Sustainability Initiatives

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30,January, 2019

Agenda

- Renewable Energy Sourcing.
- **Life Cycle Assessment (LCA)**
- Reduction of Carbon Footprin,
- Role of Chemicals - Energy savings

1.Renewable Energy

- Renewable Energy Sourcing.
  - Grey to Green Energy Initiatives- Stahl.
  - Green energy - solar, wind, biomass or other renewable sources.
  - Switching energy sourced for our (4) European plants from

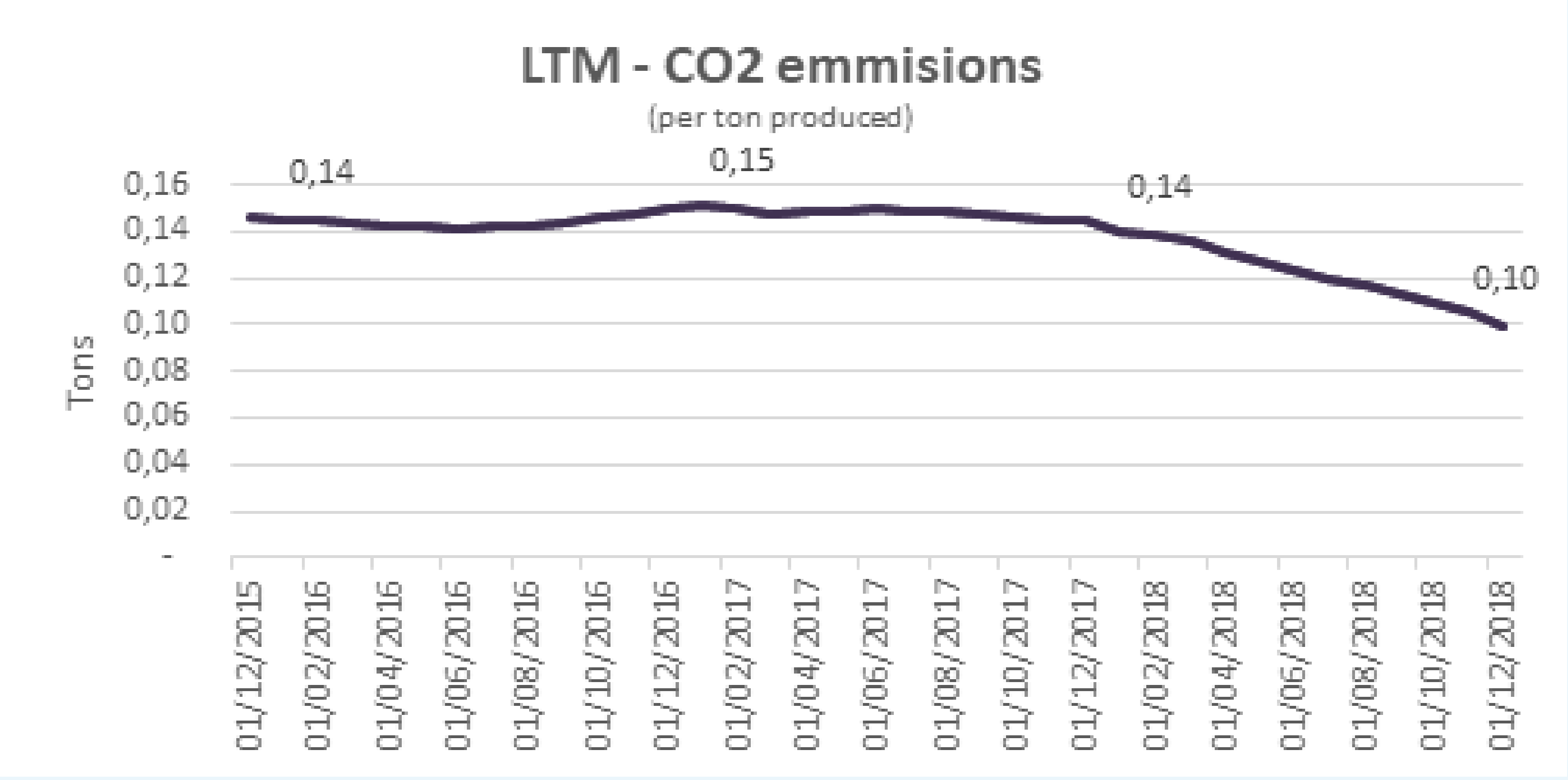
Solar Project-Change over

- Energy sourcing has changed over the years from fossil fuel based energy to green energy and recent shift to solar energy at our Stahl Brasil facility.
- India's renewable energy sourcing at stahl factories as well.
- Over the last 5 years we have switched all the energy sourced for our (4) European plants from "grey" energy to "green" energy.

Solar Project-Change over

- The environmental benefit of green energy vs grey energy sourcing - Reduction in C02 emissions.
- Green energy means zero C02 emissions, grey energy is fossil fuel, so we have to report the equivalent amount of burned fuel, which means C02 emissions.
- Enclosed is a graph that shows the progressive improvement in our C02 emissions over recent years,is mostly because of our policy of sourcing green energy.

Solar Project-Change ~~over~~



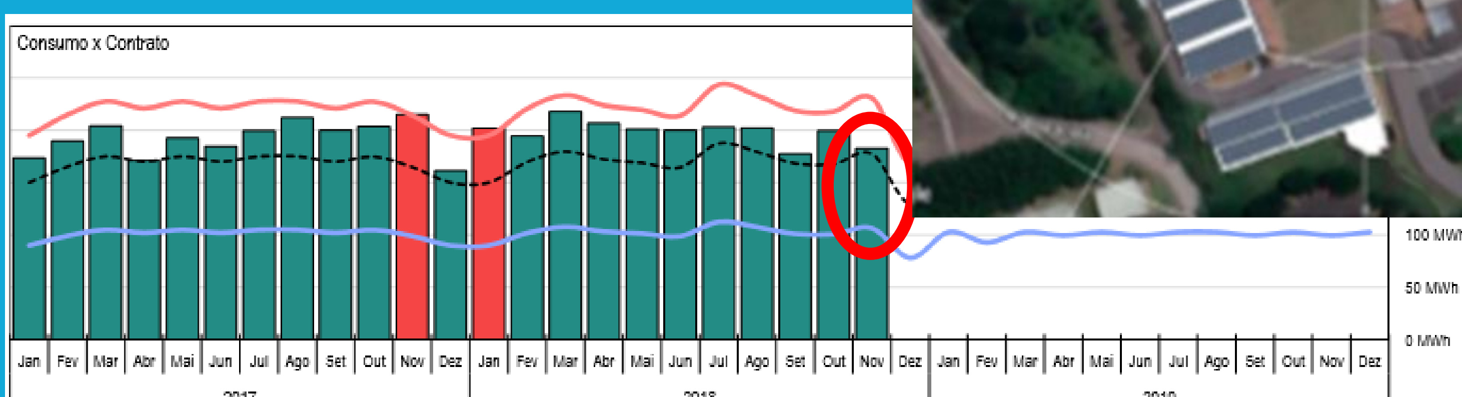
Solar Project-Change over

- In Brasil, Portao plant, we just started with the installations of solar panels - already can supply 40-50% of the energy used at this site-Solar panels installed on the roof.
- Plans to extend solar panel usage at our India, Singapore,Spain factories,where we have a lot of sun.
- The long term goal is to have self-sufficient energy at our sites, which is not just better for the environment but also more secure against power shortages

Main Project:

- Installation of 2225 photovoltaic modules

- 50% Solar Energy before 2020



Time line Stahl Brazil Instalation:

PROJECT

- 21th June – Start of EP
- 20th July – EP approval
- 31st August – Oficial Purchase Orders

ENGINEERING

- 12th September – Start of Final Engineering Projetc
- 24th September – Arriving of Materials in Portão Plant
- 27th September – Start of installations

INSTALATION

- 28th October – 100 solar modules running on-grid Cantine
- 30th October – 300 solar modules running on-grid Technical Center A900
- 28th November – 95 solar modules running on-grid Maintenance
228 solar modules running on-grid A130 (Waterbase)
- 1st December – 305 solar modules running on-grid A360 (Warehouse)
- 10th December – 322 solar modules running on-grid A320 (Warehouse)

Brazil Solar Project

Cantine – 100 solar modules

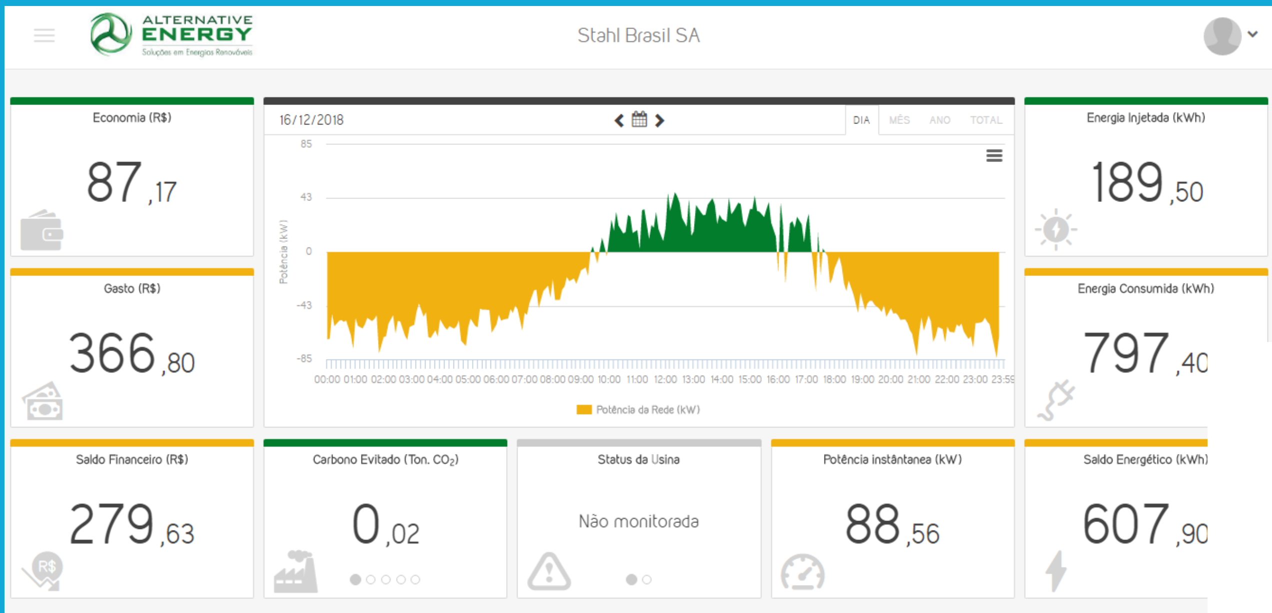
A900 - Technical Center/ CSD - 300 solar modules

A130 – Waterbase plant - 228 solar modules

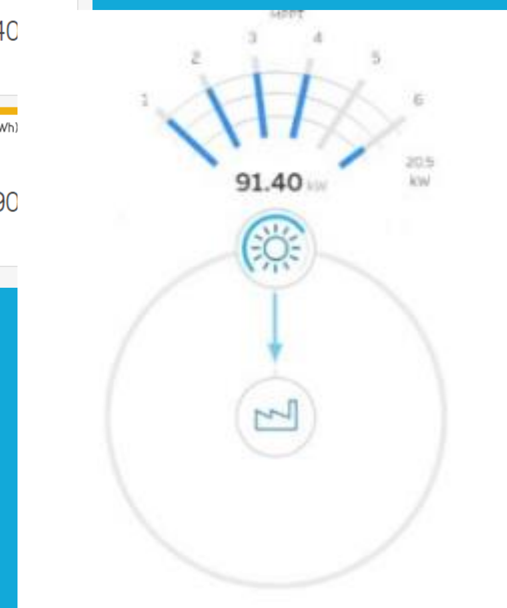
A360 – RAW MATERIAL WAREHOUSE – 305 solar modules

A320 – FINISH PRODUCTS WAREHOUSE - 322 solar modules

On-line monitoring:



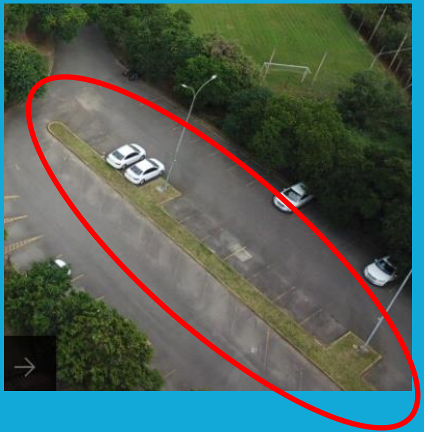
Consumption monitoring

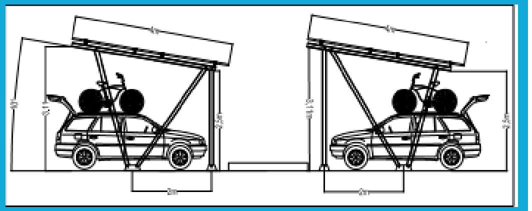


Generation monitoring

Next steps:

Parking Lot –
240 solar modules





A310 Raw-Material Warehouse
183 solar modules

Ground place
300 solar modules

Budget date for Conclusion: 25th January ´19

2. Life Cycle Assessment (LCA)

- Life Cycle Assessment (LCA)
  - Methodology and terminology
  - What is measured and reported
  - Environmental impact data & categories
  - Environmental Product Declaration (EPD)
  - Product Category Rules & boundaries
- Example - tannery chemicals
- Summary

Methodology, ~~term~~inology

- A system is available to capture the environmental impact of leather
- Product Category Rules are defined (European Commission)
- Life Cycle Analysis calculates environmental impact
- Complete leather process is quantified
- Cradle to Gate approach

Measuring, Reporting

- Life Cycle Inventory (LCI) data is collected for the process
- Resource consumption and manufacturing emissions are measured
- Environmental Impact Data is calculated (Life Cycle Software)
- Results are reported in well known environmental language
- Output is an Environmental Product Declaration (EPD)

Material flows

- Measuring Inputs & Outputs is known as Life Cycle Inventory (LCI)

- Input (consumption)
  - Chemicals
  - Resources

- Output (Emission)
  - Waste products
  - Effluent

Leather process

Consumption Energy

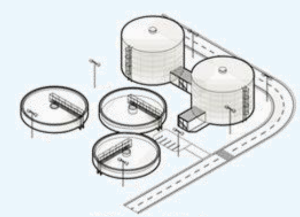
Consumption Water

Consumption Hides

Consumption Chemicals

Air Emission

Solid Waste Emission



Wastewater Emission

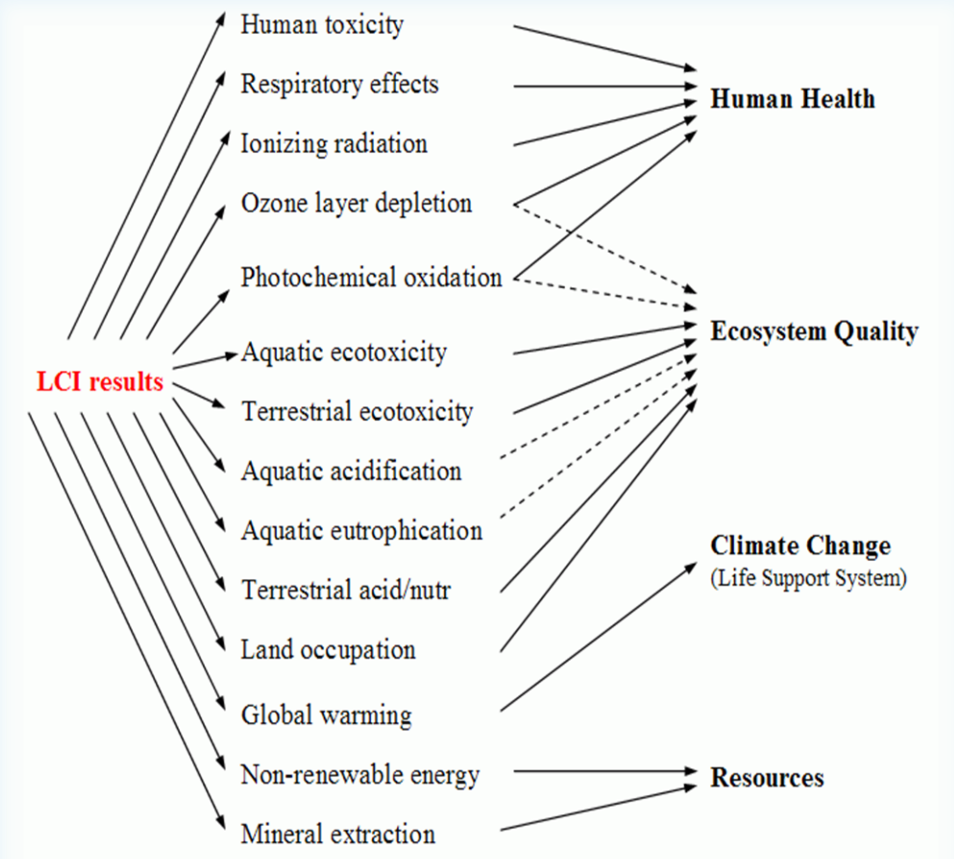
Beamhouse example

Input	Tannery Operation	Output
Surfactants	Soaking	Blood, Detritus Salts
Sodium Sulfide	Unhairing	Hair, Epidermis Pigments
Calcium hydroxide	Liming	Protein, Fats Hair Roots
	Splitting	Fresh Splits
Ammonium Salts Deliming Agents	Deliming	Lime, Fats
Bating Agents Auxiliaries	Bating	Proteins, Elastin
Salts, Acids	Pickling	

Converting LCI data

<u>Material Flow</u>

Production Data (LCI)
Is Processed in LCA
software and converted into
Environmental Impact Data



<u>Output data</u>

Environmental
Impact Data
Is reported in
the EPD

Impact Categories

Use of Energy and Resources	Climate Change	Acidification of Land and Water Resources	Eutrophication	Destruction of Ozone Layer	Formation of Photochemical Oxidants
Primary Energy (PE)	Global Warming Potential (GWP)	Acidification Potential (EP)	Eutrophication Potential (EP)	Ozone Depletion Potential (ODP)	Photochemical Ozone Creation Potential (POCP)
Resource Consumption	Carbon Footprint	Acid Rain	Water Quality	Ozone Hole	Ground Smog

Product Category Rules

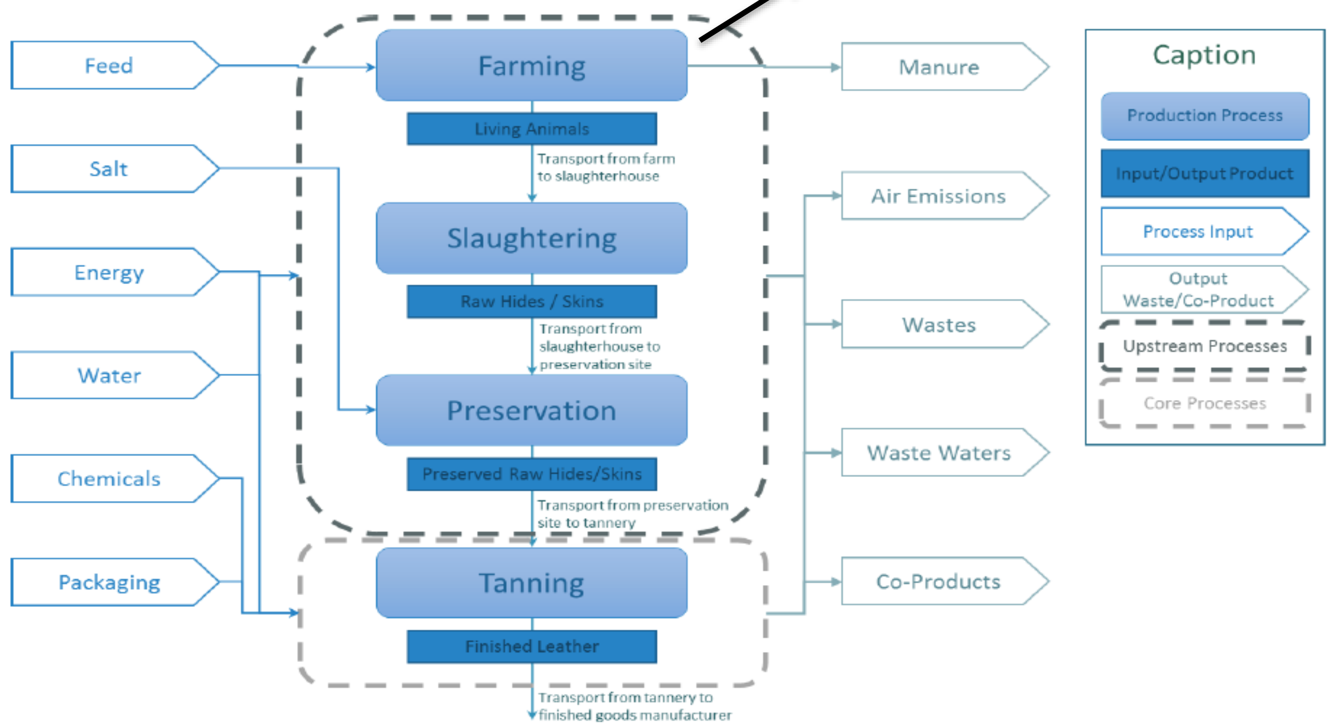
- Product Category Rules (PCR or PEFCR) represent the specific LCA guidelines as applied to a narrow field of use
- Leather PCR was developed by COTANCE, ICT, UNIC
- Leather PCR defines the system boundary information
- LCA begins at farming and ends at tannery discharge

System boundaries

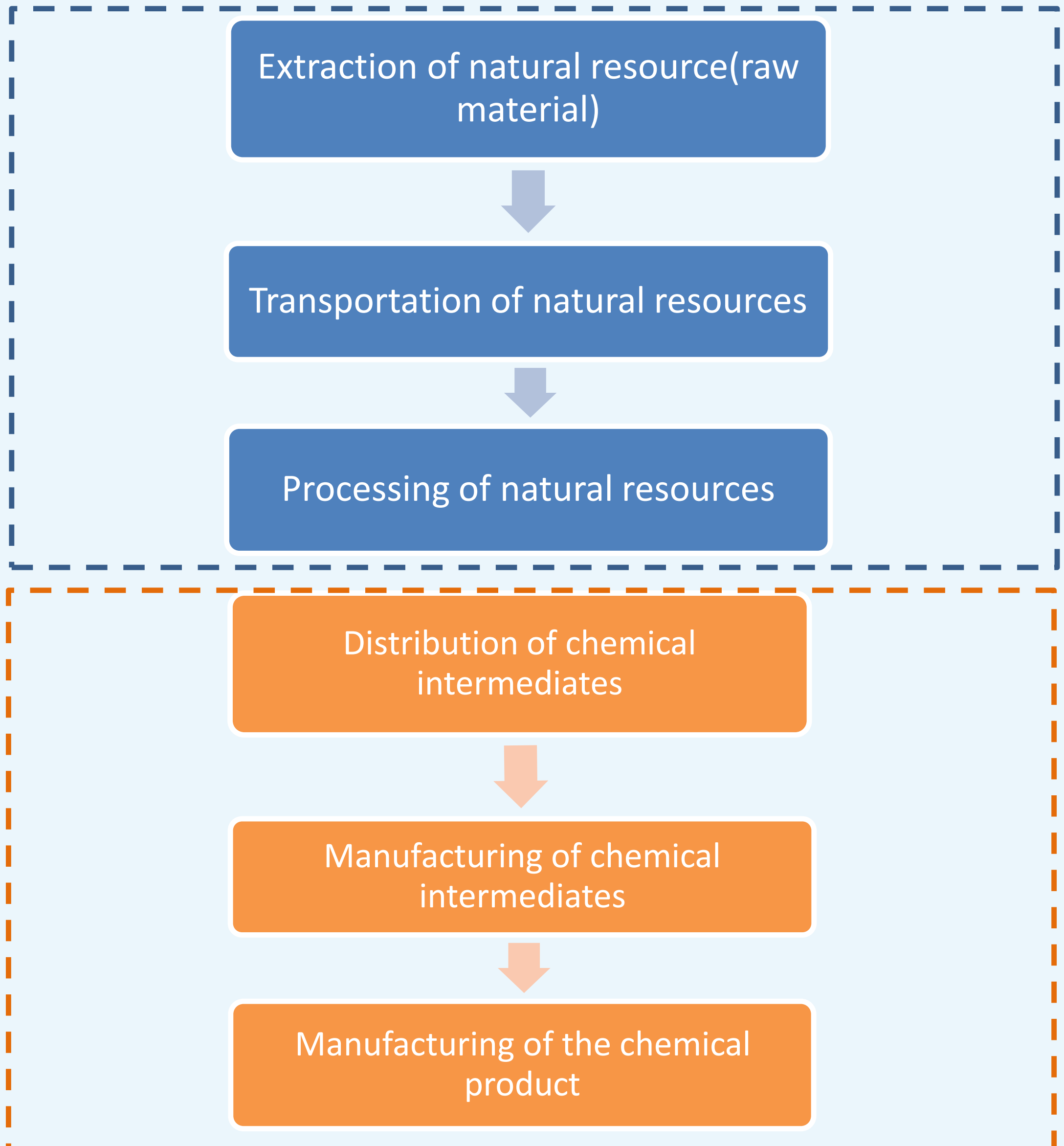
12% farm impact allocated to livestock

System boundaries are schematically illustrated in Figure 1.

Figure 1 System boundaries



Environmental Impact of Tanning chemicals



Tanning chemical EPD

Environmental Product Declaration based on Product Category Rules

Potential environmental impact per declared unit	Unit	Upstream	Core	Downstream	TOTAL
Acidifcation Potential (AP)	kg SO_2 eq	0,009	0,001	-	**0,009**
Global Warming Potential (GWP100)	kg CO_2 eq	1,413	0,151	-	**1,564**
Eutrophication Potential (EP)	kg PO_4 eq	0,003	1,48E -04	-	**0,003**
Photochemical Ozone Creation Potential (POCP)	kg C_2H_4 eq	4,25E-04	3,10E-05	-	**4,56E-04**
Ozone Depletion Potential (ODP)	kg CFC-11 eq	4,32E-07	1,92E-08	-	**4,51E-07**

LCA Methodology

Summary

- LCA methodology represents an important development for leather
- The EC framework and Product Category Rules allow for valid comparisons to be made
- New processes/chemistry will require LCA data in order to be valid
- As tanners become LCA modelled, impact analysis will improve

3. Reduction of Carbon Footprint- Process Time

- Shorter **process time** lowers energy consumption for a smaller carbon footprint.
- A lower effluent load in water output leads to energy savings in waste treatment efforts.
- **Pickle-Free:** Whatever the % reduction in energy can be achieved using better processes, skipping pickling etc., then the same % reduction in carbon footprint (C02 emissions) will also be achieved.
- Energy savings are dependent on using special chemicals.
- Similarly, by minimizing water effluent load, overall environmental footprint can be reduced, and this can be calculated using an LCA methodology.

4. Role of Chemicals

- Energy savings by using highly penetrative auxiliaries, chemicals whereby reduction in energy.
- By skipping the pickling step, energy is reduced significantly.
- Using higher performing topcoats, less coating can be applied to get the same properties
- Lower performing coatings, thereby reducing the energy required to dry/cure them.

We believe that if it can be imagined, it can be created.