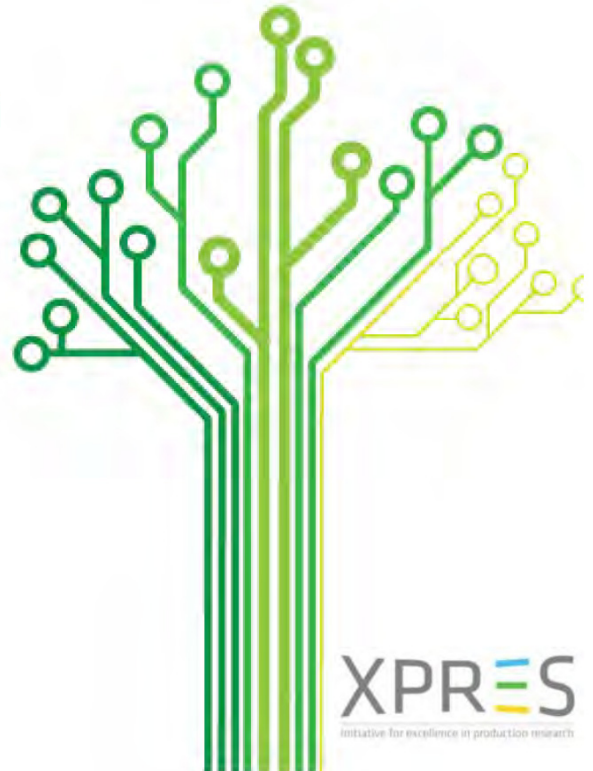


# Lean and Green Experience from Swedish industry

## Green performance map

Martin Kurdve, Mälardalen University  
SMARTLOG seminar 2013-10-14



XPRES  
Initiative for excellence in production research



## Martin Kurdve

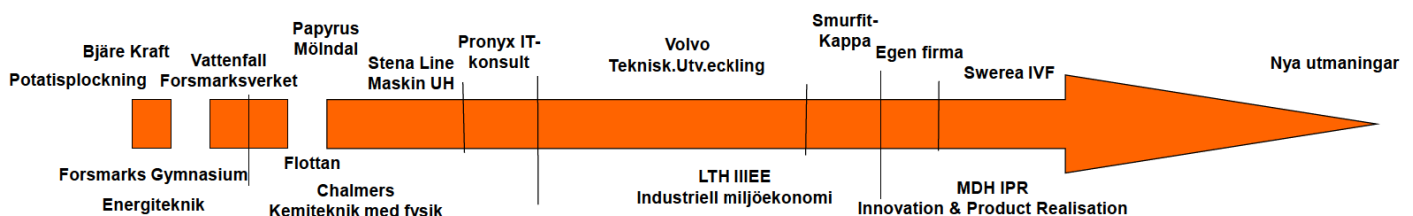


Martin Kurdve  
42 år,

- Swerea – IVF Forskare och konsult
  - Green Lean, ProduktionsLyftet (Lean for SMEs).
- Mälardalen University, Forskare - Green Lean, PhD
- Eget företag Verksamhetsutveckling, projektledning
- Smurfit Kappa Sverige, Lean Manager – Wellpappförpackningar
- Intern konsult inom Volvo Group 9 år – Produktionsutvecklingsingenjör
- IT-konsult, Pronyx IS - Papper-, Energi- och Stål-industri som kunder

### Utbildning

- Licentiate of Technology, Industriell miljöekonomi Lund University, IIIEE 2010
- Civilingenjör Kemiteknik med Fysik, Chalmers, Process- och Energiteknik 2000





# Department of Product Realisation Mälardalen University

## Department of Product Realisation



**Focus area:** Production system design  
and Industrialisation

*Provides new knowledge, understanding  
and methods that enable competitive  
production*

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## Presentation

- Research of Green Lean in Swedish companies
- Green Performance Map
- Results of some cases
- Questions/Discussion



# Lean and Green integration into production system models

Experiences from Swedish industry

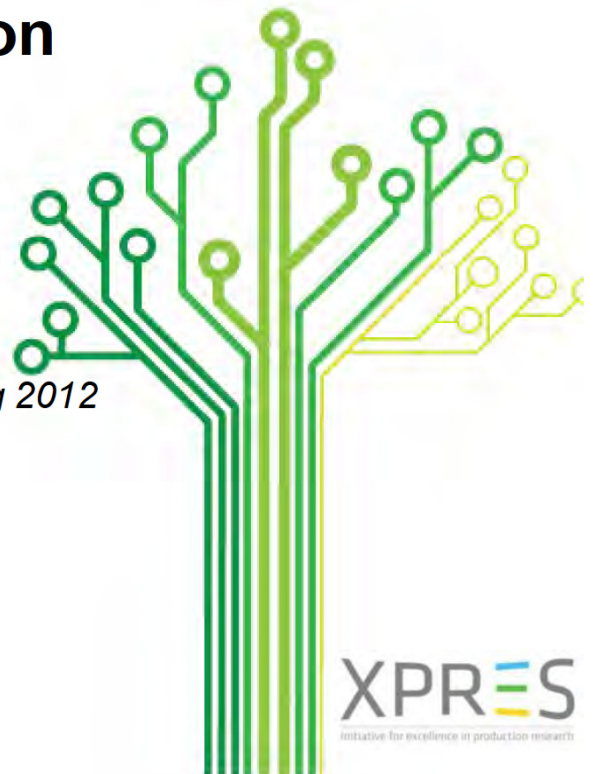
*Selected parts of paper presented at the Swedish Production Symposium Linköping 2012*

Martin Kurdve, Mälardalen University

Mats Zackrisson, Swerea IVF

Magnus Wiktorsson, Mälardalen University

Ulrika Harlin, Swerea IVF



**In a Green Production System, Lean and Clean are merged to ensure maximum benefits**

Cleaner production is  
“A systematic approach to eliminating waste by optimizing use and selection of resources and technologies while lessening the impact on the environment.”  
- EPA, US govt.

*Muda is “anything other than the minimum amount of equipment, materials, parts, space, and worker’s time which are absolutely necessary to add value to the product.”*  
- Shoichiro Toyoda, President, Toyota

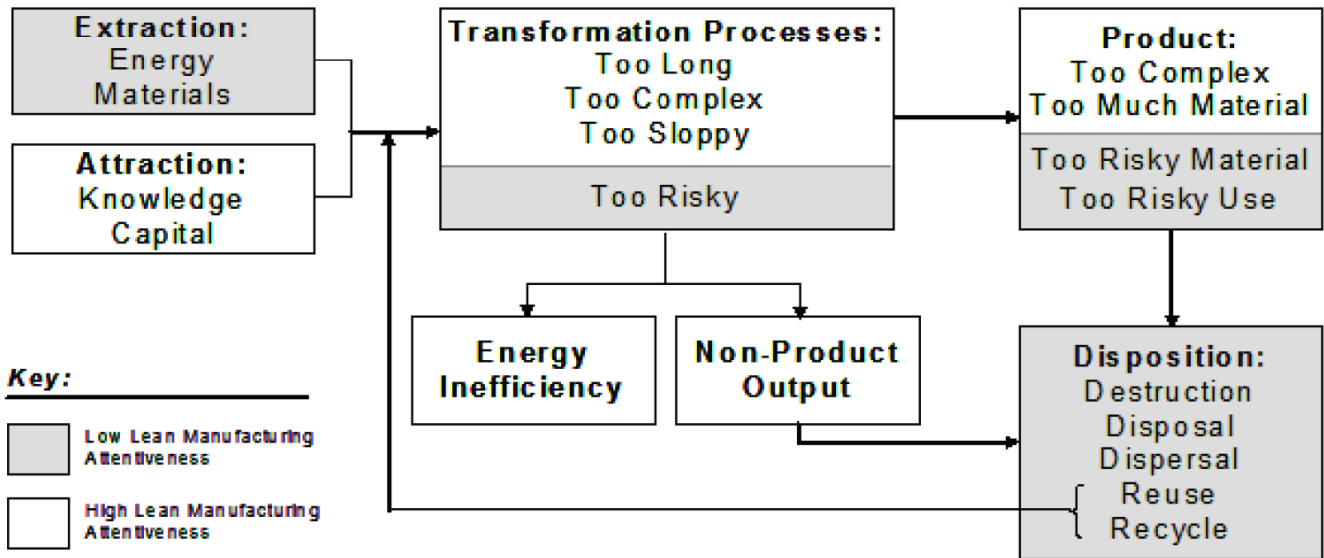
Involve Re-thinking products, product components and production processes to achieve a *sustainable and profitable* production



# Green Lean



Figure A  
Lean "Blind Spots": Risk and Lifecycle Impacts



Picture from US EPA Webpage



## Summary of previous work

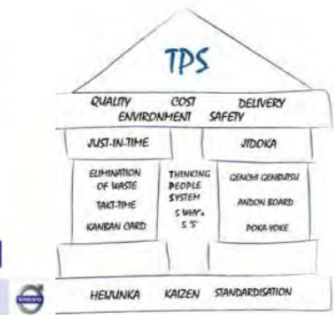
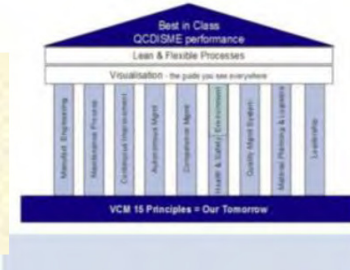
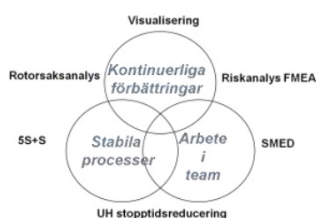
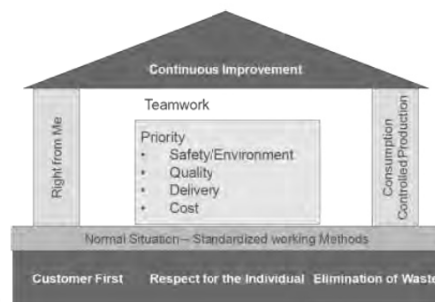
- **LEAN Improvement work is beneficial for Environmental Management**
- **Environmental Management will help where lean tools are insufficient**
- **Integration of the systems will increase the benefits of both**
- **Common language is helpful**



# Elements in EMS and XPS

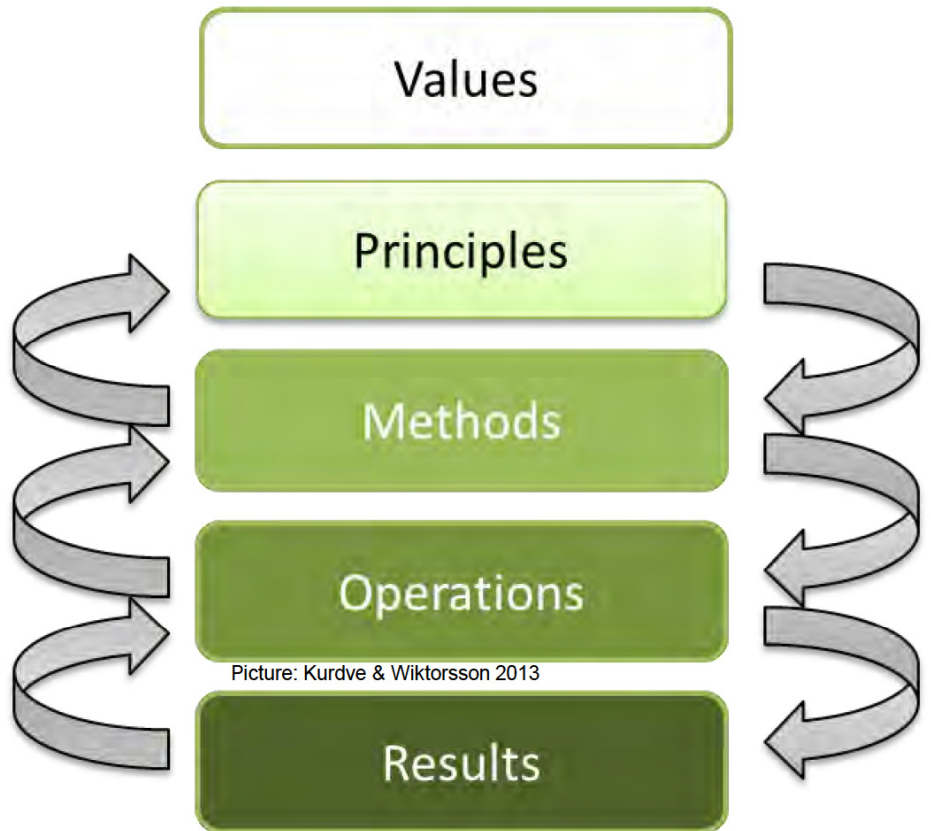
<u>Components</u>	<u>XPS</u>	<u>EMS</u>
Values	X	X
Visions-Policy	X	XX
Legal requirements		XX
Goal/targets	X	XX
Principles	XX	
Visualisation of principles	X	X
Aspects (Risks in OHS)		XX
Prioritisation	X	XX
Methods & Tools for CI	X	
Operational procedures		XX
CI roles & training	x	XX
Monitoring	x	XX
Audit system	x	XX
Standardised corrective actions		XX
Management CI review	X	XX

## Studied description of XPSes





# Integration in different levels



# Resulting picture

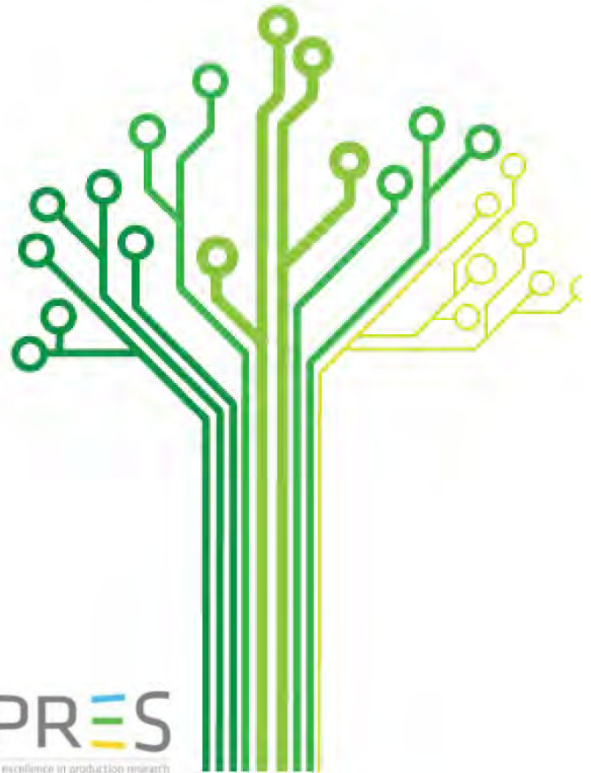
<u>XPS element</u>	<u>Company A</u>	<u>Company B</u>	<u>Ref company C</u>	<u>Ref company D</u>
<u>Vision &amp; Values</u>	Q, E, OHS	Q	Q, (OHS)	Q, E, OHS
<u>Principles</u>	Q, E, OHS	Q	Q	Q
<u>Organisational integration</u>	Q, E, OHS, CI	Q, CI	<i>(Not investigated)</i>	<i>(Not investigated)</i>
<u>Methods</u>	<b>Not fully integrated</b>	<b>Not fully integrated</b>	<b>Not fully integrated</b>	<b>Not fully integrated</b>
<u>Auditing</u>	Partly integrated in internal audits	Not integrated	<i>(Not investigated)</i>	<i>(Not investigated)</i>
<u>KPIs</u>	S,Q,D,C,E,P	D,Q1,Q2	<i>(Not investigated)</i>	<i>(Not investigated)</i>
<u>EMS integration</u>	Coherent, Top down	Correspondent, Bottom up	<i>(Not fully analysed)</i>	<i>(Not fully analysed)</i>



# Green Performance Map:

*From presentation of Green Performance  
Map Handbook 2011*

Karin Romvall, Martin Kurdve,  
Magnus Wiktorsson & Monica Bellgran  
School of Innovation, Design and  
Engineering  
Mälardalen University, Sweden



**XPR=ES**  
Initiative for excellence in production research

## Green Performance Map

För ett ökat  
engagemang  
i miljöarbetet

# Om att involvera alla...

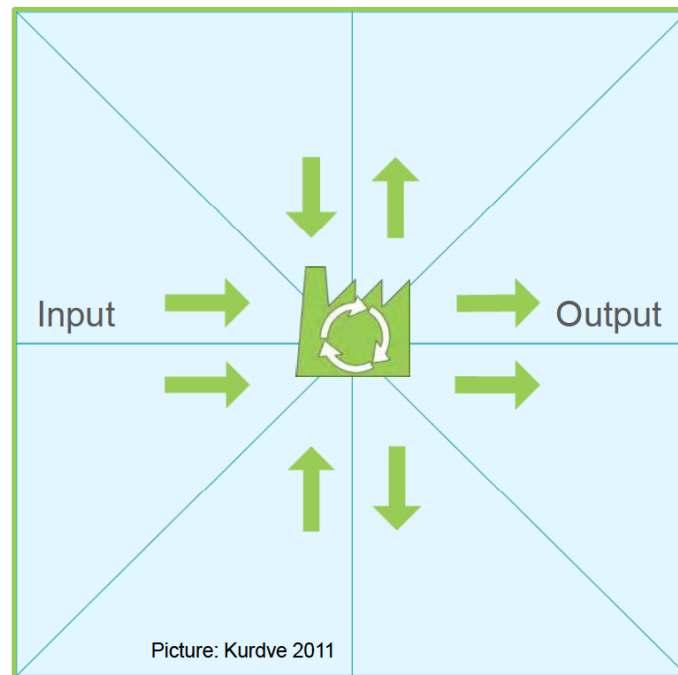


# ... steg för steg

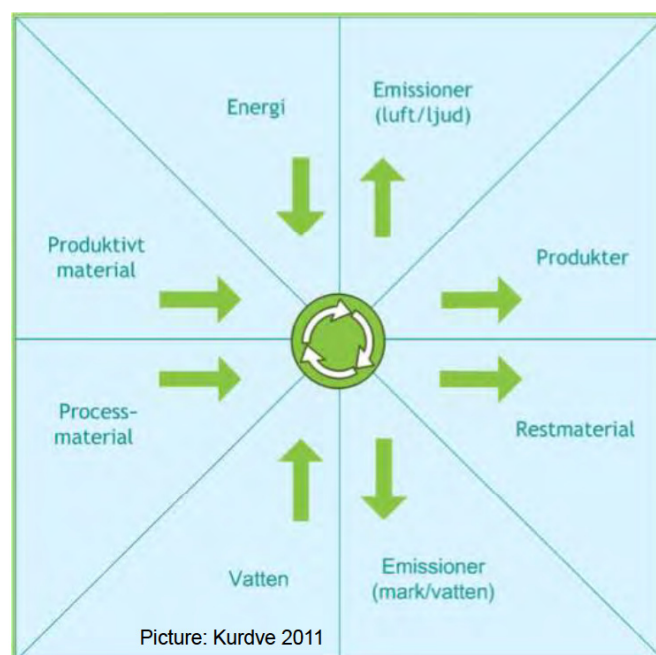


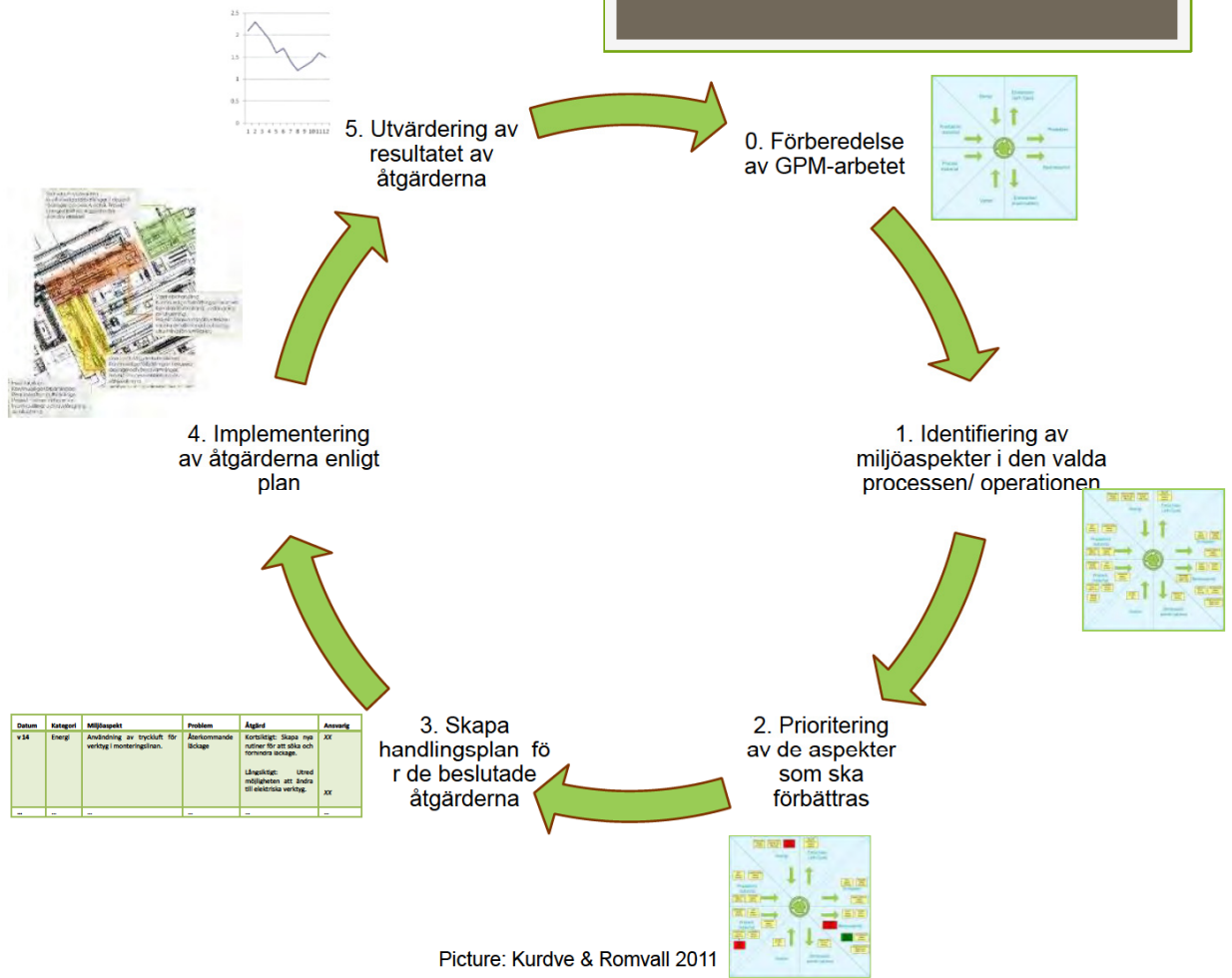


# Att beskriva en process

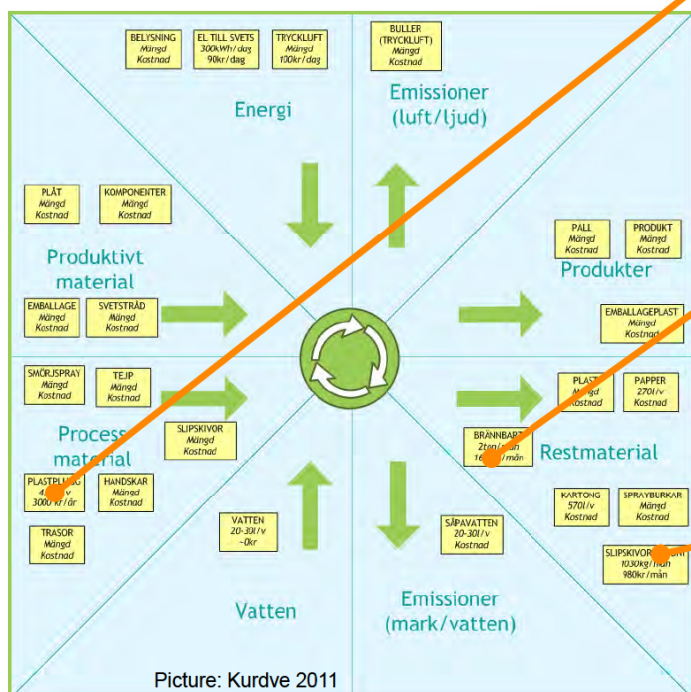


# GPM: En enkel karta





# Identifiera...



**PLASTPLUGG**  
4,7kg/v  
3000 kr/år

- 1. Miljöaspekt
- 2. Mängd
- 3. Kostnad



**BRÄNNBART**  
2ton/mån  
1600 kr/mån

- 1. Miljöaspekt
- 2. Mängd
- 3. Kostnad

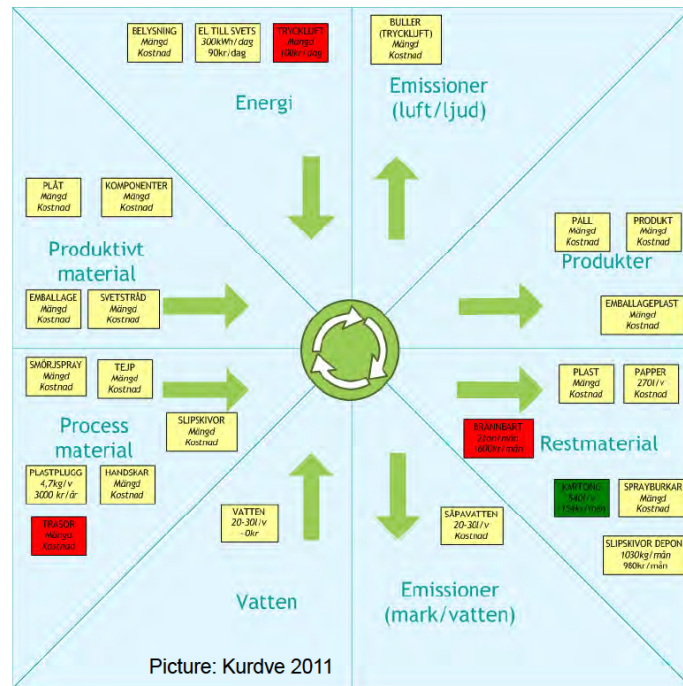


**SLIPSKIVOR DEPONI**  
1030kg/mån  
980 kr/mån

- 1. Miljöaspekt
- 2. Mängd
- 3. Kostnad



# Prioritera...

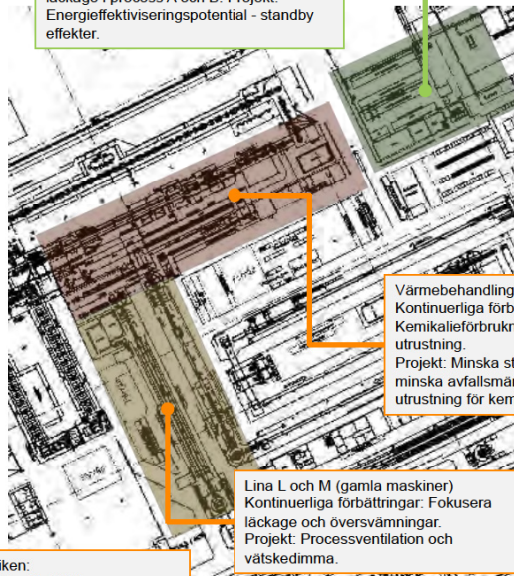


# Besluta...

Datum	Kategori	Miljöaspekt	Problem	Åtgärd	Ansvarig
v 14	Energi	Användning av tryckluft för verktyg i monteringslinan.	Återkommande läckage	Kortsiktigt: Skapa nya rutiner för att söka och förhindra läckage.  Långsiktigt: Utred möjligheten att byta till elektriska verktyg.	XX   XX
...	...	...	...	...	...

# Genomföra...

Svarvar i huvudsak bra.  
Kontinuerliga förbättringar: Fokus på läckage i process A och B. Projekt: Energieffektiviseringspotential - standby effekter.

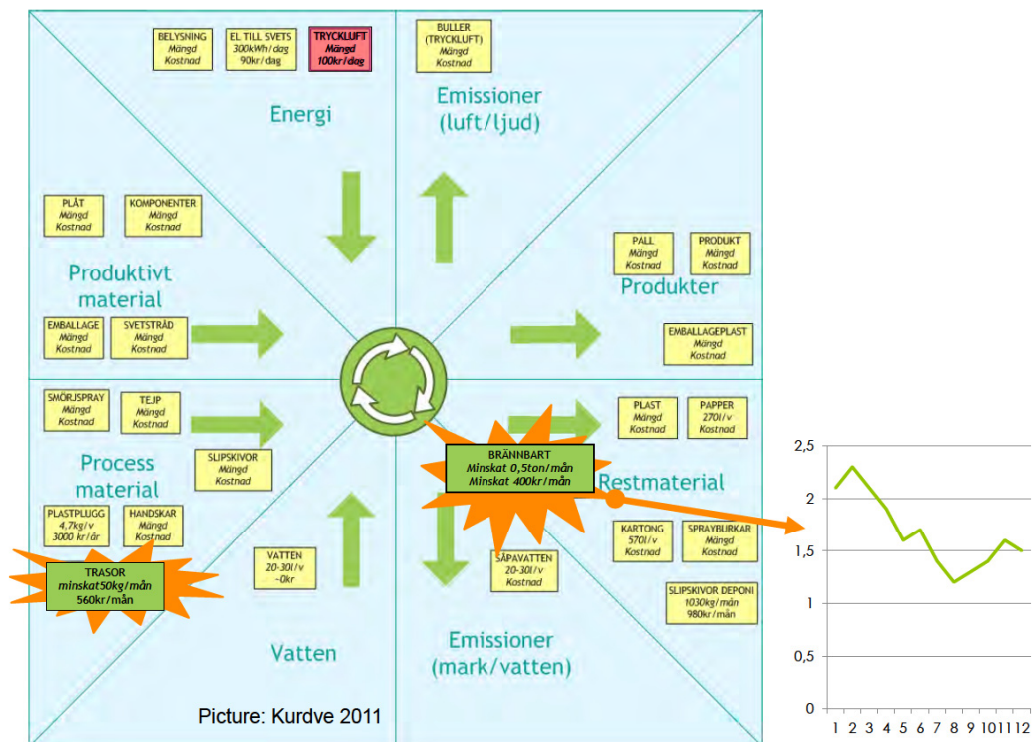


Värmebehandling  
Kontinuerliga förbättringar i teamet: Kemikalieförbrukning, avstängning av utrustning.  
Projekt: Minska standbyeffekten, minska avfallsmängd och byt ut utrustning för kemikalier.

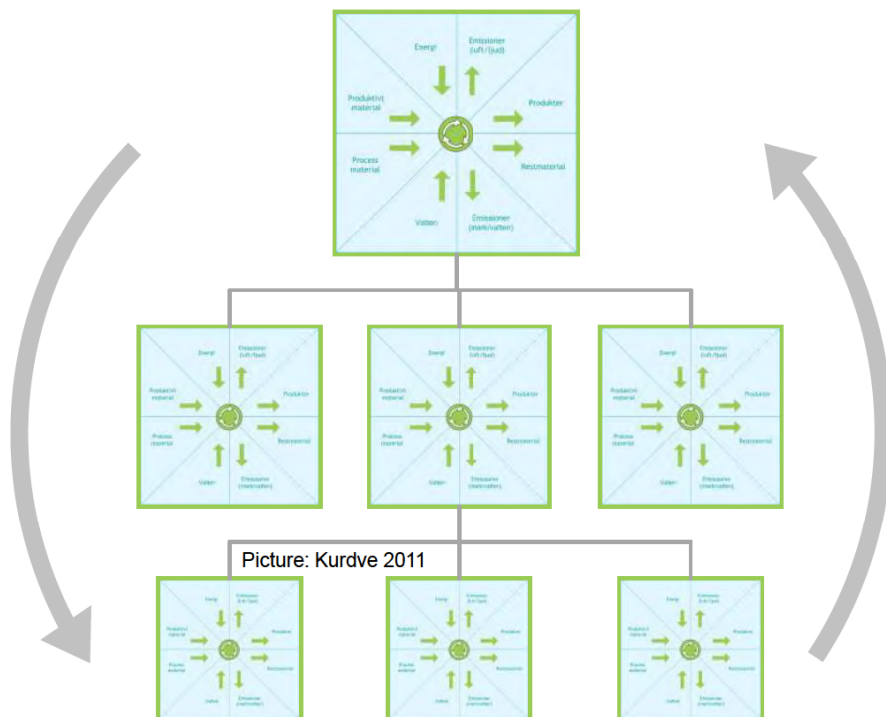
Lina L och M (gamla maskiner)  
Kontinuerliga förbättringar: Fokusera läckage och översvämningar.  
Projekt: Processventilation och vätskedimma.

Hela fabriken:  
Kontinuerliga förbättringar: Reducera tryckluftsläckage.  
Projekt: Ta fram riktlinjer för inomhusklimat och avstängning av utrustning.

# Utvärdera...

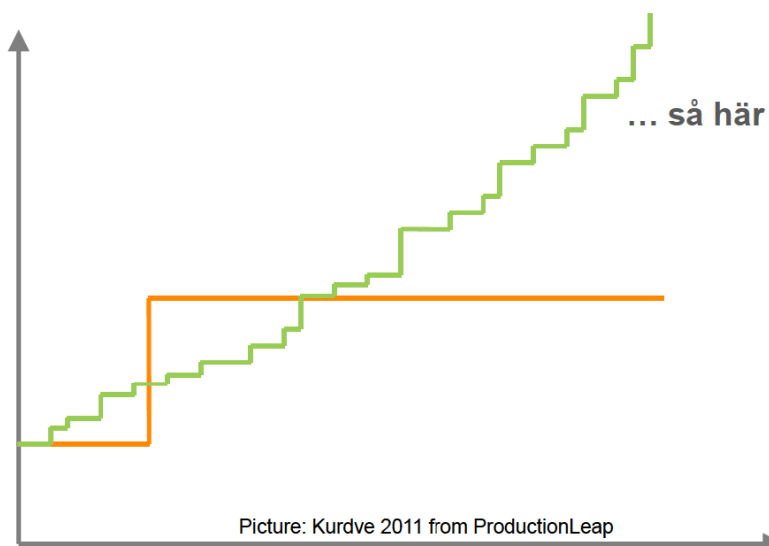


# Miljöarbete på olika nivåer



# Ständiga miljöförbättringar

Satsa på ständiga små förbättringar som involverar alla...



# Green Performance Map: Visualizing environmental KPI's

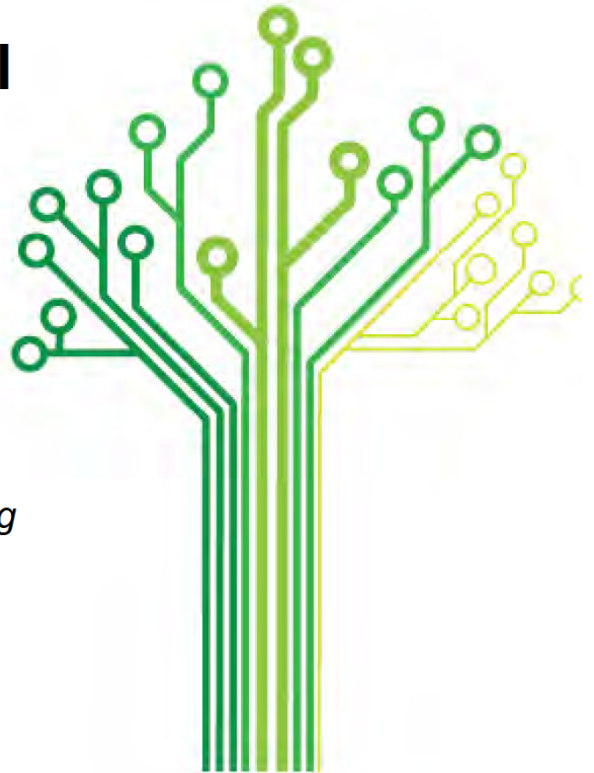
Case studies in Swedish industry

Martin Kurdve ([martin.kurdve@mdh.se](mailto:martin.kurdve@mdh.se))

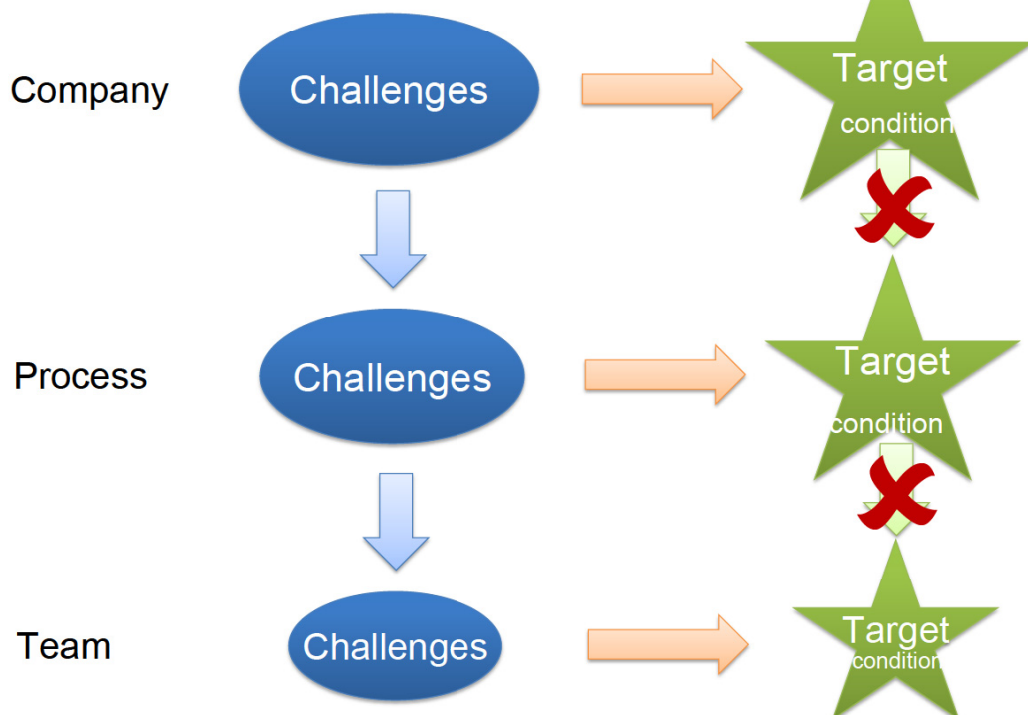
Magnus Wiktorsson

School of Innovation, Design and Engineering

Mälardalen University, Sweden



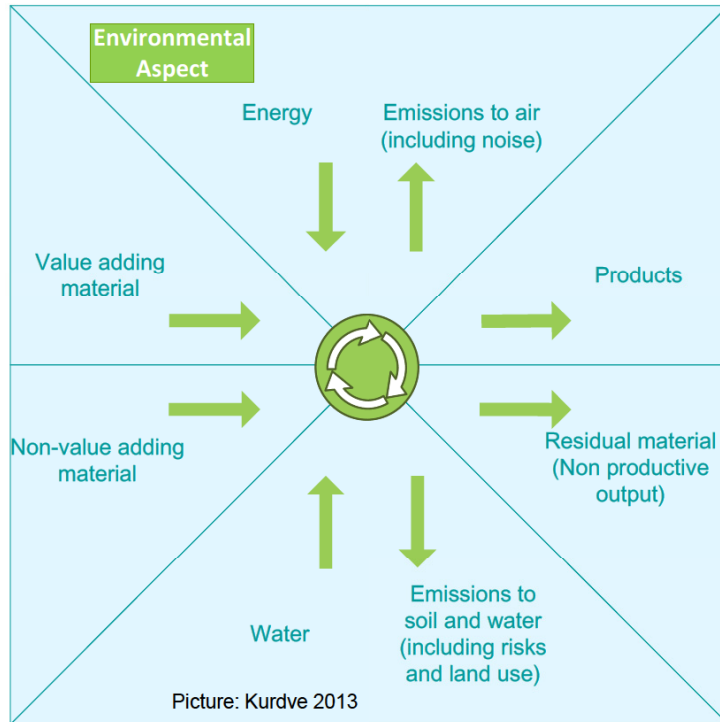
## Identify your challenges?



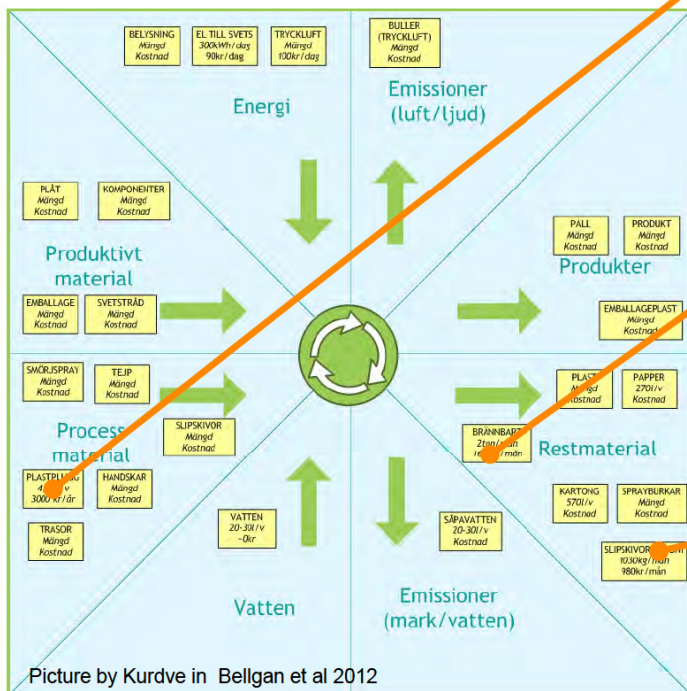
On each level, Identify your most important challenge and target condition?



# Green Performance Map



## Identify environmental losses on operator level



**PLASTPLUGG**  
4,7kg/v  
3000 kr/år

- 1. Miljöaspekt
- 2. Mängd
- 3. Kostnad

**BRÄNNBART**  
2ton/mån  
1600 kr/mån

- 1. Miljöaspekt
- 2. Mängd
- 3. Kostnad

**SLIPSKIVOR DEPONI**  
1030kg/mån  
980 kr/mån

- 1. Miljöaspekt
- 2. Mängd
- 3. Kostnad



# Company A – before GPM

## Plant level Env. goals

- Climate neutral and efficient energy use
  - saving X% (per yr)
  - Increase use of green energy

Recently added focus areas:

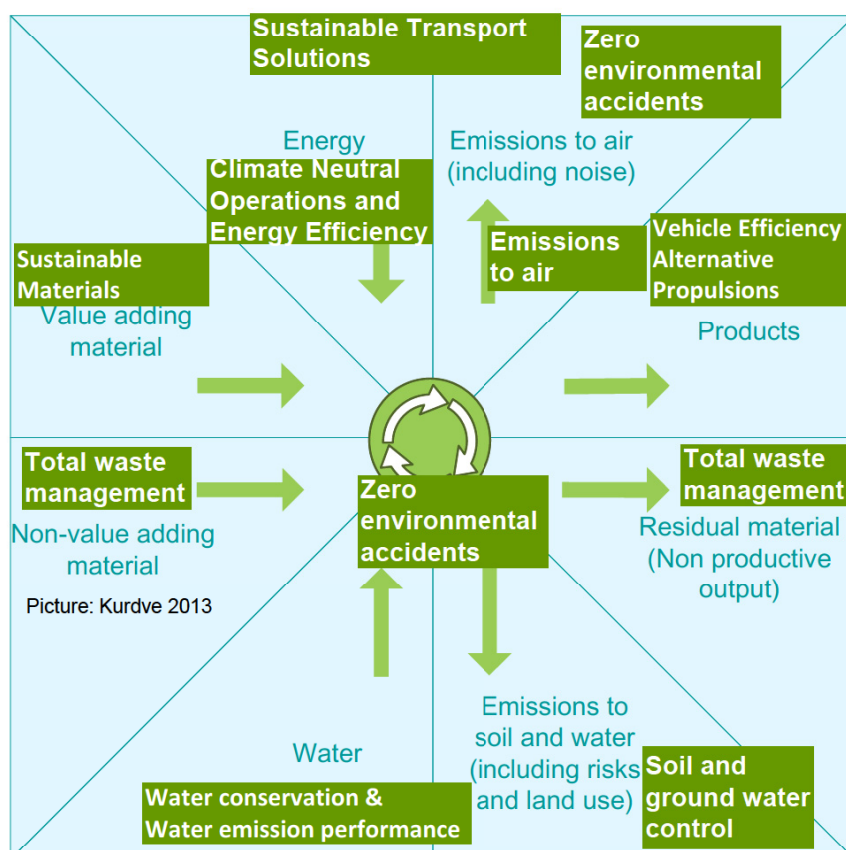
- Zero environmental Accidents
- Water Footprint
- Total waste management
- Sustainable Transport Solutions
- Emissions to air
- Soil and Ground water management

## Operations Team level Env. goals

- Continue energy-saving activities
- Try to broaden focus to added areas starting with mainly:
  - Zero env. Accidents
  - Water consumption and emissions



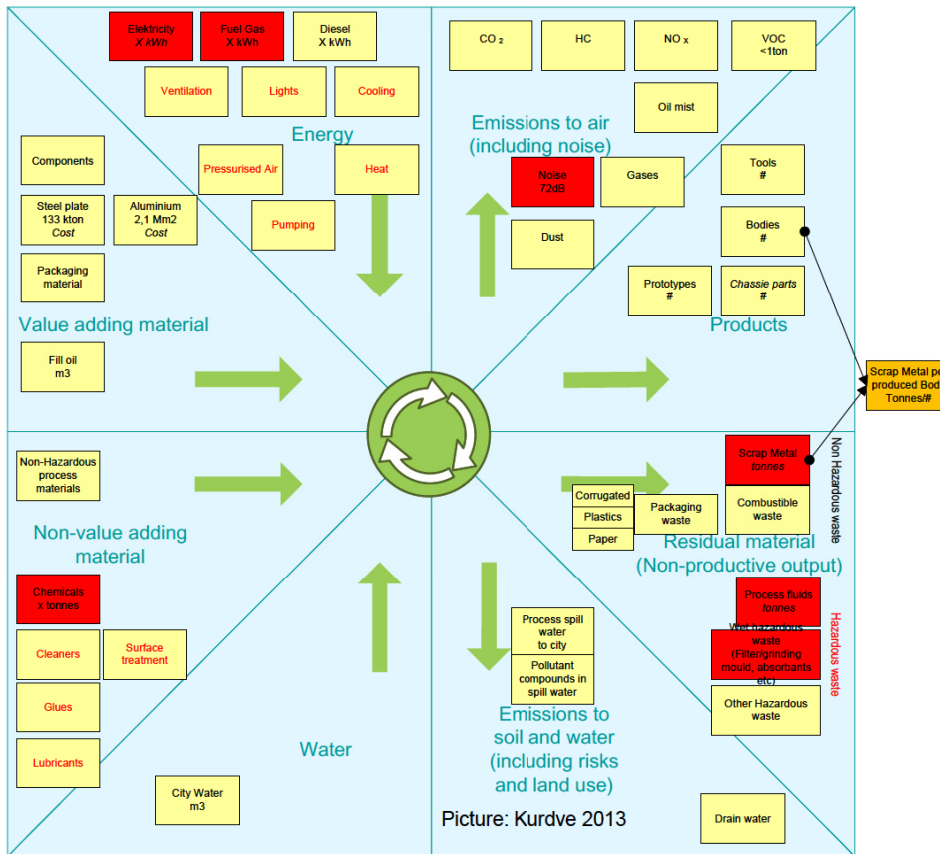
# Company level goals Company A



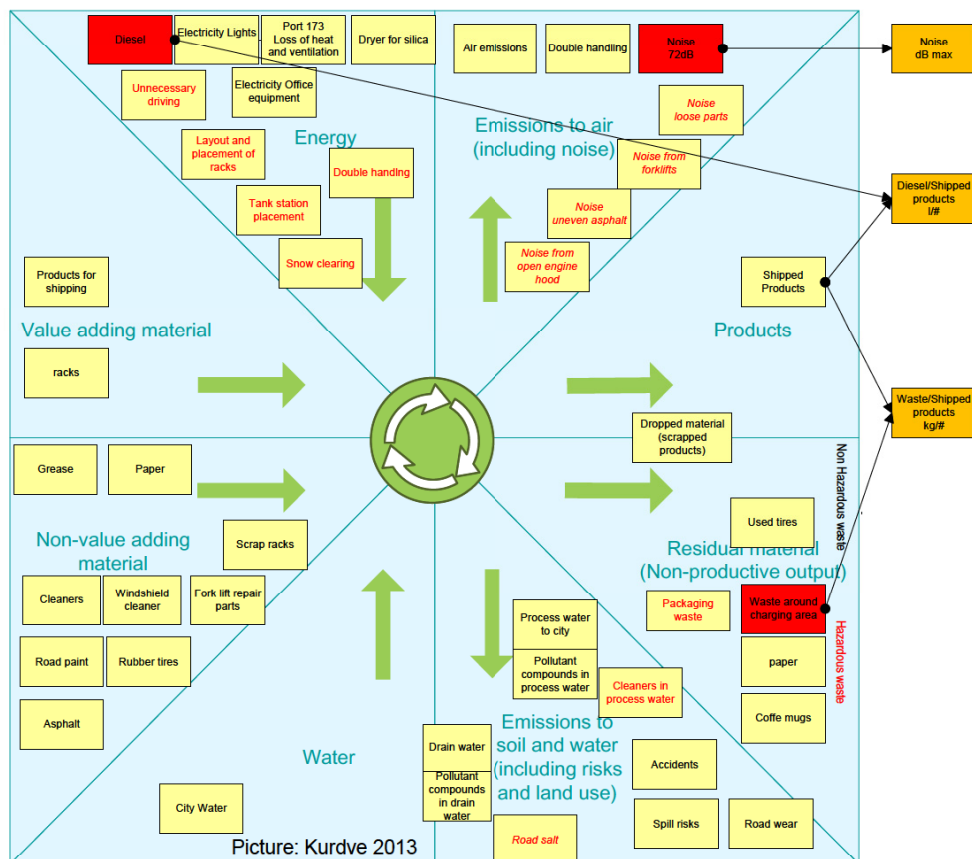




# Plant level

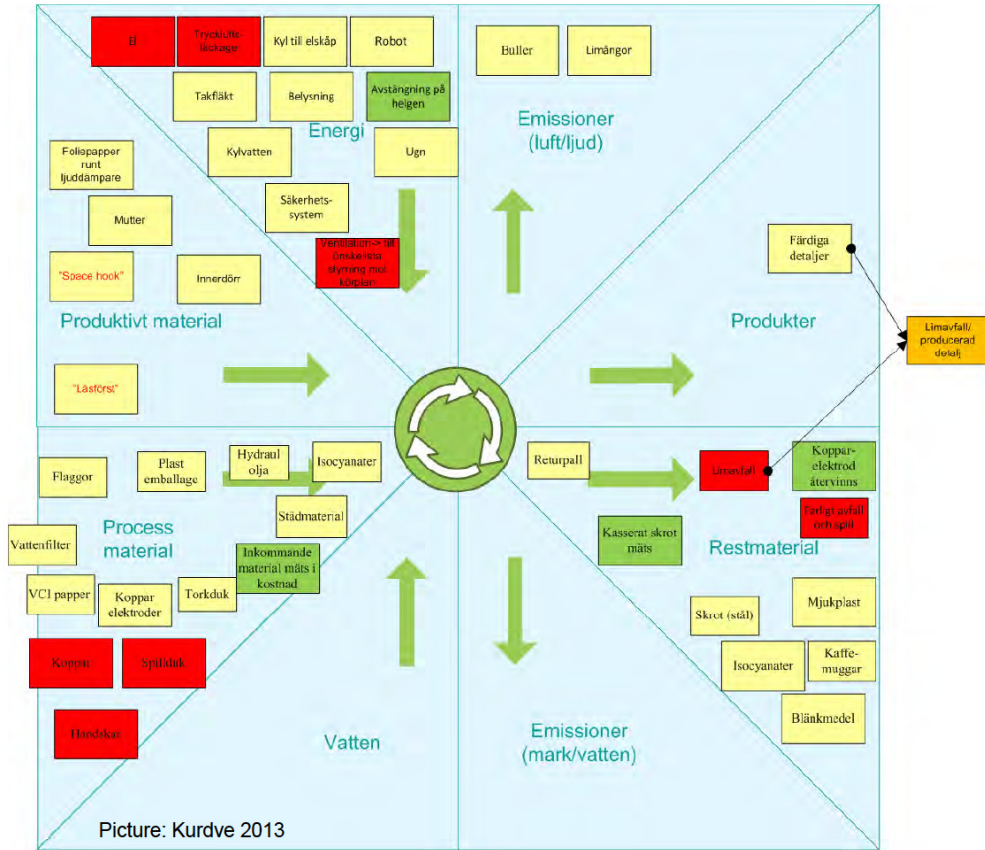


# Team level team I

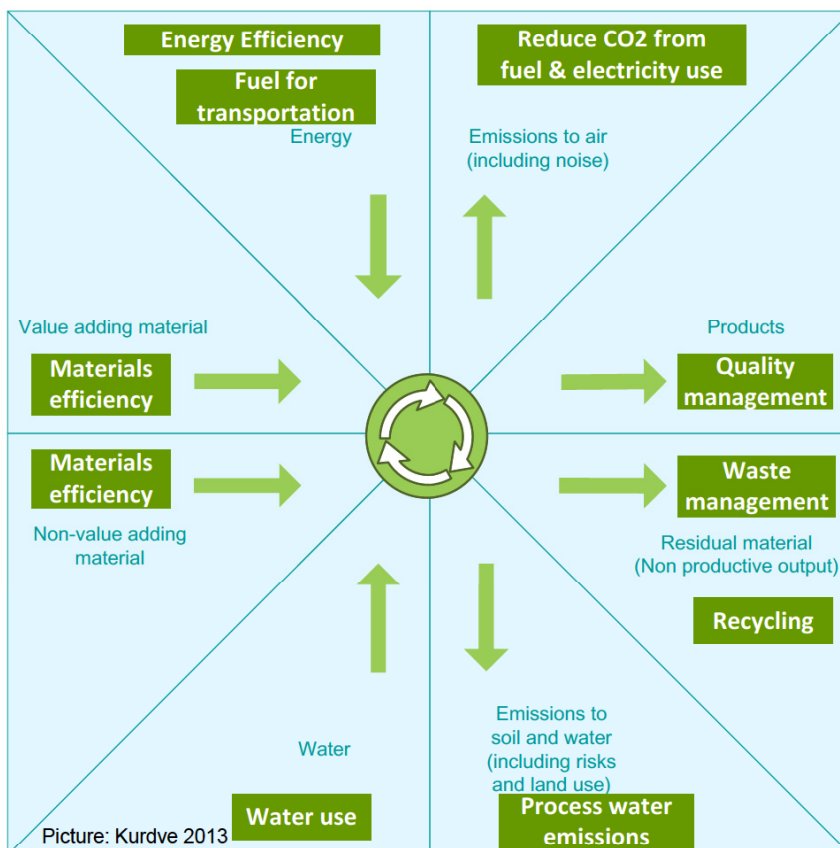




# Team level team II



# Case Company B



# Company B – before GPM

## Plant level Env. goals

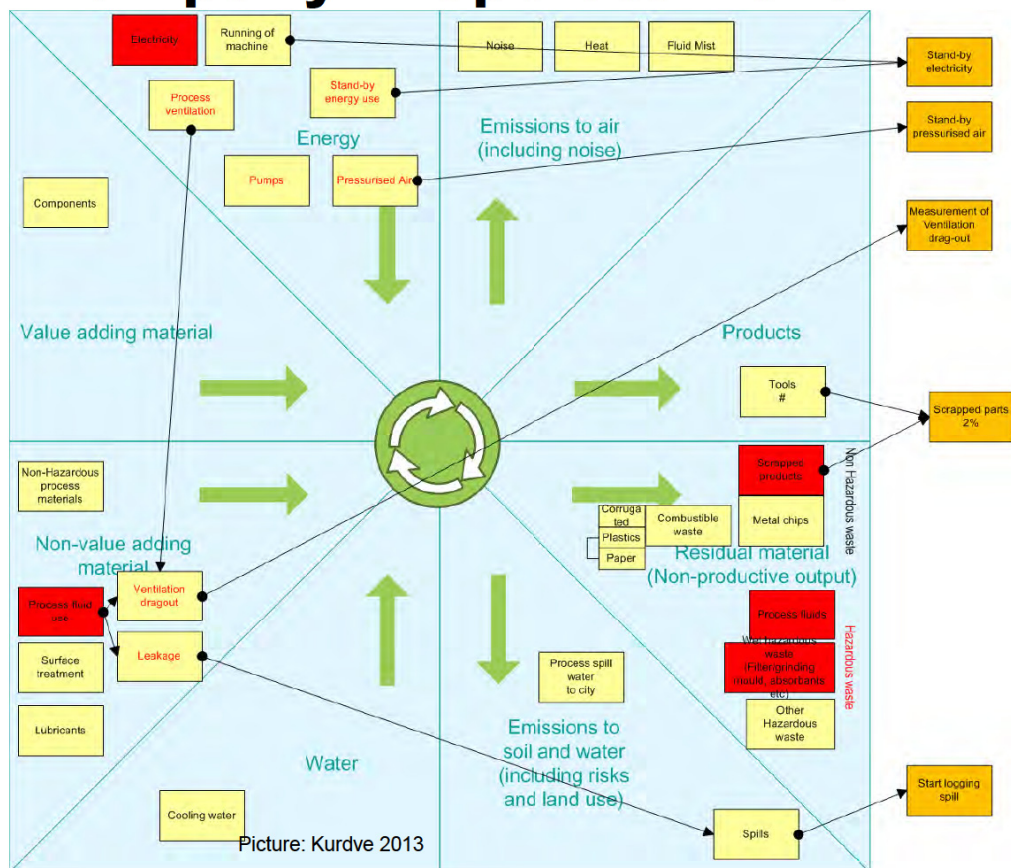
- Reduce scrap below 2.8%
- Energy saving 10% (4yr)
- CO2 reduction 10% (4yr)
- Reduce water use by 10%
- Increase packaging recycling above 42%

## Team level Env. goals

- Participate in energysaving activities



## Company B operator level





# Results

Empirical studies in case companies

- Increased environmental awareness in operations
  - Due to "new" focus on the issue
- Breakdown of objectives to teamlevel
  - Feature of the method
- Team involvement
  - Visualisation
  - Understanding "What can I do" and "What I do matter"
  - Time to start doing actions
- Time efficiency of method
  - 2 + 1hr/team
  - Possibility to include in regular Continuous Improvement work

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# Contribution

- **Add awareness of sustainability issues in OM-research**
- **Add awareness of Lean Management in Environmental research**
- **Confirm the mutual benefit of 'green' and 'lean'**
- **Demonstrate practical implementation of how to overcome obstacles in integrating green and lean management**

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# Conclusions

**It is possible to apply operational goals on team level also for sustainability concerns**

- **Visualisation and operator involvement will help speed of actions**
- **The GPM is one tool that may enhance this.**

**The application of the GPM crystalized into two tracks:**

1. **The management's at-a-glance tool for visualizing the sustainability situation.**
2. **The operational data gathering method for supporting sustainability decisions.**

**The tools adds to e.g. ISO 14031, by being much more visual and it is easy to see if any important aspects are forgotten or left out, also by non-experts.**



**Thanks for listening.**

**Questions & Comments?**



**[Martin.Kurdve@swerea.se](mailto:Martin.Kurdve@swerea.se)**