



IEA Technology Roadmap

The global iron and steel sector

Peter Levi, Energy Technology Analyst, IEA

American Steel Experts Dialogue, São Paulo, 22nd August 2018



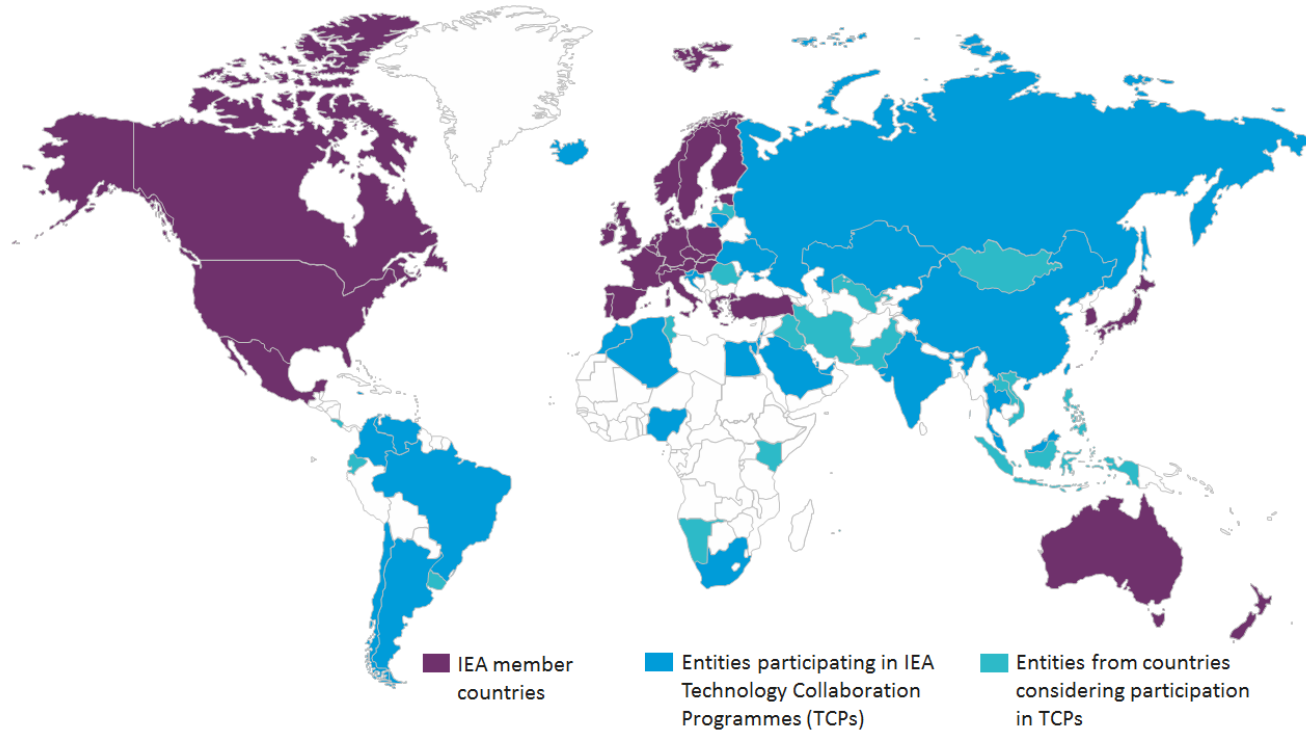
Introduction

Background and broader context

- Founded in 1974 following the Middle East War crisis, hosted at the Organisation for Economic Cooperation and Development (OECD) in Paris.
- Many OECD countries found themselves inadequately equipped with the information and organization necessary to meet the corresponding challenges.
- Established with a broad mandate on energy security and other questions of energy policy co-operation among Member countries.
- The IEA has evolved and expanded over the decades. It is today at the heart of global dialogue on energy.



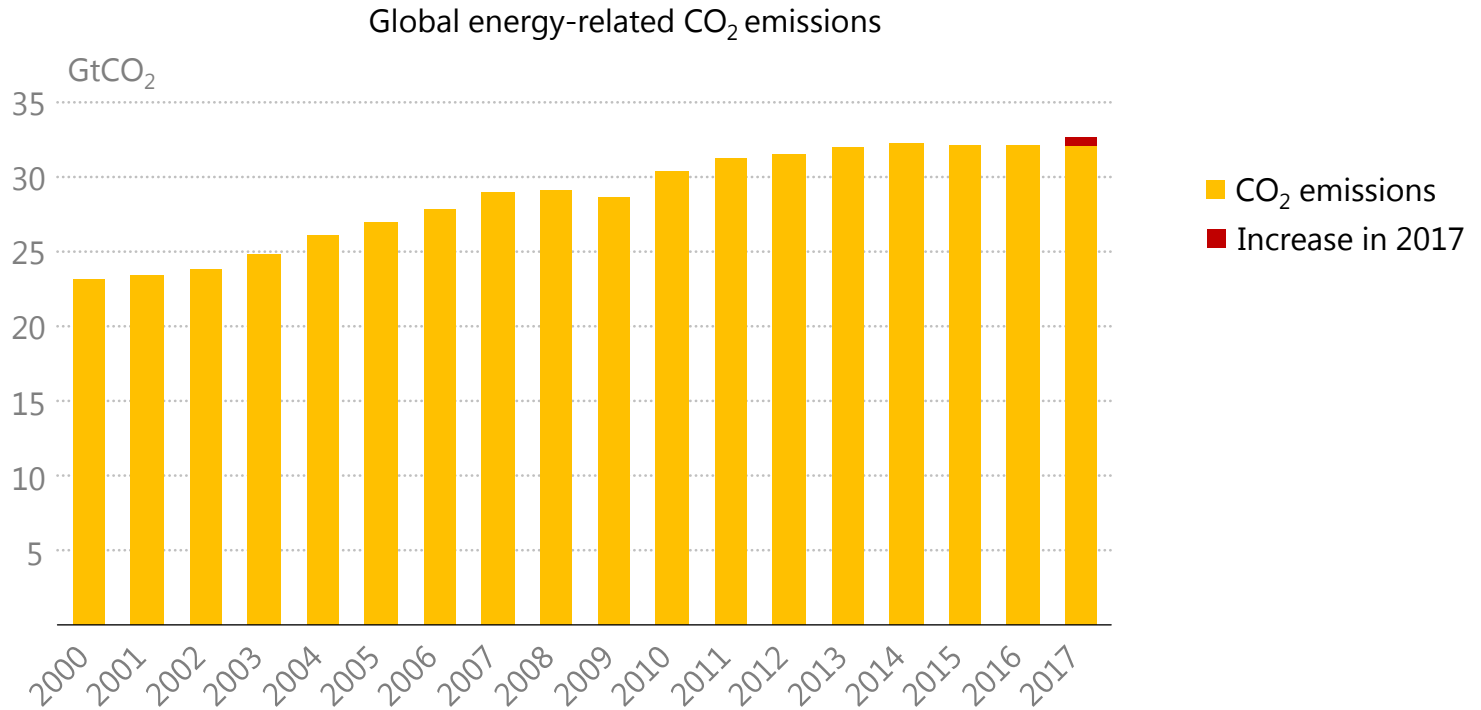
Our mission is guided by four main areas of focus: energy security, economic development, environmental awareness and engagement worldwide.



This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

The IEA works around the world to support accelerated clean energy transitions that are enabled by real-world solutions, supported by analysis, and built on data

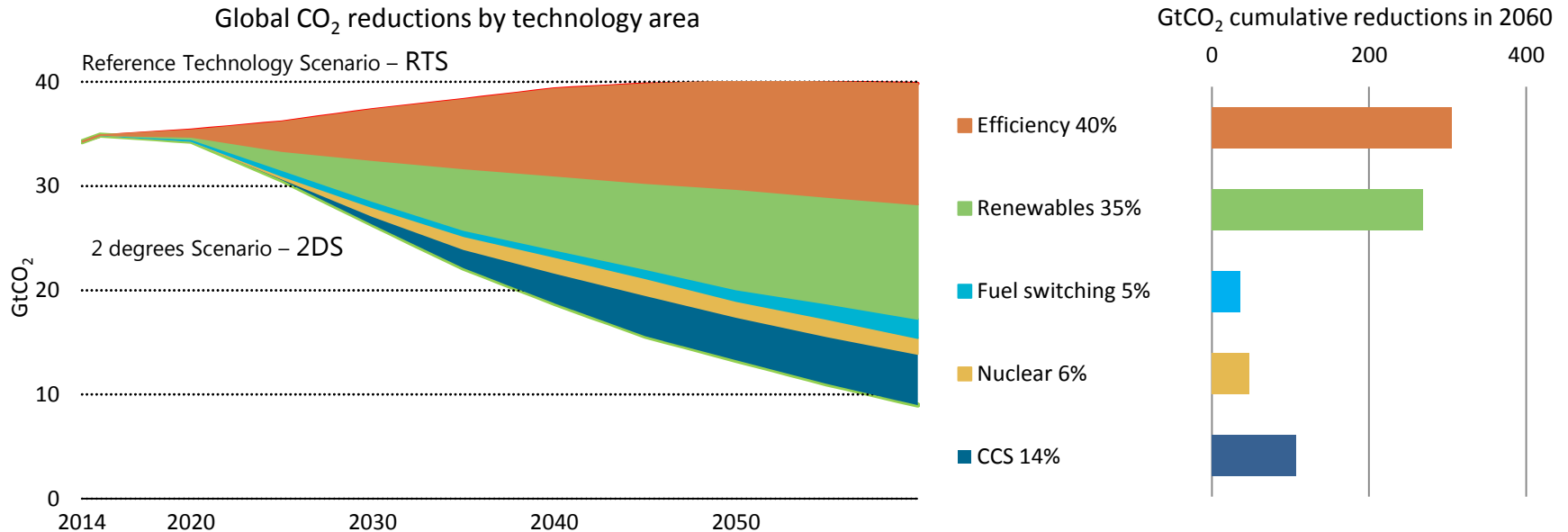
The global climate challenge: Where are we?



After remaining flat for 3 years, global CO₂ emissions rose again in 2017, to an all-time high.

The global climate challenge: Where do we need to go?

Contribution of various levers to global cumulative CO₂ reductions

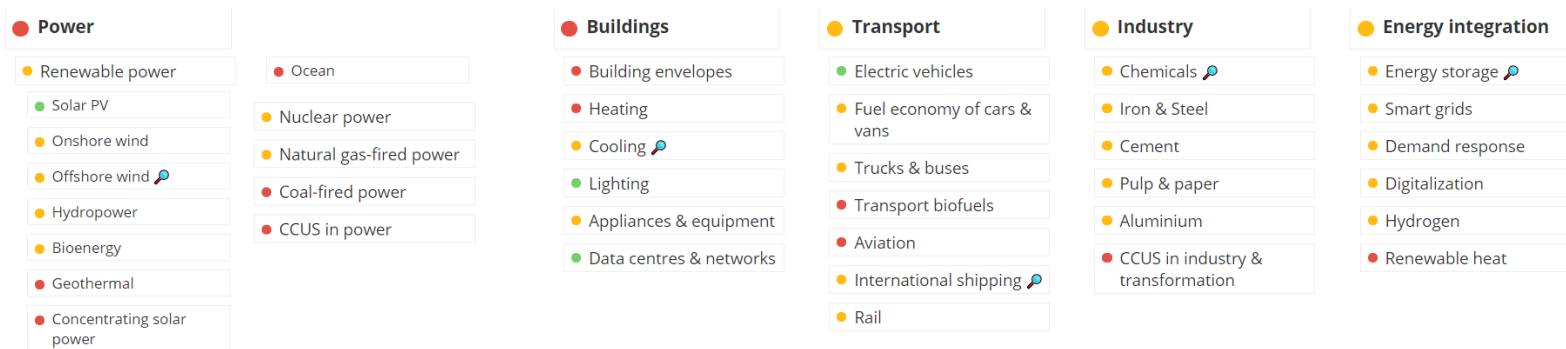


A wide variety of technologies are necessary to meet carbon emission reduction goals, notably energy efficiency, renewables and CCUS.



Are clean energy technologies on track?

Some technologies have made tremendous progress in 2017 – particularly solar PV, LEDs and EVs – but most are not on track. Energy efficiency improvements have slowed and progress on key technologies like carbon capture and storage remains stalled.



The IEA tracks the progress of various technologies critical to a successful clean energy transition.

IEA Technology Roadmaps

Low-carbon pathways for key technologies

- Since 2009, 22 Technology Roadmaps and How2Guides (33 publications)
- Re-endorsed at G7 Energy Ministerial Meetings in 2016 (Japan) and 2017 (Italy) *“(G7 Ministers) welcomed the progress report on the Second Phase of IEA’s Technology Roadmaps, focused on viable and high impact technologies”*



- Long-term vision (2050/2060), near term action (2020/2030)
- Regional relevance and partnerships for implementation (TCPs, MI, CEM,...)
- 2DS and beyond...
- Metrics and Tracking

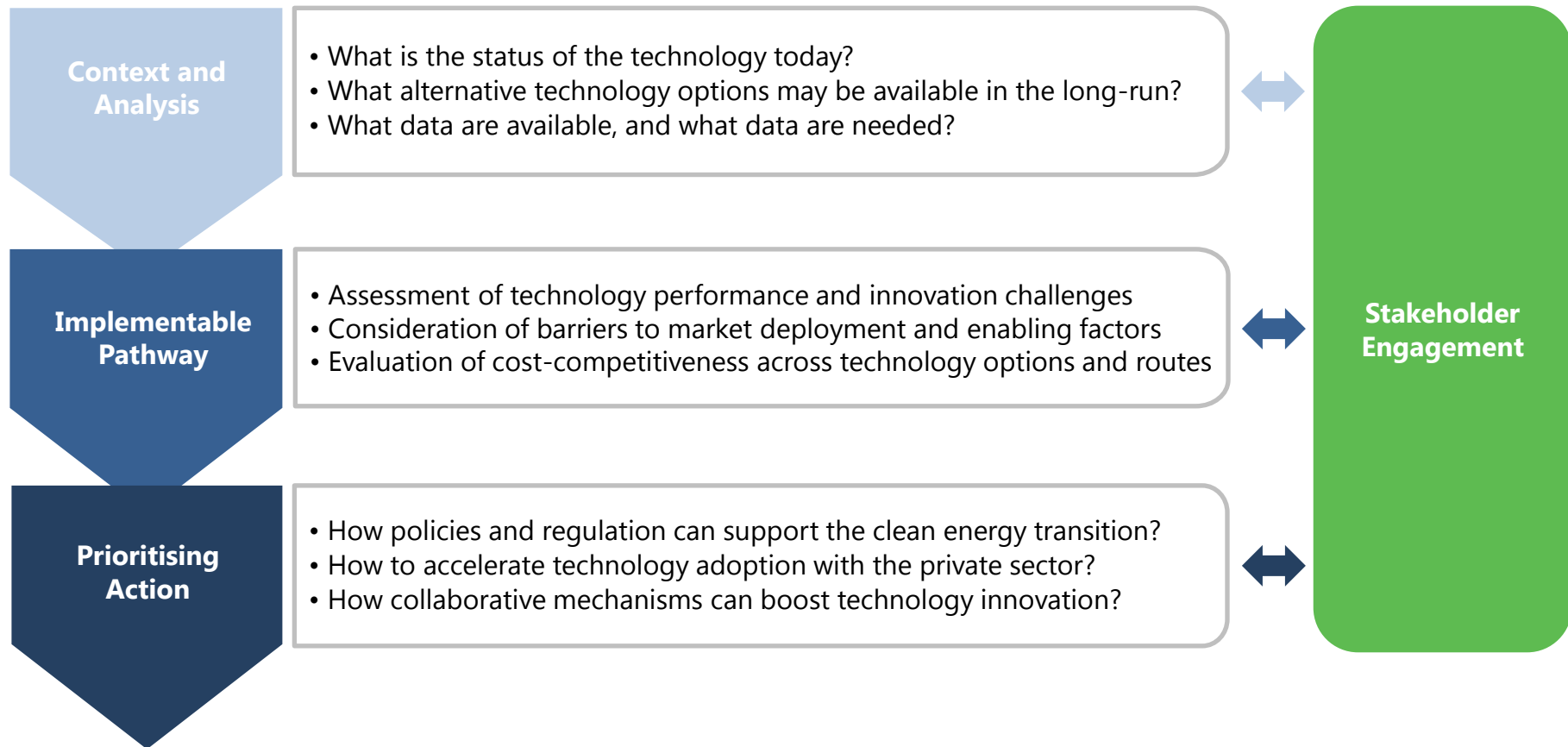
Updates (2017 -2018)

- Smart Energy Systems
- Bioenergy
- Cement

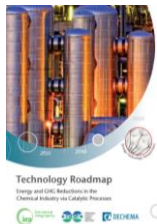
New Titles (2018-2019)

- **Iron and Steel**
- Cooling and refrigeration
- How2Guide for Solar Energy

How do we get there?



Global Chemicals



Global Cement update



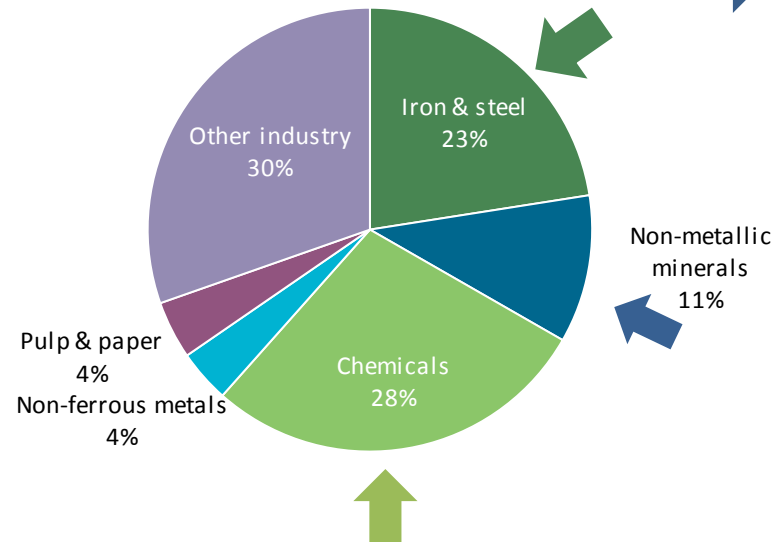
Global Iron and Steel



Global Cement



Regional Cement



Global Iron and Steel sector

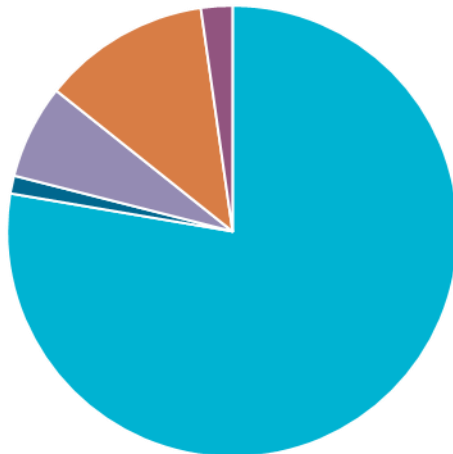
Aims and scope of the roadmap

Iron and Steel sector opportunities and challenges



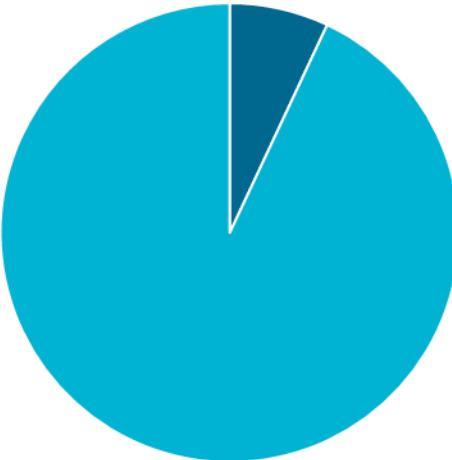
Global iron and steel sector indicators

Final energy use
(2nd industrial energy user)
(1st industrial coal use)



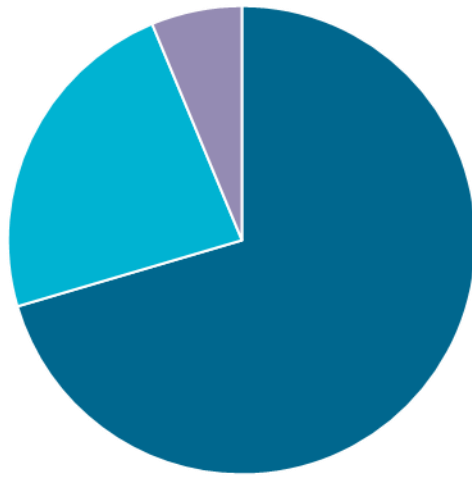
- Coal
- Oil
- Natural gas
- Electricity
- Other

Direct CO₂ emissions
(1st industrial CO₂ emitter)



- Process CO₂
- Energy-related CO₂

Liquid steel production by route

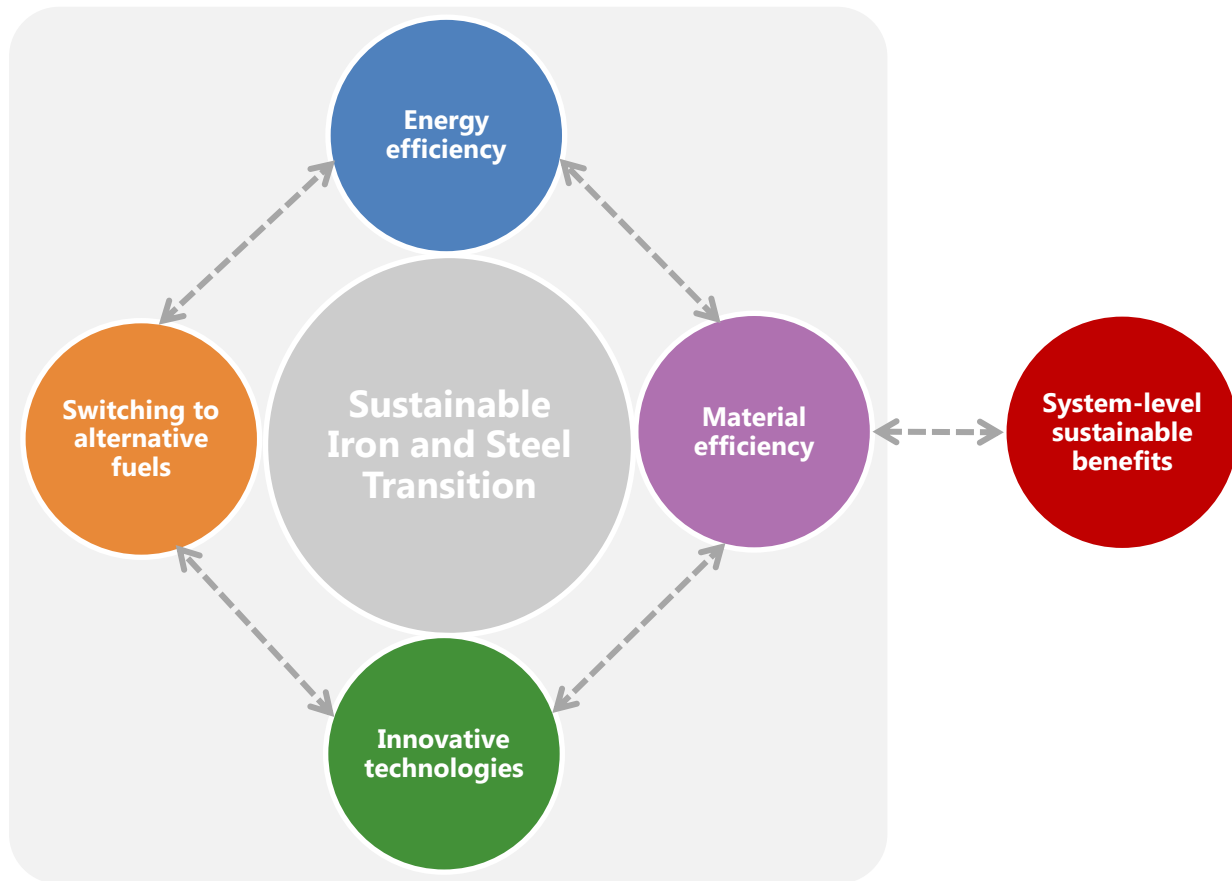


- BOF
- EAF - scrap
- EAF - DRI

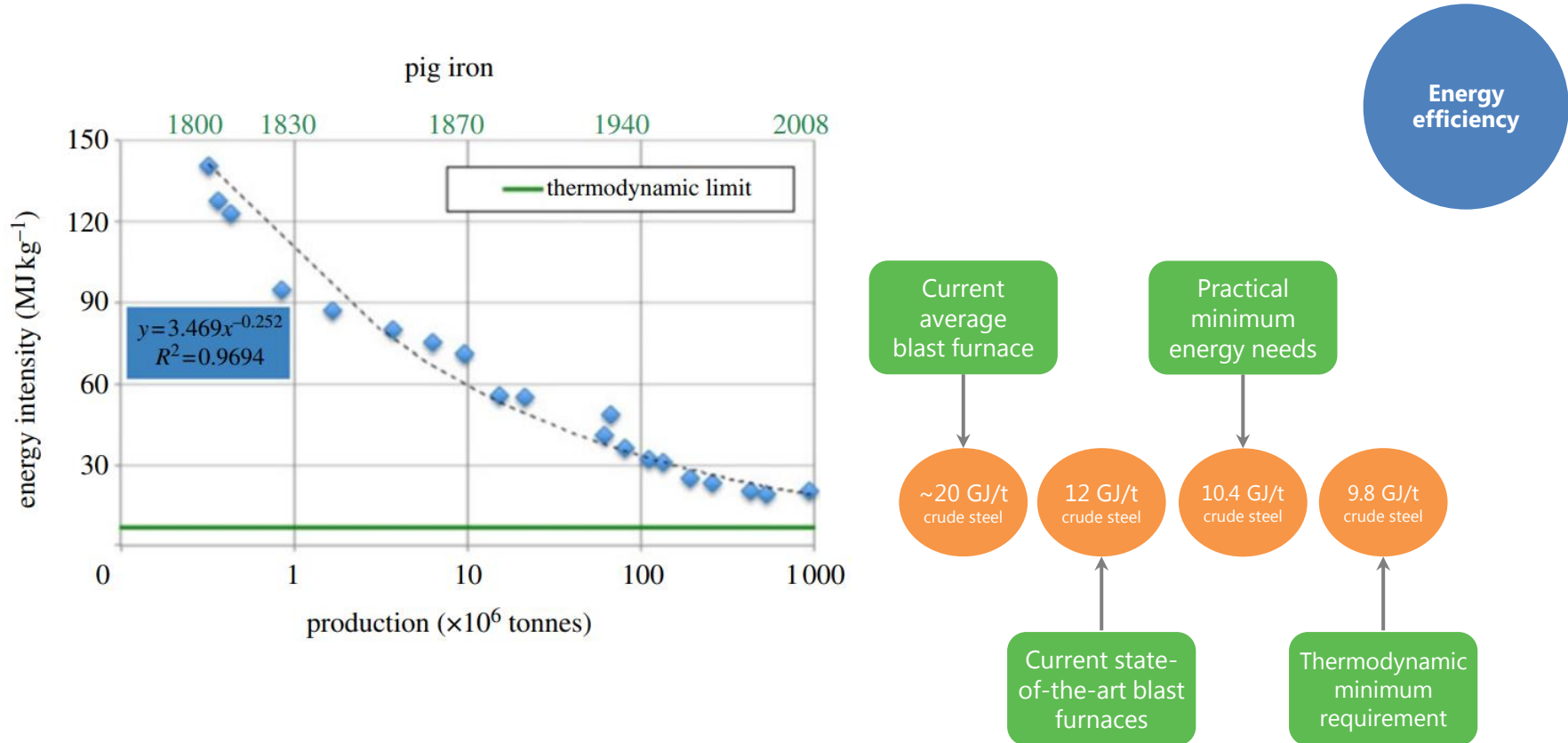
Note: 2014 data, blast furnaces and coke ovens (energy-usage recorded within transformation statistics) are included

Sustainable transition goals:

- Environmental sustainability
- Energy security
- Least-cost transition pathways
- Synergies between Iron and Steel and other sectors



Enabling strategies for sustainable iron and steel production





Innovative technologies

- **Upgraded smelting reduction.** Maximises the CO₂ content of the off-gases through pure oxygen operation, facilitating CO₂ capture. Pilot trials currently underway. Avoids the need for coke or sinter. [Large pilot demonstration TRL 6-7]
- **Oxy blast furnace and top gas recycle:** The CO₂ content of the top gas is raised by replacing the air in the blast furnace with oxygen and recycling the top gas. Lowers coke requirements. [Large pilot demonstration TRL 6]
- **Upgraded DRI process** (based on natural gas) that reuses off-gases from the shaft as a reducing agent after CO₂ capture. [Paper studies]
- **Coke oven gas (COG) reforming:** Increasing the hydrogen concentration of COG through reforming tar to reduce net energy consumption. Through integration with oxy blast furnaces, CO₂ capture can be added.



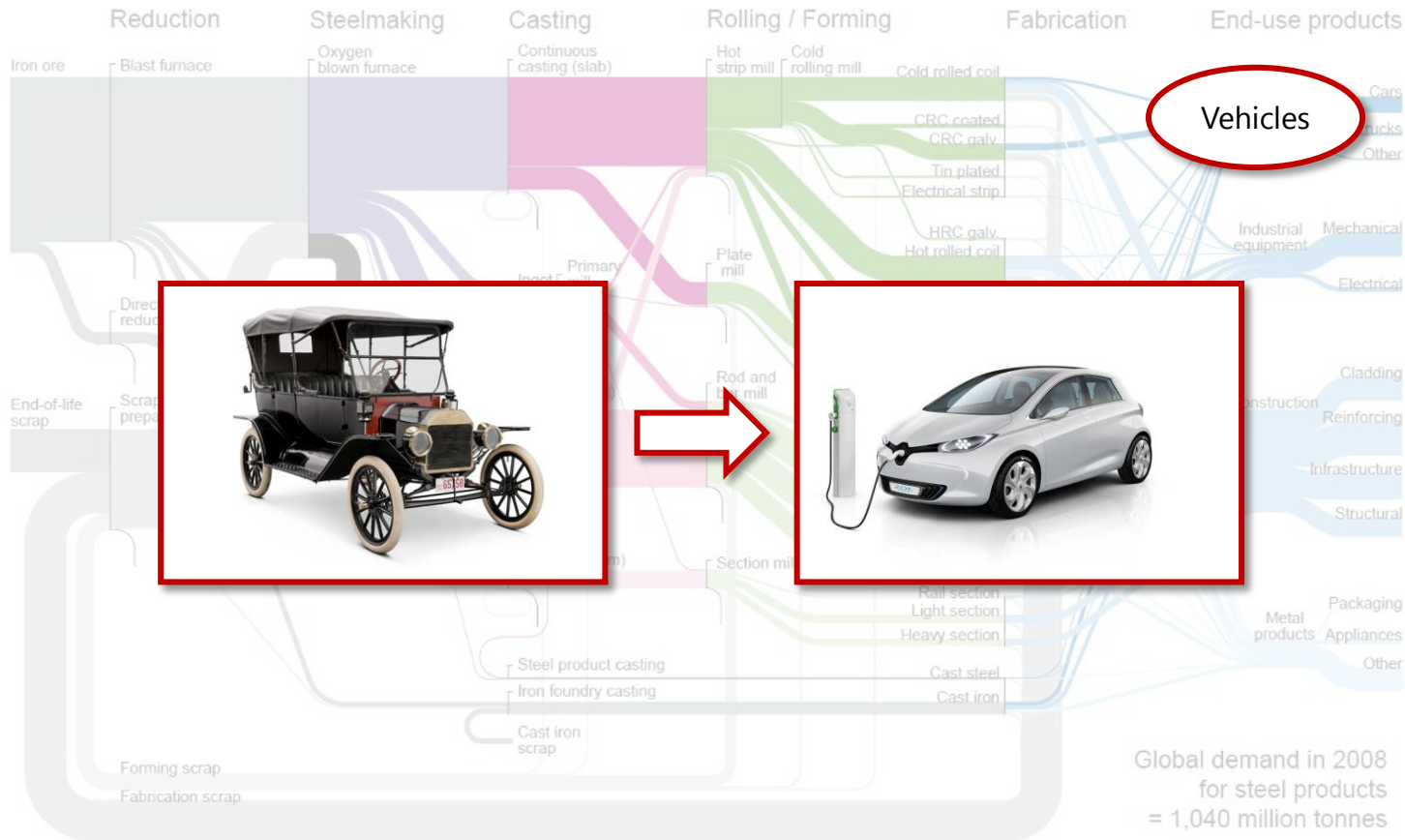
CARBON MANAGEMENT

- **Hydrogen from renewable-electricity for DRI production** [Pre-feasibility]
- **Direct use of electricity to reduce iron ore** relying on renewable electricity. [Intermediate TRLs]



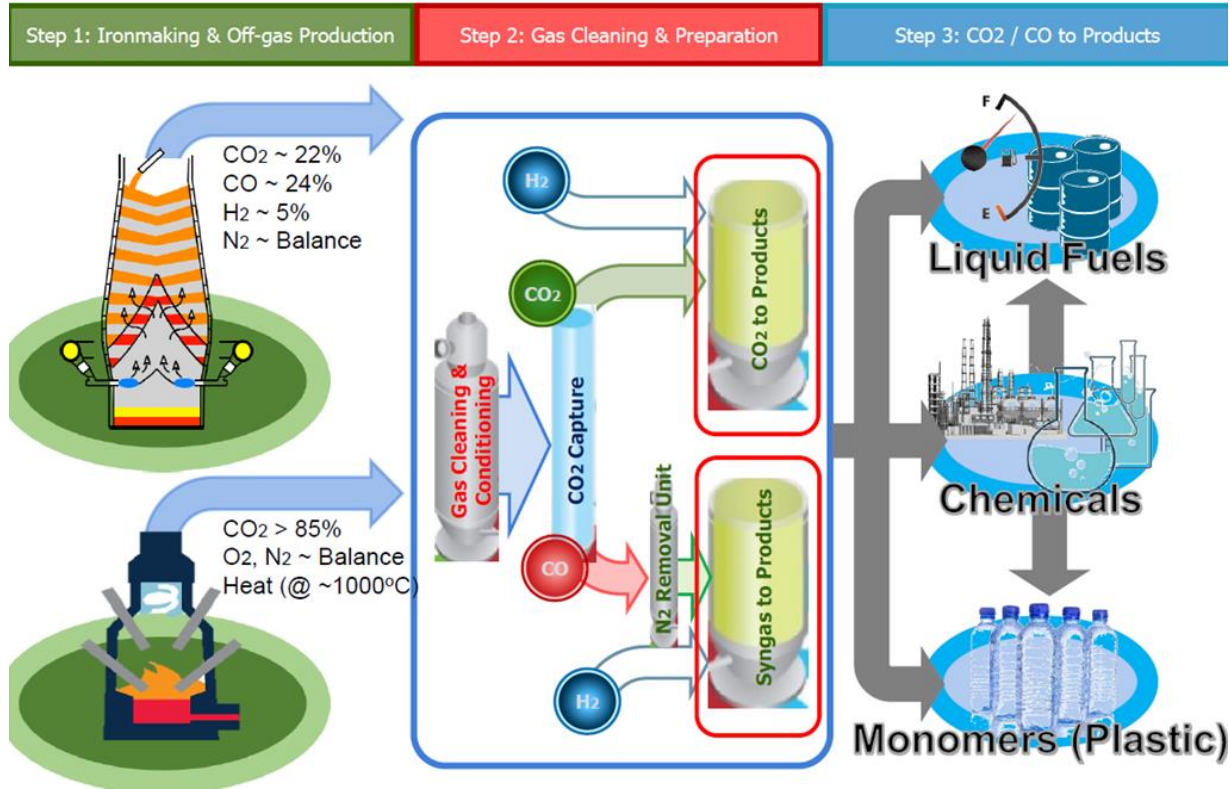
CARBON AVOIDANCE

Understanding current and future supply value chains is critical



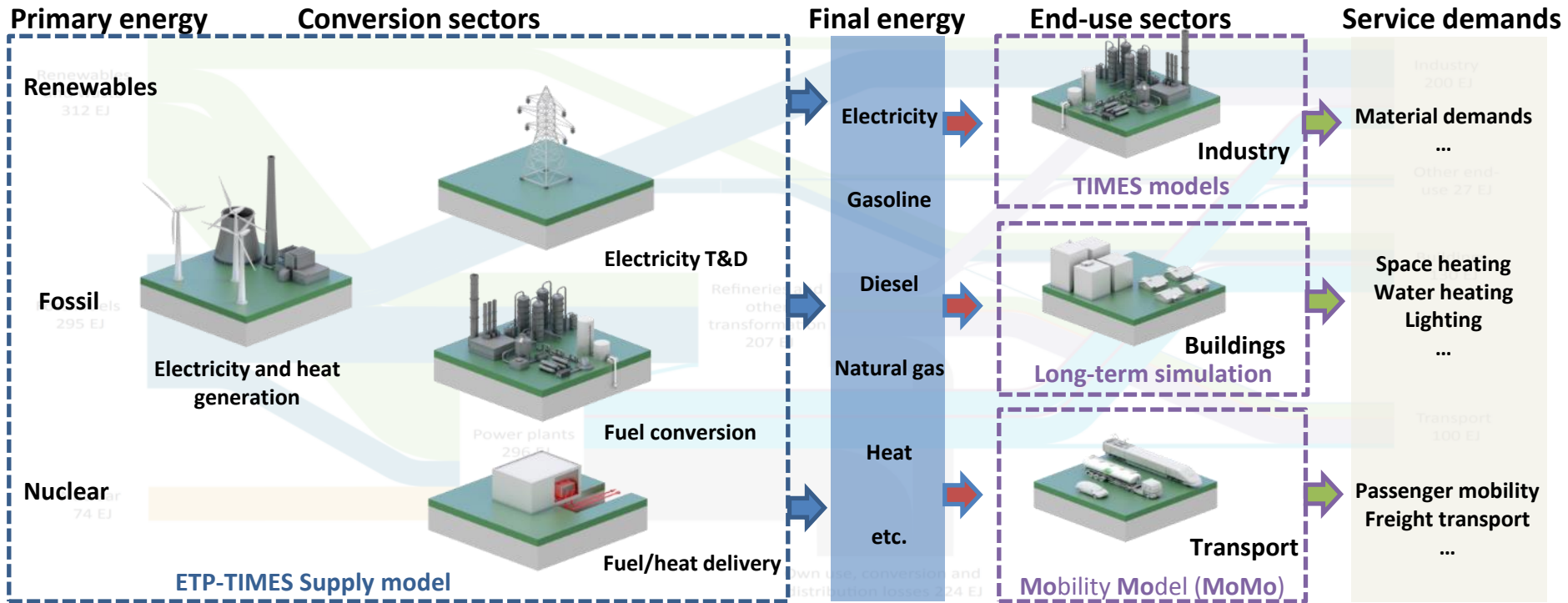
Material efficiency

Exploring further sustainability opportunities



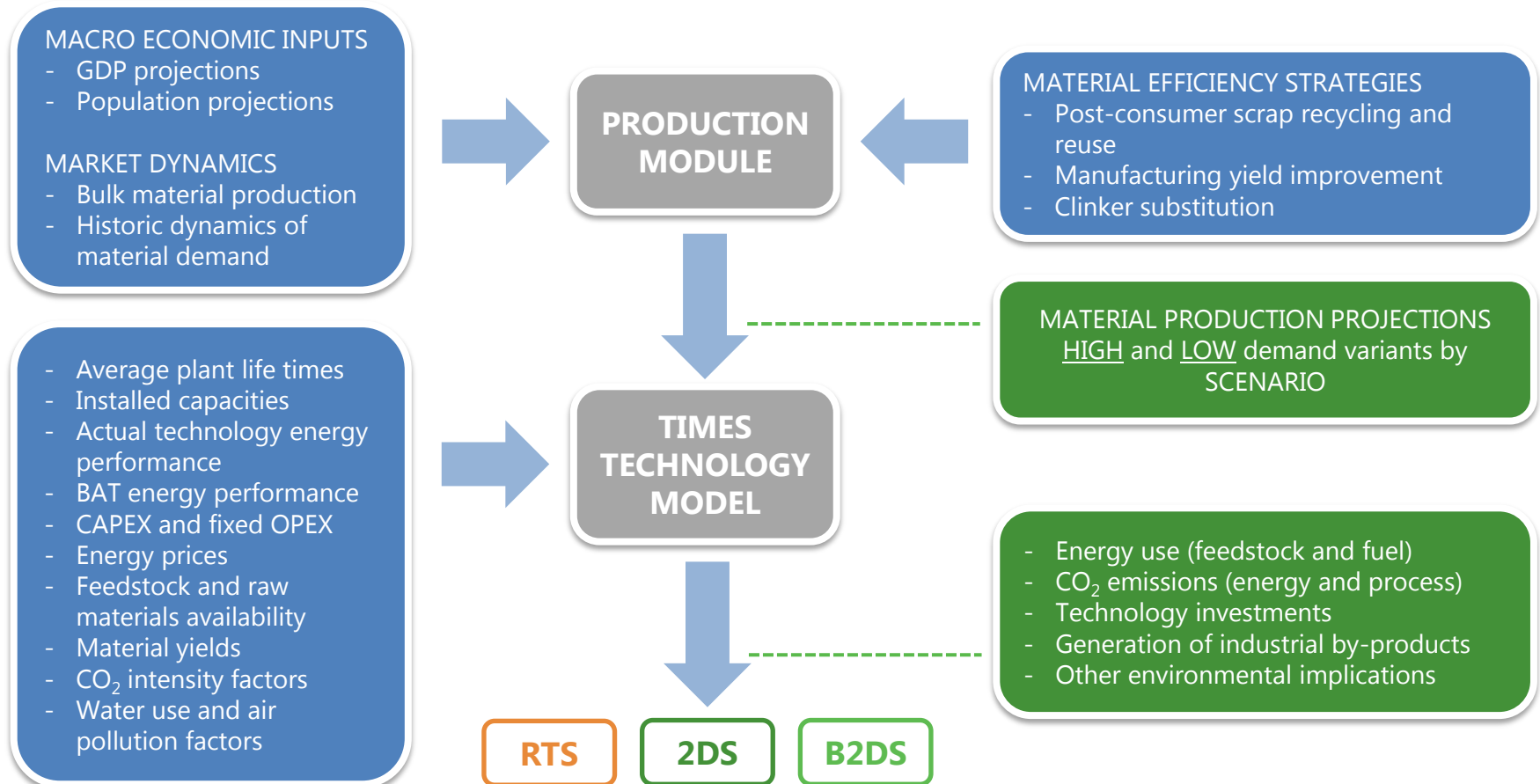
System-level sustainable benefits

ETP modelling: the engines behind the analysis



Bottom-up, technology-rich modelling to yield sector-specific insight

ETP Industry sub-sector model structure



American Experts' Dialogue

Next steps

Timeline

- Project kick-off – *November 2017, Paris*
- Materials demand trends in Transportation and Construction – *March 2018, Paris*
- Asian Steel Experts Dialogue – *May 2018, Shanghai*
- American Steel Experts Dialogue – *August 2018, São Paulo (Today!)*
- Expected launch Q2 2019

Slides

- Please send your slides to Priscilla Ferreira (ACO Brazil) if you have not done so already
- Please also fill out the disclosure form, permitting their distribution

Further engagement

- Experts are welcome to get in contact directly, and become part of our network
- As a part of the stakeholder engagement process, we will approach you at various stages of the modelling and drafting process, unless you prefer otherwise

The Future of Petrochemicals

- An in-depth look at one of the key “blind spots” of the energy system
- Report will be freely available on the IEA’s website
- Project online launch – *September 2018*

What-if? 2DS project

- Global, integrated analysis of all aspects of the energy system
- Two variants on the IEA’s 2DS:
 - Limited deployment of CCS
 - Increased material efficiency

Global analysis of Hydrogen

- Interim report as an input for Japan’s G20 Energy and Environment ministerial
- Final report launch in 2020

Thank you!

Stakeholder engagement greatly enhances these projects

Peter Levi

peter.LEVI@iea.org

Araceli Fernandez Pales

araceli.FERNANDEZPALES@iea.org



www.iea.org

