



Cemafroid

L'expertise de la chaîne du froid

from **A** to **Z**

**26 CHALLENGES FACING
REFRIGERATED TRUCKS FOR
SUSTAINABLE DEVELOPMENT**

Gérald Cavalier

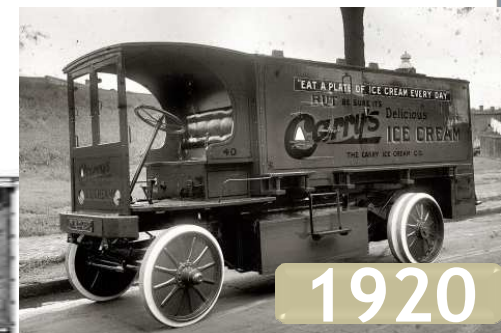
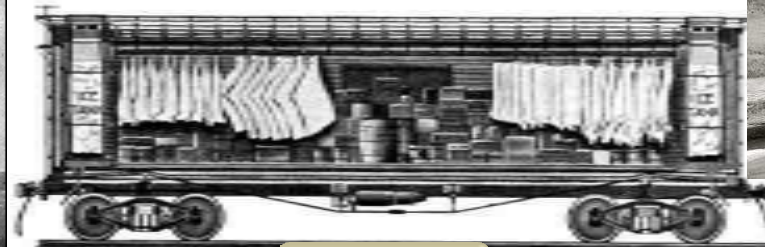
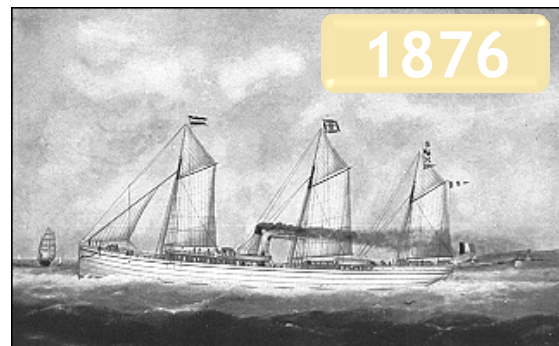
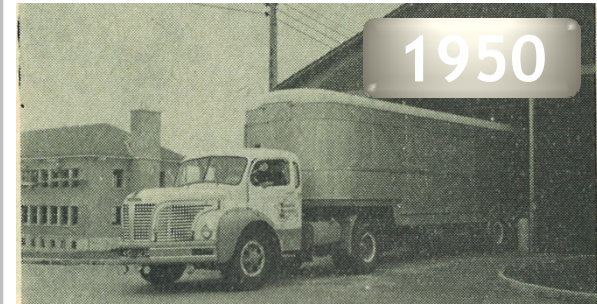
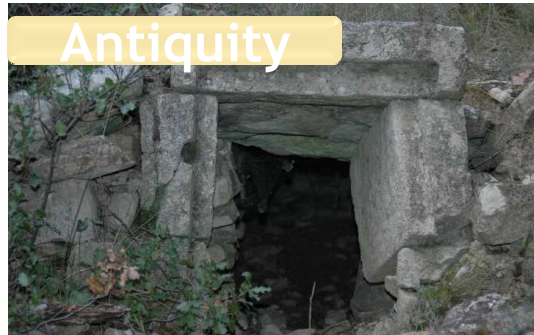
ICR 2011 - Prague

26th of August 2011



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Before A : introduction





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A : like Aerodynamics

1950



To many trucks without spoilers

1980



2010



2020



Improve aerodynamism :
reduce consumption



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B : like Bumpers

1960



2010



2020

Better protection for better
ageing ad energy saving



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| C : like Color



Black you can't



Humor ?



White trucks are the champions !



2010

2020

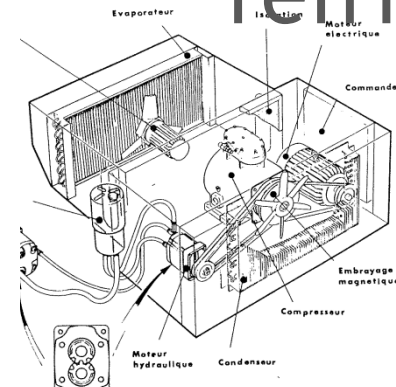
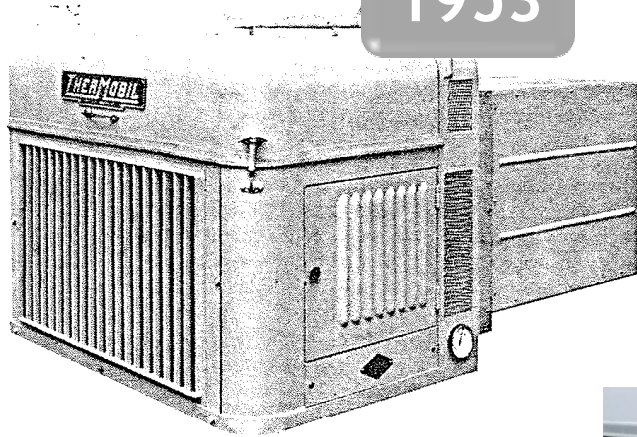
Tomorrow :
reflective skins,
Less absorbant
materials



D : like Development of new refrigeration systems

Fig. 4 — Groupe frigorifique autonome (1953).

1953



2010



1970



2030

- CO2, NH3 ?
- Absorption ?
- Undirect refrigeration?
 - Energy reuse?
- Mixt units ventilated refrigerant ?

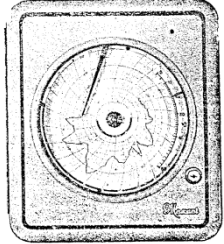


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E : like Electronic temperature recorders and indicators

1950



**MANOMETRES
THERMOMETRES**

HYGROMETRES PSYCHROMETRES
Appareils à Cadran et Enregistreurs
avec ou sans contact électrique

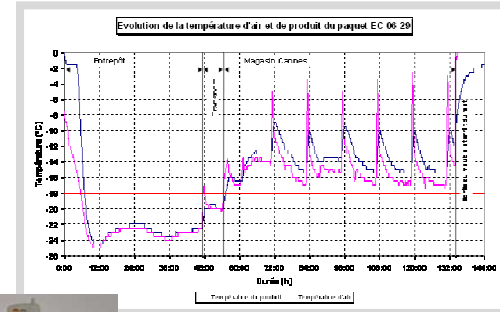


Ets MAXANT

41, rue Emile-Zola, MONTREUIL (93)



Use of temperature recorders mandatory in EU R37/2005



1970



• Développement de simple and cap indicators

2010



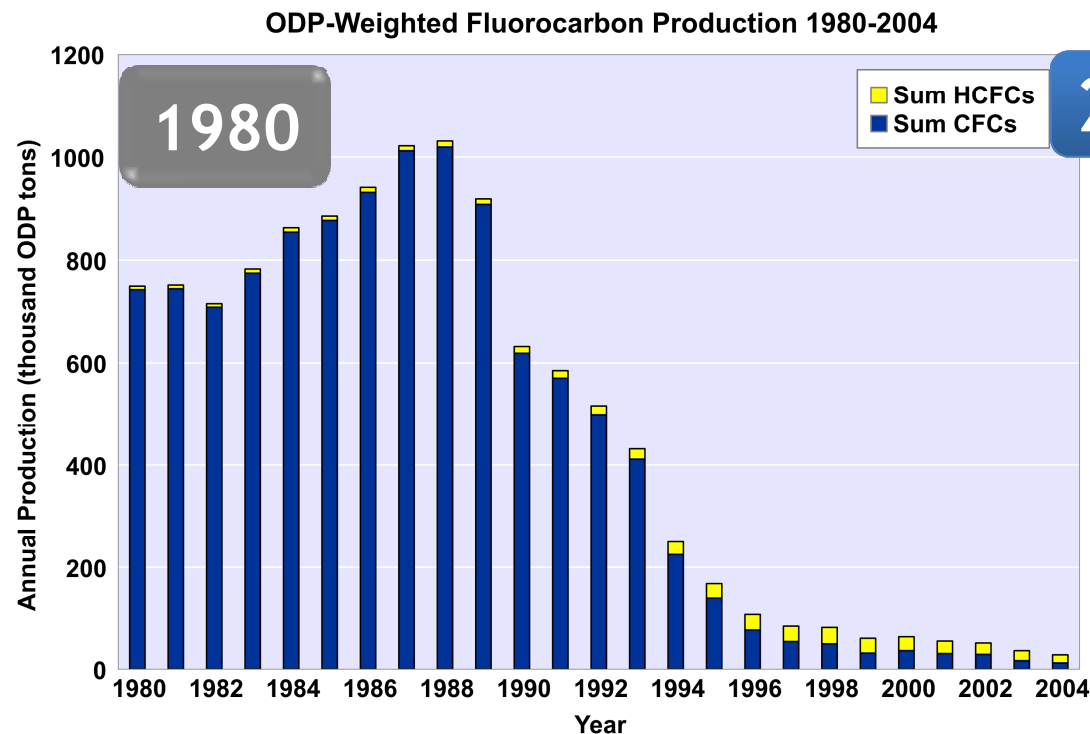
2030



ACCREDITATION
N° 1-0699 - N° 1-1695
PORTÉE COMMUNIQUÉE
SUR DEMANDE



IF : like F-gases Refrigerant and



2010

Today :
Mechanically
refrigerated units with
HFC >95% of trucks
market

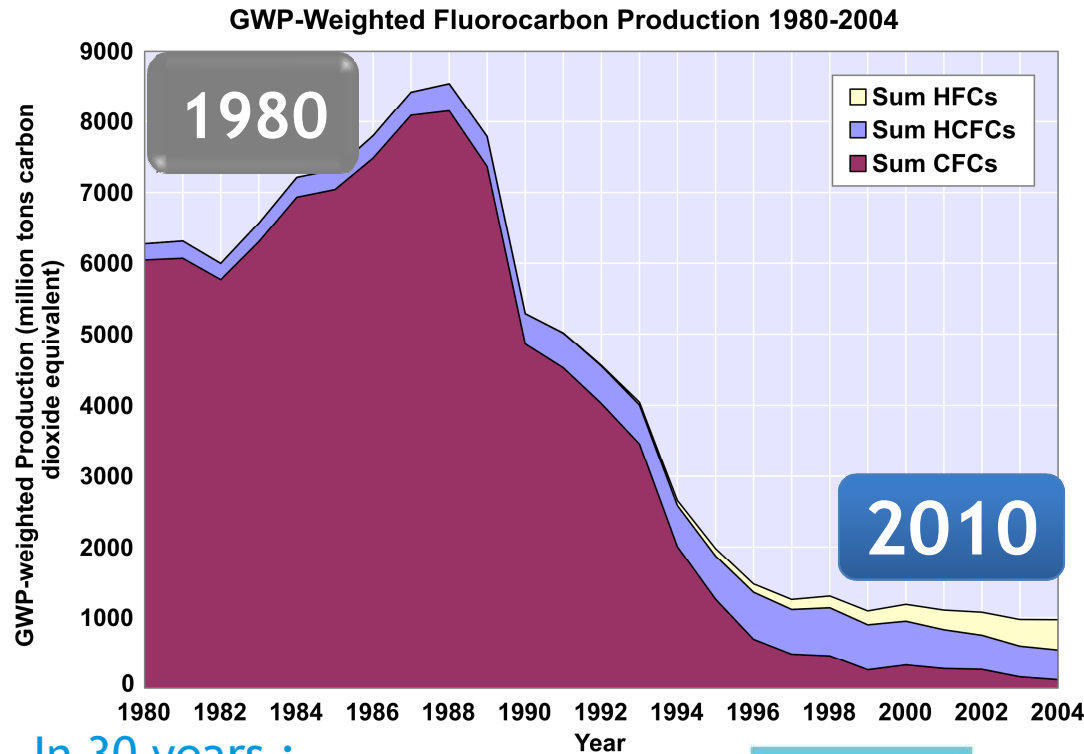
- Tomorrow :
- Natural fluids (CO₂, NH₃...)?
 - Cryogeny?
 - Absorption ?



2030



I G: like Green house effect



In 30 years :

- Average speed: +50%
- Engine power: +200%
- Gas consumption: -40%.



2030



Famille de frigorigènes	Principaux frigorigènes	PRG
CFC	CFC-11	1960
	CFC-12	8100
HCFC	HCFC-22	1500
HFC	HFC-134a	1300
	HFC-404A	2010
	HFC-410A	1725
Frigorigènes naturels	R-717 (Ammoniac)	< 1
	R-744 (Gaz Carbonique)	1
	Hydrocarbures	20

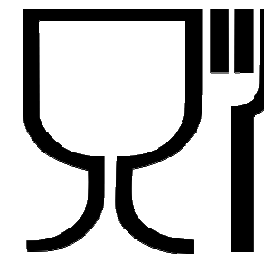
Direct effect reduction : F-Gaz changes
 Undirect effect reduction : energy consumption reduction



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IH : like Hygiene

For foodstuff and pharmaceuticals



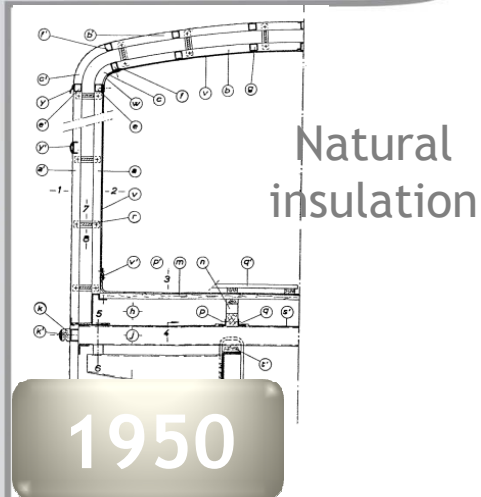
2020

Integration of hygiene standards : food, pharmaceuticals...
Certification process for products : IFS, BRC, ISO 22000, HACCP, CertyPHARM...



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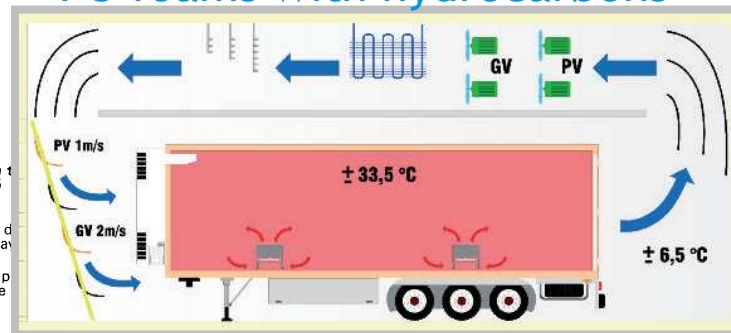
II : like Insulation



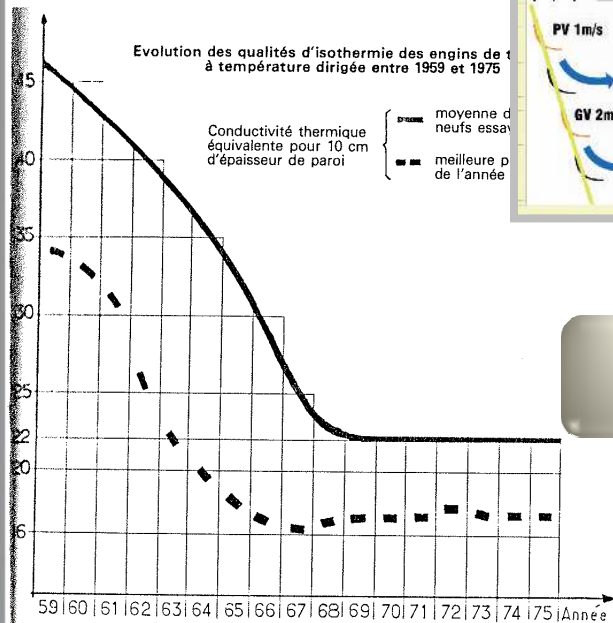
2030

2010

PU foams with hydrocarbons

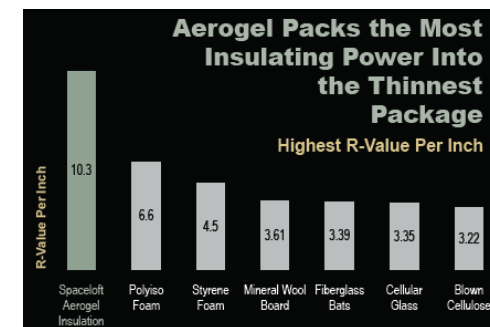


New insulation materials:
Aerogels,
multilayers, organic
insulation ...



1980

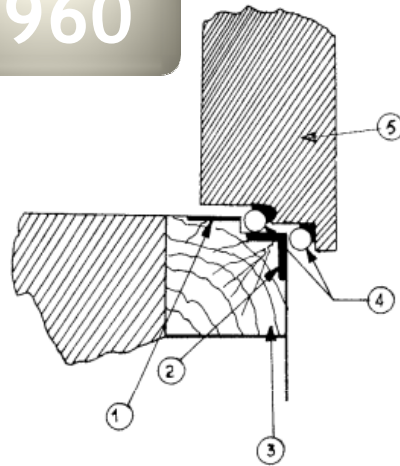
PU foams with CFCs or HCFCs



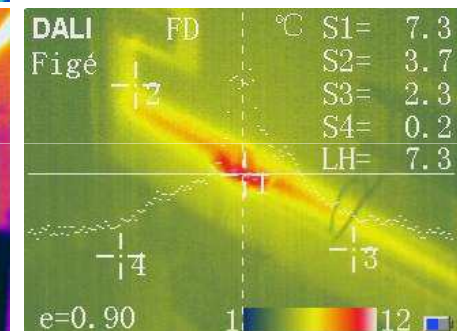
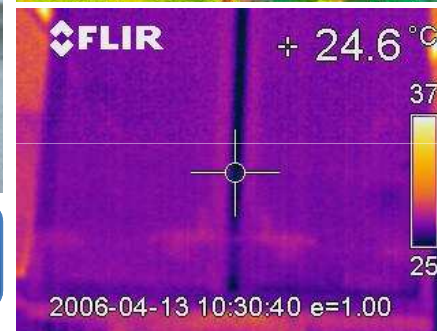
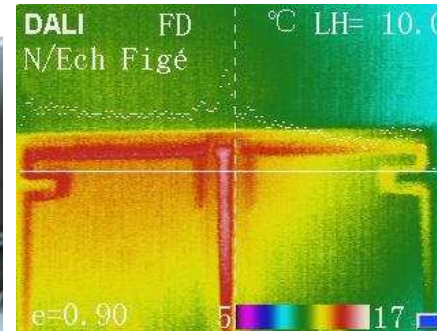


IJ : like Joints And etancheity

1960



2010



2030

Towards a better etancheity,
reduction of thermal bridges,
Improvement of bulkheads...



|K : like Kits

1990

European industry
Multisites production
Rationalisation and
specialisation
World Economy

2010



2020

Quality control
Système management
Equipments certification
Harmonisation of certification process
Improvement of ATP certification process



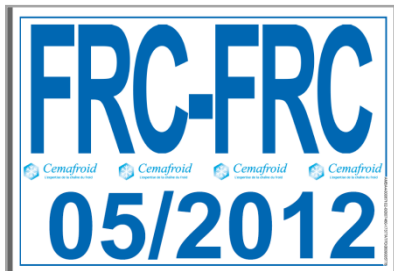
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L : like Labels



1970



1990



2010



2030

Secured ATP certificates

- ATP a quality label?
- A world system?



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IM : like Multi-temperature

A long way to ATP !

1990

- First multi-temperatures refrigeration units and test procedure



2010

- 30% of new equipments
- 20% of in service equipments
- 42% of trucks and trailers
- More than 80% of some fleets



2030

- An ATP certificate?
- Reduction of conduction losses
- New multi-temperatures technologies





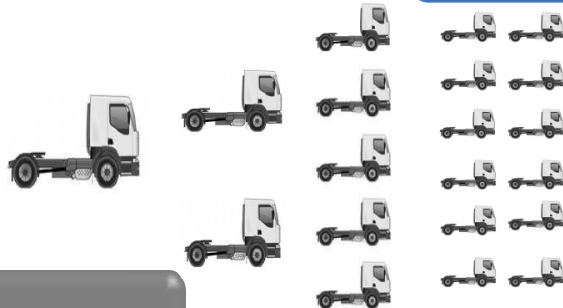
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IN : like Noise

Le niveau de bruit d'1 camion en 1980 =

2010



1980

88 dB (A)
1985

84 dB (A)
1990

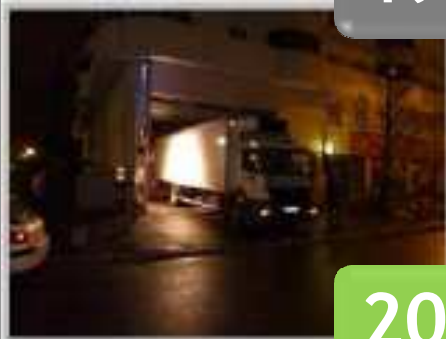
80 dB
1996

12 times less noise in 30 years

Noise first environmental constraint for people

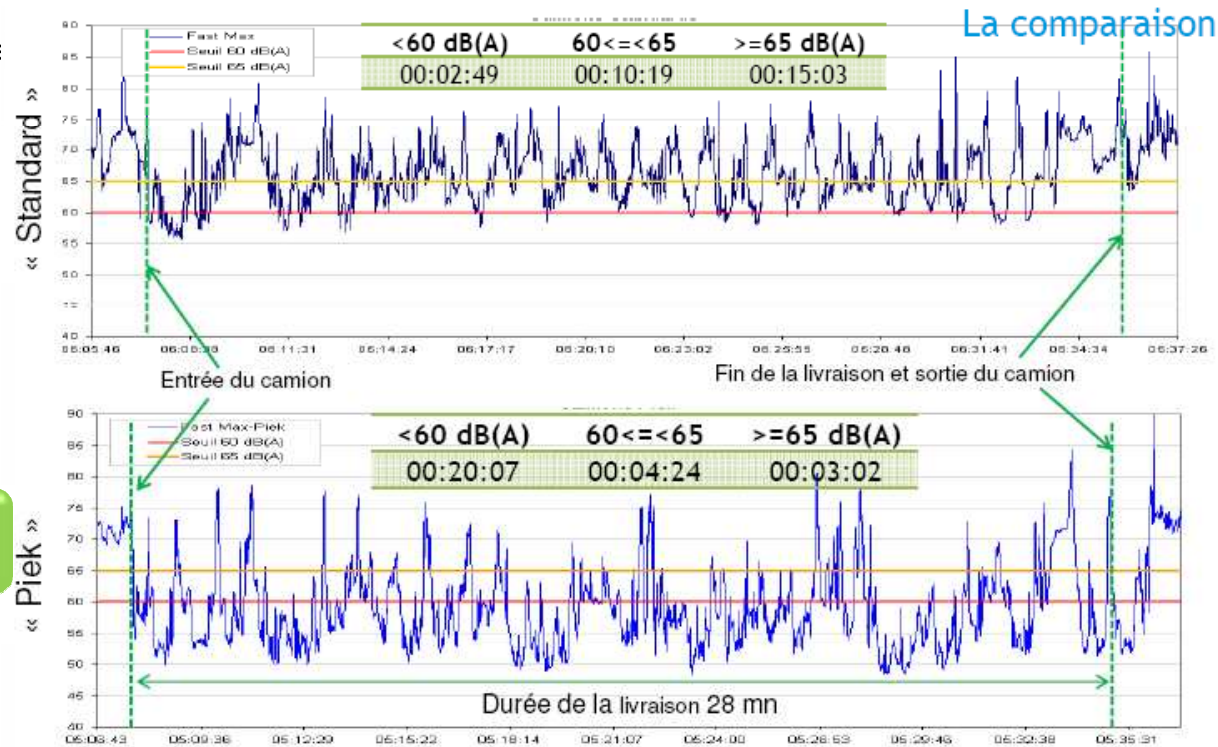


1990



2020

Tomorrow silent night delivery to reduce pollution





IO : like Openings

- Doors and

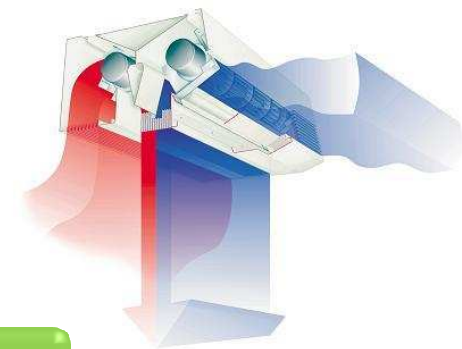


Curtains,



2010

- Automatic doors

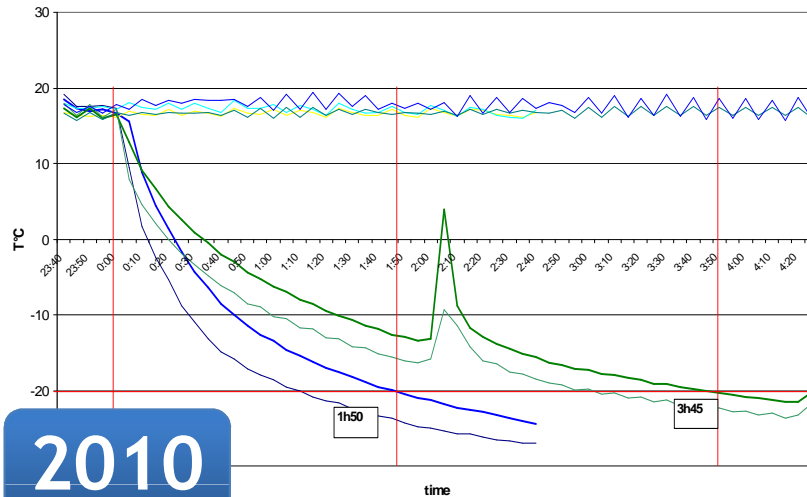


2020

- Air curtains
- Reduction of air losses



IP : like Performance



2010

Longue distance

Régional

Suburbain

Urbain

Hyper centres

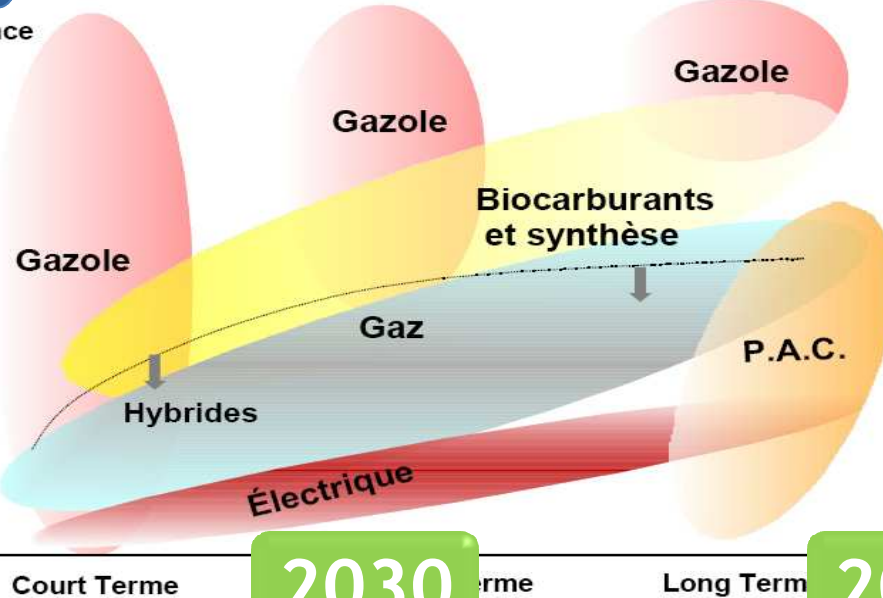
Court Terme

2030

Terme

Long Terme

2050



Driver behavior

- 13 %

Equipment definition

- 40 %

Road resistance

- 5 %

Aerodynamism

- 15 %

Transport efficiency

- 18 %

Maintenance

- 12 %

Control

- 5 %



IQ : like Quality

Recognition and continuity of quality



- 200 tests centers = periodic control
- End of sanitary control = temptation

2000

2010

- ATP = type conformity and quality control
- No continuous check = variability of production



2030

- ATP quality label
- ATP performance identification
- ATP improvement and innovation driver
- Harmonisation of tests, procedures and systems

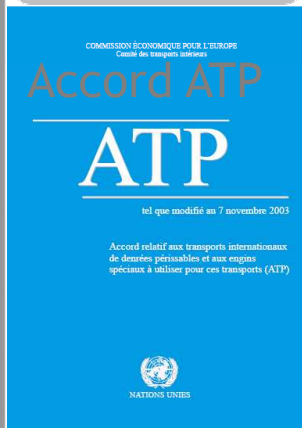


IR : like Regulations Standards and references

1952

French Standard

1970



- Code Rural
 - articles L. 231-1 et L. 231-4-1
- Décret n° 2007-1791 du 19 décembre 2007
 - Transport conditions
- Arrêté du 1er juillet 2008
 - Technical control
 - certification process
- Arrêté du 2 juin 2008
 - New independant ATP competent authority

2010



2020

Transport equipment CEN standard
Implementation of modernised ATP worldwide
Integrated approach including +/- methodology



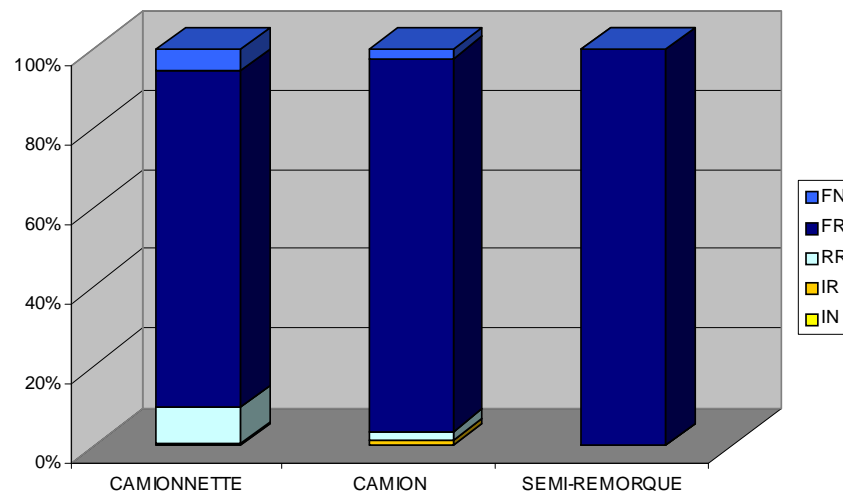
IS : like Safety coefficient

1970

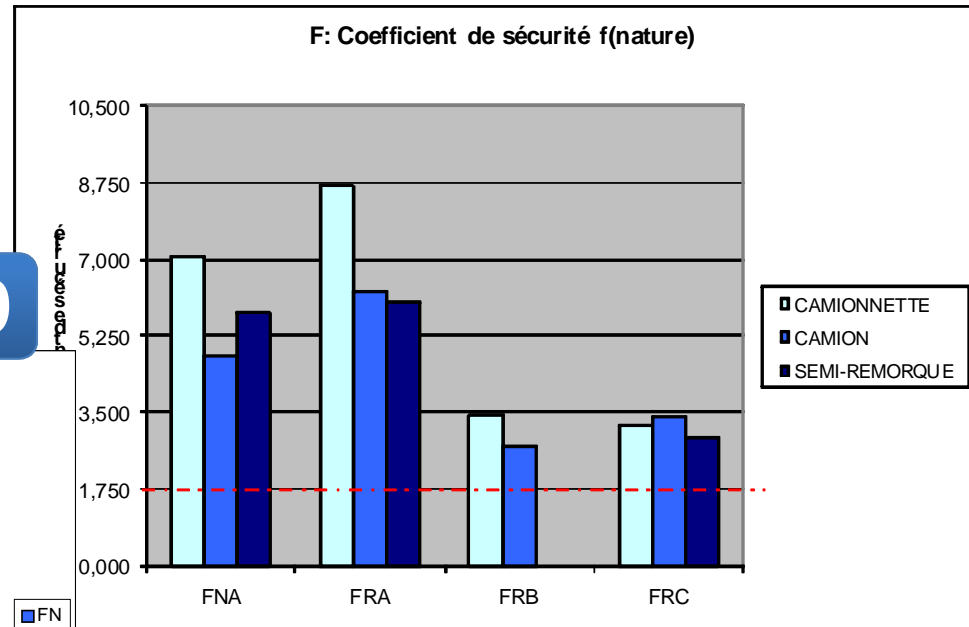
Safety coefficient $k= 1,75$
For ageing and unit installation

2010

B: Répartition de la nature des véhicules f(Catégorie)



F: Coefficient de sécurité f(nature)



2020

Safety coefficient linked with operation :
Distribution, long distance transport, ...



IT : like Temperature Air and load temperatures

1964

Deep frozen food definition in
French regulation

+2°C/+6°C

0°C/+2°C

0°C/+4°C

0°C/+4°C

2010

+2°C/+8°C

+15°C/+25°C

Précautions particulières de conservation:
Avant ouverture:
à conserver à une température comprise entre +2°C et +8°C et à l'abri de la lumière.
Après première ouverture:
le médicament peut être conservé pendant 15 jours à une température ne dépassant pas 25°C et à l'abri de la lumière.



<-18°C



<-25°C

2020



<-80°C

The right temperature for lower energy consumption



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U : like Usage

1970

Supermarkets
development



2010

Foodstuff,
health products,
works of art,
chemistry...



2020

Night delivery,
Home delivery,
High added values
Flows optimisation,
Combined transports





IV : like Ventilation

And air circulation

1952

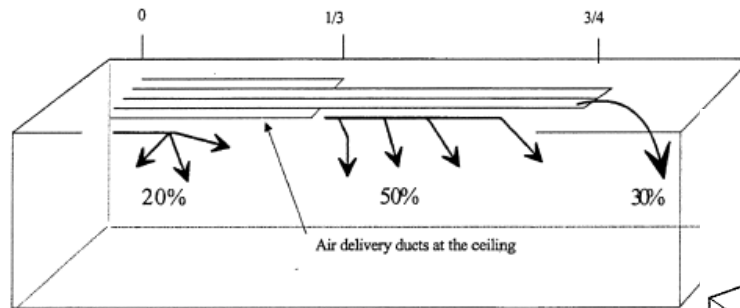
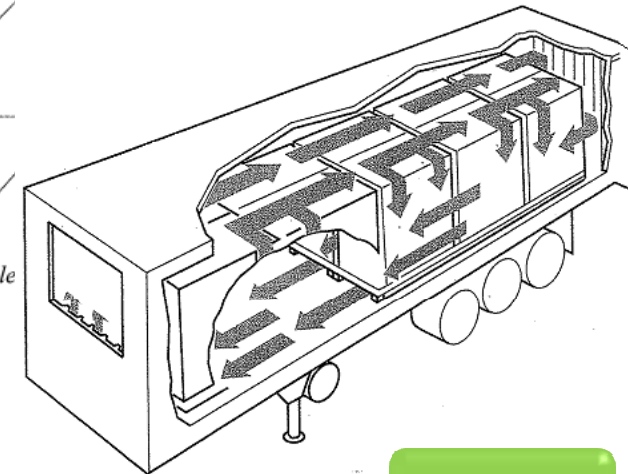


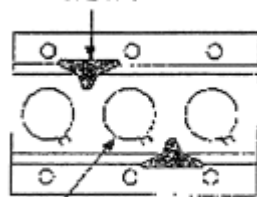
Figure 2: Air delivery ducts with openings at 0, 1/3, 3/4 length of the vehicle body.

Air delivery ducts with openings at 0, 1/3, 3/4 length of the vehicle

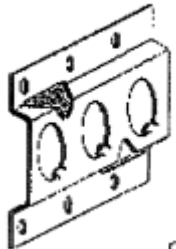


1970

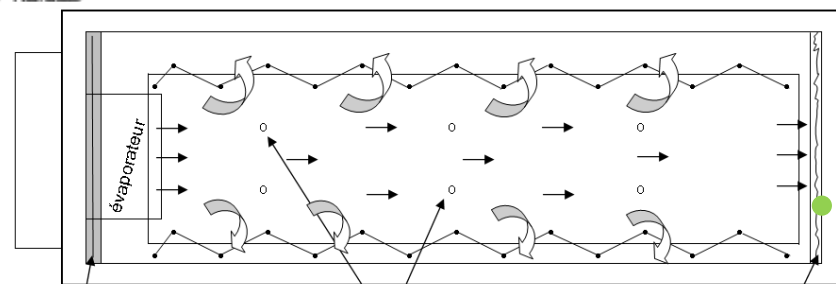
VERTICAL AIR-CIRCULATION
OPENING



OPENING FOR BLOCKING
THE STOWING BAR



2010



Ecran de reprise d'air (50m/m)

CEillets ø25m/m implantés dans la toile

Extenseur AR de passage d'air (50 m/m)

2030

- Increase :
- air flow,
- homogeneity,
- circulation



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2010

Second life...



W : like Waste
and recycling



Recycling
organisation
Ecoconception
Reusable materials

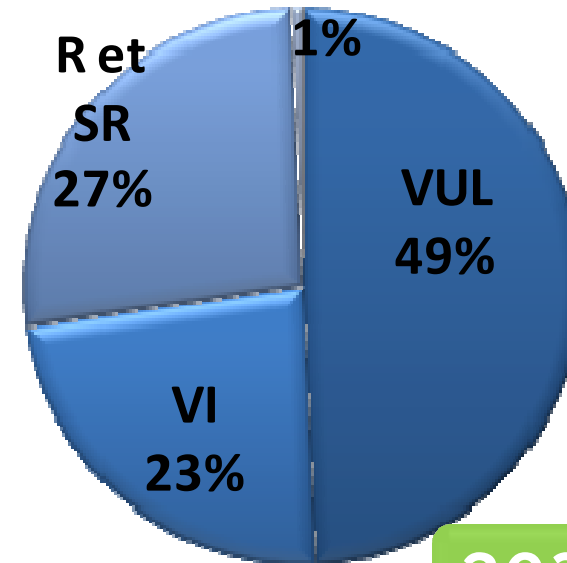
2030



IX : like the unknow factor of the market

- 103 841 valid certificates
 - 1495 tanks
 - 102 346 bodies
- Répartition par PTAC :
 - 51 121 vans
 - 24 281 Trucks
 - 27 655 trailers and semi trailers
 - 694 other equipments
- 1,5 M equipments in the world
 - 30 000 in China
 - 5 000 in Tunisia

In service equipments in France 2011



2030

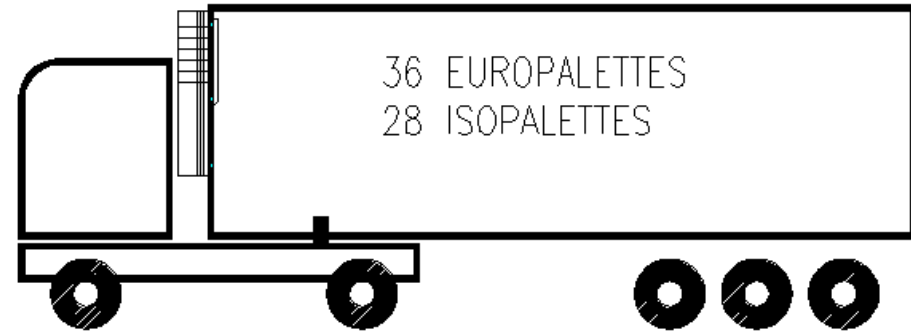
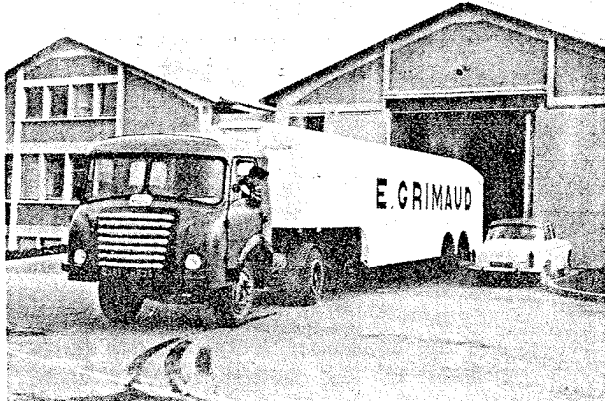
- Which manufacturers tomorrow ?
- Which equipments in the world tomorrow ?



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Y : like yards, meters and tons

For a better efficiency



1950

1970

1990

2010

2020

2,5 m
16,5 m
30 euro-palettes
38 tons

2,6 m
16,5 m
33 euro-palettes
38 tons

- 17,86 m for 36 euro-palettes
- 44 tons harmonisation
- EMS at 25,5 m





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IZ : like Zoning

Of the load in the bodies



2030

- Improve air circulation
- Improve homogeneity

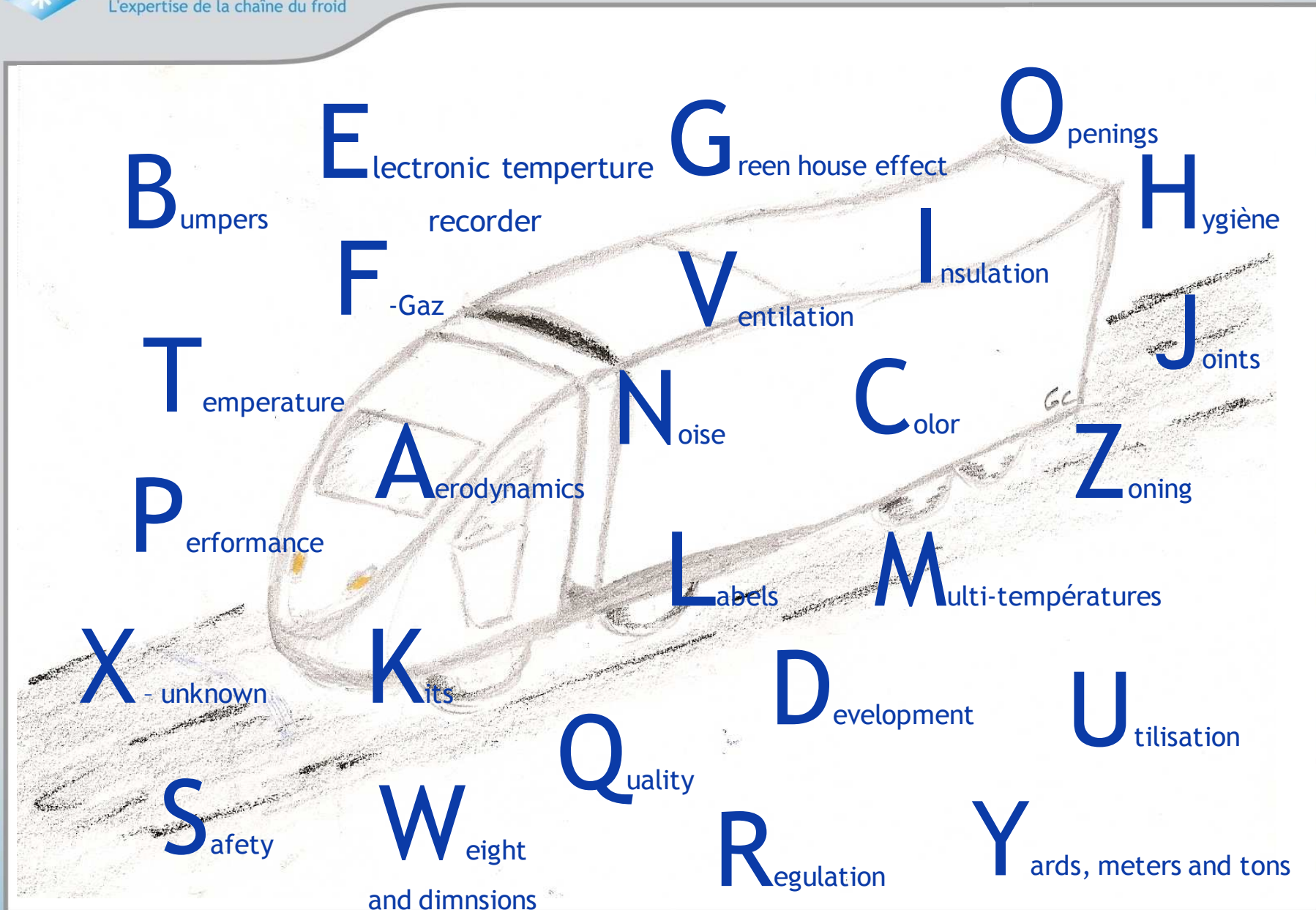
Conclusion





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Thank you for your attention !

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