Industrialization and Green Design

How to utilize CapEx to create sustainable, circular and profitable production operations

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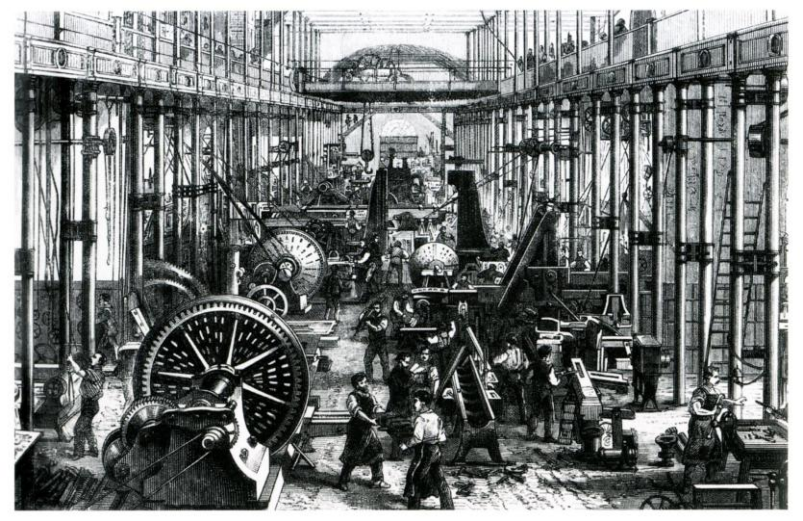
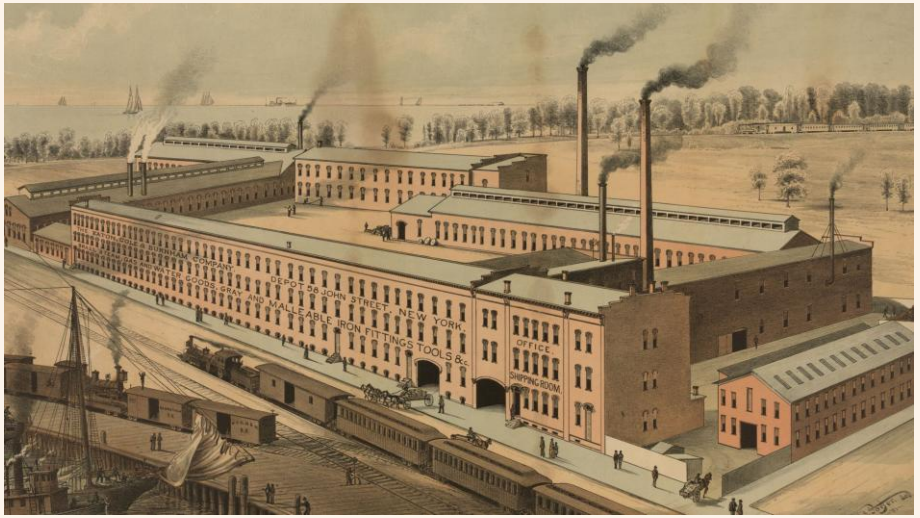
Context: Industrialization on national level driving investments

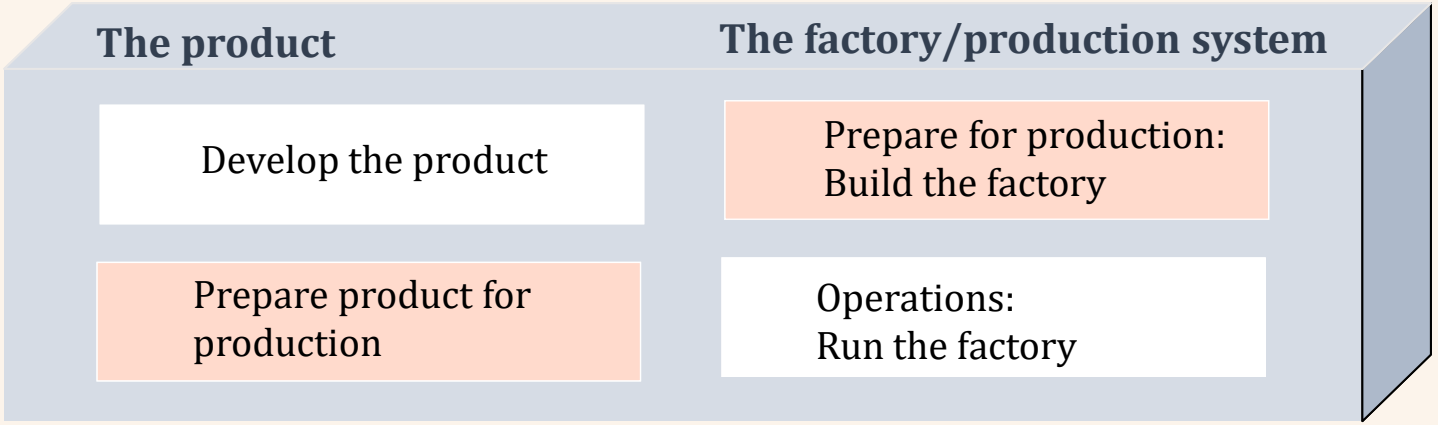




Industrialization on national level (Wikipedia):

- "The period of social and economic change that transforms a human group from an agrarian and feudal society into an industrial society. This involves an extensive re-organisation of an economy for the purpose of manufacturing.
- The first Industrial Revolution took place mid-18th to early 19th century in Great Britain.
- **Financial investments in new industrial structures (and not in trade).**

Context: Industrialization used on corporate level driving investments



Industrialization on corporate level (from industry perspective):

- Part of the product realization process → preparing for production
- From prototype to SoP and (planned) volume production (**Time To Volume**)
- Industrialization sets the preconditions for production operations
- Often implies **investments in facilities and production equipment → CapEx projects**

Investment plan for production

Examples of drivers for investing in machines and production equipment

- Capacity & growth
- Productivity & cost reduction
- New product introduction (part of industrialization process)
- Sustainability & compliance
- Resilience & risk reduction
- Others..

CapEx – Capital Expenditure.
The money spent to acquire, upgrade or maintain long-term physical assets, such as equipment, technology and buildings

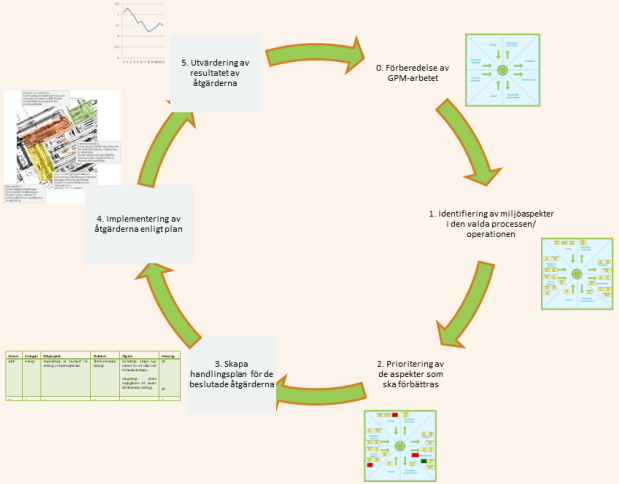
Consider the **green** dimension in all production investment projects

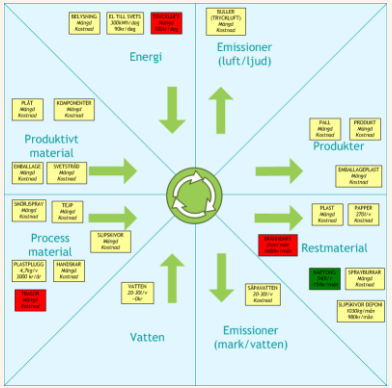
… and not only for the sustainability driven investments (environment, energy, emissions etc)

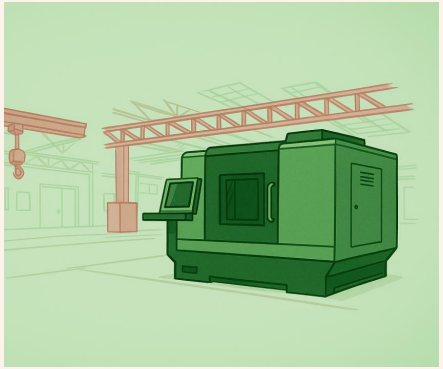
Our two approaches to increase sustainability in production

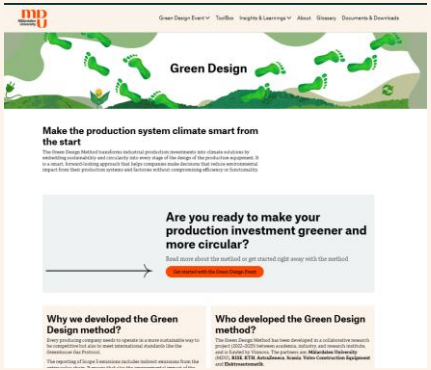
OpEx:
Green kaizen

CapEx:
Green Design









The idea of Green Design:

Design focus. Do right from the start.

Build in sustainability and circularity in the production equipment already in the investment project.

Collaborate with the equipment supplier.

Green Design – Invest in ‘greener’ production equipment

GREEN DESIGN: A design method supporting team-based Green Design Events in the early phases of a production investment project.

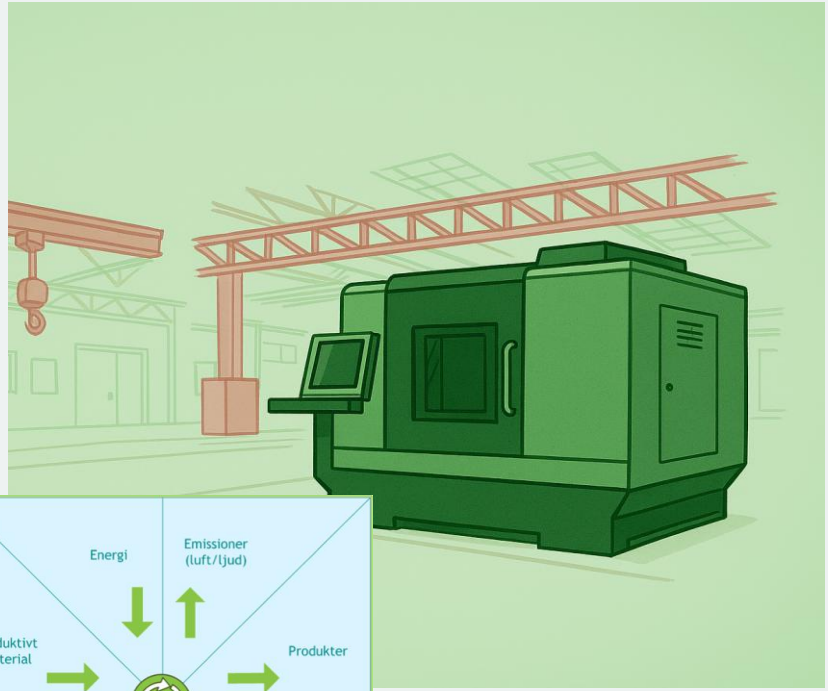
Why?

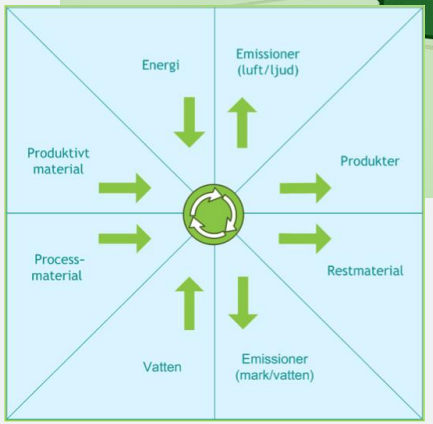
- **To design and build more sustainable and circular machines and production equipment**
- **To secure high OEE in operations**
- **To challenge conventional technology solutions built in the equipment**
- **To contribute to green innovations**

The GREEN DESIGN method is web-based and comprises:

1. **A working procedure** to be integrated into the company’s own investment process/project model
2. **A toolbox**
3. **Insights & learnings** as a support

The Green Design Events uses the “green performance map” as a structure for questions challenging the existing thinking, and inspiring to new green innovations.





Partners:

MDU, KTH, RISE, Volvo CE, Scania, AstraZeneca, Elektroautomatik

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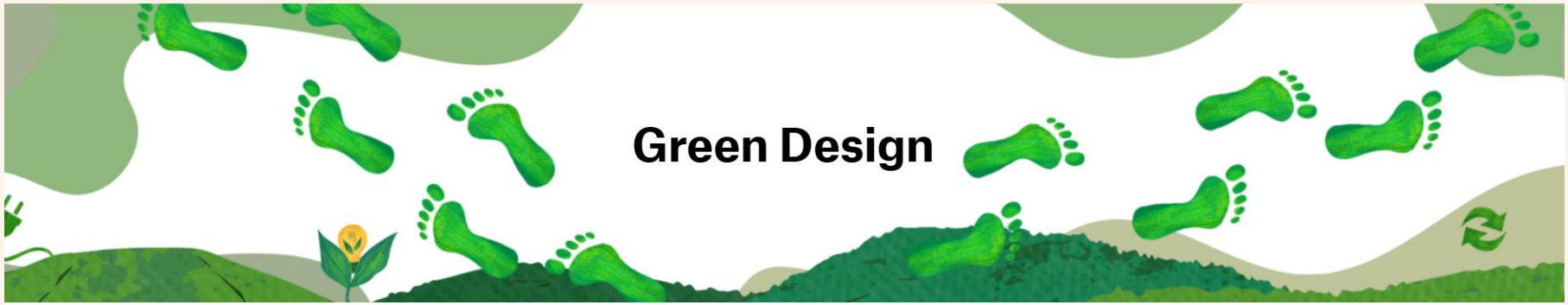
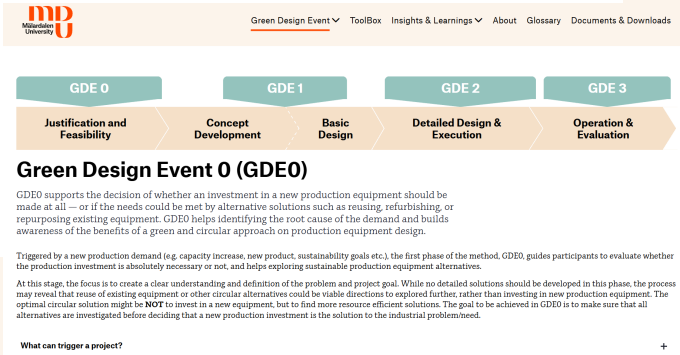
Green Design Event ToolBox Insights & Learnings About Glossary Documents & Downloads



Make the production system climate smart from the start

The Green Design Method transforms industrial production investments into climate solutions by embedding sustainability and circularity into every stage of the design of the production equipment. It is a smart, forward-looking approach that helps companies make decisions that reduce environmental impact from their production systems and factories without compromising efficiency or functionality.



GDE 0 | GDE 1 | GDE 2 | GDE 3

Justification and Feasibility → Concept Development → Basic Design → Detailed Design & Execution → Operation & Evaluation

Green Design Event 0 (GDE0)

GDE0 supports the decision of whether an investment in a new production equipment should be made at all — or if the needs could be met by alternative solutions such as reusing, refurbishing, or repurposing existing equipment. GDE0 helps identifying the root cause of the demand and builds awareness of the benefits of a green and circular approach on production equipment design.

Triggered by a new production demand (e.g. capacity increase, new product, sustainability goals etc.), the first phase of the method, GDE0, guides participants to evaluate whether the production investment is absolutely necessary or not, and helps exploring sustainable production equipment alternatives.

At this stage, the focus is to create a clear understanding and definition of the problem and project goal. While no detailed solutions should be developed in this phase, the process may reveal that reuse of existing equipment or other circular alternatives could be viable directions to explored further, rather than investing in new production equipment. The optimal circular solution might be **NOT** to invest in a new equipment, but to find more resource efficient solutions. The goal to be achieved in GDE0 is to make sure that all alternatives are investigated before deciding that a new production investment is the solution to the industrial problem/need.

What can trigger a project? +

Green Design Event 0

GDE0 supports the decision of **whether an investment in a new production equipment should be made at all** — or **if the needs could be met by alternative solutions** such as reusing, refurbishing, or repurposing existing equipment. GDE0 helps identifying the root cause of the demand and **builds awareness** of the benefits of a green and circular approach on production equipment design.

- What happens if we do nothing? Consider the consequences of maintaining the current setup.
- Could this specific need be addressed through operational changes or by existing resources instead?
- Are there alternative ways to meet the specific production need without investing in new equipment?

Green Design Event 1

When the decision from GDE0 was to continue the process, creating a new production investment project, GDE1, is the next step. **It supports the generation of interesting and innovative green solutions** for the new production equipment to be invested in. There are different alternatives supported; both development of new equipment and **renovation or refurbishment** of existing equipment. The focus is on **designing in sustainability, resource efficiency, and long-term value already from the start**.

Green Design Event 2

At this point, it is decided to move forward with the investment. Equipment supplier quotations have been received, and a supplier is probably selected. GDE2 supports the process in going from the concept development to the detailed planning of the (production) equipment to be invested in. Now, **concrete sustainability targets** should be defined, such as energy use, emissions, and material efficiency. To get the best results, this is **made in collaboration with the selected supplier**. These targets reflect the company's environmental ambitions and should guide the integration of green solutions into the production equipment.

Green Design Event 3

GDE3 builds on all previous Green Design Events and focuses on **capturing the final sustainability-related learnings** from the project. The goal is to consolidate the project's green experience into a White book or similar format. It will ensure that **knowledge is documented and transferred** within the organisation to learn for future projects. The White book should be made while team members are still actively involved in the project.

When to Perform? +

Questionnaire

The Excel file contains all the questions that could be used for the events.

Questionnaire Green Design Event

Guiding Questions +

Involved functions

Include individuals with relevant competence — not just based on their formal role, but on their ability to contribute to sustainable and circular investment decisions. The team of participants should be tailored to the specific context.

Core Functions +

Extended Functions +

Recomended tools

In the Toolbox you will find a selection of tools to use. For this event, some tools have been listed to be of help.

Recommended Tools +

Input & Preparations

Before the event, participants should:

- Review background information including identified need for a potential investment.
- Review the company's sustainability strategy and re levant goals.
- Review documentation such as investment plans, long term production road map, production strategy and sustainability KPIs.
- Review insights and performance data from existing or similar equipment if available.
- Understand the scope and timeline of the potential investment.

Output & Takeways

After the event, participants should:

- Make a decision on whether to initiate an investment or upgrade existing equipment.
- Describe a clear problem statement and project goal related to the identified need.
- Agree on defined environmental targets (e.g. reduced energy use, lower waste, extended equipment lifespan).
- Document the outcome to support the next step in the acquisition or improvement process.
- Decide on who to involve in the next GDE event.

Questionnaire

The Excel file contains all the questions that could be used for the events.

Questionnaire Green Design Event

	Applicable event no.					Theme	No.	Question	Clarifications	Yes/No/NA	Answers/Suggested Solutions (Green Innovations)	Recomended tools from toolbox	Feasability
	0	1	2	3	Priority								
	☐	☐	☑	☑	☑								
Introductory	0				P	General	1	What is the estimated lifespan (and estimated usetime) in years of the investment?	If the estimated lifetime exceeds the estimated use time, is there a plan what to with it the rest of its lifetime?			LCC	
	0				P		2	Does the equipment need to be adapted for the future in terms of production volumes, expanded capacity, preparation for new products/variants or similar?				If yes (Use simple checklist to ensure flexibility requirements are met.)	
	0				P		3	Is the equipment or components available for rent/lease instead of ownership?	Could also be availbe from other parts fo the company(line or factories)			LCC/TCO	
	0				P		4	If there is an old process equipment, has it been inventoried for possible reuse?				LCC/TCO	
	0	1			P		5	Is there a risk of oversizing the equipment unnecessarily?				LCC/TCO	
	0	1			P		6	What level of modularity and reconfigurability of the equipment is useful/possible?					
	0	1			P		7	What level of traceability of equipment and its components will be needed?					
	0	1					8						
	0	1					9						
	0	1					10						

Introductory

- General

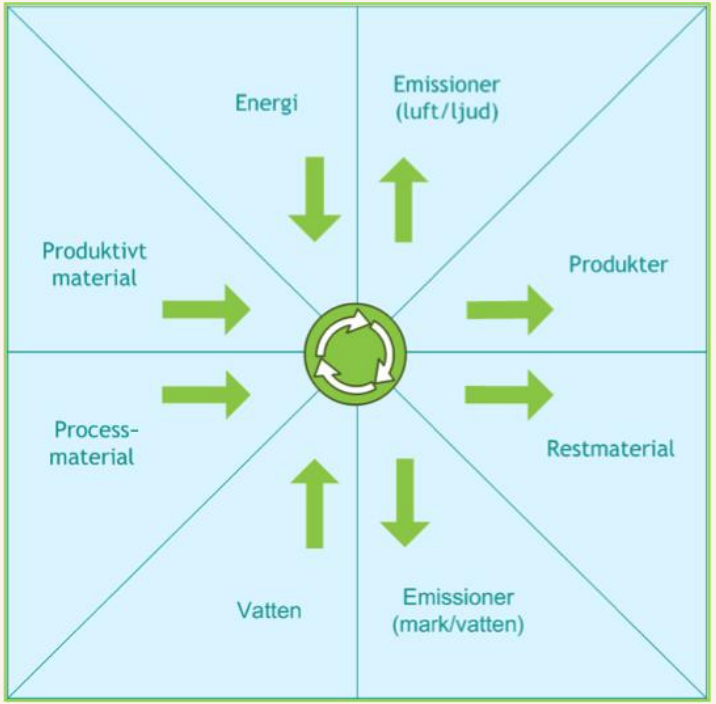
Into the Process

- Energy
- Productive Material
- Process-Maintenance-and Investment - materials
- Water

From the Process

- Emissions to air, including noise and heat emissions
- Products
- Waste
- Emissions to sewage systems and risks to recipients
- Miscellaneous

Follow-up



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https://sites.mdu.se/green-design

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