Second Batch of Domestic TOP TENs List

France Industrial BP List

BP1: Cooking of Food Products Using Micro-waves

1.Technology description

Conventional process:

•Steam Autoclave

•Cycle time: about 60 minutes

•Cooking temperature: 95°C ~

•Specific consumption: 0.65 kWh/kg product

New microwave solution:

•SAIREM Installation

•Tunnel with a conveyor belt

•Microwave of 24 kW power and hot-air battery of 12 kW

•Tunnel dimensions: 9x1m²

•Cycle time: 20 minutes

•Cooking temperature: 95°C

2.Technical scheme

Refer to Figure 1&2.

3.Level of Energy Savings

Classical solution: specific consumption of 0.65 kWh gas / kg of treated product.

MW solution: 0.20 kWh electric / kg of treated product.

Energy gain with MW solution: 7% of the process.

4.Market prospect

Food Industry.

5.Economic Characteristics

•Additional cost compared to conventional solution: 40%

Figure1: Microwaves Tunnel

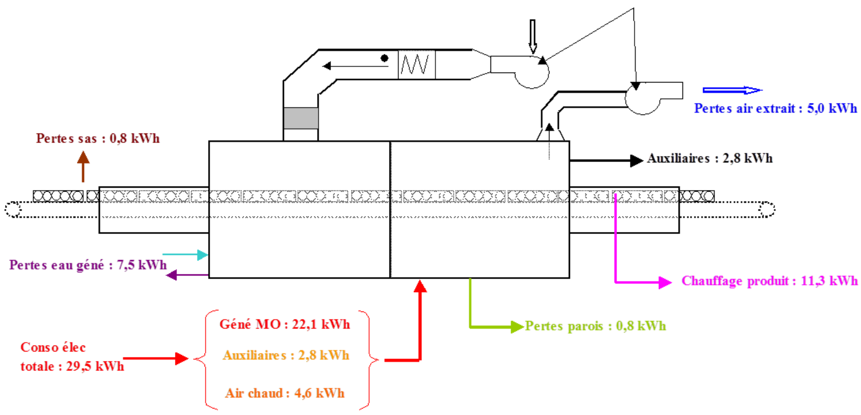


Figure2: Microwaves Tunnel-Process heat balance

• Estimated payback time: 2 years

6.Social Characteristics and co- benefits

Advantages of the MW solution:

• ~ 70% energy saving.

• Continuous and rapid treatment (20 minutes against 60 minutes in autoclave).

•Increased productivity by 30%.

•Space saving: a tunnel replaces 3 MW autoclaves.

•Improved quality of finished products.

BP2: High Frequencies for Gelation of PVC Coverings

1.Technology description

Conventional process:

•Furnace forced air

•Heat exchanger associated with a gas burner

•Cycle time: about 2 minutes

•Annual consumption: 6,300,000 kWh

27.12 MHz High frequency solution:

•HF power of 270 kilowatts

•Length: 3 m

•Production rate 900 kg/h

•Cycle time: 10 seconds

2.Technical scheme

Refer to Figure 1 to 4.

3.Level of Energy Savings

Energy saving: 78%

4.Market prospect

•Thermal gelation of rubbers and plastics

•PVC coating manufacturing and linoleum

5.Economic Characteristics

Reduction of cycle time by 12.

Gains with the MW process:

4900 000 kWh/year,representing 78% of the hot air process.

6.Social Characteristics and co-benefits

Classical solution:

Specific consumption of 1.87 kWh/kg of plastisol.

HF solution:

Specific consumption of 0.4 kWh/kg of plastisol.

Gains with the HF process: 4,900,000 kWh/year,representing 78% of the hot air process.

HF solution advantages:

Energy saving: 78% (selective heating) .

Reduction of gelling time by 10.

Product quality improvement .

50% reduction of gas emissions.

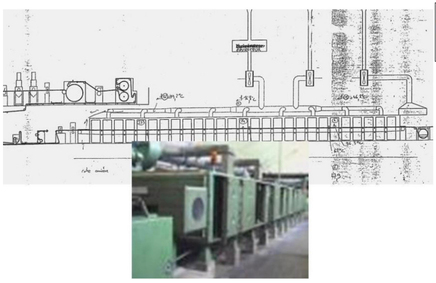


Figure 1 : Conventional process

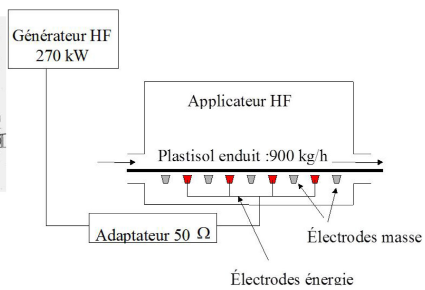


Figure 2 : PVC Gelling by High Frequency process

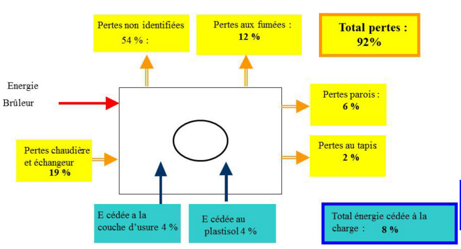


Figure 3 : Conventional process heat balance

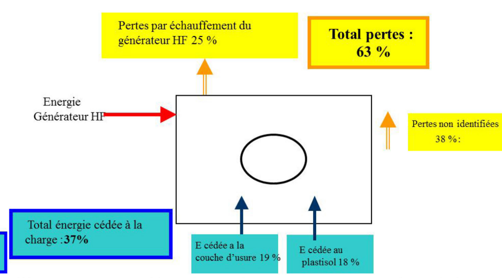


Figure 4 : PVC Gelling by High Frequency process heat balance

BP3: High Frequency Sticking of Composite Products

1.Technology description

Conventional process:

•Heated Veneer Press (circulation of hot water - conduction heating)

•Natural gas boiler

•Cycle time: about 10 minutes

•Annual consumption: 72.7 MWh

High frequency solution:

•EURO HERTZ Installation

•HF installed power of 24 kW - frequency of 27.12 MHz

•Dimensions: 2.0 x 1.0 x 0023 m^3

•Cycle time: 70 s

2.Technical Scheme

Refer to Figure 1 to 4.

3.Level of Energy Savings

Classical solution:

•Specific consumption of 47.5 kWh / ton of treated wood

HF solution:

•Specific consumption of 9.5 kWh / ton of treated wood

•Gain in HF process: 58.2 MWh / year,or 80% of the conventional method

•Reduced cycle time by approximately 9

4.Market prospect

Mechanical woodworking.

5.Reliability

Mature technology. ■

Figure 1 : Conventional process

Figure 2 : sticking composite parts by High Frequency process

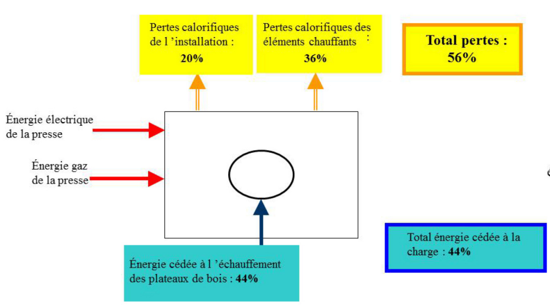


Figure 3 : Conventional process heat balance

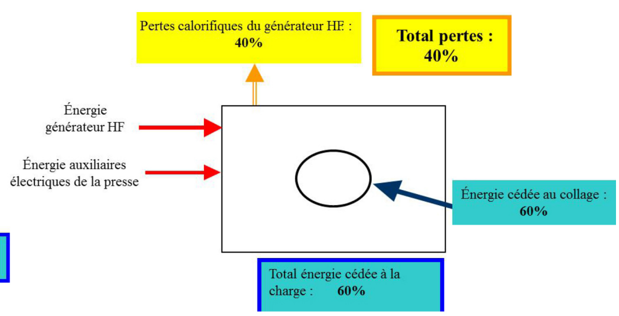


Figure 4 : by High Frequency process heat balance

BP4: Recovery of Animal Fats and Transformation into Biofuel

1. Technology description

The technology implemented involves two different phase:

The first one concerns the recovery of waste animal fat and its transformation into animal oil. Creation and implementation of a special static lamella clarifier that is used to separate (i) oil (ii) solids parts (iii) water.

The second phase concerns the transformation this animal oil into bio-fuel and its combustion in the boiler. For burning the bio-fuel in the boiler,an alternative gas/fuel burner has been adapted into an alternative gas /bio-fuel burner.

The Argoat workshop company annually produces about 500 tons of sausages,of which 90% is hand processed.

However,the finished products represent only 30% of the initial raw materials purchased. The remaining 70% are mainly composed of fat and water polluting discharges.

The company has implemented a comprehensive and systemic solution of waste recovery and their transformation into biofuels and marketable co-product. For this,the animal fats are trapped at the working table,melted out,and decanted in orderto separate,water solids and animal oil.

2.Technical Scheme

Figure 1: Retention basin and storage tank

Figure 2: Hot water tank

Figure3 : Lamella clarifier

Figure 4: New boiler

Figure 5: 'Biothermie' reactor

3.Level of Energy Savings

Decrease of 20% in the electricity bill and 60% in the gas bill.

4.Market prospect

Any kind of animal fats.

5.Reliability

Emerging technology,which requires a comprehensive approach of process management and adaptation of technologies for optimization of co-products.

6.Economic Characteristics

The installation has cost € 380,000:

-Recovery of fats and oil processing: € 197,000

-Oil processing into bio-fuel and combustion in the boiler: € 183,000.

Gains generated:

• Decrease of the volume of waste: gain € 16,000 per year
• Decrease of of pollution generated: gain € 8,000 per year
• Decrease of of gas consumption: gain € 45,000 per year
• Decrease of power consumption: gain € 7,000 per year
• Sale of the marketable co-product: gain € 15,000 per year

Nevertheless,it must be assigned to all these gains the costs of the implementation ofthe process,monitoring and maintenance tools for about € 20,000 per year.

7.Social Characteristics and co-benefits

Significant reduction of environmental impacts:

-The pollutant loadings were reduced by 23%

-The water recovery at the end of the process is increased by 10%

-The fossil fuel consumption has decreased by 60% due to the use of new bio-fuel from animal fat.

In addition,installation generates significant induced savings:

-On the sanitation bill.

-By the sale of animal oil surplus.

-By the diminution of about 50% of the waste removal bill.

Moreover,there was a significant drop in the number of workplace accidents due to improved cleanliness of the working areas,less greasy and thus less slippery.

Figures of the energy gains and environmental impacts are the followings:

-Reduction of waste volume: 180 tons

-Decrease of the pollution generated by the company:
BOD5: - 23%
COD: - 28%

-Decrease in the consumption of fossil fuels (gas): currently 60% being 70 tons over a full year.

-Reduction of the electricity consumption: about 20% being 110 MW.

-Creation of a co-product instead of waste: 50 tons.

-Creating a renewable energy: about 80 tons. ■

BP5: Waste Heat Recovery (Exhaust Gases, Compressor Cooling Systems, Data Centers…)

1.Technology description

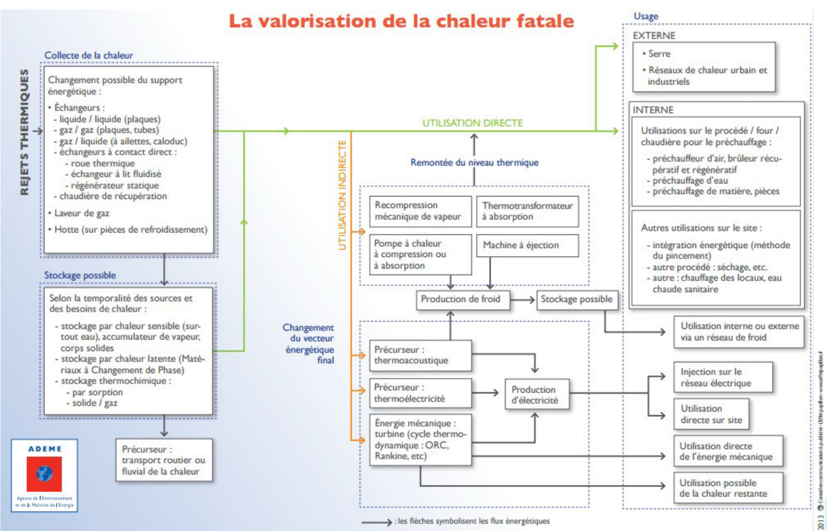
Depending on the temperature at which the heat sources are available on the industrial site and the nature of needs (local and / or external),heat can be recovered:

By means of a heat exchanger,the heat is transferred to other fluids /processes /storages: for example,the heating of premises,the heating of other fluids/processes onsite,etc.

The temperature of the process determines the recovery method to be implemented. In allcases,the energy can be recovered under the form of heat or mechanical work (which can be converted into electricity or used to raise the temperature of another heat source).

2.Level of EnergySavings

The lost heat (called waste heat) represents in the french industry a potential of more than 100 TWh of which 60% to over 100°C.



3.Market prospect

Chemicals,plastics,paper,metals,agro-food industry.

4.Reliability

Mature technology.

BP5-application: Heat recovery from a boiler exhaust in an equipment manufacturer

1.Technical Principle

An energy audit showed that 7%-8% of the boiler output was going up in fumes. The company thus installed a heat recovery on the chimney flue,which recovers the heat to preheat the water of chemistry process.

This water is pre-heated from15℃ to 46℃. It resulted a 7.2% saving on gas consumption. A buffer tank was also installed in order to store the hot water and maintain the temperature,because the process water is not consumed continuously by the chemistry process unit. Finally,monitoring is performed through a flow meter and two temperature sensors (inputand output of process water),which allows to calculate the energy saved.

2.Co-benefits

145.8 tons of CO_2 avoided

3.Cost- effectiveness Analysis

Investment costs: € 150,000

Financial gain: € 70,000 / year

Payback time: 2.1 years.

BP6: Optimization of Refrigeration Facilities with the Use of Floating High Pressure and Floating Low Pressure Controls; VSD on Fans and Compressors

1.Technology description

Floating high pressure:

The floating high pressure control is a method of regulation that consists in adjusting the condensing pressure to the outside temperature and allow the lowest consumption possible of the whole system (compressor,condenser and auxiliaries). A difference of 10°C between the pressurized condensate and the qexterior temperatures is enough for the system to work efficiently. The Floating Head pressure control is an electronic system that will regulate the condensing temperature in relation with the ambient air temperature. This system is made to avoid over pressurization and overworking of the compressor which would require more energy from the compressor for no reasons.

Reducing the high pressure is interesting in terms of energy: when the high pressure decreases,the compressors coefficient of performance increases and inversely. By reducing the high pressure,we adapt the condensation temperature. As the condensation temperature is closely linked to the coefficient of performance,it results a better efficiency of the compressors.

In terms of financial gains,1°C decrease on the condensation temperature allow an economy of about 2,5% on the consumption,and this gain can go up until 35% depending on the variation of the outside air. The payback back time is usually between 2 and 4 years.

Floating Low Pressure:

The floating low pressure functions on the same model as the Floating Head Pressure. This time,the control system can rise the evaporation temperature to reduce the compression ratio and improve the coefficient of performance of the installation.

The floating low pressure consists in regulating and adapting the evaporating pressure to the value that will lead to the lowest consumption of the couple compressor / evaporator (and auxiliary).

An increase of 1°C in the evaporation temperature set point enables reductions in consumption of 2.5% to 4%. However,the temperature variation amount is limited to 2°C to 4°C maximum.

Variable Speed Drive:

The technology called electronic speed variation is a very promising technology. It can be used for compressors,fans,pumps... These installations operate at a fixed rotational speed. thus the flow control is obtained by energy dissipation. Electronic speed variation permits to regulate the flow of the fluid by reducing the engine rotation speed (compressor,pump or fan) thanks to an electronic frequency converter.

This technology has a wide range of advantages: reduction of consumed electric power,precision and flexibility of operation,high control flexibility,reducing the number of starts. For many machines,the system is particularly efficient for the engine that regularly do not function at full load. For a cost of about € 200 per kW,the energy gain between 10% and 25%.

3.Level of Energy Savings

Generally,in temperate regions,the energy savings are in a range of 15% to 35%.

4.Market prospect

Industrial refrigeration plants with air condensers

5.Reliability

Good

6.Economic Characteristics

Payback time less than 2 years in temper countries.

7.Implement Cases

Refer to Table 1&2.

In a cold store,a fixed high pressure at 40°C is compared to a floating HP. The comparison is made for 2 external temperatures: 30°C and 15°C.

Table 1: – HP flottante : exemple de gain

	Centrale positive (R 404A)	Centrale négative (R 404A)
Régime de fonctionnement	- 15 °C/+ 40 °C	- 38 °C/+ 40 °C
Durée fonctionnement/an	4 380 h	6 000 h
COP*	2 soit 0,5 kW(e)/kW(f)	1 soit 1 kW(e)/kW(f)
Gain moyen avec la HP flottante	0,137 kW(e)/kW(f)	0,275 kW(e)/kW(f)
Gain annuel	600 kWh/kW(f)	1 650 kWh/kW(f)

* coefficient de performance (EER) = kW de froid produit par kW électrique absorbé.

Table 2: - HP flottante : autre exemple de gain

	HP à 40 °C	HP flottante	Économie
Pour une température extérieure de 30 °C			
Besoin frigorifique	300 kW	300 kW	
Valeur de la HP	40 °C	40 °C	
Puissance électrique des compresseurs	129 kW	129 kW	
Puissance électrique des condenseurs	22 kW	22 kW	
Puissance totale	151 kW	151 kW	0 %
Pour une température extérieure de 15 °C			
Besoin frigorifique	240 kW	240 kW	
Valeur de la HP	40 °C	25 °C	
Puissance électrique des compresseurs	103 kW	62 kW	
Puissance électrique des condenseurs	7 kW	15 kW	
Puissance totale	110 kW	77 kW	**30 %**

BP7: Uranium Enrichment by Centrifugation

1 . Technology description

Two different industrial processes for uranium enrichment are exploited worldwide: gaseous diffusion and centrifugation. The centrifugation technology is considered the best technology in the field of uranium enrichment.

The differences in chemical properties are very mall between the isotopes of uranium. One way to separate them from one another is to use the difference of mass between the two isotopes(uranium 238 and uranium 235). (The isotope uranium 235 is lighter than uranium 238 isotope)

Gaseous diffusion (developed by French CEA)

• All gas molecules are in movement. they strike the wall of the chamber in which they are confined.

• The lightest molecules being the fastest,they statistically hit the wall more often.

• If the wall is porous,the lightest molecules pass through the wall more often than the heaviest molecules.

• The isotopes are then separated and this separation product the enrichment.

• Enrichment is here accomplished by successive steps: the UF6 gas is pushed by a compressor through a set of diffusers containing porous diffusion barriers. The gas is enriched with uranium hexafluoride 235 at each passage (1400 in total).

Centrifugation: (developed by ETC in Germany and the Netherlands):

•The UF6 gas is introduced into a rotating cylinder,at high speed,under vacuum and in a sealed housing.

•The heaviest molecules,under the centrifugal force effect,are sent to the periphery of the tube while the lightest (U235) migrate toward the centre.

•The gas enriched with light isotopes (U-235),in the centre of the tube rises. The gas enriched in uranium-238,heavier,goes down.

•The enriched and depleted products are recovered at the upper and lower ends of the tube.

This basic step of separating molecules is repeated in a set of centrifuges connected in series,called a cascade.

The progress achieved in the late 1980s in the field of resistance to carbon fibre materials,allowed the centrifugation method to be regarded now as the reference technology relating to uranium enrichment.

2.Technical Scheme

Refer to Figure 1 to 4.

3.Level of Energy Savings

Centrifugation consumes 50 times less electricity than the gaseous diffusion and does not require to take off water from the near river,being 98% of energy saving -5% of French electricity consumption.

4.Market prospect

Technology of nuclear power generation from uranium

5.Reliability

This technology is industrially proven and tested since 1992 in Germany,the Netherlands and the UK.

The technology developed by ETC,and its model of centrifugal 'TC12' which equips the Georges Besse II site,offers the best guarantees in terms of competitiveness,energy savings,technical reliability and environmental impacts.

6.Economic Characteristics

The overall cost of the project'Georges Besse 2' is 3 billion euros of which over 50% is the provision of centrifuges.

7.Social Characteristics and co-benefits

The Georges Besse II plant was originally designed to have an environmental impact even lower than that of the Georges Besse EURODIF:

•The centrifugation consumes fifty times less electricity than the gaseous diffusion.

•The process does not require to take off water from the near river for its cooling needs.

•Due to a building height two times lower than that of the current plant and the absence of noise,the Georges Besse II plant has an easy integration into the landscape and its immediate environment.

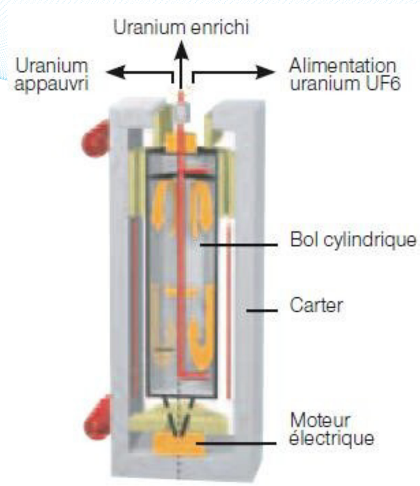


Figure 2 : Centrifuge drawing


Figure 3 : Ultracentrifugation

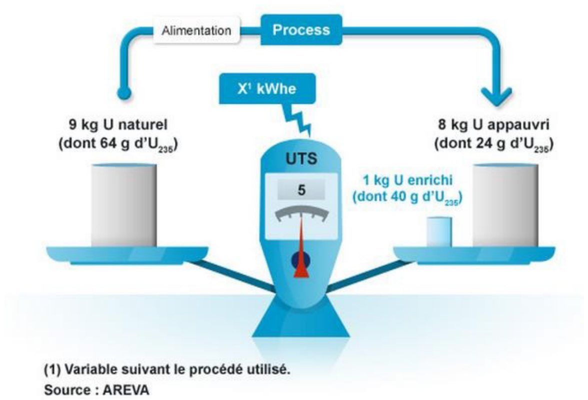


Figure1 : Enrichment of uranium process


Figure 4 : Set of centrifuges

BP8: Energy Management and Control System

1.Technology description

The implementation of a Centralized Technical Management system for the entire site,production offices and workshops,proved to be the right solution adapted to the steady energy cost rise.

This centralized management system aims to reduce natural gas and electricity consumption and thus CO_2 emissions. It integrates with an ancient and heterogeneous installation.

It includes heating equipment,ventilation,extraction,air conditioning and compressors.

The technical objectives were:

• The creation of a data collection network for the Centralized Technical Management system;

• The setting up of automatic actuators and sensors,equipment command and control;

• Field data acquisition and management by an IT supervisor;

• Archiving and processing of data (for reporting,creation of indicators ...).

Heating devices had obsolete control systems,disparate or non-existent. The open and flexible management system covers 40000m^2 of workshops and 2500m^2 of offices.

The Centralized Technical Management system has selected:

For equipment:

-2 automatons;

-A field network for the acquisition and control of various equipment;

-An optical fibre network dedicated to the centralized management system for communication between the automatons and the remote modules;

-Two servers for supervisor applications.

For IT:

- A Panorama E2 supervisor for management and maintenance;

- A server for storing data;

- A system that can manage about 800 data from the field (digital or analogical inputs and outputs).

The centralized management system allows both a management and an optimization of the energy consumptions.

It provides:

-The control of process gas and compressed air networks (counting,pressure measurements,leakage rate measuring);

-The management of buildings air extraction;

-The management of air extraction at the weld processes.

-The management of air introductions.

A monitoring is now done from SQL databases and from specific tools for processing and formatting of the information collected.

2.Level of Energy Savings

- Natural gas: 1 MWh/year being about 20% of consumption
- Electricity: 0.5 MWh/year being about 20% of consumption

3.Market prospect

This kind of operation is completely reproducible in all kind of industrial facilities because this concept centralized management is applicable to any kind of activity areas. The system is a management and control tool for the facilities as well as for consumption monitoring. Before engaging in this type of project a cost-effectiveness analysis should be performed with respect to the energy challenges of the company.

4.Reliability

Mature technology

5.Economic Characteristics

•Investment costs: € 325,000

•Financial gain: About 100 k€ per year

•Return on Investment: 3 years

6.Social Characteristics and co-benefits

•Tons of CO_2 avoided: 450t to 500t CO_2 per year (all fuels included)

•Reduce of air polluting emissions (leakage control on the process gas networks)

•Improved working conditions through better control of the premises atmosphere (heating,ventilation,air conditioning,...) workshops and offices. ■

BP9: Optimization of Ambient Conditioning Systems in the Industry (Clean Rooms, Food Industries ...)

1.Technology description

A controlled contamination zone may be defined using three criteria:

•A delimited space (enclosed with a specific envelope)

•Access to this space by a procedure system and airlock for people,materials and equipment

•Existence of an air treatment system with filtration and maintenance of pressure or depression.

Definition given the ISO 14644-1 norm:

"Room in which the concentration of airborne particles is controlled,and which is constructed and used in a manner to minimize the introduction,generation and retention of particles inside the room,and in which other relevant parameters,e.g. temperature,humidity and pressure,are controlled as necessary".

The aeraulic system has the function of keeping the air inside the cleanrooms under the conditions defined by the requirements:

• of the process

• of the product

• of the staff

• of the environment (discharge of waste gases)

The 5 key criteria are:

• The air filtration

• The air distribution

•The continued positive or negative pressure

•The mixing rate (recycling and / or extraction)

•The control of physical air conditions

The technique of cleanrooms entails the implementation of a certain number of components that need to be optimized from the beginning if you do not want them to become great energy consumers.

These provisions begin at the conception phase:

Energy Consumers in the study:

Temperature,Humidity

Dust analysis

Mixing rate

Quality of filtration

Renewed air

Free-cooling

Process

•Collection of the calories in the room

•Input/output air exchanger

Air treatment

Energy Consumers in the material:

T°Regulation (control of the dew point replaced by other systems)

Moto-ventilation

Filter box

Aeraulic network

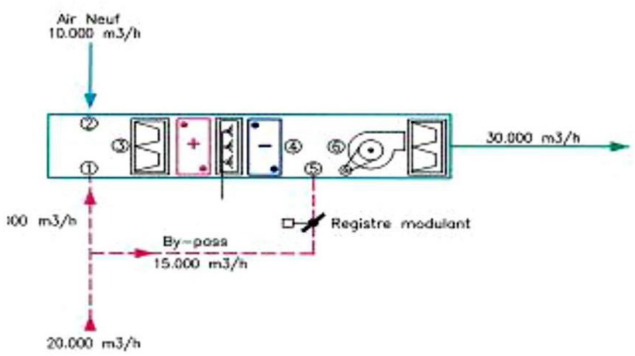
Water resistance of ducts

Insulation of ducts

The BYPASS central allows under certain conditions to maintain a controlled humidity by by-passing the treated air to obtain a final mixture adapting to the supply air temperature thus avoiding successive dehumidification and reheating. The bypass is regulated according to internal loads.

2.Technical Scheme

CENTRALE BY-PASS / MELANGE



Points	Conditions
① ⑤	24°c / 43%
②	30°c / 45%
③	28°c / 45%
④	11°c / 100%
⑥	17,5°c / 65%

3.Level of Energy Savings

- Exemple : Débit soufflé 30.000 m3/h à 17,5°c (ambiance : 22°c / 50%)
  Débit repris : 5.000 m3/h
  Débit by-pass : 15.000 m3/h
  Air neuf : 10.000 m3/h

  Soit puissance BF : 123 kW

- Une installation classique avec centrale de mélange air neuf / air repris aurait nécessité pour les mêmes conditions :

  Puissance BF : 192 kW
  Puissance BC : 73 kW

4.Market prospect

<table>
<tr><th>Classe 1</th><th>Classe 10</th><th>Classe 100</th><th>Classe 1 000</th><th>Classe 10000</th><th>Classe 100 000</th></tr>
<tr><td colspan="3">Microelectronics : Fabrication de semi-conducteurs circuits Intégrés avec des géomètries submicroniques.</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td colspan="4">Chimie Fine Pharmaceutique : Médicaments injectables, Production d'implants prothèses chirurgicales, Conditionnements buvables, Gélules.</td></tr>
<tr><td></td><td></td><td colspan="4">Supports D'information : Fabrication de films plastiques, Cassettes video, CD, Disques durs microphotographies.</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Electronique / Opto-electronique Matériel optique de haute précision. Assemblage de micro supports.</td><td></td></tr>
<tr><td></td><td></td><td></td><td colspan="3">Micro-Mécanique : Appareillage de mesure, Roulement Optique, Robinetterie, Instrumentation de bord.</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">Industries Agro-Alimentaires : Plats cuisinés, Boisson, Industrie de la viande, Conditionnement.</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">Spatial : Assemblage et intégration de satellites, Fabrication de miroirs.</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">Automobile : Cabines de peinture, Equipements électriques.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td>Hydraulique et Pneumatique : Assemblage de composants.</td></tr>
</table>

5.Reliability

Known good practices. The challenge is to maintain the level of the clean room while minimizing energy consumption.

6.Economic Characteristics

Economic gain due to a decrease in energy consumption. ■