The Metal Machining Industry and Climate Change mitigation

The relationship of metal machining activity to greenhouse gas emissions is centred on the energy consumption of the sector.

On the one hand, the main consumption is electrical energy , which is needed for the operation of machinery used in the various shaping and machining processes, for complementary equipment such as degreasing washing machines, centrifuges for the recovery of oil from parts and shavings and finally, for pumps, transmissions, fans, etc.
On the other hand, fossil fuels are also used as the energy source for ovens and boilers used in heat treatments.

Among the most common alternatives for the reduction of greenhouse gas emissions we find the use of biomass as the cleanest alternative fuel, as its emissions level is considered neutral. Similarly, there are opportunities for improving the overall energy efficiency of the process by maintenance of the equipment, monitoring and controlling emissions into the atmosphere or the use of highly energy efficient equipment.

The source of greenhouse gas emissions

- Consumption of fossil fuels
  - Used as the energy source for ovens and boilers in heat treatment
  - Natural gas and diesel fuel are the most widely used fuels.
- Electric energy consumption
  - The machines that consume electric energy do not emit greenhouse gases directly, but rather indirectly as they generated emissions at the point where the electric energy was produced, if it was generated from burning fossil fuels.
  - To calculate each machine's actual emissions, the electric energy source must be traced to ascertain the actual associated emissions. The associated emissions will change for each country, depending on their electricity production mix.
- Energy consumption for the cold-rolling processes and the subsequent annealing process are displayed below.

Energy consumption for cold-rolling

PROCESS	ELECTRIC ENERGY CONSUMPTION	STEAM ENERGY CONSUMPTION
Carbon steel rolling in tandem roller	0.2 - 0.3 Gj/t	0.01 - 0.03 Gj/t
Carbon steel rolling in reversible trains	0.24 - 0.245 Gj/t	-
Stainless steel rolling in reversible trains	0.6 - 0.8 Gj/t	-

Energy consumption for annealing after cold-rolling

PROCESS	ELECTRIC ENERGY CONSUMPTION	STEAM ENERGY CONSUMPTION
Discontinuous annealing of cold-rolled carbon steel	0.6 - 0.12 Gj/t	0.62 - 0.75 Gj/t
Continuous annealing of cold-rolled carbon steel	0.173 - 0.239 Gj/t	0.775 - 1.487 Gj/t
Annealing of cold-rolled stainless steel	0.3 - 0.4 Gj/t	1.0 - 1.5 Gj/t

Emissions reduction alternatives for greenhouse gases

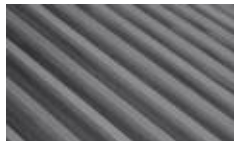
USE OF ALTERNATIVE FUELS

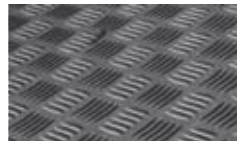
- The metal machining industry has traditionally used fossil fuels with a high heat content. The most common are natural gas, propane, butane and diesel
- The alternative is to use biomass as the cleanest alternative fuel, as its emissions levels are considered neutral

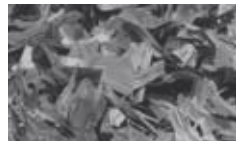
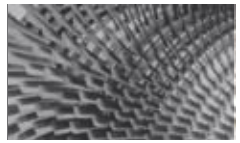
IMPROVING THE ENERGY EFFICIENCY OF THE PROCESS

- Equipment maintenance to detect possible anomalies that involve greater energy consumption
- Regular cleaning of the equipment and installations to prevent blockages of ducts or filters
- Control of emissions into the atmosphere to detect incorrect combustion or a malfunction of the machinery.
- Usage of high energy efficiency equipment for lighting, climatisation, etc.







Case study:
DD ZICA (Sarajevo, Bosnia & Herzegovina)

(Source: MedClean-53)

The company was created 1950 and is dedicated to the manufacture of wire and nails by cold rolling. From its inception until now there have been several changes and improvements in the production process to improve quality and speed. An industry of this type impacts the environment due to its use of pollutant chemicals and production of waste that is difficult to treat.

GENERAL MEASURES TO REDUCE EMISSIONS

- In 2002 it was decided to replace part of the process equipment to permit greater respect for the environment while at the same time improving profit for the company.
- The change was made by a machine that used sand blasting to prepare the wire before processing, significantly reducing water and energy consumption.

RESULTS

Measures	Old precess		New process	
	Quantity	Cost (€)	Quantity	Cost (€)
Material balance				
Sulphuric acid	195.5 t	18,049	0	0
Inhibitor	579,458 kg	5,823	0	0
Carbamide	579,458 kg	5,823	0	0
Lime	9,414 kg	965	0	0
Water	17,383 m^3	23,174	0	0
Natural gas	13,035.6 Nm^3	4,010	0	0
Steam	1,448,400 kg	40,852	0	0
Electric energy	225,226.2 KWh	15,592	173,815 KWh	11,969
Steel sand	0	0	72,423 t	3,714
Wastewater neutralisation	17,338 m^3	35,565	0	0
Water fee		18,461		4,923
Total expenses		168,314		20,606
Savings				147,707 € /y
Investment				297,435 €
Payback period				2.013 years

INVESTMENT COST AND AMORTIZATION

The company achieved an 87% savings in electricity consumption, representing significant impact on expenditures, which were 88% lower.