

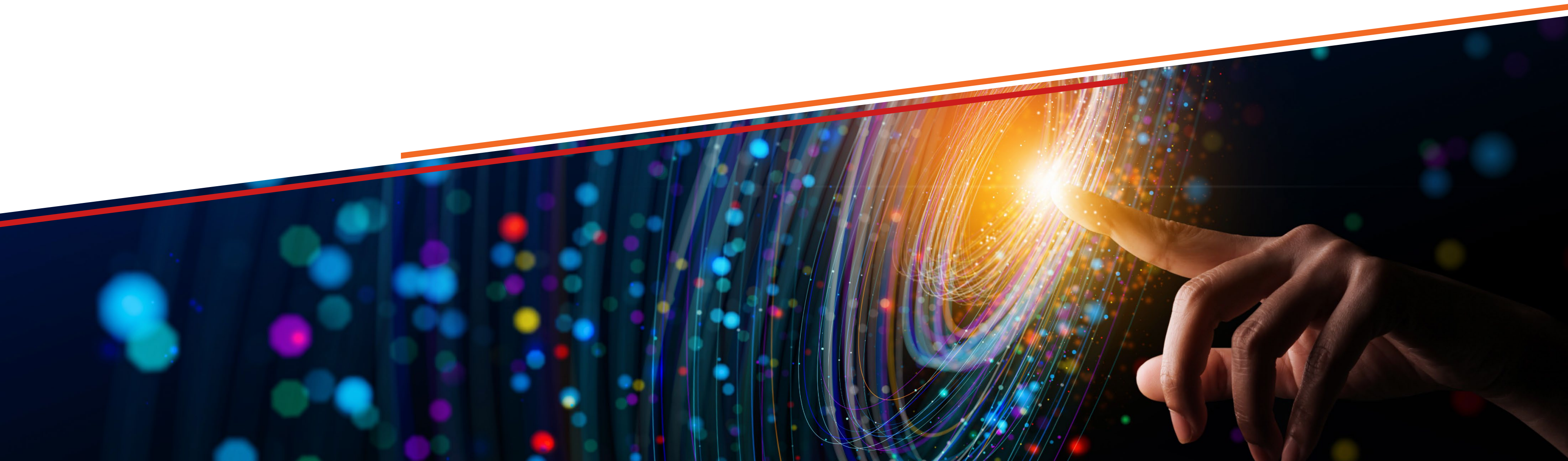
ACE23

REIMAGINE YOUR POSSIBILITIES

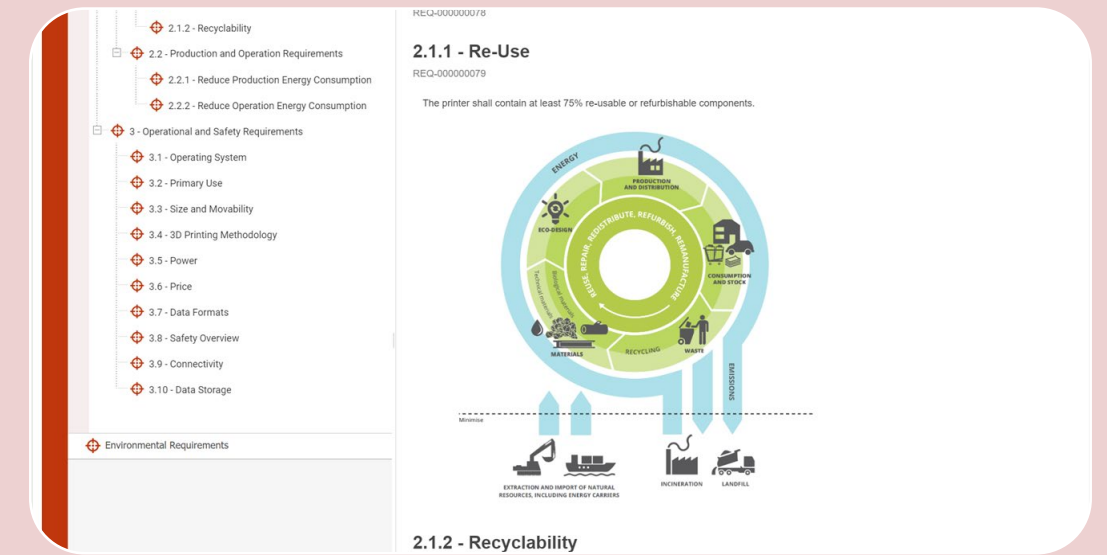
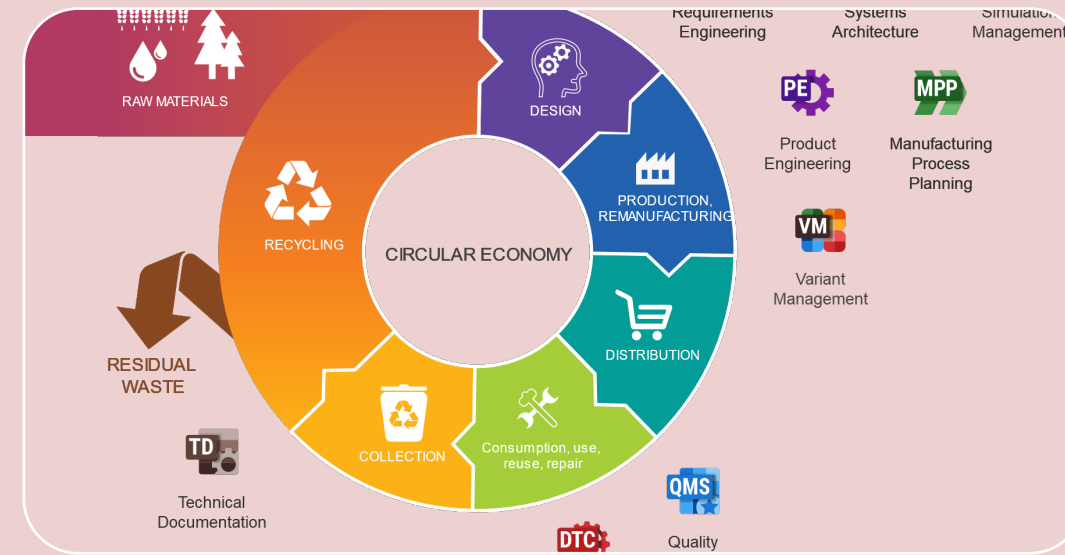
Supporting Environmental, Social and Governance (ESG) Initiatives with Aras Innovator

Alan Mendel, Patrick Willemsen, Tim Keer

May 2023



Agenda



Sustainability

1

Green PLM

2

Demonstration

3

Sustainability

ACE23

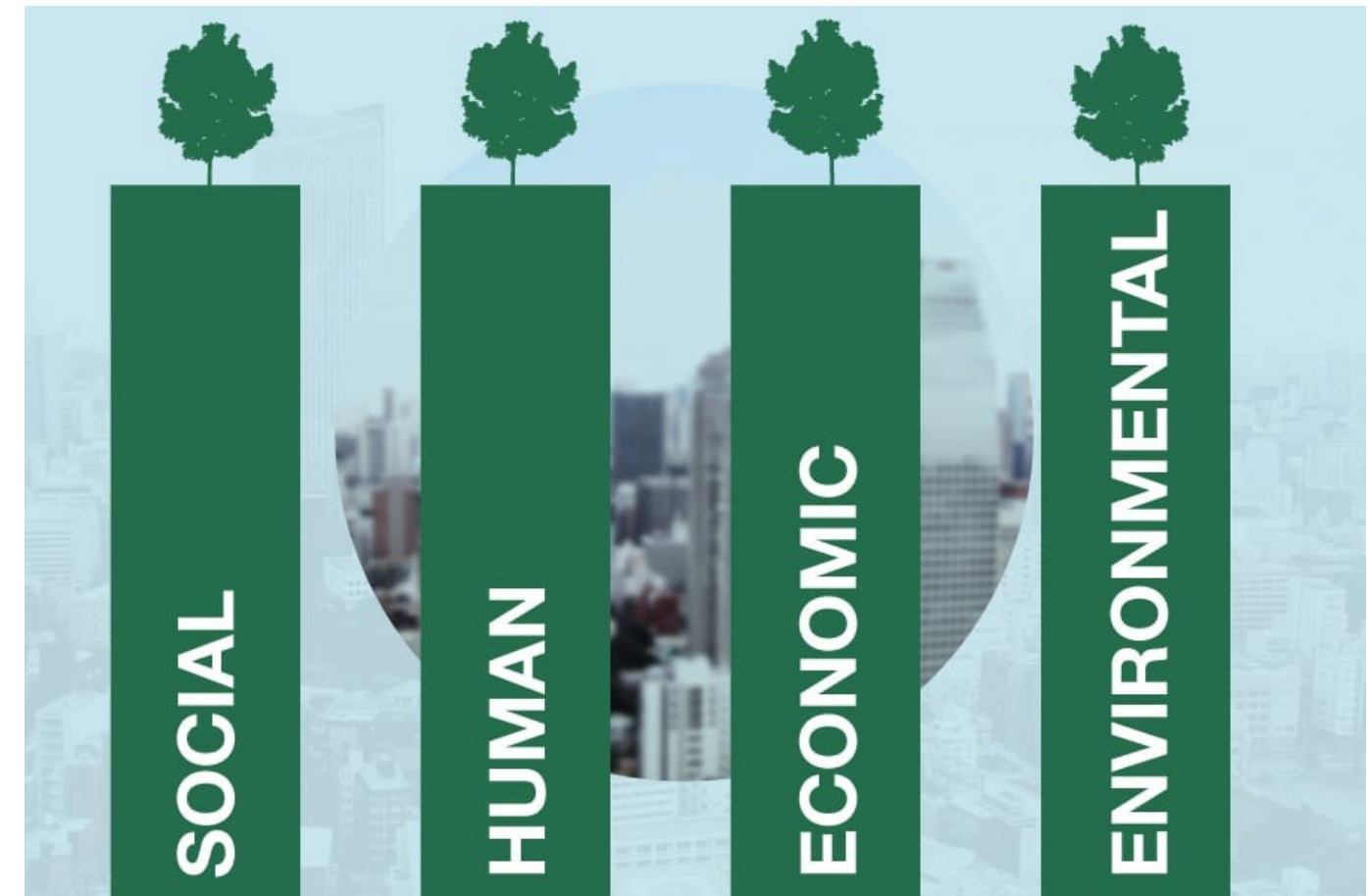
REIMAGINE YOUR POSSIBILITIES



What is Sustainability?

Four Pillars

- **Social:** preserve social capital by investing and creating services that constitute the framework of our society (communities, cultures, globalization). Preserve future generations and acknowledge what we do has an impact on others and on the world.
- **Human:** maintain and improve the human capital in society. Investments in the health and education systems, access to services, nutrition, knowledge and skills are all programs.
- **Economic:** improve the standard of living, efficient use of assets to maintain profitability over time.
- **Environmental:** Improve human welfare through the protection of human capital (land, air, water, minerals). Needs of population met without the risk of compromising the needs of future generations.



Sustainable Development Goals

17 United Nations Goals



PLM biggest impact

Regulations will come ..

Reporting, Tax, Transitions, ...

▪ <https://www.aras.com/en/resources/all/wbr-de-20221025-sustainable-future> - Jos Voskuil Webinar



GHG reporting



Investments



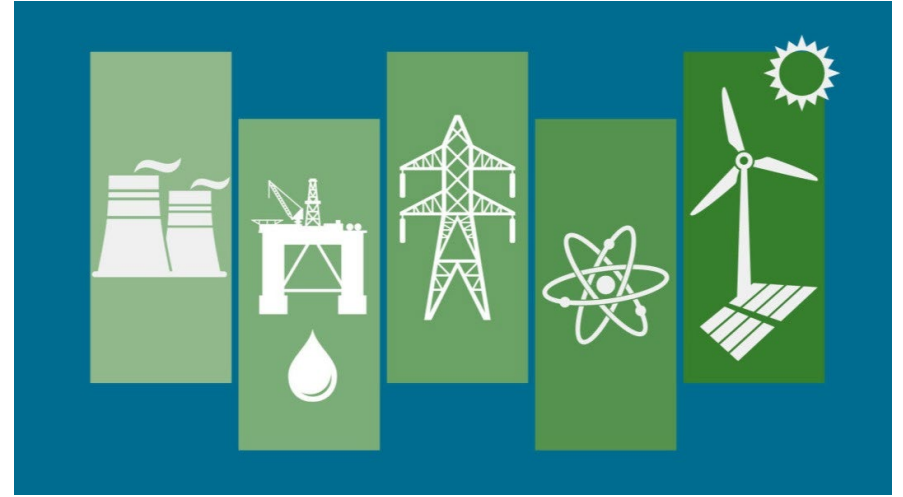
Carbon tax



Task Force on Climate-related Financial Disclosure



Opportunities



Energy transition

PLM and the **Green** Context

ACE23

REIMAGINE YOUR POSSIBILITIES

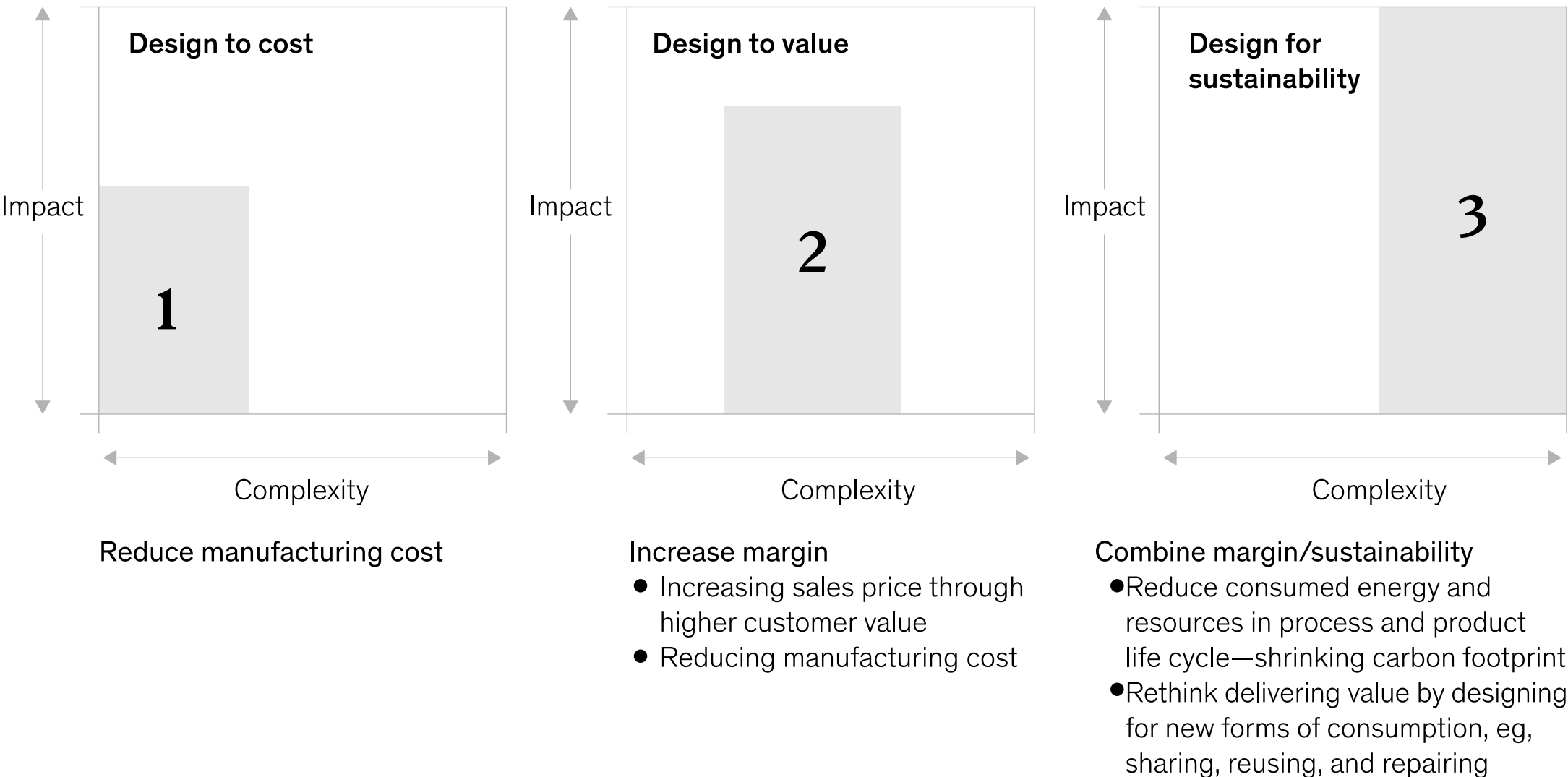
PLM and the **Green** Context

Design Methodologies: Design-to-Cost → Design-to-Value → Design-for-Sustainability

- DfS requires more data and systems thinking, ergo more PLM

Design for sustainability builds on the principles of design to cost and design to value.

Impact of optimization

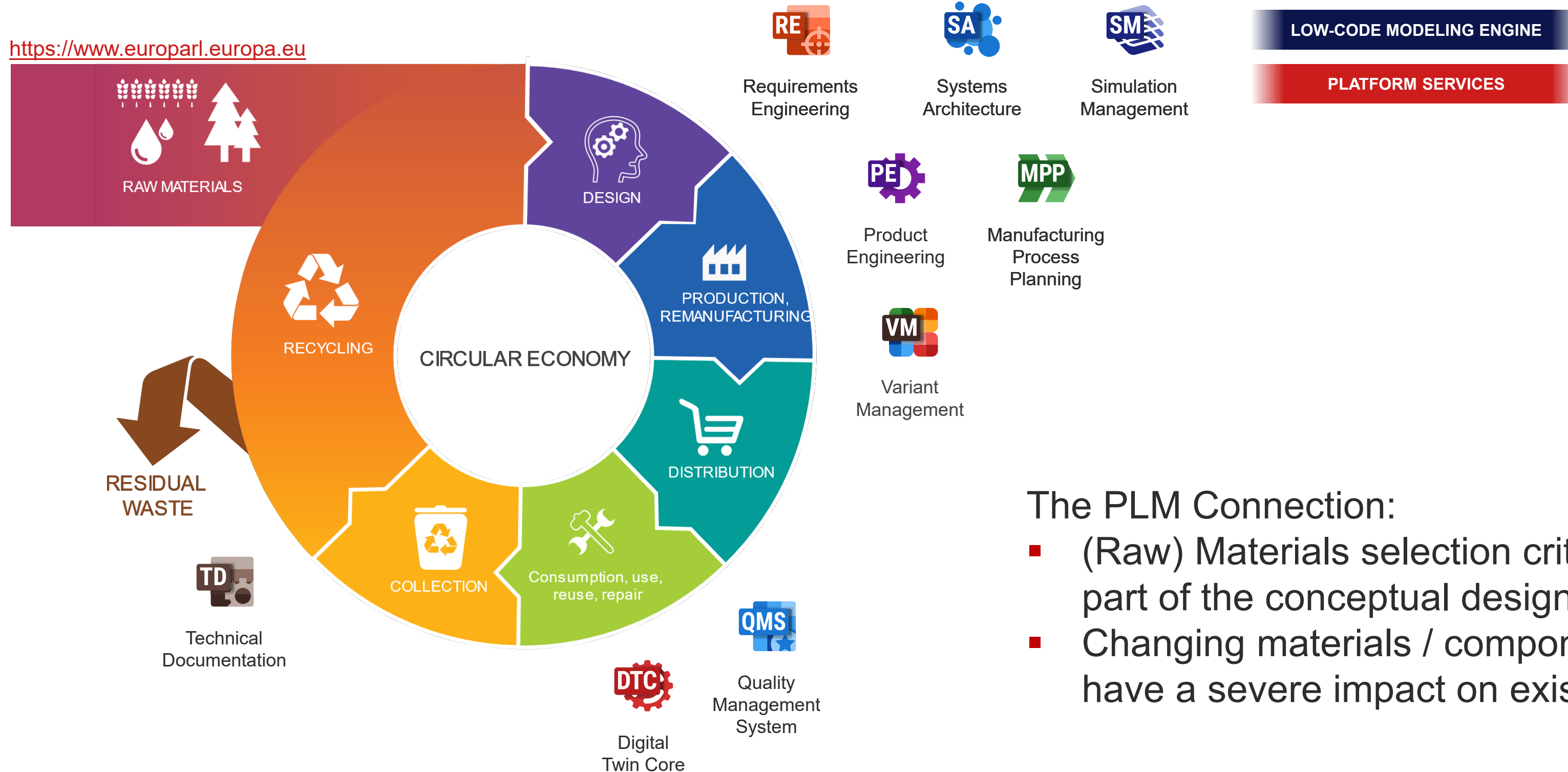


McKinsey & Company

PLM and the **Green** Context

Circular Economy starts with making the right decisions early

<https://www.europarl.europa.eu>

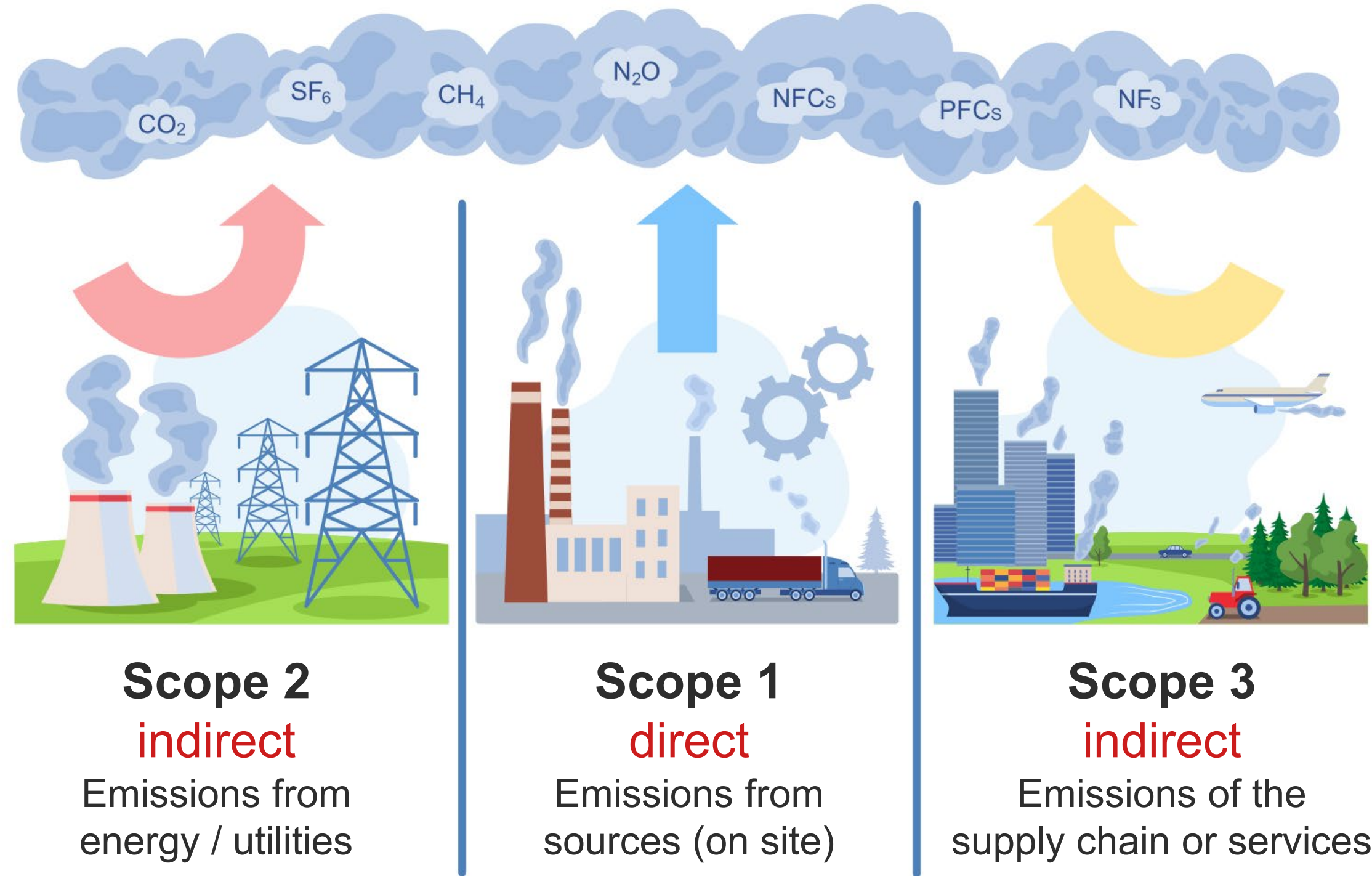


The PLM Connection:

- (Raw) Materials selection criteria must be part of the conceptual design phase
- Changing materials / components may have a severe impact on existing products

PLM and the **Green** Context

Scopes of Emissions: Scope 1 – 3



Scope 1 emissions

Scope 1 covers emissions from sources that an organization owns or controls **directly** – for example from burning fuel in their fleet of vehicles (if they're not electrically-powered).

Scope 2 emissions

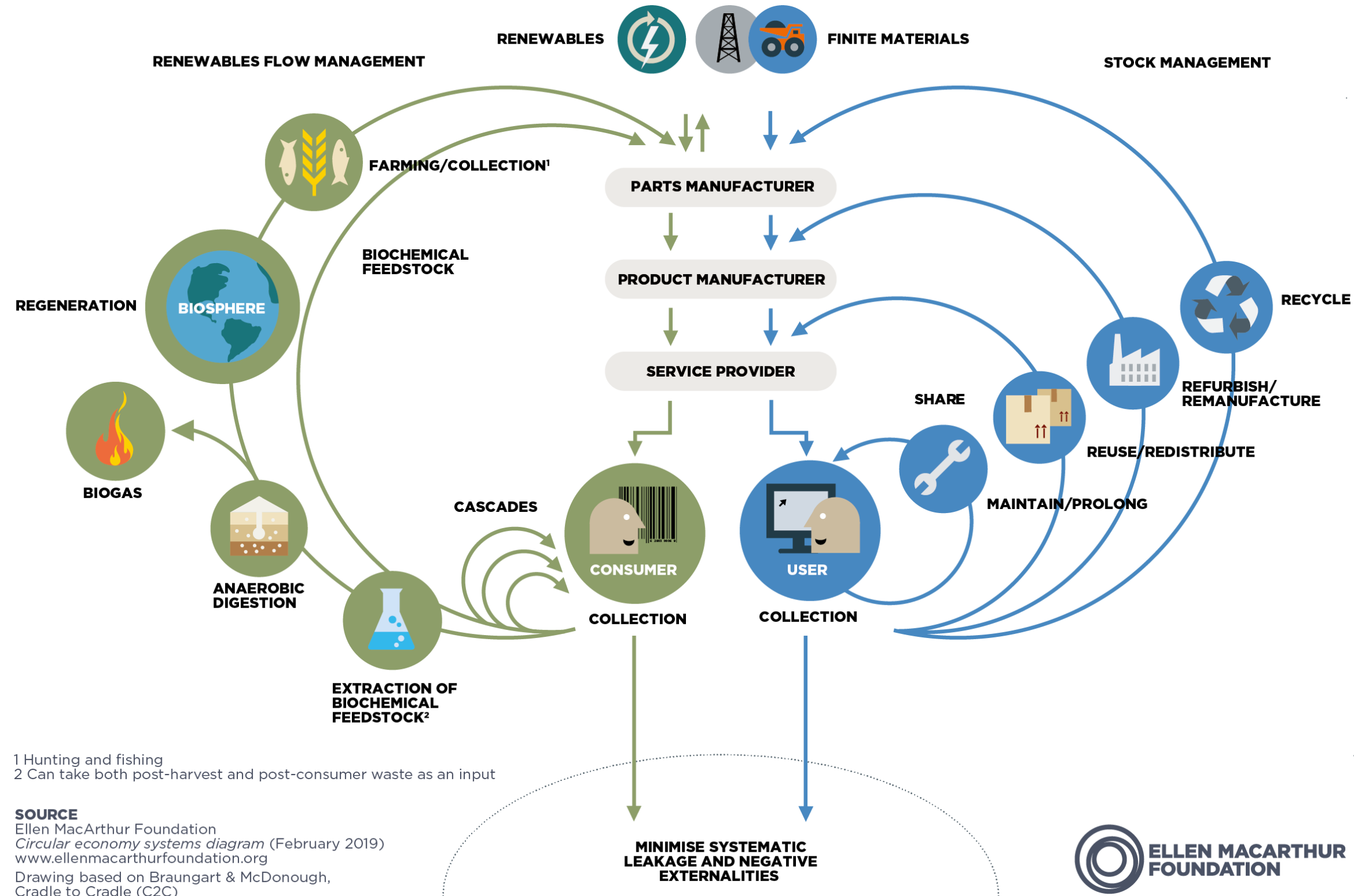
Scope 2 are emissions that a company causes indirectly when the energy it purchases and uses is produced. For example, for an electric fleet of vehicles and machines the emissions from the generation of the electricity they're powered by would fall into this category.

Scope 3 emissions

Scope 3 encompasses emissions that are not produced by the company itself, and not the result of activities from assets owned or controlled by them, but by those that it's indirectly responsible for, up and down its value chain. An example of this is when companies buy, use and dispose of products from suppliers. Scope 3 emissions include all sources not within the scope 1 and 2 boundaries.

PLM and the **Green** Context

Circular Economy: Technical cycle and Biological cycle



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input

SOURCE
Ellen MacArthur Foundation
Circular economy systems diagram (February 2019)
www.ellenmacarthurfoundation.org
Drawing based on Braungart & McDonough,
Cradle to Cradle (C2C)

- Technical cycle → Materials that do **not** biodegrade (metals, plastics) and are in need for recovering
- Biological cycle → Materials that **do** biodegrade (wood, cotton, food, ...)

PLM and the **Green** Context

Vision

Our ECO system: we need help from our friends

- Several external / cloud data sources will need to enrich and complement the internal data – *Data-as-a-Service*



Requirements Engineering



Systems Architecture



Program Management



Simulation Management



Variant Management



Product Engineering



Component Engineering



Technical Documentation



Manufacturing Process Planning



Quality Management System



Digital Twin Core



METI - Chemical Substances Control Law

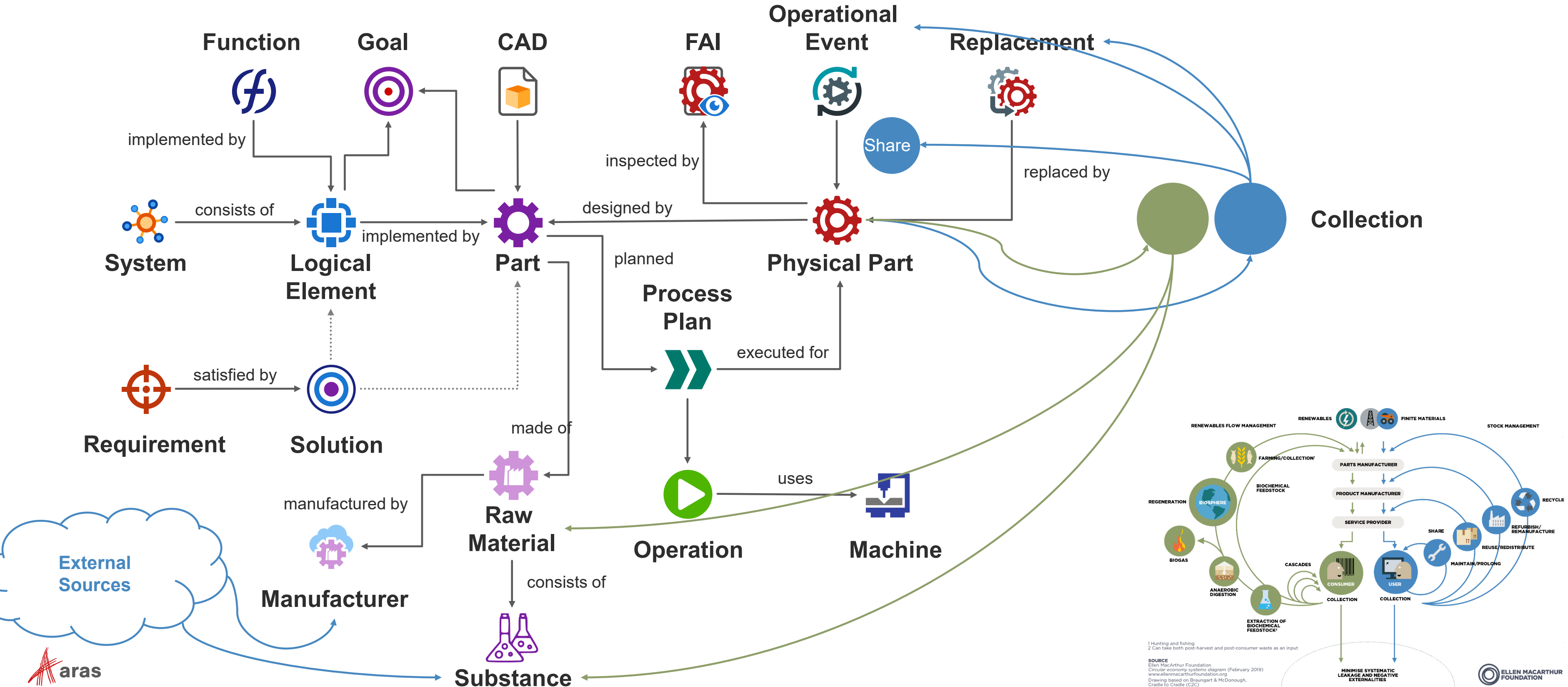


Granta Material Intelligence
Restricted Substances Solution



PLM and the Green Context

Data Centric Product Development → Navigate the Digital Thread and Leave Documents Behind

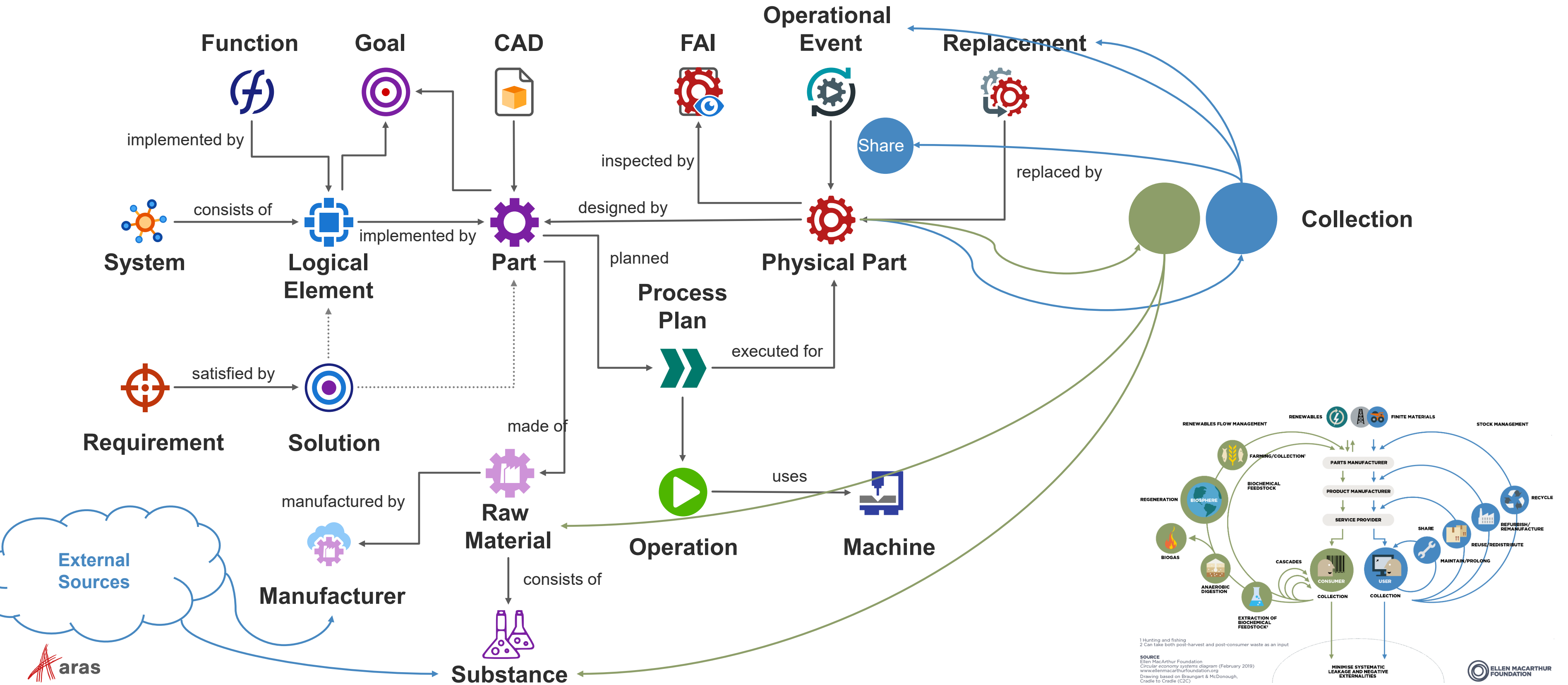


Demonstration Examples



PLM and the **Green** Context

Data Centric Product Development → Navigate the Digital Thread and Leave Documents Behind



Story Line



Requirements Engineering

- Requirements Document

RD-00006

3D Printer Product Specification - NG PaaS Ecologix

- 1 - Overview
- 2 - Environmental Requirements
 - 2.1 - Re-Use and Recyclability Requirements
 - 2.1.1 - Re-Use
 - 2.1.2 - Recyclability
 - 2.2 - Production and Operation Requirements
 - 2.2.1 - Reduce Production Energy Consumption
 - 2.2.2 - Reduce Operation Energy Consumption
- 3 - Operational and Safety Requirements
 - 3.1 - Operating System
 - 3.2 - Primary Use
 - 3.3 - Size and Movability
 - 3.4 - 3D Printing Methodology
 - 3.5 - Power
 - 3.6 - Price
 - 3.7 - Data Formats
 - 3.8 - Safety Overview
 - 3.9 - Connectivity
 - 3.10 - Data Storage

Environmental Requirements

2 - Environmental Requirements

REQ-000000077

2.1 - Re-Use and Recyclability Requirements

REQ-000000078

2.1.1 - Re-Use

REQ-000000079

The printer shall contain at least 75% re-usable or refurbishable components.

2.1.2 - Recyclability

REQ-000000080

All components and materials that cannot be re-used or refurbished shall be recyclable.

2.2 - Production and Operation Requirements

REQ-000000075

2.2.1 - Reduce Production Energy Consumption

REQ-000000076

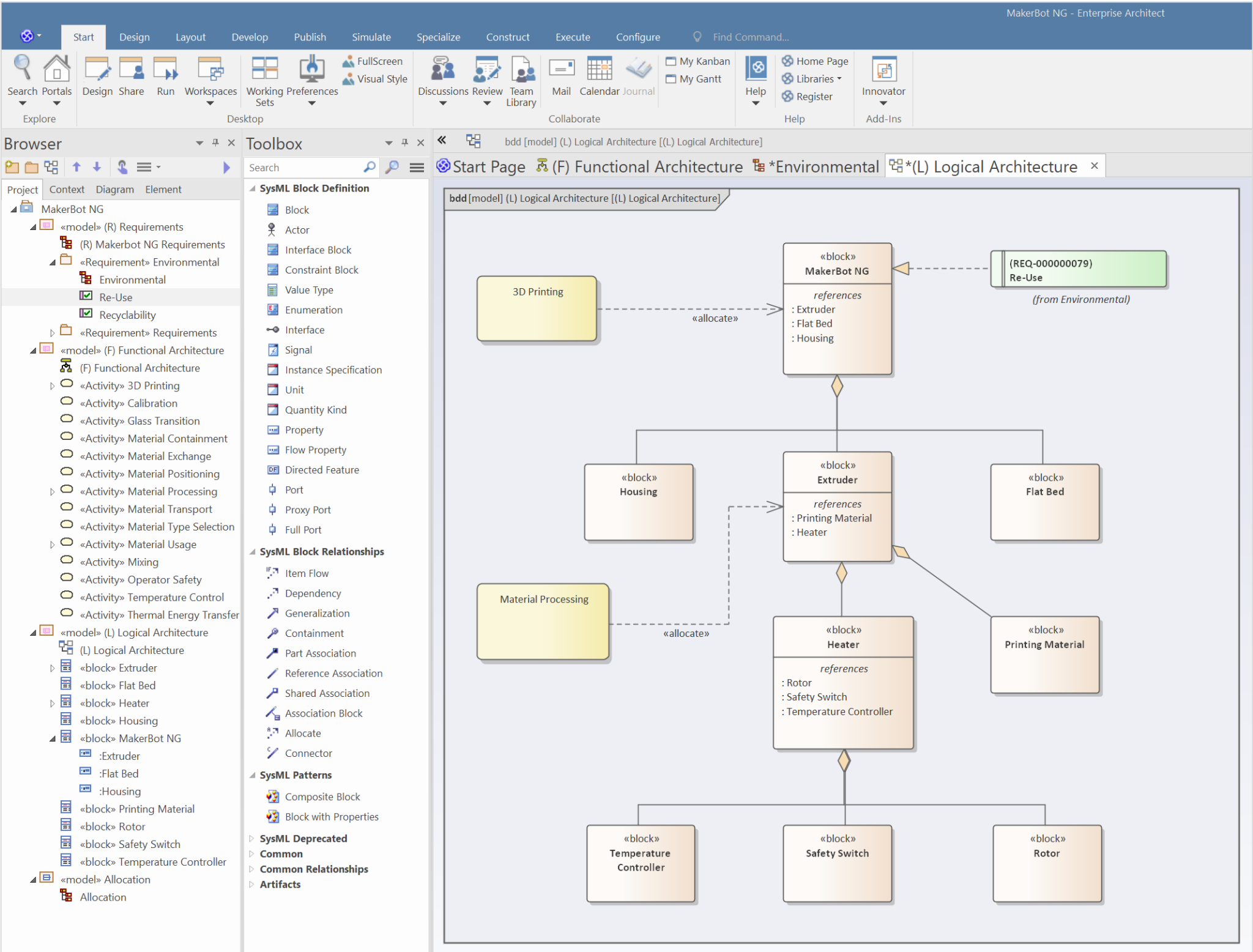
The energy consumption during printer production shall be reduced by 25% to reduce the CO2 footprint of the end product (combined scope 1, 2 and 3).

Story Line



Systems Architecture

■ MBSE

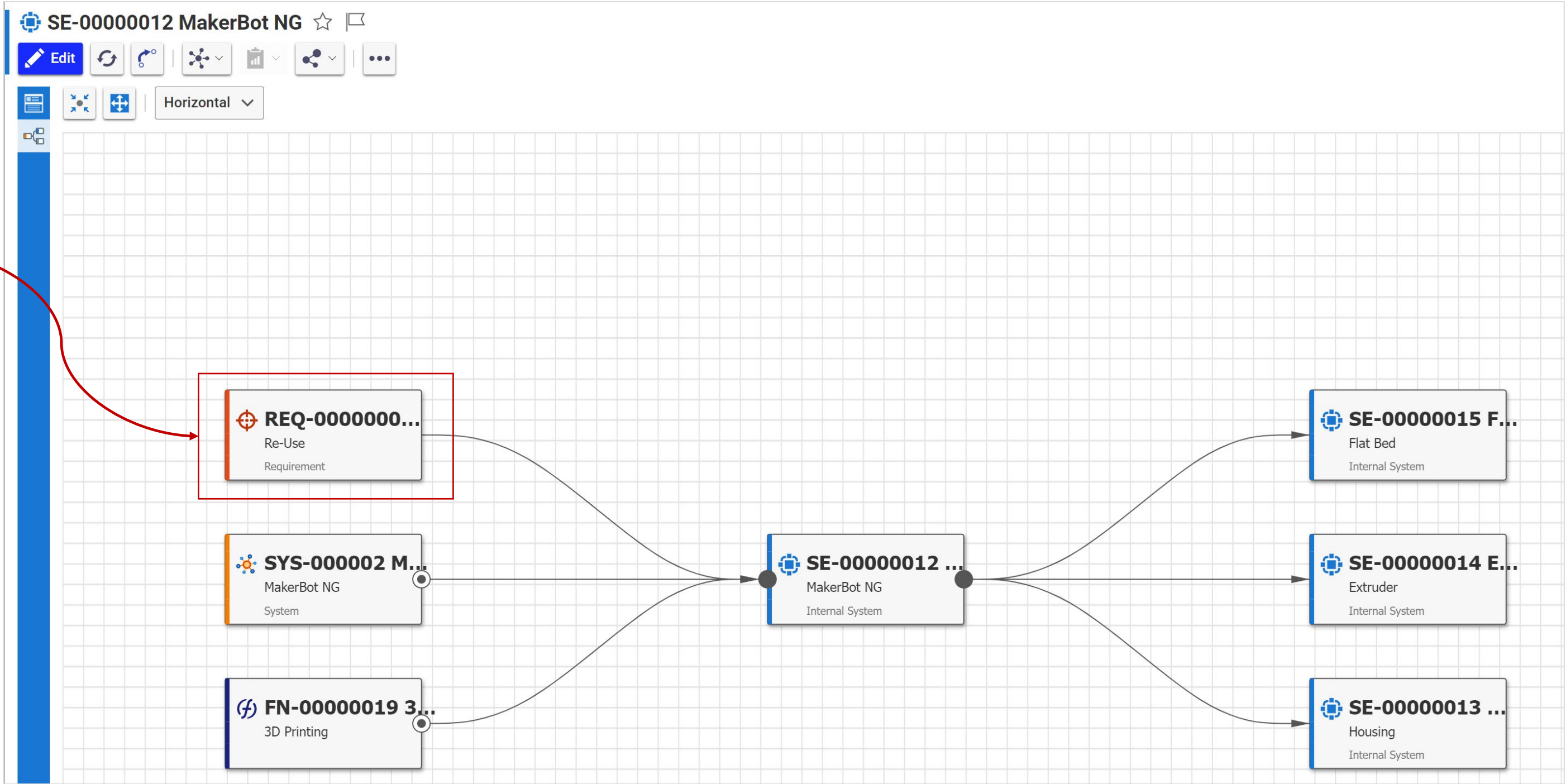
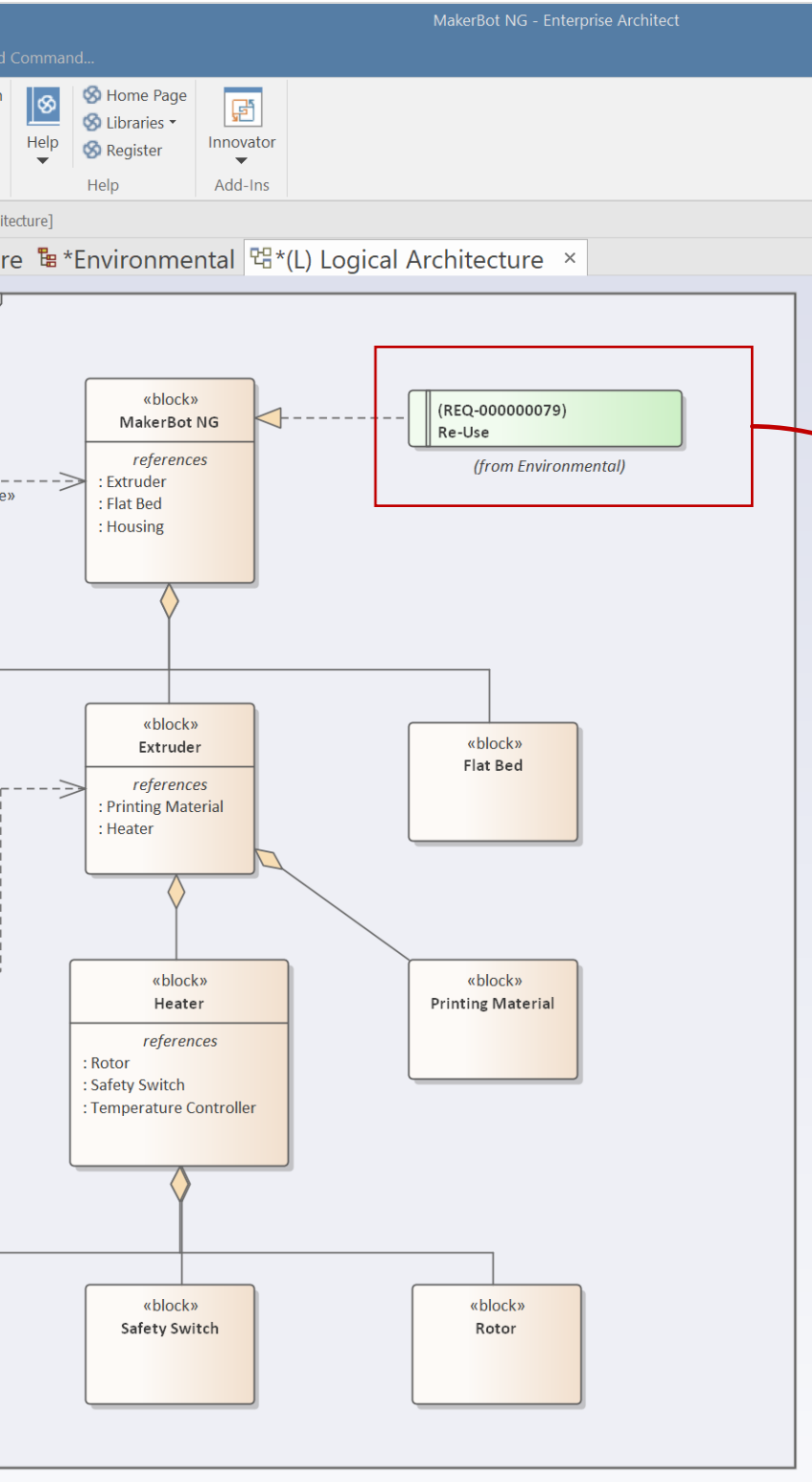


Story Line



Systems Architecture

■ MBSE

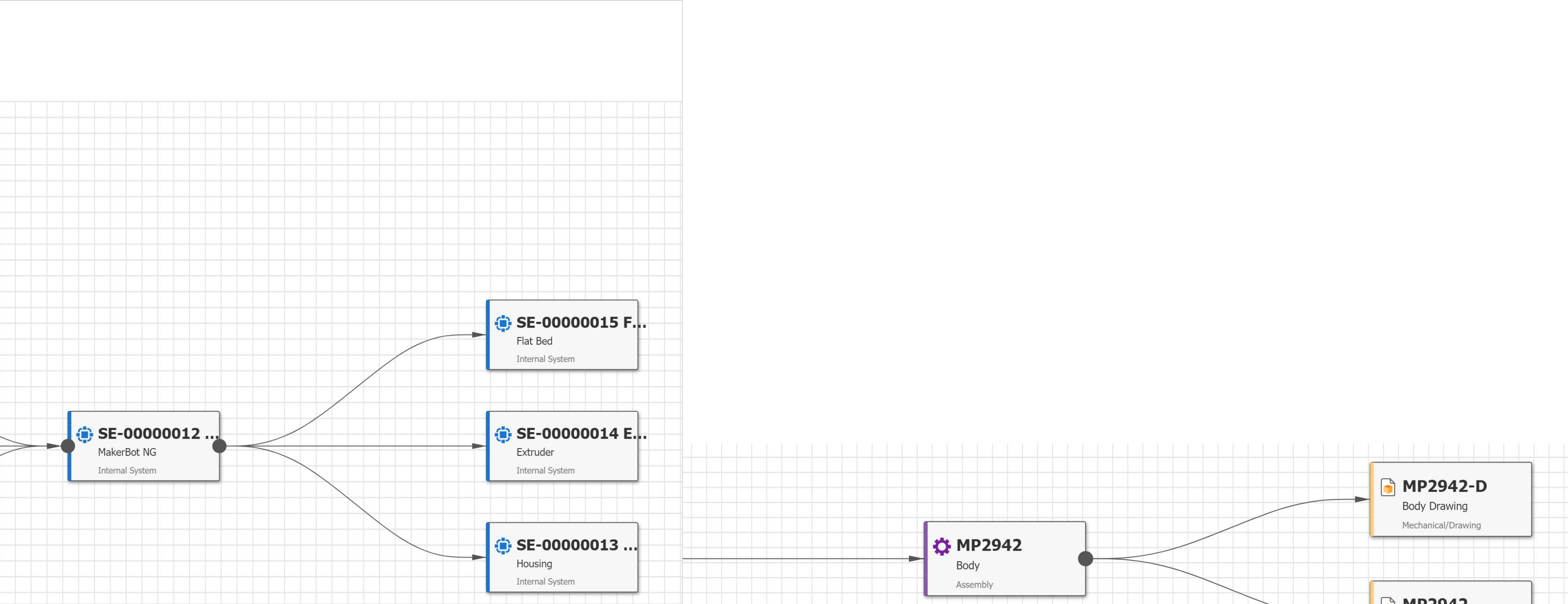


Story Line



Systems Architecture

- MBSE



Story Line

Dashboard

- CO₂ Target

The screenshot displays the Aras Innovator software interface. On the left is a navigation menu with categories like Administration, Assets, Design, and Quality Management. The main area is divided into several panels:

- MakerBot LeaseToPrint:** A table listing project elements with their numbers, revisions, and states.

Element	Number	Revision	State	Safety?	Environment?
MakerBot LeaseToPrint	SE-00000012	A	Preliminary		
Actuators	SE-00000009	A	Preliminary		
Wiring	SE-00000002	A	Preliminary		
Control System	SE-00000007	A	Preliminary		
Sensors	SE-00000003	A	Preliminary		
UI	SE-00000004	A	Preliminary		
Extruder	SE-00000005	A	Released		
- Material Plywood Board:** A table listing board components with their numbers, revisions, names, and statuses.

Number	Revision	Named	Status	Make / Buy	Type
MP2193	C.2	Thing-O-Matic 2 Top Panel	Released	Make	Series
MP2194	B.4	Thing-O-Matic 2 Front Panel	Released	Make	Series
MP2195	C.5	Thing-O-Matic 2 Bottom Panel	Released	Make	Series
MP2196	A.3	Thing-O-Matic 2 Back Panel	Released	Make	Series
MP2198	A.4	Thing-O-Matic 2 Left Panel	Released	Make	Series
MP2199	A.2	Thing-O-Matic 2 Right Panel	Released	Make	Series
MP2199-2	A.4	New Thing-O-Matic 2 Right Panel	Released	Make	Series
- MakerBots:** A table listing parts with their numbers, revisions, names, and types.

Part Number	Revi...	Name	Type
MP0101	B	MakerBot Replicator Original	Assembly
MP0102	A	Cover Option for MakerBot Replicator	Assembly
MP0103	A	MakerBot Replicator with Cover	Assembly
- Fails CO2 Target:** A table listing failed parts, highlighted in yellow.

Part Number	Revi...	Name	Type
MP0101	B	MakerBot Replicator Original	Assembly

Story Line

Product Engineering

- Part

MP2942 ☆

Edit [Refresh] [Undo] [Share] [Print] [More]

Part

Part Number: MP2942 | Revision: B | State: Preliminary | Assigned Creator: []


Name: Body | Designated User: []

Type: Assembly | Unit: EA | Make / Buy: Make | Cost (Calculated): 443.5369 | Effective Date: []

Long Description: []

Raw Material: [] | Control Type: Serial

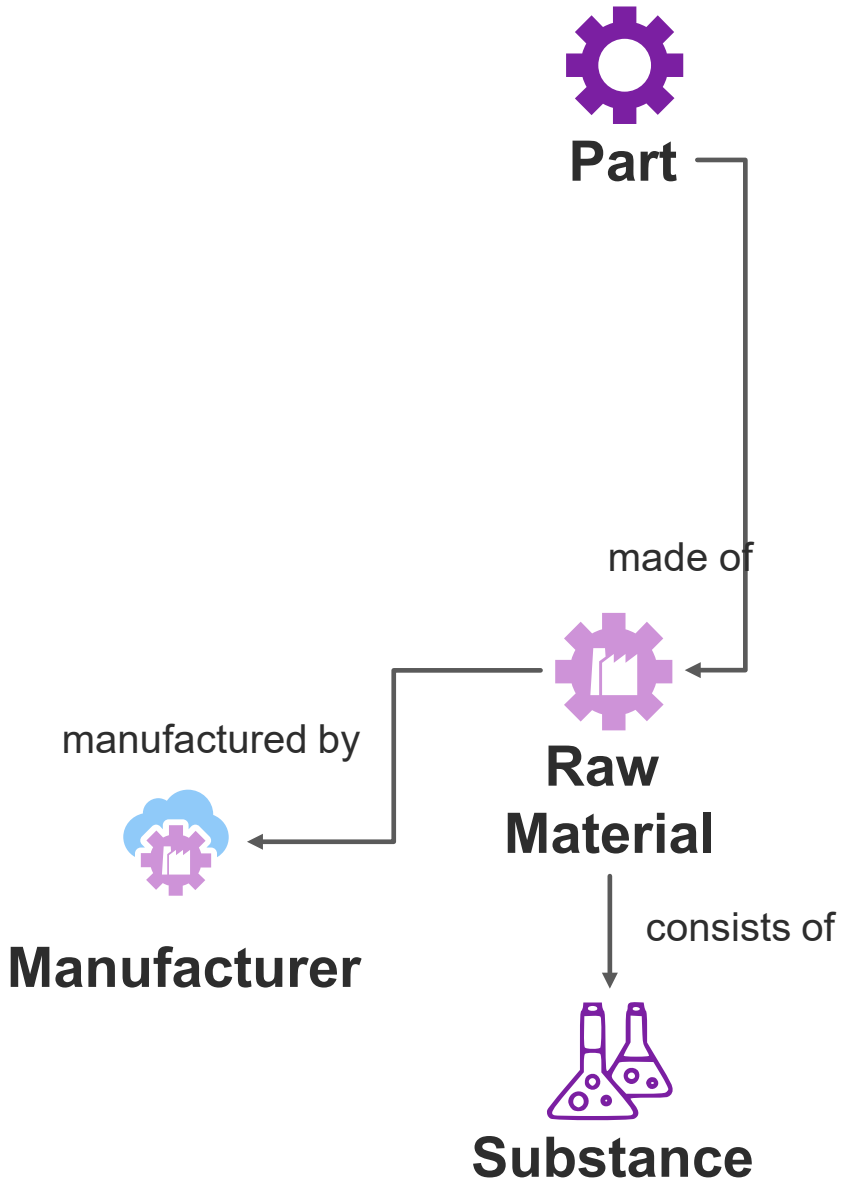
Changes Pending



BOM | **BOM Structure** | Substances | Alternates | AML | Documents | CAD Documents | Goals | Changes | Part Submission Warrants | Requirements | Requirements Documents | FAI

[Refresh] [Filter] [View] [Zoom] | 3 | [Back] [Forward] [Close]

Part Number	Re...	State	Sequence	Quantity	Claimed By	Name	Effectivity	Reference De...
MP2667	B	Released	5	1		Spacer Black 5-16 in length .14in ID .25in ...		
MP2322	C	Released	10	1		RGB LED Strip Common Anode		
MP2660	B	Released	15	2		Spacer Black 1-2 in length .14in ID .25in OD		
MP2939	A	Released	20	1		Body Fan Assembly		
MP2940	A	Released	25	1		Body Hardware		
MP2941	B	Preliminary	30	1		Body Panels		
MP2194	B	Released	5	1		Thing-O-Matic 2 Front Panel		
W1005388						Hardwood Plywood Board		



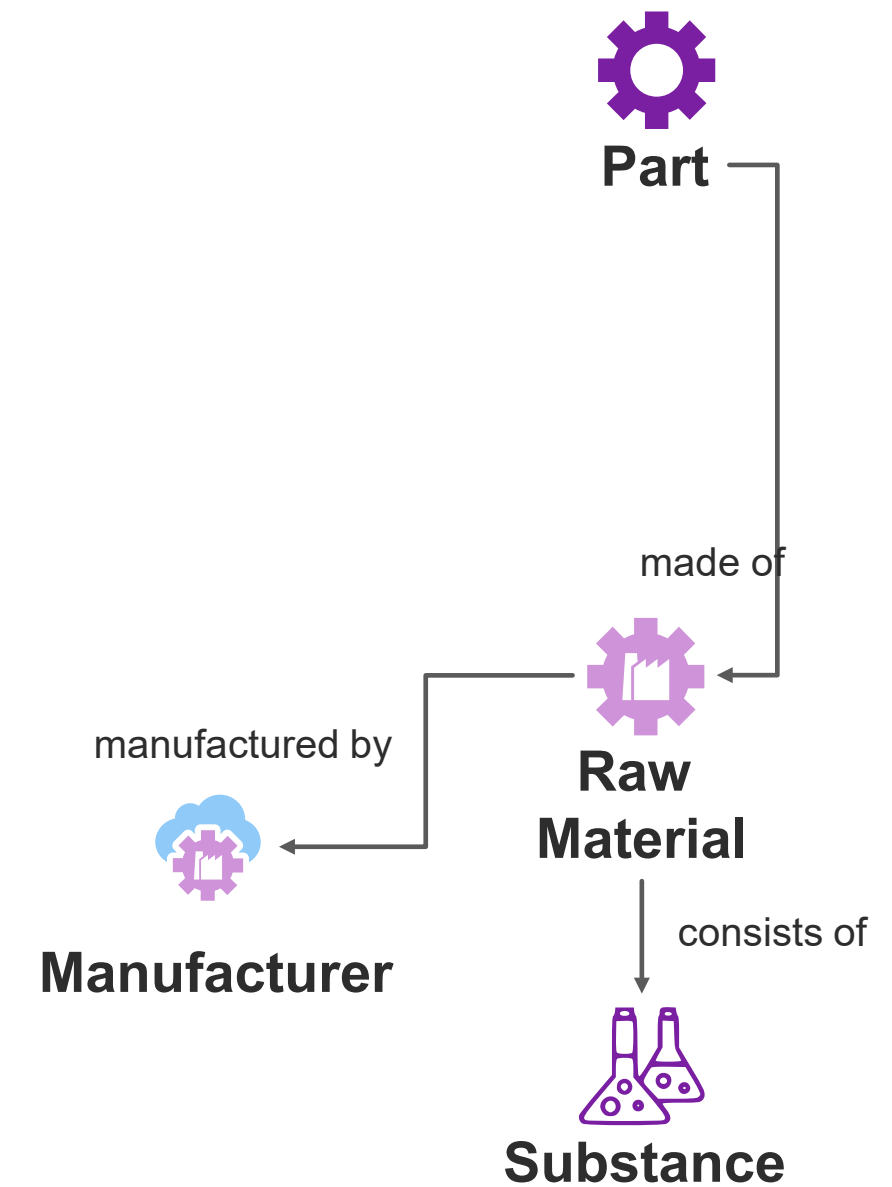
Story Line

Product Engineering

Materials / Substances

The screenshot shows the 'Raw Material' tab for a 'Hardwood Plywood Board'. The interface includes a header with the part name and icons for edit, refresh, and other actions. Below the header, there are fields for 'Part Number' (W1005388), 'Type' (Wood), and 'Base Material' (Plywood). A 'Name' field contains 'Hardwood Plywood Board' and a 'Description' field contains 'Regular Hardwood Plywood Board'. The 'Manufacturer' is listed as '中国木业公司'. A 'Properties' section is expanded, showing 'Sustainability' properties: 'Ready Biodegradation [% DOC]' (100), 'Recyclability [%]' (15), and 'Origin' (CN). Below the properties, there are sections for 'Usage', 'Substances', and 'Files'. The 'Substances' section is active, showing a table with one entry: Formaldehyde.

EC Name ↑	CAS	State	Molecular Fo...	Internal Num...	Quantity	Unit [...]
✓ Formaldehyde	50-00-0	Active	CH2O	S00095	1.5	w%



Story Line

Product Engineering

- Materials / Substances
 - Hazards
 - Risks

Formaldehyde
☆

Edit
↺
↻
🔍
📄
🔗
⋮

Substance

Internal Number: S00095 State: ✓ Active

Name: Formaldehyde

Substance Identity

IUPAC Name: formaldehyde

EC / List Number: 200-001-8	Molecular Formula: CH2O
CAS Number: 50-00-0	Type of Substance: <input checked="" type="checkbox"/> Mono constituent substance
Index Number: 605-001-00-5	Origin: Organic
	ECHA Dossier: 100.000.002 <input type="checkbox"/>

Description

This substance is registered under the REACH Regulation and is manufactured in and / or imported to the European Economic Area, at ≥ 1 000 000 tonnes per annum.

This substance is used by consumers, in articles, by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing.

Hazard Classification and Labelling

Common Name:

REACH Status

REACH Pre-Registration

REACH Registration

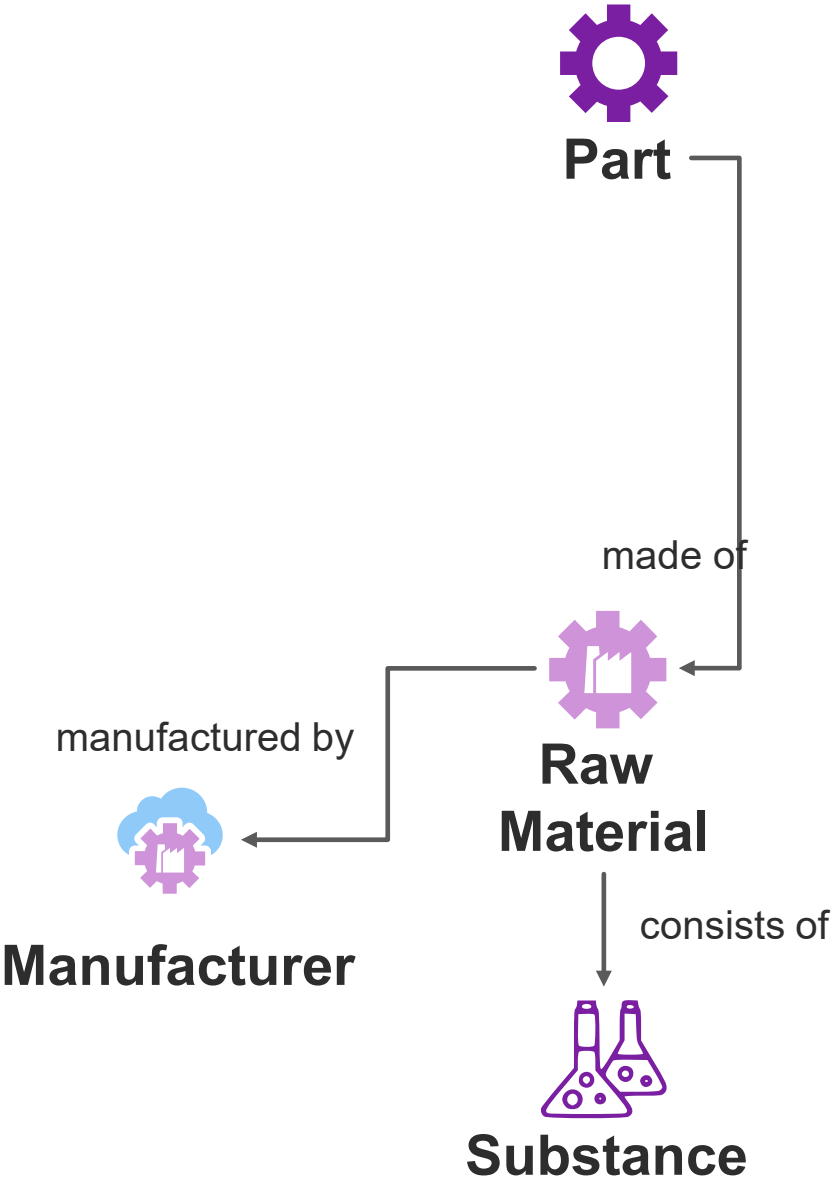
REACH Authorisation List

Hazards
Usage
Manufacturer Part (CE)

⚠ Risks
☆

🔍
✉
Hidden
🔍
📄
🔗

o [...]	Name ↑	Classification	Category	Status	Number	Keywords
	Corrosive	Substances/Dangerous Good	Physical Hazard	Active	R00009	
	Health	Substances/Dangerous Good	Health Hazard	Active	R00006	
	Poison	Substances/Dangerous Good	Health Hazard	Active	R00008	



Story Line

Product Engineering

- Materials / Substances
 - External links

Formaldehyde

CAS Registry Number®
50-00-0

Compound Properties

Boiling Point (1)
-19.5 °C

Melting Point (1)
-92 °C

Density (2)
0.8 g/cm³

Source(s)
(1) Hazardous Substances Data Bank data were obtained from the National Library of Medicine (US)
(2) International Chemical Safety Cards data were obtained from the National Institute for Occupational Safety and Health (US)

Other Names and Identifiers

InChI
InChI=1S/CH2O/c1-2/h1H2

InChIKey
InChIKey=WSFSSNUMVMOOMR-UHFFFAOYSA-N

SMILES
C=O

Canonical SMILES
O=C

Other Names for this Substance

- Formaldehyde
- BFV
- Fannoform
- Formalin
- Formalith

[View All](#)

Deleted or Replaced CAS Registry Numbers

8005-38-7, 8006-07-3, 8013-13-6, 112068-71-0, 1053659-79-2, 1156543-56-4, 1158237-02-5, 1196157-74-0, 1227476-28-9, 1357848-44-2, 1416946-65-0, 1609158-91-9, 2100305-91-5

Substance Identity

IUPAC Name
formaldehyde

EC / List Number	Molecular Formula
200-001-8	CH2O

CAS Number	Type of Substance
50-00-0	Mono constituent substance

Index Number	Origin	ECHA Dossier
605-001-00-5	Organic	100.000.002

Description

This substance is registered under the REACH Regulation and is manufactured / or imported to the European Economic Area, at ≥ 1 000 000 tonnes per annum.

This substance is used by consumers, in articles, by professional workers (widespread uses), in formulation or re-packing, at industrial sites and in manufacturing.

Hazards Usage Manufacturer Part (CE)

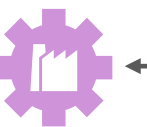
Risks

Name	Classification	Category	Status	Number	Keywords
Corrosive	Substances/Dangerous Good	Physical Hazard	Active	R00009	
Health	Substances/Dangerous Good	Health Hazard	Active	R00006	
Poison	Substances/Dangerous Good	Health Hazard	Active	R00008	



Part

made of



Raw Material

consists of



Substance

Story Line

Product Engineering

- Materials / Substances

MP3840

Part

Part Number: MP3840, Revision: B, State: Preliminary, Assigned Creator: [blank], Extended Classification: [blank]

Name: Microcontroller, Designated User: [blank]

Type: Component, Unit: EA, Make / Buy: Buy, Cost (Actual): 8.8500, Effective Date: [blank]

Long Description: 8-bit Microcontroller with 8/16/32K Bytes of ISP Flash and USB Controller

Raw Material: [blank], Control Type: Serial

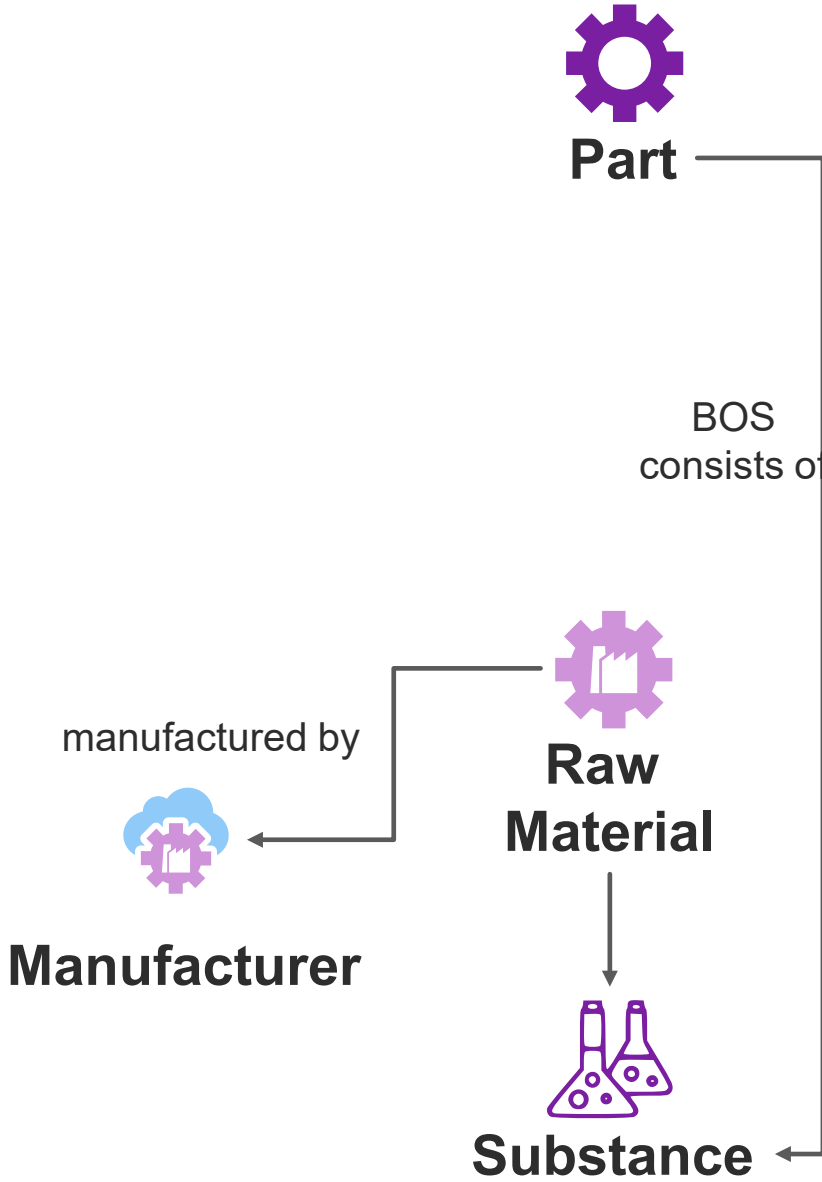
Changes Pending: [checkbox]

BOM BOM Structure Substances Alternates AML Documents CAD Documents Goals Changes Part Submission Warrants

Substances

o	EC Name ↑	CAS	State	Molecular Fo...	Internal Num...	Quantity	Unit [...]
✓	Aluminium	7429-90-5	Active	Al	S00146	10.72	w%
✓	Gold	7440-57-5	Active	Au	S00145	77.08	w%
✓	Nickel	7440-02-0	Active	Ni	S00144	1.6	w%
✓	Silicon	7440-21-3	Active	Si	S00143	7.35	w%
✓	Silicon Dioxide	14808-60-7	Active	SiO2	S00142	1.75	w%
✓	Silver	7440-22-4	Active	Ag	S00147	1.51	w%

< Prev Next > Page: 1 of 1 | 6 Results



Story Line

Component Engineering

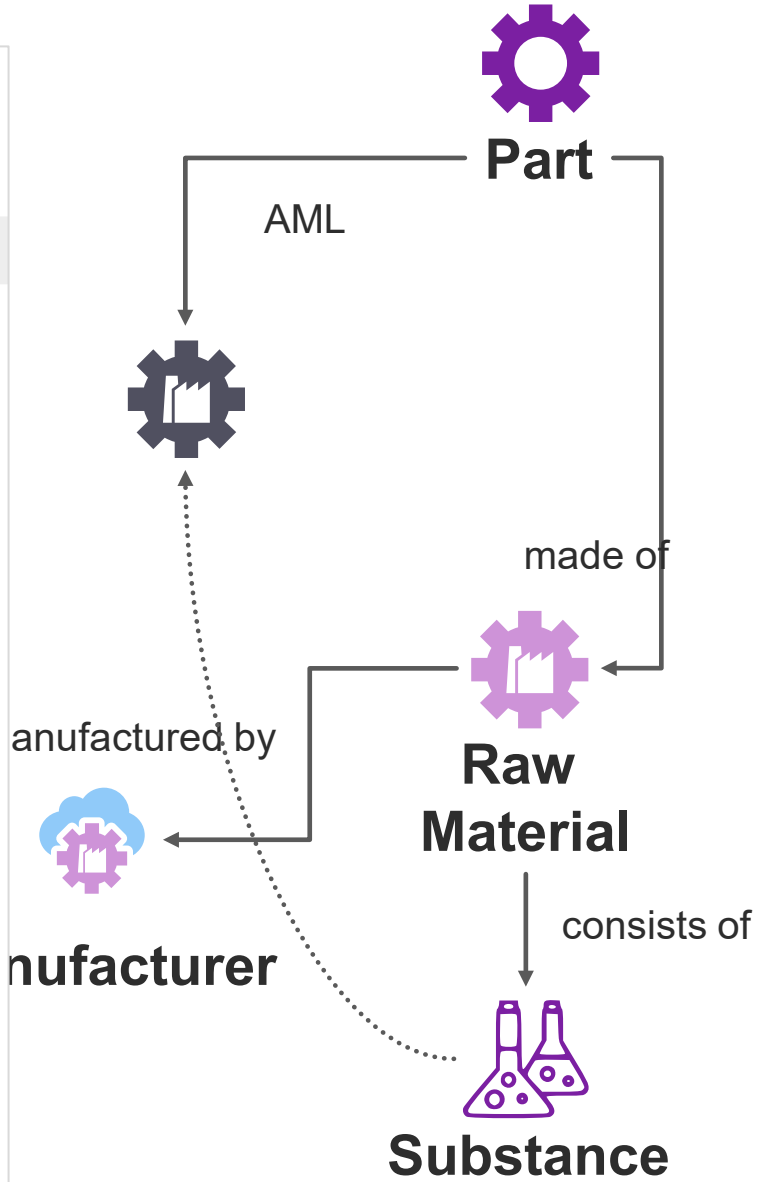
- Materials / Substances

The screenshot shows the 'Silver' substance details in the Aras Component Engineering system. The interface includes a top toolbar with 'Edit', refresh, and other icons. The main content area is divided into several sections:

- Internal Number:** S00147
- Name:** Silver
- State:** Active (indicated by a green checkmark)
- Substance Identity:**
 - IUPAC Name: silver
 - EC / List Number: 231-131-3
 - CAS Number: 7440-22-4
 - Index Number: [empty]
 - Molecular Formula: Ag
 - Type of Substance: Mono constituent substance
 - Origin: Element
 - ECHA Dossier: 100.028.301
- Hazard Classification and Labelling:** Features a GHS hazard pictogram (environmental) and a common name 'Silver'.

At the bottom, there are tabs for 'Hazards', 'Usage', and 'Manufacturer Part (CE)'. The 'Manufacturer Part (CE)' tab is active, showing a table with columns for Item, Weight, Total Weight, and PPM.

Item	Weight	Total Weight	PPM
AD605BN	1.096125	925.000000	1000000



Story Line

Component Engineering

- Regulated Substances

⚙️ AD605BN ☆ 📄

Edit ↻ 🔍 🗑️ 📄 ⋮

Manufacturer Part

Part Number
AD605BN

Name
Analog Circuit

Description
Analog Circuit, 2 Func, PDIP16

Manufacturer
[ANALOG DEVICES INC](#)

CE Part Number
AD605BN

Files Attached

Responsible
[Component Engineering](#)

Unit
EA

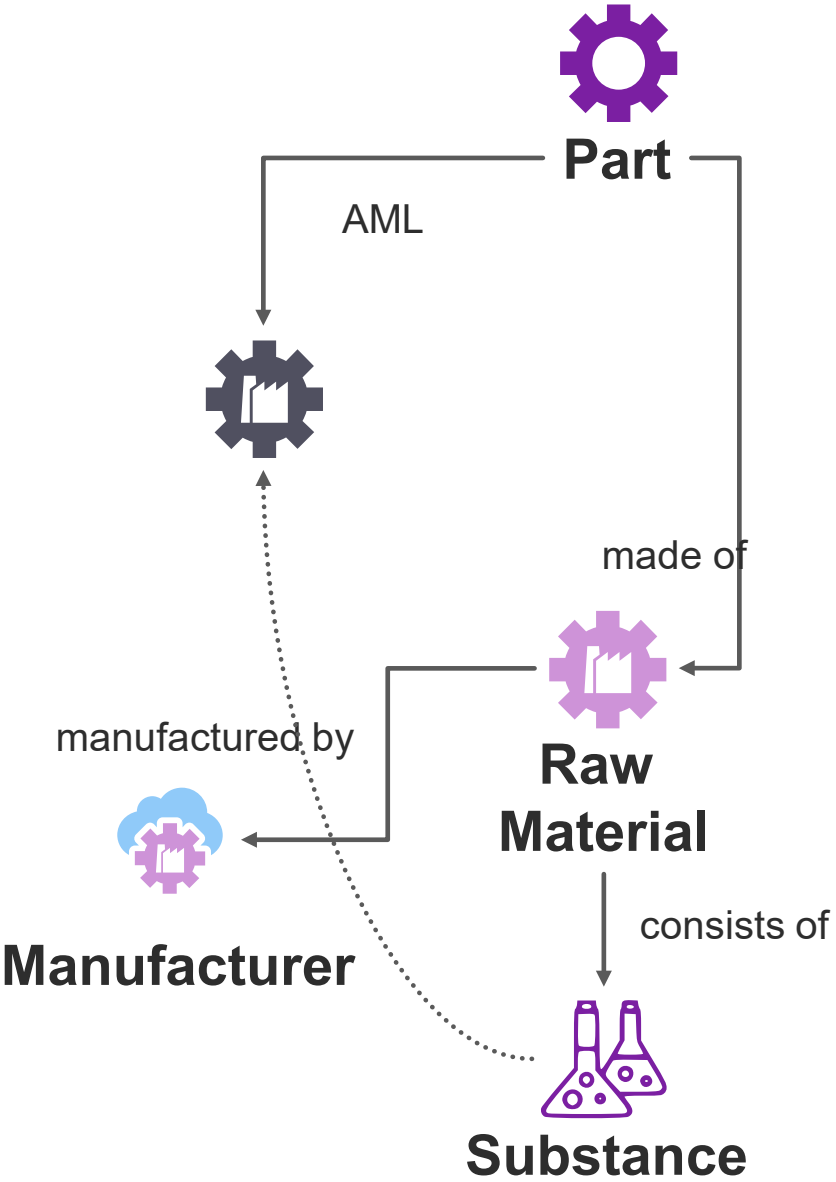
Unit Price

Latest Datasheet
[Get Latest Datasheet](#)

Extended Classification

Files
Related Parts
Part Detail
IPC 1752A
Alternates
Regulated Substances
Environmental Documents
Materials Declaration
Alerts
Documents
Transfers

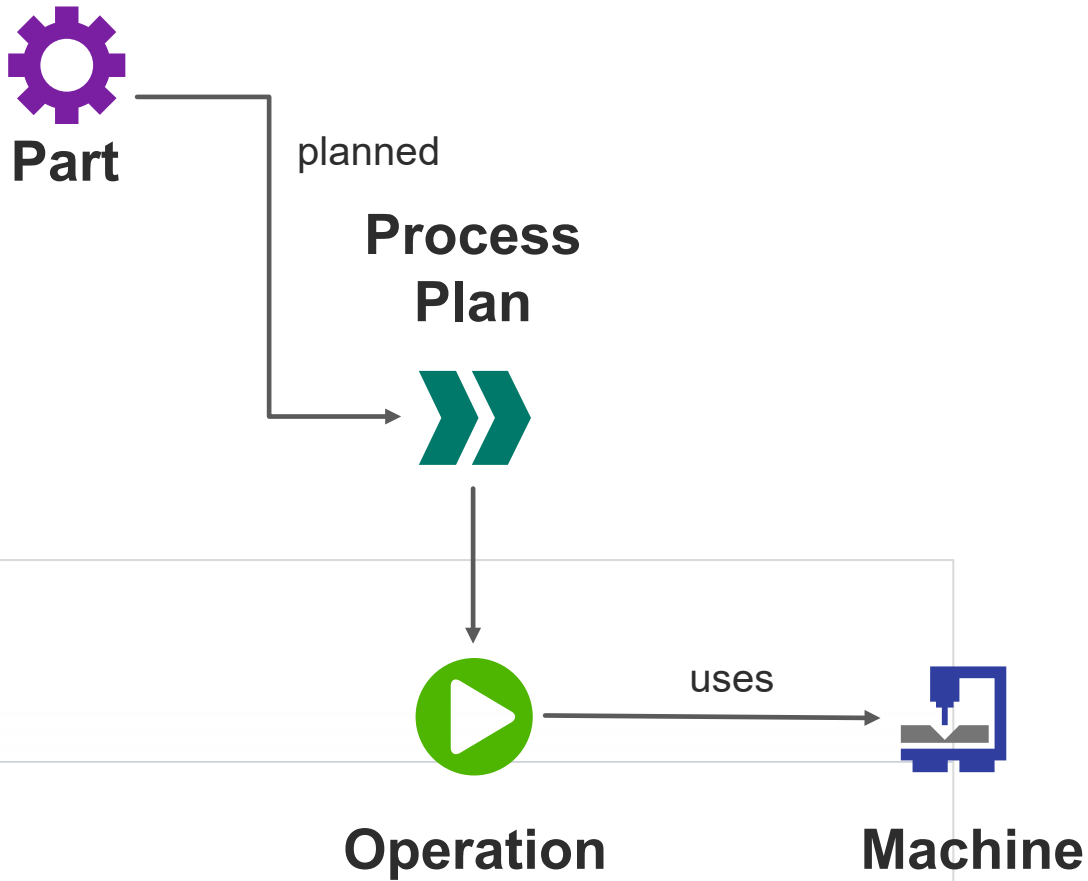
Row	Generation	Updated [...]	Attribute	Value
1	1	3/7/2023	EFUP	50
2	1	3/7/2023	Conflict Mineral Source	FMD
3	1	3/7/2023	EU RoHS Compliant	No
4	1	3/7/2023	China Mercury Compliant	0
5	1	3/7/2023	Max Reflow Time	
6	1	3/7/2023	Max Reflow Cycles	



Story Line

Manufacturing Process Planning

- Power consumption



PP001
Location: Detroit Language: English

- ▶▶ Extruder Assembly → MP2954
 - ▶▶ 10 : Assemble Fan
 - ▶▶ 20 : Assemble Heat Sink
 - ▶▶ 30 : Assemble Mount Assembly
 - ▶▶ 1 : Take the fan assembly and put the bolts throug...
 - ▶▶ 2 : Tighten the bolts down
 - ▶▶ 3 : Place in bin
 - ▶▶ P23124
 - ▶▶ 1731
 - ▶▶ H1234
 - ▶▶ 40 : Assemble Filament
 - ▶▶ 50 : Assemble Drive Block

Operation 30 : Assemble Mount Assembly

Step 1 : Take the fan assembly and put the bolts throught the mountr bar

After cleaning the work surface place the mount plate in front of you with the double notch to your left.

- Place the bar on top of the mount plate
- Thermal Barrier should be in the center

Step 2 : Tighten the bolts down

Step 3 : Place in bin

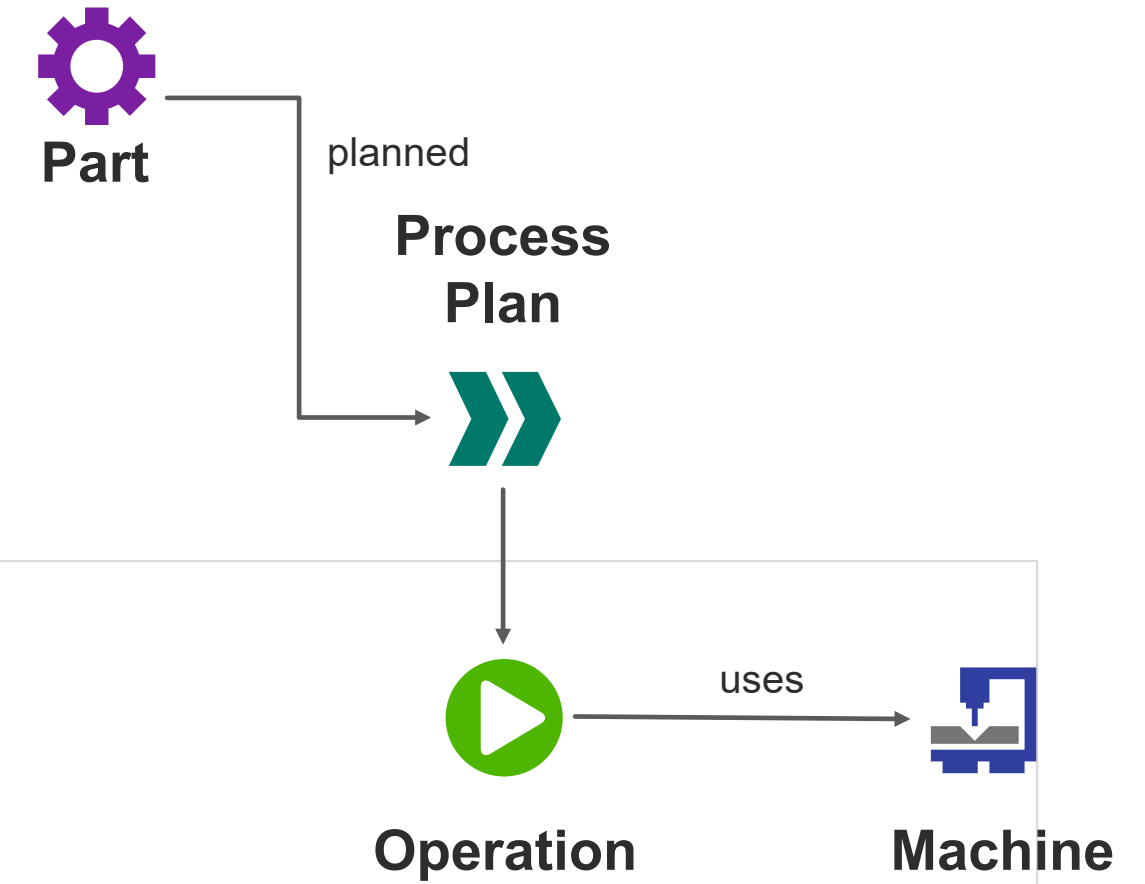
Part Number	Part Name	Type	Quantity	Alternates	Substitutes
P23124	Mount Assembly	Phantom	1		

Resource Number	Name	Type	Class	Power [kW]
1731	Wrench	Tool	Power Tool	0.1
H1234	Cutting Machine	Machine	Metal Forming	2.5

Story Line

Manufacturing Process Planning

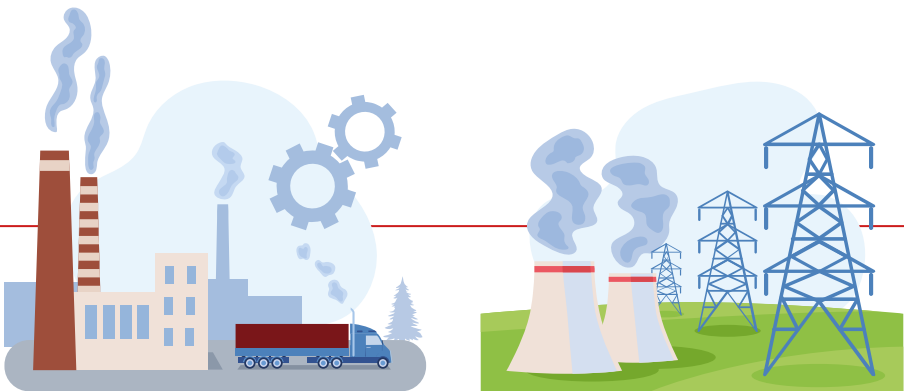
- Power consumption



Story Line

Power Consumption – Scope 1 / Scope 2

- Machine / equipment power consumption



Manufacturing
Process
Planning

PP001

Location: Detroit Language: Eng

- Extruder Assembly → MP2954
 - 10 : Assemble Fan
 - 20 : Assemble Heat Sink
 - 30 : Assemble Mount Assembly
 - 1 : Take the fan assembly and
 - 2 : Tighten the bolts down
 - 3 : Place in bin
 - P23124
 - 1731
 - H1234
 - 40 : Assemble Filament
 - 50 : Assemble Drive Block

Operation Number 30

Name Assemble Mount Assembly

Description Assemble Mount with power tools

Setup Time 10

Cycle Time 20

Operation 30 : Assemble Mount Assemb

Step 1 : Take the fan assembly and put the bol

After cleaning the work surface place the mount plate in front of you with the double notch to your left.

- Place the bar on top of the mount plate
- Thermal Barrier should be in the center

Step 2 : Tighten the bolts down

Step 3 : Place in bin

H1234 Cutting Machine

Machine

Machine Number H1234 Location Toulouse

Name Cutting Machine

Description The V320 is a CNC pass-through plate processing machine built to automate part handling. The machine is equipped with both plasma and oxy-fuel cutting technology as well as a drill.

State In Operation

Type Metal Forming

Properties

- Cutting
 - Power [kW] 2.5

Thumbnail

Workbench

Machines Search

Machine Number	Name
H1234	Cutting Machine
D8123	Lathe

Part Number	Part Name	Type	Quantity	Alternates	Substitutes
P23124	Mount Assembly	Phantom	1		

Resource Number	Name	Type	Class	Power [kW]
1731	Wrench	Tool	Power Tool	0.1
H1234	Cutting Machine	Machine	Metal Forming	2.5

Converts to CO₂e

Questions

ACE23
REIMAGINE YOUR POSSIBILITIES

