Decarbonization Roadmap towards Net Zero Carbon by 2060

Presented for 2022 SEASI Mega Event and Expo

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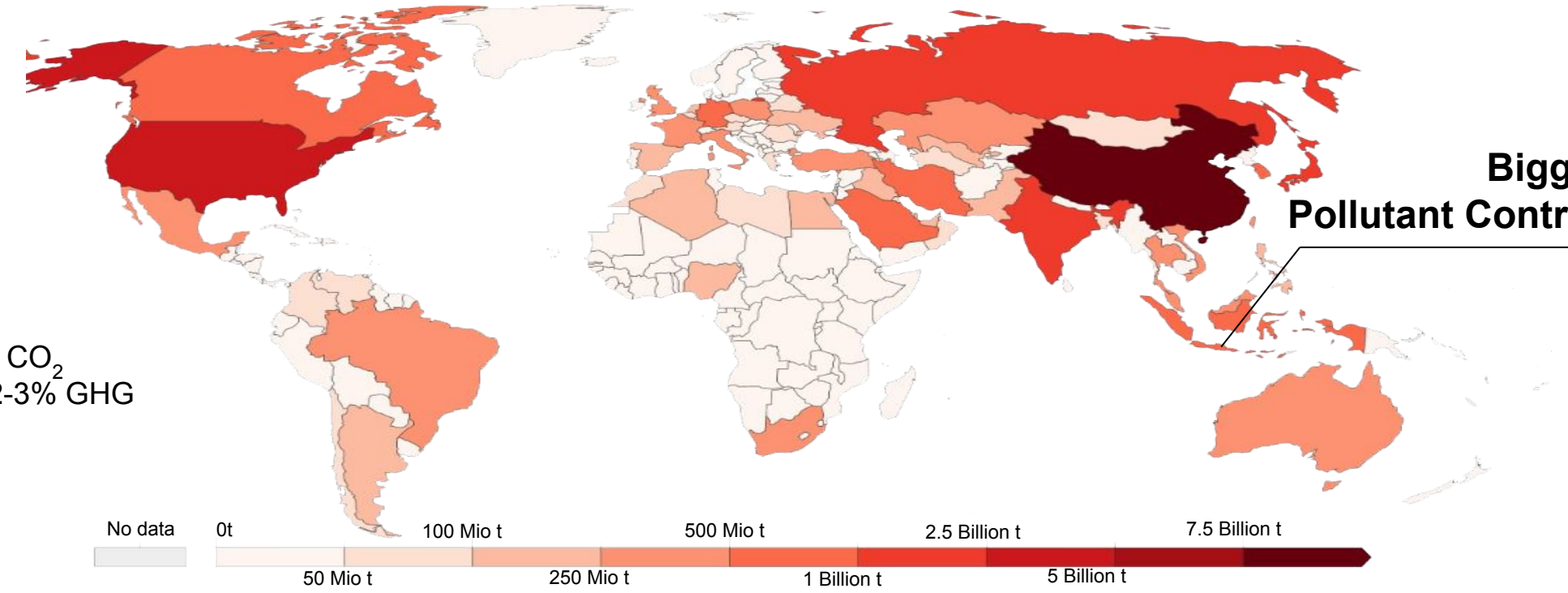
BUMN UNTUK INDONESIA

KRAKATAU STEEL

Indonesia facing potential risk of high GHG emission, initiative of emission reduction is doing not for Global enforcement, but for saving our next generation

CO_2 emission is produced from fossil fuel combustion to generate energy

Indonesia contribute 1.6 Gt CO_2 Equivalent with 2-3% GHG Emission in total



Biggest 8th Pollutant Contributor

~42 Mio houses
Will be flooded caused of sea level rising

Uncertain weather causing
20% crop failure

~2000 Islands
Will sink before 2050

~145 Mio Population
of Indonesia will be affected by terrible heat wave

Source: McKinsey, US NASA Goddard Institute for Space Studies (GISS) GISTEMP Reanalysis dataset (2019), World Resources Institute (Processed by PTKS)

The decarbonization roadmap of Krakatau Steel is referring to the Paris Agreement and related policies for climate change in Indonesia

Paris Agreement

United Nations Framework Convention on Climate Change (UNFCCC)

- The Paris Agreement aim:

2°C **Keeping a global temperature rise this century well below** < 2°C

Increase the ability of countries to deal with the impacts of climate change

Making finance flows consistent with a low GHG emission and climate resilient pathway

- Indonesia signed this Agreement on Climate Change at April 2016

Indonesia's climate change policies

Law No 16/2016
Confirmation of Paris Agreement UNFCCC

- Indonesia has to put forward its commitment to reduce emissions domestically in form of NDC (*Nationally Determined Contribution*)
- 2030 NDC target of Indonesia:
  a. 29% on its own effort
  b. 41% with international supports

Law No 79/2014
Indonesia's National Energy Policy (KEN)

Key Point of KEN	**2025**	**2050**
1. Target of Renewable energy mix	23%	31%
2. Electricity consumption per capita (kWh)	2.500	7.000
3. Minimum supply capacity of energy (MTOE)	400	>1.000

President decree No. 22/2017
The National Energy General Plan (RUEN)

Important target of RUEN	**2025**	**2050**
1. Capacity of renewable-energy power plant (GW)	45,2	167,7
2. Renewable fuels (MTOE) - *Biofuel, Biomass, Biogas and CBM*	23	74,9
3. Emission reduction of CO_2 eq (million ton/%)	476 (34,8%)	2.726 (58,3%)

Law No 07/2021
The harmonization of tax carbon regulation

Carbon tax will be imposed on individuals or entities that buy good containing carbon and/or carry out activities that produce carbon emission which are further regulated by or based on government regulation

Iron and steel production is a highly energy-intensive industrial activity and also a large contributor of emission

Total energy consumption for steel industry:

8% of **Global energy**

Total CO_2 emission for steel industry:

7% of **Global emission**

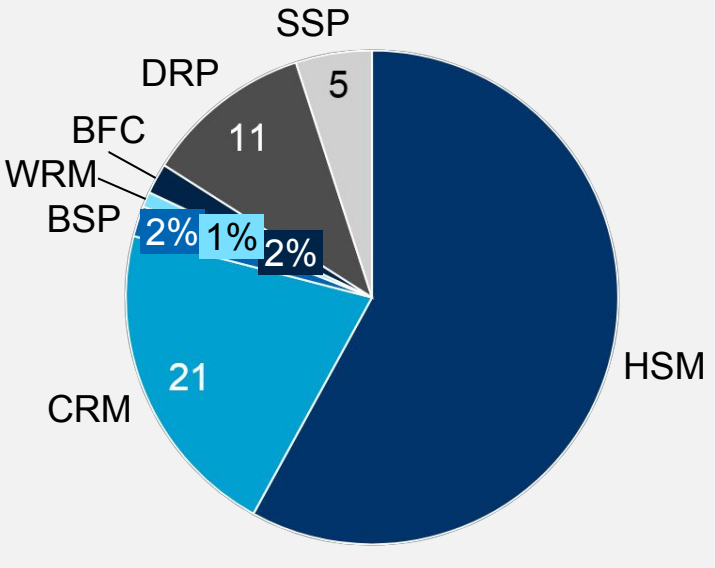
or

2.6 of **GT CO_2 equivalent**

KRAKATAU STEEL

6.45 Mio **GJ**

Total Energy Consumption of Krakatau Steel *)



1.81 Mio **GJ**
Electricity

4.64 Mio **GJ**
Natural Gas

**) Steel industry is an energy-intensive user, Total energy Consumption of Krakatau Steel is equivalent to electricity consumption per annual for North Sulawesi Province with total land area 13,892 km^2 and 2.5 mio population*

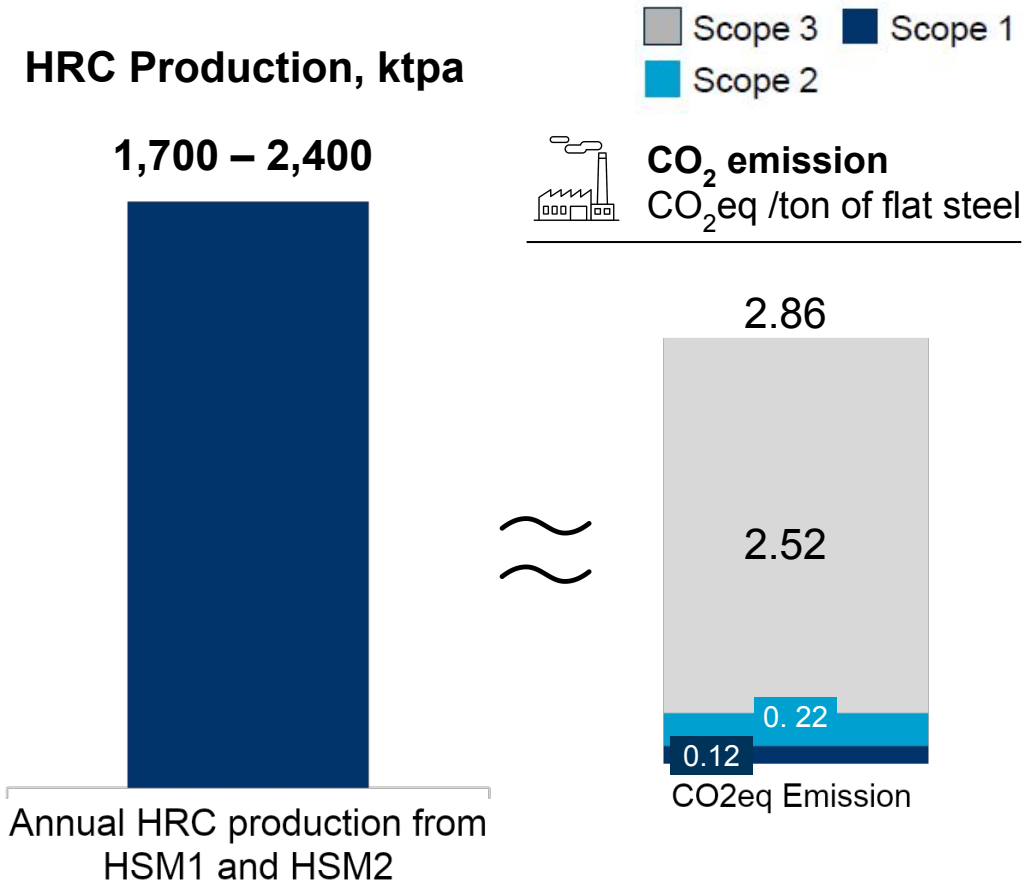
Steel production methods: blast furnace and electric arc furnace

Production route options of Krakatau Steel

(Internal study of KS | 2021)

- **Krakatau Steel has had flexibility to determining product competitiveness**
  between blast furnace based or Direct reduction based.
- **Specific emission from BF-BOF route is higher than DR-EAF route**
  if carbon tax will be applied, product competitiveness needs to be analyzed for each route

By today, largest rolling process emissions coming from purchased goods and services



Scope 1:

Fuel combustion

Scope 2:

Purchased electricity

Scope 3:

Purchased goods and services

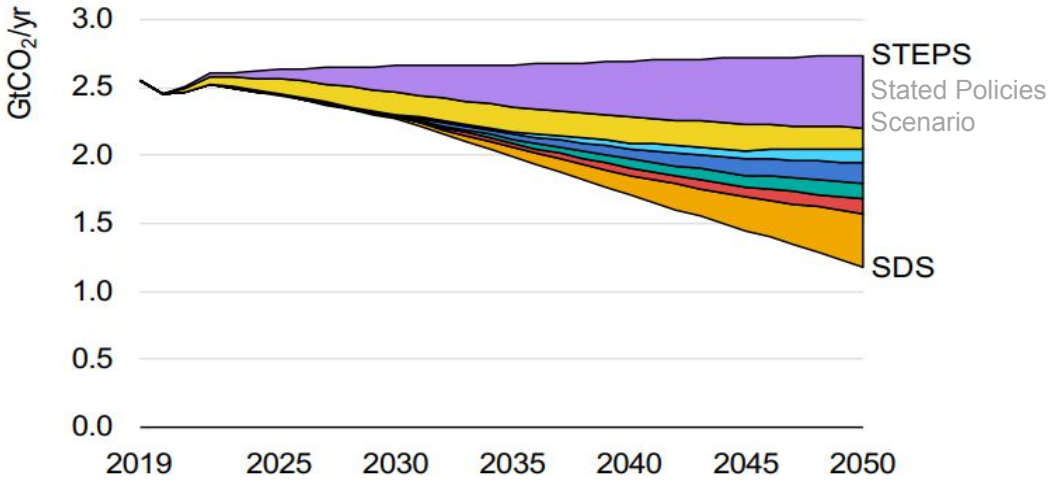
Transportation and distribution

KS emission factor is largely contributed by slab production (scope 3) which KS would need to work closely with its suppliers to reduce the emission

The development of global steel industries is a reference to developing technology to reduce CO_2 emission from process production

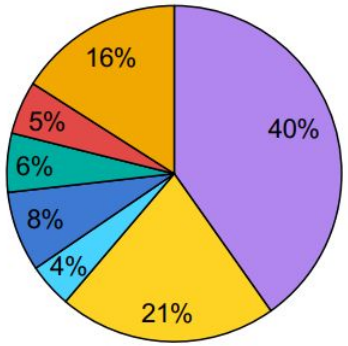
Direct Emission CO_2 reductions In the Sustainable Development Scenario (SDS)

(EIA, Iron and Steel Technology Roadmap)



Cumulative direct emission reduction between 2020 and 2050

(EIA, Iron and Steel Technology Roadmap)



Technologies compared for future steelmaking

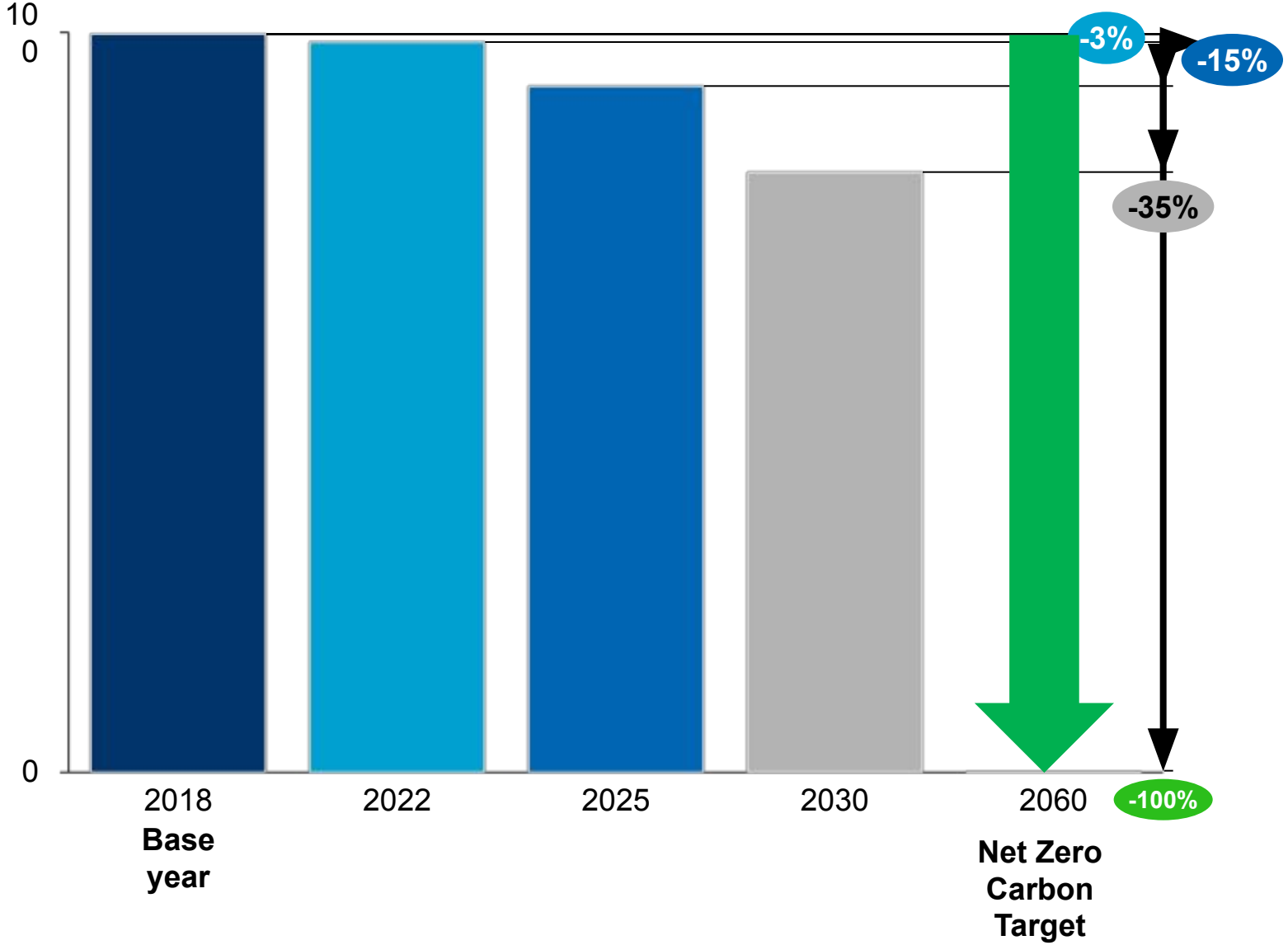
(The future of steelmaking, Roland Berger | 2020)

	Technologies	Tech. Readiness	Dev. Cost[1]	Capex[2]	Opex[3]	Transform Brownfield plant
CCUS	Carbon capture, use and/for storage	◕	◑	◔	◕	●
	Carbon capture, use and/for storage with biomass	◑	◕	◑	◔	◕
Alternative Reductant Agent	H_2 based – DRI shaft furnace	●	◔	◕	◕	◕
	H_2 based – DRI fluidized bed	◕	◕	◕	◕	◕
	Suspension ironmaking technology	◔	◕	◔	◔	◔
	Plasma direct steel production	◔	●	◔	◔	◔
	Electrolytic process	◔	◕	◔	◔	◔

[1] Compared to the other presented carbon neutral technologies
[2] Compared to CAPEX of BF-BOF greenfield plant in 2040-2050
[3] Compared to BF-BOF plant in 2040-2050 (incl. carbon tax)

● High ○ Low

Decarbonization strategy with the short-term target of reducing the company's carbon dioxide emission intensity rate for steel production by 35% in 2030



Energy Management
Initiative of energy conservation in production activities

Green Building
Utilization of renewable energy to support operational of office building

Renewable Energy Development
Implementation of Solar Panel in KS Group

Roadmap Green Technology
Carbon capture technology for blast furnace off gas, Natural Gas and Hydrogen Based DR

Waste & By-product Management
Utilization and waste processing for natural material and energy substitution
- waste gas utilization (Coke oven gas) to substitutes natural gas
- Mill scale and slag valorisation

To meet the emission reduction target by 2060 Krakatau Steel will continuing energy improvements and the adoption of low-emissions technologies

Future development of low carbon technology

Optimalization of Coke Oven Gas for Reheating Furnace Rolling Mill

~12,000 Nm^3/h excess of COG utilized for NG Substitute

Efficiency & Energy Conservation Program

Continuous improvement of energy utilization by adopting ISO 50001

Natural Gas Based DR–EAF route production

Optimalization on DR-EAF route

Carbon capture technology for blast furnace off-gas

62% CO_2 from BFG is captured by CO_2 Absorption system

To 2030

2030

After 2030

Implementation of Renewable Energy

Application of ~17 MWp of Solar power for office building, industrial water processing and warehouse

Implementation of coke dry quenching

Changing wet dry quenching of COP to generate over 18 MW power

~35% CO_2 emission reduction

Hydrogen as fuel

The use of H2 to substitute fossil fuels

Hydrogen based direct reduction

Potentially reducing **1.800 K Ton of CO_2** per year

THANK YOU

For Further Question

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