



Life cycle-CO₂ calculation

Innovation for a Sustainable World

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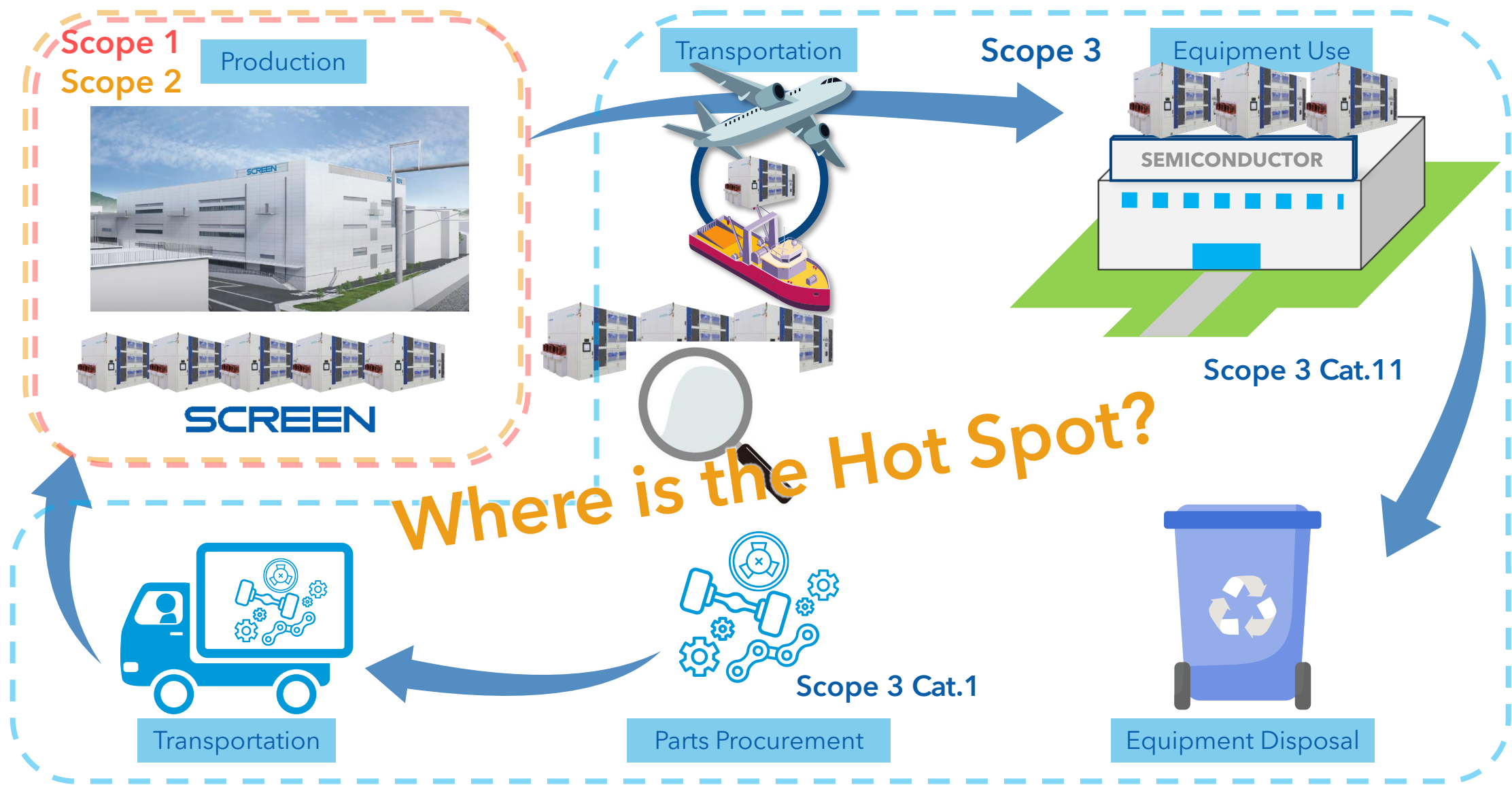
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SCREEN SU-3200 Single Wafer Clean Equipment



SU-3200

Expandable up to 12 Chambers,
Impressively High Throughput of up to
800 wafers per hour



"Parts Procurement" - Parts lists and groupings

Custom Parts



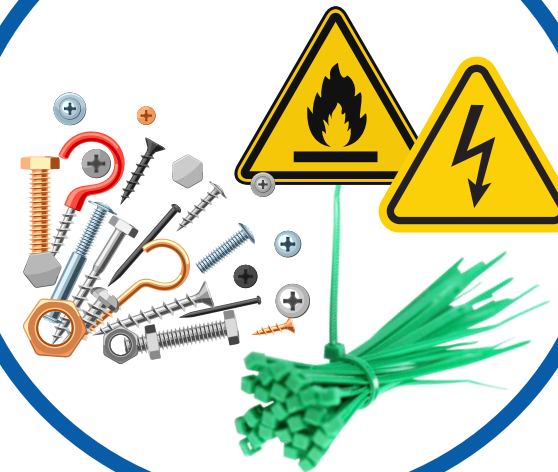
Grouping by **Material** <25 types>

Commercial Parts



Grouping by **Part** <196 types>

Miscellaneous



Excluded from total*

*Since the weight-based ratio is small and the impact on the overall emissions of the equipment is expected to be similarly small.

"Parts Procurement" - Parts lists and groupings

- IDEA v3.2 intensity is a mix of "material" and "product" items.

	"Material" intensity	"Product" intensity
Image of target products	Chemical industry products, steel industry products	Plastic processed products, metal processed products
Intensity unit	Mainly weight-based	By weight or by value
Advantages	Fine classification, <u>suitable for material-specific environmental impact analysis</u>	CO ₂ emissions during processing by component manufacturers are <u>included</u> .
Disadvantages	CO ₂ emissions during processing by component manufacturers <u>are not included</u> .	Coarse classification, <u>not suitable for material-specific environmental impact analysis</u>
Example of intensity	163521000pJPN Vinyl chloride resin 223113220mJPN Stainless steel 163525000pJPN Fluororesin	181511000pJPN Processed parts of plastic sheets, rods, tubes, fittings and deformed extruded products (cutting, joining, painting, vapor plating and buffing) 245211000pJPN Parts of punching and pressing machines (without machine finishing)

Intensities were selected based on the following:

- 1. Product-based intensity shall be applied.**
- 2. Priority is given to weight-based intensity.**

(i) easier to link to reduction actions (ii) not subject to fluctuations due to market conditions

Exceptions

- fluororesin has a greater environmental impact than general resins, the intensity per unit of material (= fluororesin) is applied to fluororesin-derived parts.

1. Parts Procurement

- Results of CO₂ Emissions Calculation (Configuration 1)

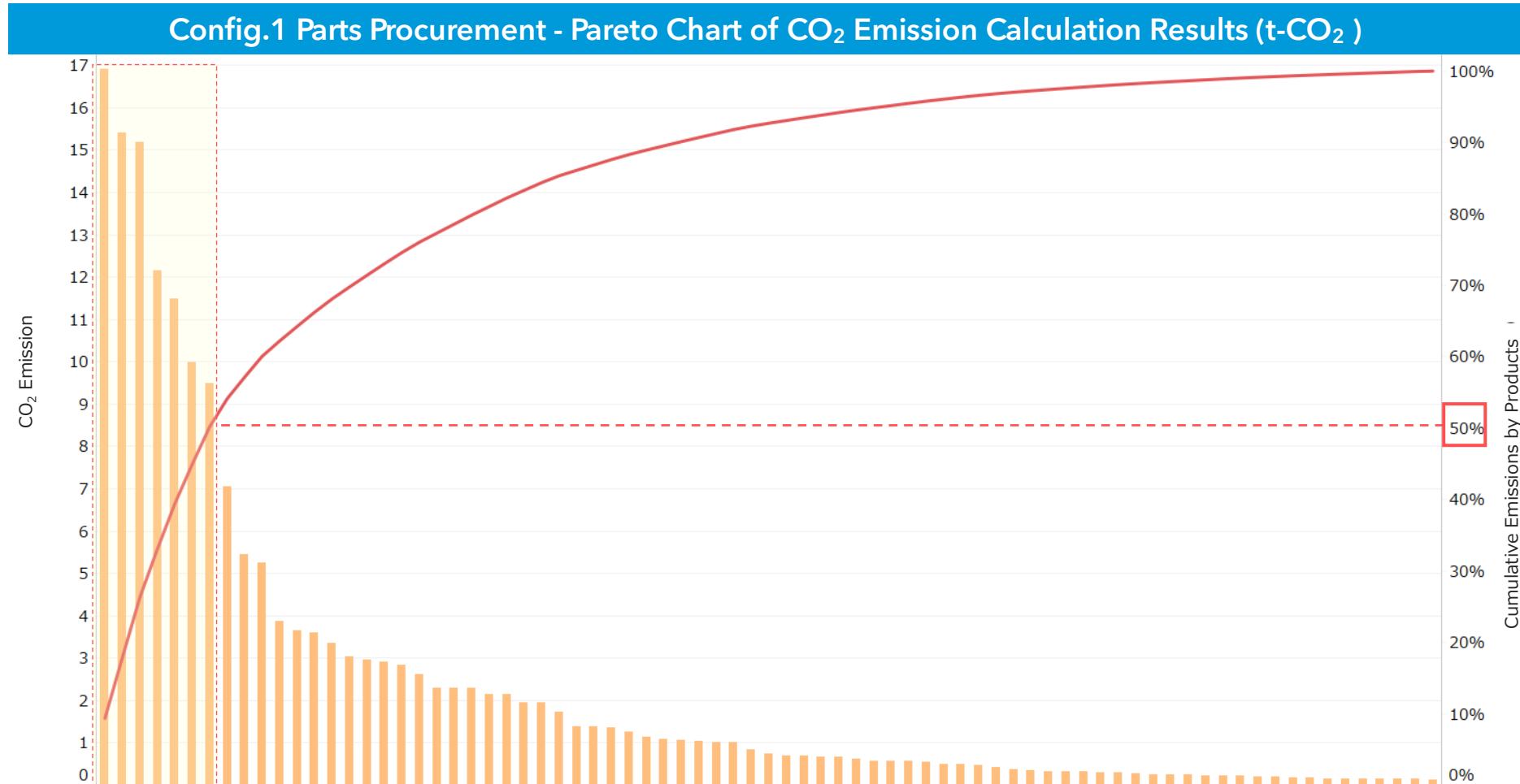
- Collect and calculate actual data on the weight or value of parts of the entire equipment.
- Emissions from procurement of parts for the entire equipment were ~**2.3% of the total life cycle of Config.1 products.**
- Fluorine compounds (PFAS) are considered to have a high environmental impact, and there is a movement to tighten regulations. However, the effects from the CO₂ emissions point is not as significant as PFAS.

Parts Procurement - Results of CO ₂ Emissions Calculation (t-CO ₂) *Top 5 items and total for each item			
Category	Sub-category	Unit	Entire Equipment
Config.1 - Custom Products	Vinyl Chloride	tCO2	
	SS	tCO2	
	SS400	tCO2	
	AL	tCO2	
	Fluoroplastic-PTFE	tCO2	
Config.1 - Commercially Available Products	Ultrasonic Flowmeter	tCO2	
	Printed Circuit Boards	tCO2	
	PF Nozzle	tCO2	
	Servo Motor	tCO2	
	Solenoid Valve	tCO2	
Total of Config.1	Total	tCO2	

1. Parts Procurement

- CO₂ Emission Calculation Result of Parts Procurement (Configuration 1)

- The top 7 emission sources account for about 50% of the total emissions from parts procurement.



1. Parts Procurement

- Results of CO₂ Emissions Calculation (Configuration 2)

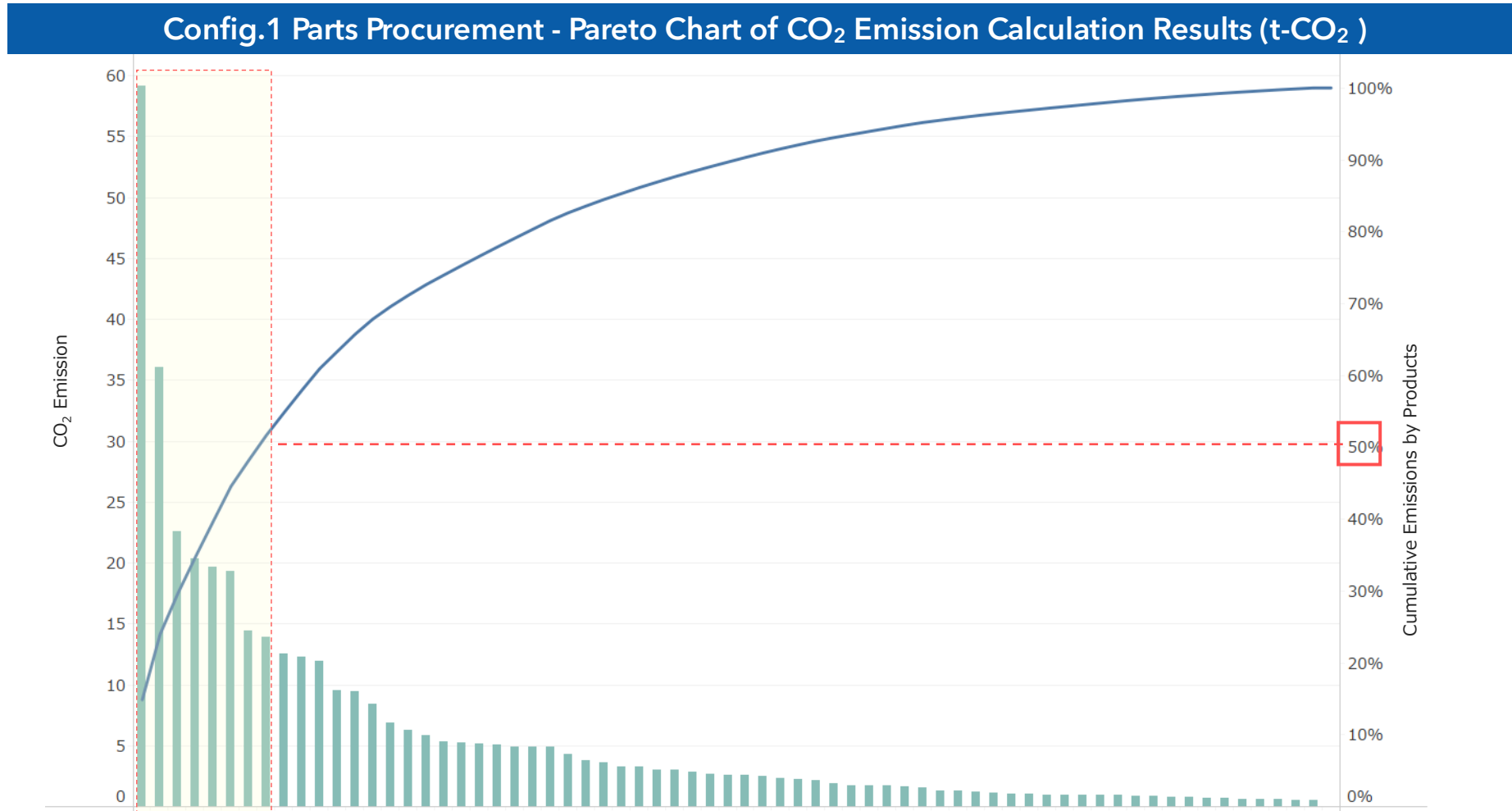
- Collect and calculate actual data on the weight or value of parts of the entire equipment.
- Emissions from procurement of parts for the entire equipment were **~2.0% of the total life cycle of Config.2 products**.
- Fluorine compounds (PFAS) are considered to have a high environmental impact, and there is a movement to tighten regulations. However, the effects from the CO₂ emissions point is not as significant as PFAS.

Parts Procurement - Results of CO ₂ Emissions Calculation (t-CO ₂) *Top 5 items and total for each item			
Category	Sub-category	Unit	Entire Equipment
Config.2 - Custom Products	SS	tCO2	
	Vinyl Chloride	tCO2	
	SS400	tCO2	
	AL	tCO2	
	Fluoroplastic-PTFE	tCO2	
Config.2 - Commercially Available Products	Other Devices	tCO2	
	Quartz Pipe Heaters	tCO2	
	Heat Exchanger	tCO2	
	Ultrasonic Flowmeter	tCO2	
	Printed Circuit Boards	tCO2	
Total of Config.2	Total	tCO2	

1. Parts Procurement

- Results of CO₂ Emissions Calculation (Configuration 2)

- The top 8 emission sources account for about 50% of the emissions from parts procurement



Calculation conditions for "Equipment Use"

- Utility and chemical usage information for Configuration 1 & 2 is as follows:

Calculation of utility consumption

Calculate consumption for each equipment mode (Processing: running, Idle: standby)

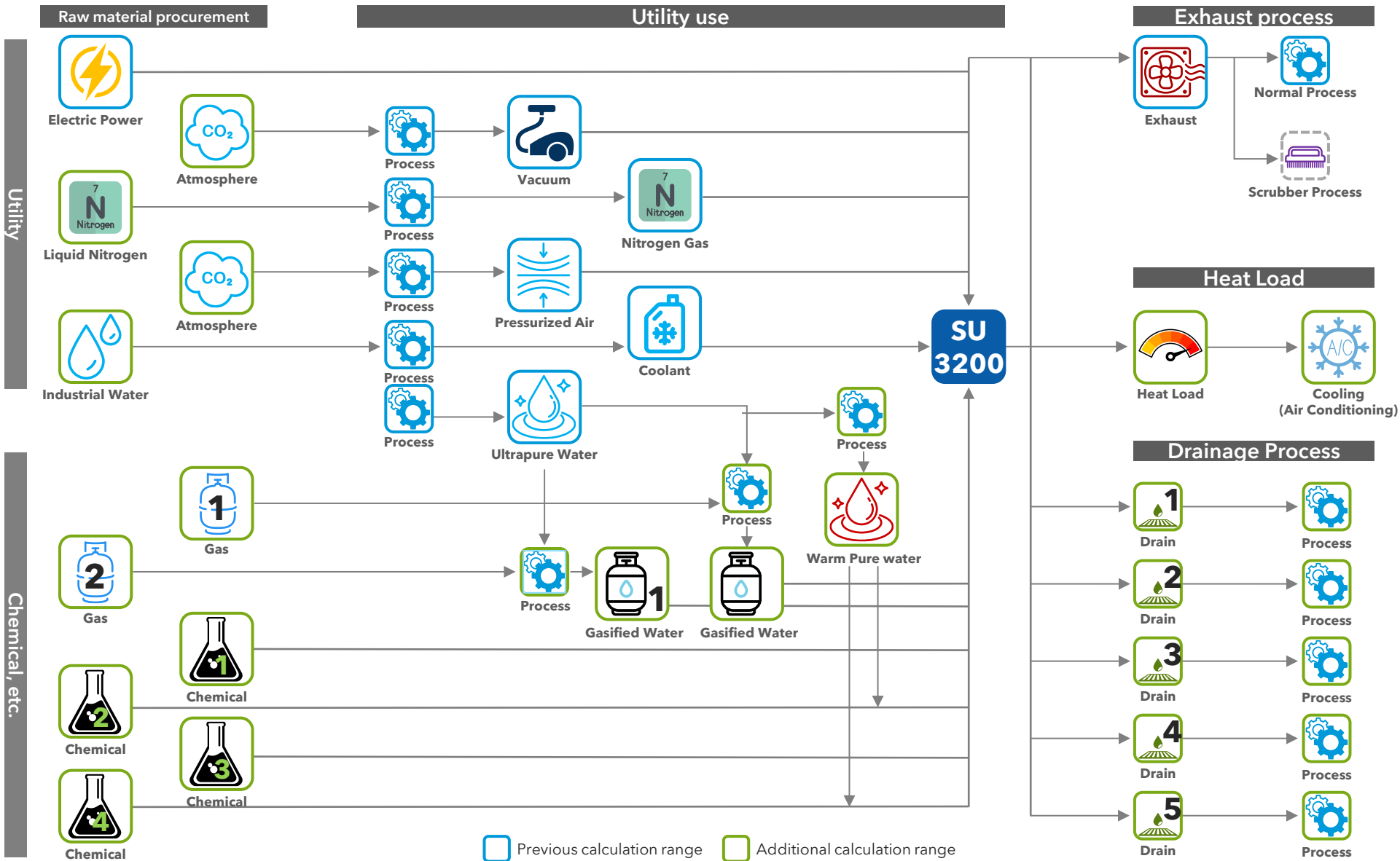
- In the absence of data on standby consumption, 40% of running consumption was assumed to be standby consumption..

Annual operating hours were based on those recommended in **SEMI S23-1021**

- Total annual hours: 8,760 h
 - Of which, annual operating hours: 6,132 (h) 70%
 - Of which, annual standby hours: 2,190 (h) 25%
 - Of which, annual downtime: 438 (h) 5% (*Consumption is assumed to be zero when stopped.)

Flow diagram for "Equipment Use"

Scope 3 Cat. 11



CO₂ emissions calculation result for "Equipment Disposal" (MPC)

Dismantling and crushing of SU-3200

Emissions from equipment disposal accounted for **0.02~0.03%** of the total life cycle.

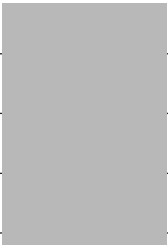
- Emission factors for each treatment method are based on IDEA v3.2
- Grouping is based on the results of a survey conducted by the Ministry of the Environment.
- Recycling rates by waste type are based on the Ministry of the Environment's survey* of industrial waste discharge and disposal.



6. Equipment Disposal

- Results of CO₂ Emissions Calculation (Config.1, Config.2)

- Emissions from equipment disposal are as follows
 - Config.1 : -CO₂/unit (approx. 0.03% of total life cycle)
 - Config.2 : -CO₂/unit (approx. 0.02% of total life cycle)

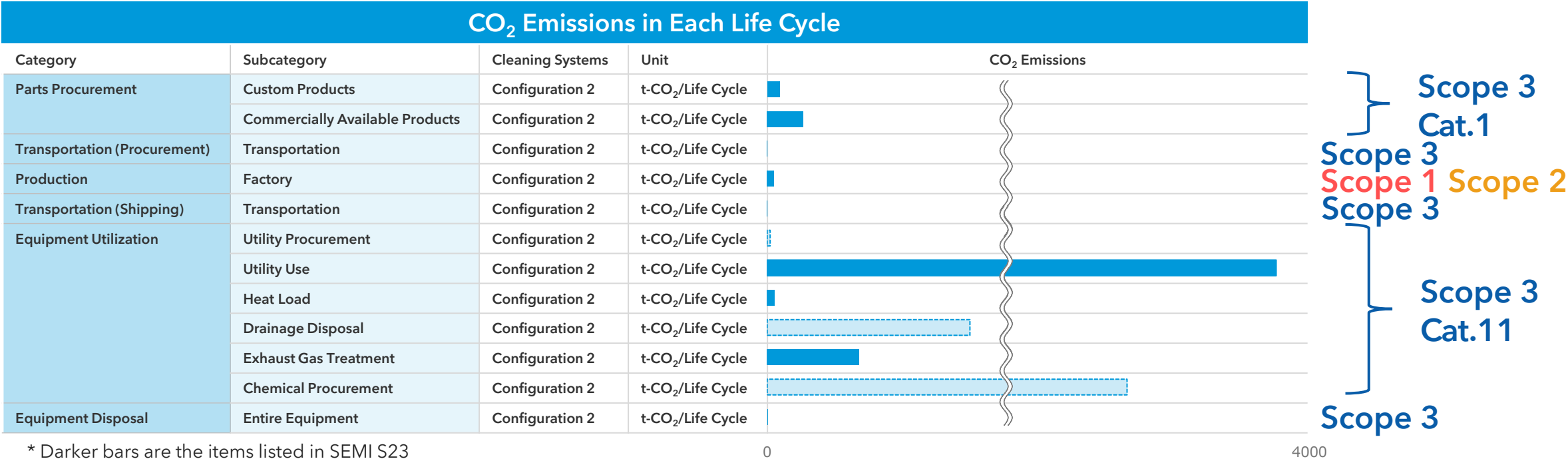
Waste Material Type		Weight	Unit	CO ₂ Emission		Unit
Dismantling and Crushing			kg			t-CO ₂ /unit
Disposal	Metal Scraps		kg			t-CO ₂ /unit
	Plastic Waste		kg			t-CO ₂ /unit
	Others		kg			t-CO ₂ /unit
Total						t-CO ₂ /unit

Waste Material Type		Weight	Unit	CO ₂ Emission		Unit
Dismantling and Crushing			kg			t-CO ₂ /unit
Disposal	Metal Scraps		kg			t-CO ₂ /unit
	Plastic Waste		kg			t-CO ₂ /unit
	Others		kg			t-CO ₂ /unit
Total						t-CO ₂ /unit

Summary. LC-CO₂ Calculation Results for SU-3200 (Configuration 1)

- The majority of SU-3200's LC-CO₂ emissions are from equipment use, indicating that reducing CO₂ emissions during use is the most significant issue.
- In particular, CO₂ emissions related to utility usage and chemical procurement were identified as hot spots.

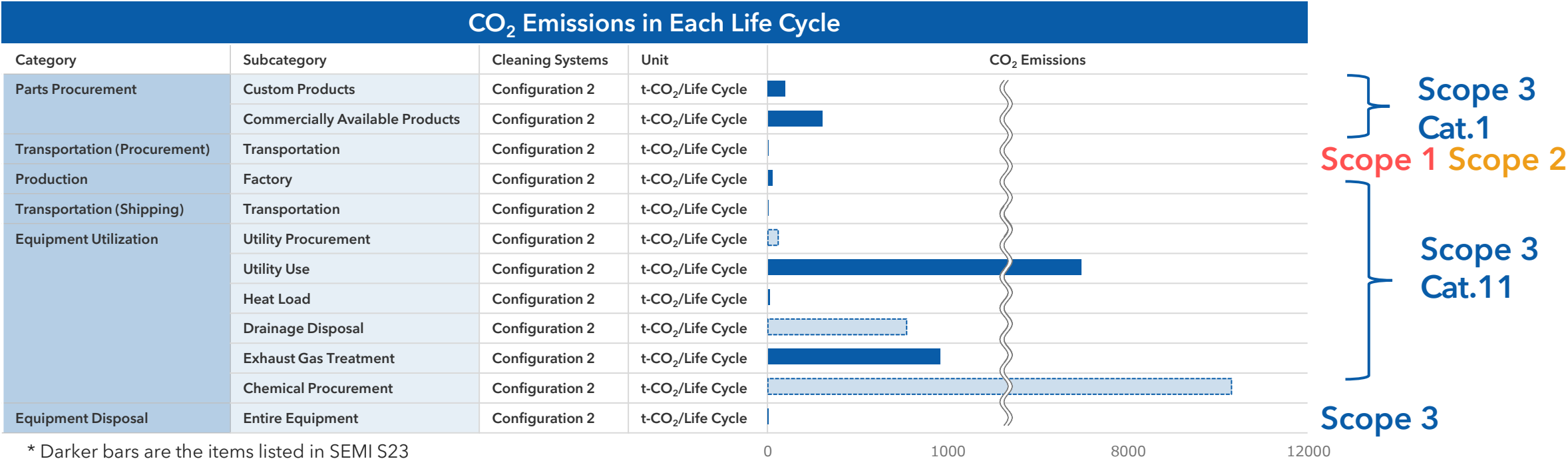
*Based on your information, it is assumed that the equipment will be in use for 10 years.



Summary. LC-CO₂ Calculation Results for SU-3200 (Configuration 2)

- The majority of SU-3200's LC-CO₂ emissions are from equipment use, indicating that reducing CO₂ emissions during use is the most significant issue.
- In particular, CO₂ emissions related to utility usage and chemical procurement were identified as hot spots.

*Based on your information, it is assumed that the equipment will be in use for 10 years.



Key takeaways

Highlights:

- SCREEN completes initial LC-CO₂ calculation for Model SU-3200 single-wafer cleaning equipment.
- The majority of SU-3200's LC-CO₂ emissions are from equipment use
- Emissions from parts procurement are ~2% of the total product life cycle
- Fluorine compounds (PFAS) are considered to have a high environmental impact, but the impact from a CO₂ perspective is not as great.

Assumptions:

- 10years estimated lifespan of equipment
- Annual operating hours based on SEMI S23-1021 recommendations
- Parts classified by material or type
- IDEA v3.2 used as the inventory data set

Challenges:

- Need to obtain primary data for chemical solutions
- There are more than 10,000 types of parts per equipment, very few manufacturers calculate and provide primary data on parts.
- Some equipment models are low-volume – applying a similar methodology potentially inefficient

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