A zero CO_2 production plant

It is vital to make plans for genuine breakthrough actions now if we are to reduce the greenhouse effect of industrial activities and reach the targets set by the Kyoto protocol and the post-Kyoto agreement. One of those actions is the zero-carbon plant.

The essential points

The energy required to build vehicles emits or not CO_2, depending on the energy form (fossil, nuclear, renewable). There are two types of CO_2 emissions:

- direct emissions, due, in particular, to the on-site transformation of fossil fuels,
- indirect emissions, by consuming electric or thermal energy generated using fossil fuels that are transformed elsewhere.

A zero-carbon plant is a plant that does not emit any CO_2, directly or indirectly, through the use of renewable energy forms and/or by neutralizing its residual emissions of CO_2. Residual emissions can be neutralized either by carbon sinks (such as forests) or by carbon offsetting, such as in a certified project to reduce CO_2 emissions that uses the clean development mechanisms (CDM) defined by the Kyoto protocol. This contribution often takes the shape of the purchase of a quantity of Certified Emission Reduction (CER) equivalent to the residual emissions.

How does it work?

Production plants can work on at least four levers to make products without emitting CO_2.

1/ Reduce energy consumption by becoming more energy efficient, recycling and recovering thermal energy. In a car plant, these efforts focus mainly on the paintshop, which uses the processes that consume the most energy in the entire plant. ***The Tangier plant will use thermal wheels and air/water and air/air heat exchangers that allow the heat in the hot air, expelled into the atmosphere by the incinerator, to be used for a number of purposes:***

- ***to preheat the fresh air captured outdoors,***
- ***to heat the hot water system.***

2/ Use renewable energies with a neutral carbon cycle, such as biomass, thermal solar energy, photovoltaic solar energy or wind power to meet the plant's thermal energy requirements. ***In the Tangier plant, a biomass boiler produces the high-pressure superheated water required to heat the painting ovens and the hot water used on the site. This 18 MW boiler will cut direct carbon dioxide emissions by 100% in comparison with a gas-powered boiler.***

3/ "Green" electricity or thermal energy from renewable sources in order to reduce indirect CO_2 emissions.

4/ Resort to carbon offsetting whenever there are still sources of CO_2 emissions, even after taking the

three actions mentioned above. Carbon offsetting consists in compensating for residual emissions by making a financial contribution to a project to reduce greenhouse gases or to trap carbon. These projects, which aim to develop renewable energies, energy efficiency or reforestation, help to capture or to prevent atmospheric emissions of an equivalent volume of greenhouse gases elsewhere on the planet. Since the greenhouse effect is a global phenomenon, action to reduce CO_2 emissions or capture carbon has the same impact on the earth's atmosphere, no matter where it is taken.

The few remaining systems emitting CO_2 that could not be replaced or done away with in the Tangier plant will be covered by carbon offsetting

Biomass

Using biomass as fuel significantly reduces the carbon balance of industrial systems by neutralizing almost all the CO_2 emissions caused by the production of heat. Moreover, biomass also reduces the impact of the variations in the price of fossil energies.

The essential points

Biomass is the total mass of all the living species in a given natural ecosystem. It can be solid, liquid or gaseous. Biomass that can be used to produce energy includes wood resources (by-products from wood processing and waste wood), energy crops (rape, maize, sugar cane, etc.) and agricultural or agrifood residues.

Unlike fossil fuels (fuel oil, coal, gas), biomass does not contribute to the greenhouse effect. Biomass is a renewable, green energy form with a neutral CO_2 balance. Moreover, it is a means of reusing some of the waste produced by the wood processing industry. Biomass has a bright future: the worldwide use of wood energy is expected to grow by 40% between 2007 and 2020.

How does it work?

<u>The virtuous carbon cycle</u>

As plants grow, they absorb a quantity of CO_2 that is equal to the quantity emitted when they burn or decompose. The impact of burning wood on the greenhouse effect is, therefore, neutral, provided that the equivalent of the burnt mass is replaced by new plant growth. If the biomass is not burnt, the same quantity of CO_2 is emitted into the atmosphere by the normal decomposition process.

<u>Reuse</u>

Biomass can be used in a number of processes. It can be used a biomaterials or biofuel, in biochemistry, or it can be burned directly (wood, etc.).

In the new production plant in Tangier, biomass is used as a biofuel with a neutral CO_2 balance to replace fossil fuels, such as fuel oil or gas, that emit CO_2.

Proper use of biomass

The proper use of biomass depends on:

• the suitability of the biomass thermal process to the changes over time in needs, which must remain relatively stable if they are to be met by biomass;

• the durability of the biomass resources dedicated to the plant (wood industry, agrifoods, sustainably managed forests, etc.);

• the price, quality and stability over time (humidity, calorific value, consistency, etc.) of the fuels taken from the source;

• the energy efficiency of the boiler (ratio between the quantity of fuel consumed and the thermal heat produced), which depends on the proper operation of the systems.

A zero industrial waste production plant

One fifth of the world's population lives in areas where water resources do not meet their everyday needs. 60% of Europeans use fresh water resources in excess of their renewal capacity. Water is a global problem and saving water is essential.

The essential points

Recycling purified water is one means of substantially reducing the consumption of water taken from the natural ecosystem. Action of this type is essential in regions that lack water.

How does it work?

In traditional bodywork and assembly plants, waste process water is cleaned by physical-chemical processes (agglomeration then decantation of polluting particles), then biologically treated using bacteria that speed up the dissolution of organic matter. In a zero-discharge plant, the purified and treated effluent is not returned to the natural ecosystem, but undergoes two more technologically advanced treatments that concentrate any traces of pollutants that it may contain by a factor of one thousand. After treatment by reverse osmosis and evaporation, the water can be used again in the production process, thereby minimizing the quantity of waste.

Reverse osmosis

The water passes through a very fine membrane that separates the pure water from the residual pollutants that contain salts and micropollutants. High pressure must be applied to the water to perform this filtration operation, which is based on the exchange of ions between two media with different concentrations. The reverse osmosis process comprises three osmosis stages that produce recycled water that can be directly used in the production processes on the one hand, and water with a high salt concentration, on the other, which must then be concentrated by evaporation and disposed of as waste.

Evaporation

The water with a high salt concentration produced by the reverse osmosis process is treated in a two-stage evaporation process: the first at 80° and the second at between 30° and 40° in a vacuum, which achieves significant energy savings. After this treatment, the salt and microparticles are concentrated into solid waste of a minimal volume. ***In this way, the Tangier plant purifies between 600 and 700 m3 of water every day.***

Energy recovery

Energy recovery is one of the most rational and economical ways of reducing a site's energy consumption and CO_2 emissions.

The essential points

In a traditional production plant, the paint booths and baking ovens consume a lot of energy. The air in the booths must be filtered, heated or cooled and permanently renewed. The paintwork process, which accounts for 70% of the thermal energy consumed by a site, represents a clear opportunity for progress in order to cut energy requirements and reduce the site's environmental impact.

How does it work?

Renault decided to call on innovative energy recovery solutions in order to reduce the quantity of energy consumed by the paintshops in its assembly plants. It has introduced air recycling in the booths, together with the recovery of thermal energy after incineration. These solutions are applied mainly to the paint booths and baking ovens on a number of Renault's sites.

Recycling the air in the paint booths

A thermal wheel is a heat exchanger that recovers about 60% of thermal energy. Made of pierced aluminum, weighing about 6 tons and measuring 6 meters in diameter, a thermal wheel is capable of recovering both heat and humidity.

Paint booths must meet a range of demands and maintain stable conditions in order to guarantee the quality of the air and, the quality of the products. On average, about 5,000 kW is required to heat the air for a complete cabin, or the equivalent of a 25kWh heating system in 25 houses.

Since the air that comes out of the paint booth is loaded with solvents, it cannot be directly reused in the booth. So it is sent to the thermal wheel, which acts as a heat exchanger. The air from the booth arrives in the wheel at about 18° and is expelled at 10°. At the same time, it heats the incoming air from 5° to 13°. As a consequence, less thermal energy is needed to heat the air.

Another advantage of thermal wheels is that they can be used in all climates. During the summer months, the wheel is used to cool the air.

Energy recovery after the incinerator

The various coats of paint are baked in ovens at 150°. The air at the oven outlet is loaded with solvents, which are then destroyed in an incinerator. ***At the Tangier plant, the heat produced is recovered at the outlet by air/water exchangers to heat the plant's hot water system, and by air/air exchangers to preheat the fresh air for the ovens to 140°. Together, these solutions reduce the energy required to heat the painting process by 35%, thereby actively contributing to the achievement of the zero CO_2 emissions target that has been set for the site.***