

ISO 20915

~Life Cycle Inventory Calculation Methodology for Steel Products~

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- ◆ Life cycle of steel products

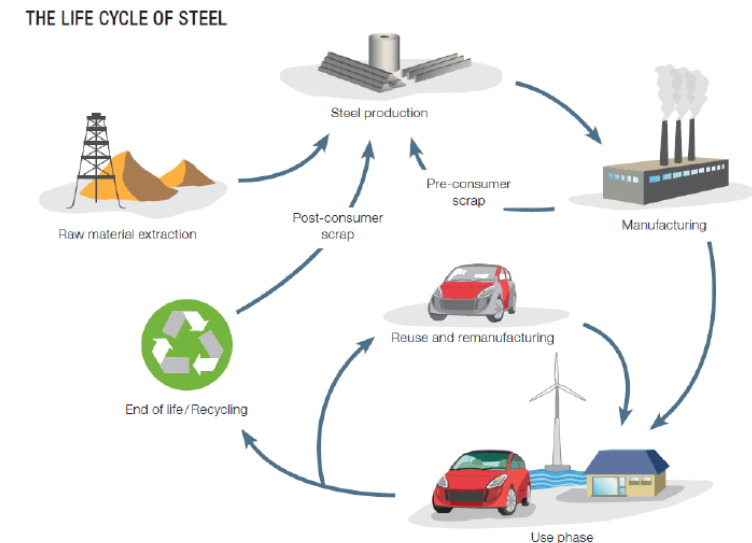
- ◆ ISO 20915:2018

 - “Life cycle inventory calculation methodology for steel products”

Life cycle of steel products

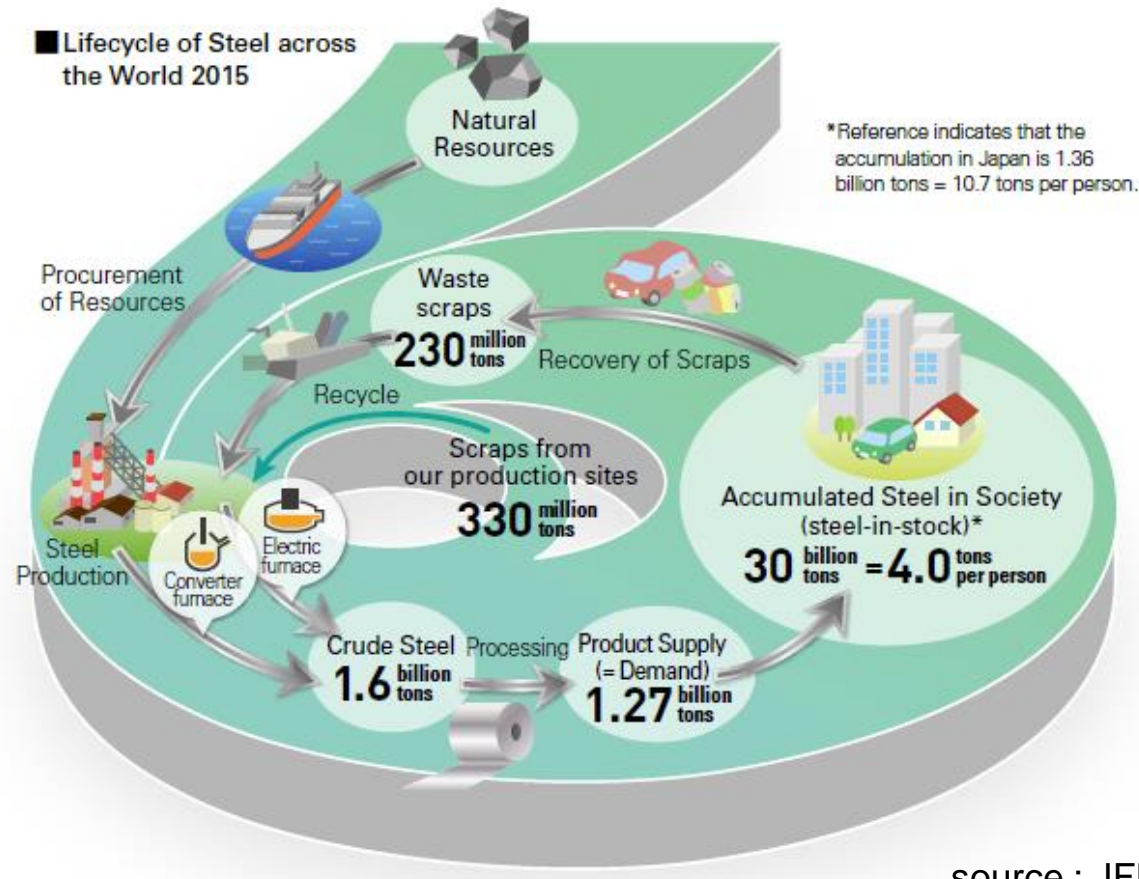
Life Cycle Assessment

- ◆ LCA is a method for assessing the **environmental impacts of products over its life cycle.**
- ◆ LCA considers **all aspects of a products life.**
 - ✓ Raw material extraction
 - ✓ Production
 - ✓ Use phase
 - ✓ Disposal and recycling
 - ✓ etc...
- ◆ LCA is used to avoid shifting the **environmental burden.**
 - ✓ between life cycle phases
 - ✓ from one impact category to another



Circulation of iron and steel products in the world (2015)

- All iron and steel are recycled in the circulating material flow composed of BF-BOF route and EAF route essentially constitute **closed-loop recycling**.



Closed-Loop Recycling (steel)



Source : JISF, <http://www.jisf.or.jp/en/activity/lca/recycle/index.html>

Closed-loop Recycling

Material is recycled as the same material maintaining inherent properties with infinite times of recycling.

Thermal Recycling (Open-loop Recycling)

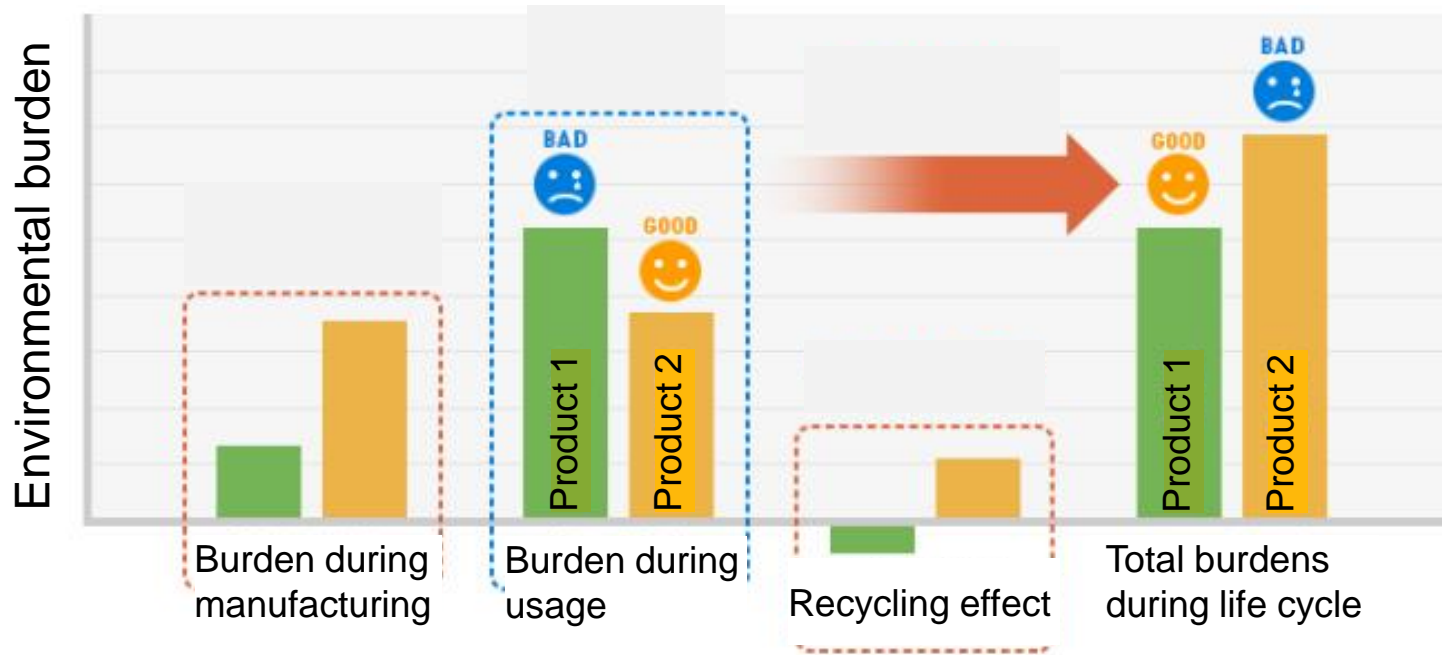
Electricity or steam are collected during incineration of waste. It is to reduce the volume of waste in some cases. Disposal of such as residual ash is necessary.

Cascade Recycling (Open-loop Recycling)

Material recycle with a change or degradation of quality. Material is disposed in the end.

Importance of “Life Cycle Thinking”

- ◆ There is a case where environmental burden is small in terms of an entire life cycle even when efficiency during use phase is high.
- ◆ “Life cycle thinking” is essential for appropriate evaluation of environmental burden of product.

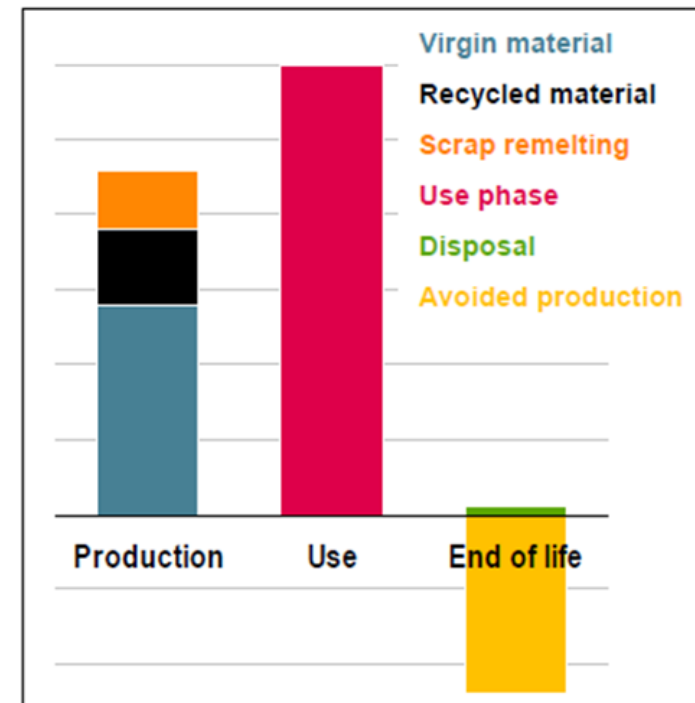
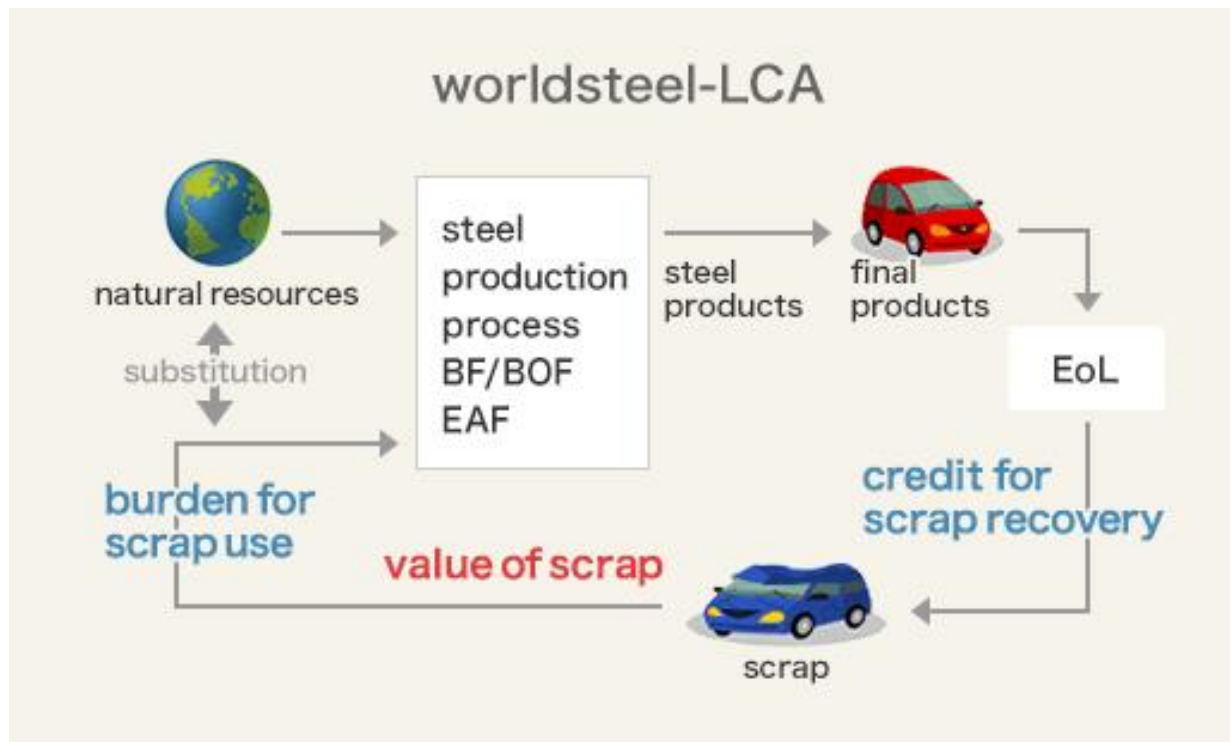


ISO 20915:2018

“Life cycle inventory calculation methodology for steel products”

Concept of worldsteel LCI calculation Methodology

- ◆ All BF-BOF, EAF or other steel production routes are the essential factors of steel product.
- ◆ **Scrap has an environmental value**, that is a credit when steel product is shipped, and it is a debit when using scrap such as end-of-life scrap.

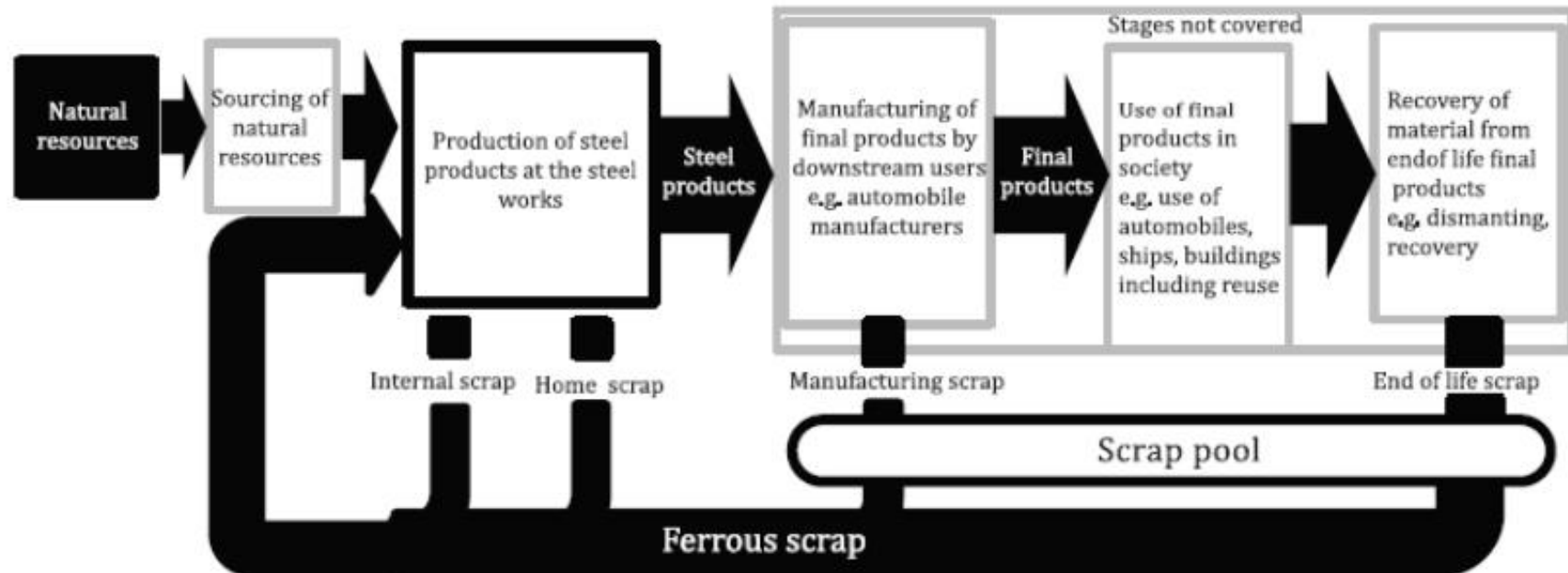


International standard

ISO 20915:2018

“Life cycle inventory calculation methodology for steel products”

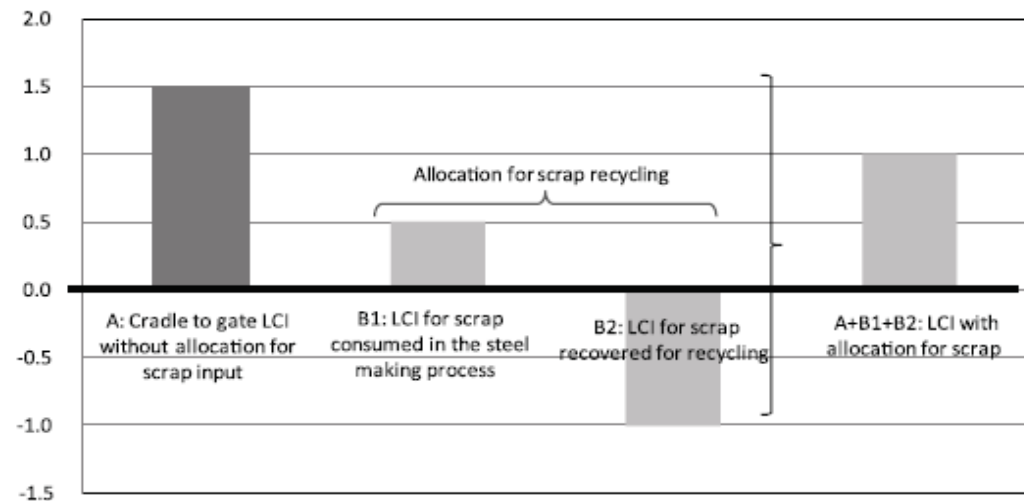
ISO 20915:2018 describes the methodology for the calculation of life cycle inventories of steel that can be applied to a wide range of steel products, and represents the main process routes for global steel production.



Published in November 2018

Methodological procedure for LCI calculation of steel products with provision for scrap recycling

- ◆ A: The LCI of the steel product to the factory gate is calculated without allocation for scrap.
- ◆ B: The LCI value for scrap is calculated. It is then applied in the sub-stages B1 and B2, both of these steps must be conducted.
 - ✓ B1: The LCI value as a burden for the mass of scrap consumed.
 - ✓ B2: The LCI value for scrap is credited for the mass of scrap that is going to be recovered..
- ◆ By aggregating A, B1 and B2 the LCI value for the steel product with consideration for scrap recycling can be determined.



Environmental burden of steel over life cycle

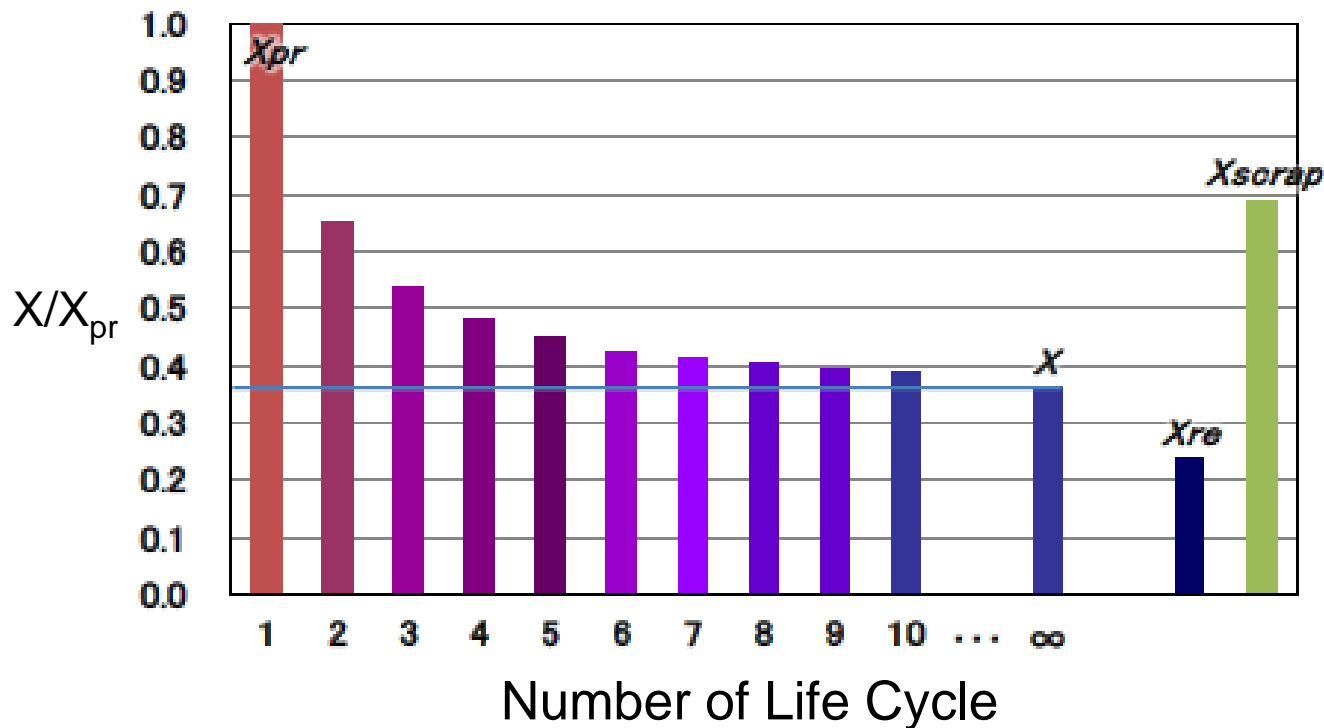
$$X \text{ (LCI)} = \frac{X_{pr} + r X_{re} + r^2 X_{re} + \dots + r^{n-1} X_{re}}{1 + r + r^2 + \dots + r^{n-1}} \quad \Rightarrow \text{Accumulated LCI}$$

\Rightarrow Total steel product

$$= (X_{pr} - X_{re}) \frac{(1-r)}{(1-r^n)} + X_{re}$$

$$\rightarrow X_{pr} - r(X_{pr} - X_{re}) \quad (n \rightarrow \infty)$$

credit of scrap recycling



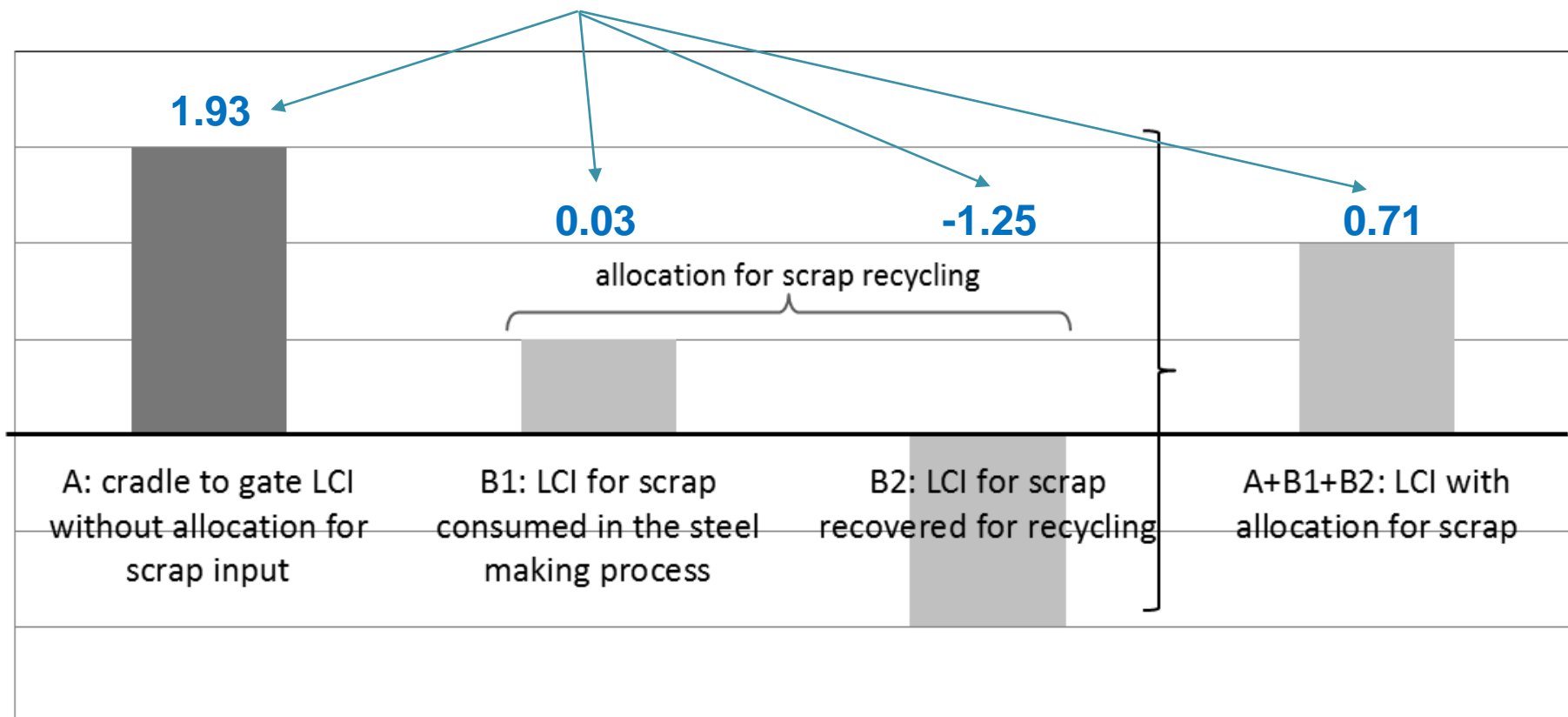
X : LCI (ex. CO₂ emission)
 X_{pr} : LCI of producing 1 kg of crude steel without steel scrap
 X_{re} : LCI of producing 1 kg of crude steel only from steel scrap
 X_{scrap} : LCI of 1 kg of scrap
 r : yield of crude steel in the X_{re} route

LCI of steel products

- ◆ The LCI of scrap is determined by considering the benefits of producing new steel from scrap compared with producing the same steel from purely iron ore based process route.

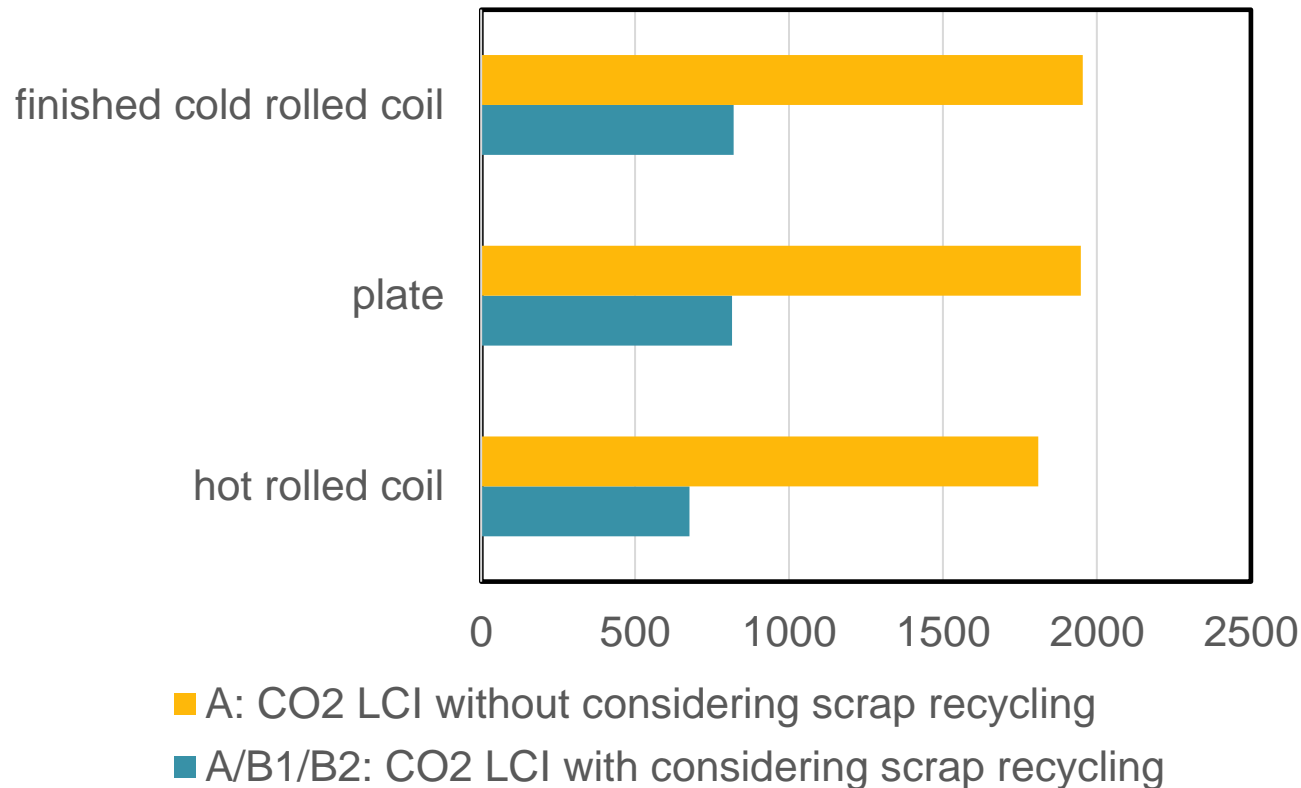
environmental impact

Example for Hot Rolled Coil of Japan 2014FY average



CO2 emission LCI data of Japan average

- ◆ Specific CO2 emission data of each steel product over the life cycle considering scrap recycling are **approximately 40% of those not considering scrap recycling.**



Reporting

- ◆ LCI results shall be reported for all of the components (A, B1, B2 and A+B1+B2).
- ◆ In cases where the goal and scope do not include an allocation for scrap burdens and credits, cradle to gate reporting includes scrap as a material input but without allocation of burdens or credits.
- ◆ It is important to ensure that the aggregate reporting is relevant to the goals and scope of any study to which the data are being applied.

A: Cradle to gate LCI without allocation for scrap input	Allocation for scrap recycling		A+B1+B2: LCI with allocation for scrap
	B1: LCI for scrap consumed in the steel making process	B2: LCI for scrap recovered for recycling	

worldsteel life cycle inventory data 2017

- ◆ Up-to-date and reliable LCI data of world/region are on worldsteel web site.



- 2012: 10 sites
- 2013: 16 sites
- 2014: 82 sites
- 2015: 1 site

- Europe: 56 sites
- Asia & Oceania: 33 sites
- North America: 8 sites
- Latin America: 11 sites
- Rest: 1 site

- **Total: 28 countries represented**

STEEL INDUSTRY LIFE CYCLE INVENTORY DATA 2017

we did our life cycle homework



NOW YOU DON'T HAVE TO

Conclusions

- ◆ A new international standard, ISO 20915, was published in 2018. It describes the methodology for the calculation of the steel life cycle inventories which can be applied to steel products and represents the main process routes for global steel production.
- ◆ ISO 20915 helps quantitatively understanding the environmental impacts of materials in closed-loop recycling, such as steel, which is the fundamental material for achieving a sustainable society because of its superior recyclability.

ขอบคุณ ครับ

Thank you!

ありがとうございました！



And steel is becoming even "lighter"

Technology is making steel lighter and lighter by increasing its strength. A series of technological innovations reduced the amount of steel required to achieve the same strength by two-thirds. With many future innovations lined up, steel is a material with a high potential to become even "lighter".

Steel can be recycled "lightly"

Steel has another life after the product is no longer used. Almost all steel is recycled worldwide, because steel can be sorted easily using magnets and has the flexibility to be recycled into a variety of steel products. Because of these properties, steel can be recycled "lightly" into all kinds of steel products.

Steel has a "light" burden on the environment

Steel production generates less CO₂ than the production of many materials. Additionally, because of its recyclability, steel has very small environmental burden at the time of disposing. Steel is a material with a "light" impact on the environment through its entire life cycle.



<http://www.jisf.or.jp/en/>

Please visit ...

◆ JISF LCA web-site

- <http://www.jisf.or.jp/en/activity/lca/index.html>

◆ worldsteel LCA web-site

- <https://www.worldsteel.org/steel-by-topic/life-cycle-thinking.html>

The screenshot displays the website for The Japan Iron and Steel Federation (JISF). The header includes the JISF logo, the name 'The Japan Iron and Steel Federation', and navigation links for 'Contact', 'Link', and 'Site Map'. There are language selection buttons for 'Japanese' and 'English', and a search bar with the text 'カスタム検索' (Custom Search) and a 'Search' button. Below the header is a navigation menu with 'Chairman's Comments', 'Statistics & Analysis', 'Activities' (highlighted), and 'JISF Organization'. The breadcrumb trail shows 'HOME > Activities > LCA of Steel Products'.

The main content area is titled 'LCA of Steel Products' and features a green circular logo with the Japanese characters 'スチール' (Steel) and a recycling symbol. Below this is a large banner image showing the Eiffel Tower, the Japanese Tower, and the Tokyo Skytree, with the text 'LCA OF STEEL PRODUCTS' overlaid. The page is organized into a grid of content blocks:

- Life Cycle Thinking**: What is Life Cycle Thinking?
- Types of Recycling**: Description of material recycling
- Life cycle of steel and recycling**: Description of the prerequisites for sustainable recycling materials
- Life Cycle Assessment Society of Japan**: The Institute of Life Cycle Assessment, Japan
- Action by the steel industry #1**: International Standard development
- Action by the steel industry #2**: data collection
- Reference information**: past presentation and publication materials related to LCA
- Japan Steel Can Recycling Association**
- worldsteel**

A sidebar on the left lists 'Activities' with a red notification icon, including: Current Major Activities(PDF), LCA of Steel Products (highlighted), Life Cycle Thinking, Types of Recycling, Life cycle of steel and recycling, Action by the steel industry, Technology Development for Environmentally Harmonized Steelmaking Process (COURSE50), STEEL CONSTRUCTION TODAY & TOMORROW, JISF's 'STEEL-MAGAZINE' e-zine, and JIS Standard for automobile L&E.

Thank you

