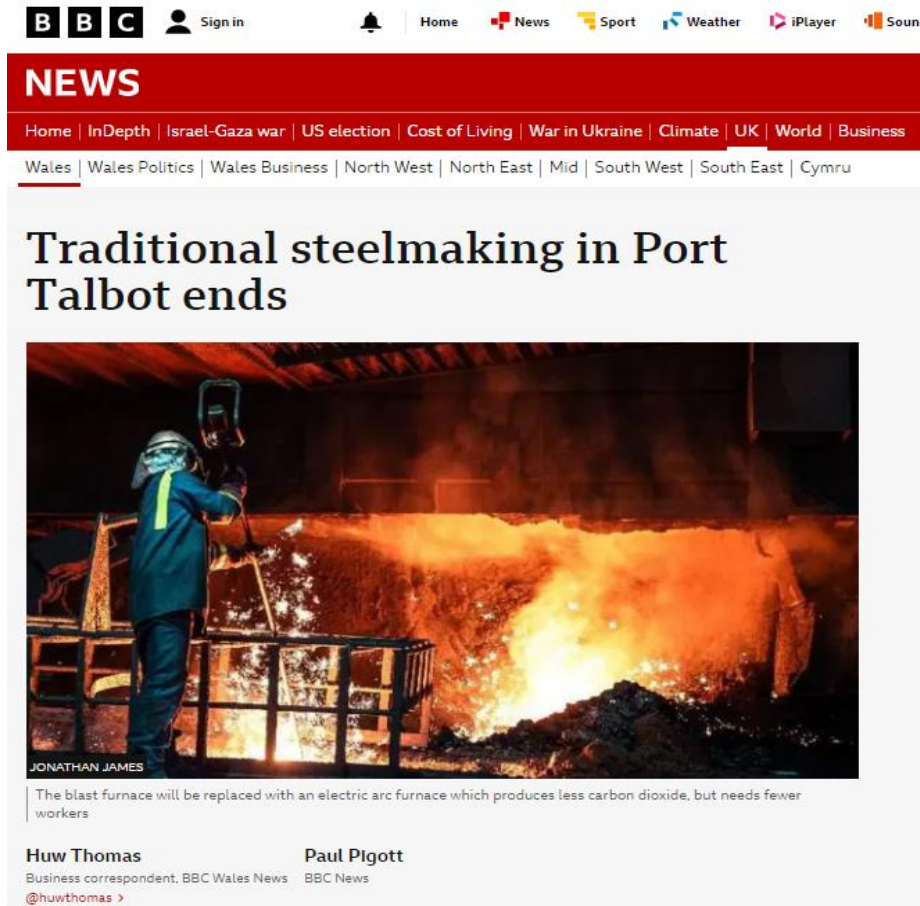


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# Decarbonisation of Steelmaking & Electricity

On 30<sup>th</sup> September 2024




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## Traditional steelmaking in Port Talbot ends



JONATHAN JAMES

The blast furnace will be replaced with an electric arc furnace which produces less carbon dioxide, but needs fewer workers

**Huw Thomas**  
Business correspondent, BBC Wales News @huwthomas >

**Paul Pigott**  
BBC News

Source: BBC. <https://www.bbc.co.uk/news/articles/c70zxjldqnxo>



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## UK to finish with coal power after 142 years



PA MEDIA

The UK's last coal plant, Ratcliffe-on-Soar Power Station near Nottingham, ends operations on Monday

**Mark Poynting**  
Climate and environment researcher

**Esme Stallard**  
Climate and science reporter

30 September 2024 • 5558 Comments

Source: BBC. <https://www.bbc.co.uk/news/articles/c5y35qz73n8o>

# Challenges of Electrification of Steelmaking

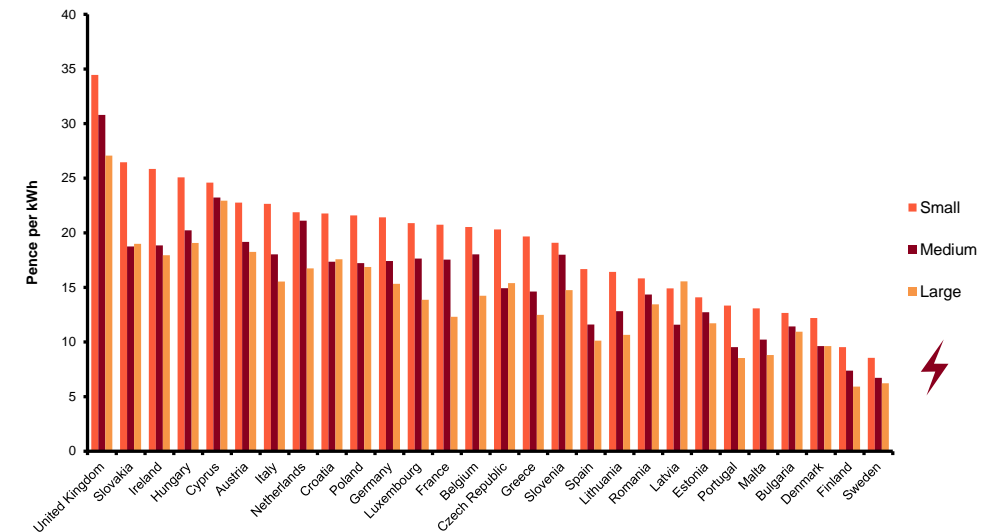
## Electrification, but



TATA Steel Port Talbot

Source: Sky News. <https://news.sky.com/story/tata-steel-thousands-of-port-talbot-steel-workers-at-risk-of-losing-their-jobs-despite-deal-to-save-plant-12997874>

## – High electricity price



Average industrial electricity prices in the EU27 plus UK (small, medium, large) including taxes / subsidies

Source: Department for Energy Security & Net Zero [https://assets.publishing.service.gov.uk/media/66559f858f90ef31c23ebafa/table\\_541.xlsx](https://assets.publishing.service.gov.uk/media/66559f858f90ef31c23ebafa/table_541.xlsx)

# Challenges of Electrification of Steelmaking

## Electrification, but



TATA Steel Port Talbot

- Availability of renewable power
  - Onsite/nearby power
  - Grid power
- Costly reinforcement of electricity infrastructure

Source: Sky News. <https://news.sky.com/story/tata-steel-thousands-of-port-talbot-steel-workers-at-risk-of-losing-their-jobs-despite-deal-to-save-plant-12997874>

# Challenges of Decarbonising Electricity Sector

– Balancing supply and demand



Source: The Daily Guardian. <https://theguardian.com/the-balance-of-life/>

# Challenges of Decarbonising Electricity Sector

- Costly reinforcement of electricity infrastructure



Source: Coruba. <https://www.coruba.co.uk/blog/the-history-of-the-national-grid/>

# Solution: Smart & Flexible Steelmaking

## Smart & Flexible Steelmaking

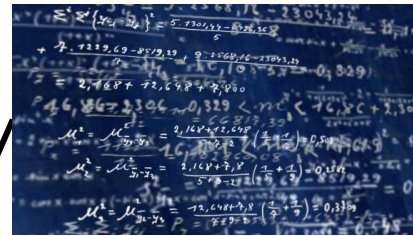
Functions	Challenges Addressed	
	For Steelmaking Plants	For Power Grid
Match production with lower electricity price	Reduce energy cost	Support supply & demand balance
Match production with the availability of renewable power	<ul style="list-style-type: none"> <li>Reduce energy cost</li> <li>Reduce carbon emissions</li> </ul>	<ul style="list-style-type: none"> <li>Support supply &amp; demand balance</li> <li>Reduce carbon emissions</li> </ul>
Reduce peak electricity demand	Reduce network cost (Connection & Use of System)	Reduce reinforcement and the related cost

# Solution: Smart & Flexible Steelmaking

## Smart & Flexible Steelmaking



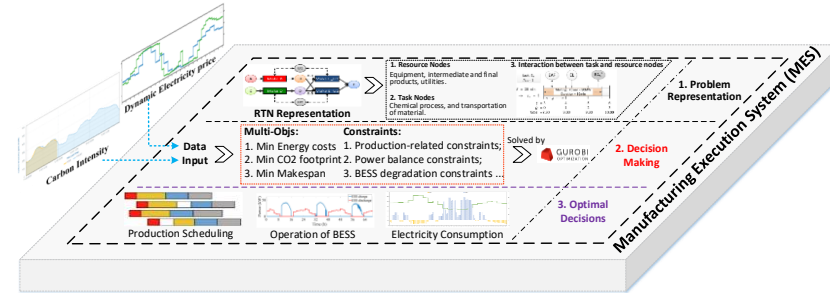
Digital Twin



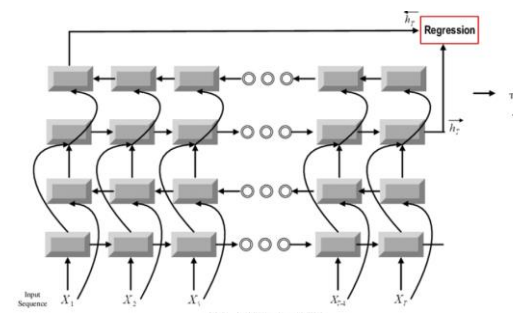
Mechanism-based Model  
(Day-ahead Scheduling)



Data-driven Model  
(Intraday Re-scheduling)



Mechanism-based multi-objective day-ahead scheduling model



Multi-layer stacked LSTM model for intraday re-scheduling



Digital twin experimental platform in Cardiff University



# Academia-Industry Collaboration in SUSTAIN



*“The SUSTAIN Future Manufacturing Research Hub is a £35M project funded by £10M of EPSRC funds as well as by Universities, Trade Bodies, RTOs and Businesses over 7 years and aims to support the industry as we develop new, more environmentally friendly options to ensure the future of manufacturing in the UK.”*

## Questions when doing academic research

- A real problem of significance?
- Model applicability
  - Assumptions
  - Level of complexities
- Data Availability



Source: Herzing University. <https://www.herzing.edu/blog/6-tips-compiling-academic-research>

# Working with Industry

## Site visit and discussion at Liberty Speciality Steels at Rotherham

- First time seeing the equipment!
- Real world problems
- Real plant setting and parameters



The case study steelmaking plant at Rotherham, UK

# Working with Industry

**But,**

- Data sensitivity and availability
- Staff availability
- Dynamic business environment
- Priority of the industry



The case study steelmaking plant at Rotherham, UK

# Thank You!

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