



FEEDBACK ON WHITE CERTIFICATE ON AN INDUSTRIAL PROCESS: ALL-ELECTRIC INJECTION MOULDING MACHINES

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WHAT ARE THE FRENCH WC ?

□ WORLD

- Kyoto Protocol (adopted in 1997) → The average target was a GHG emissions reduction of around 5% relative to 1990 levels by 2008-2012

□ EUROPE

- European Energy Efficiency Directive (2012/27/UE) → From 2014 to 2020, energy savings of 1.5% per year of the energy sales to final customers by volume, averaged over 2010-2012

□ FRANCE

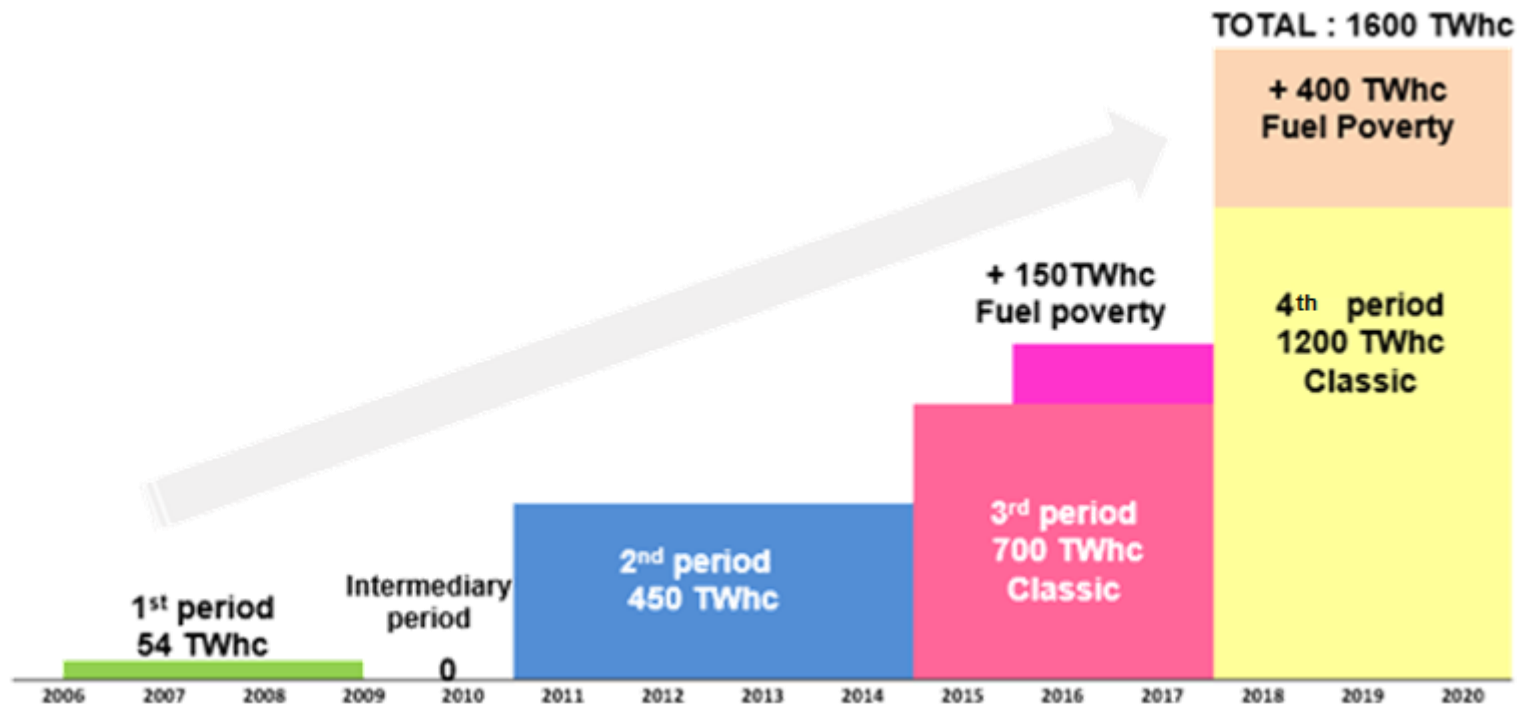
- White certificate scheme → About 90 % of the 1.5% annual savings required will be achieved through WC scheme

French government set an energy efficiency obligation (a certain amount of WC to be produced) upon final energy suppliers over three-year periods

WHAT ARE THE FRENCH WC ?

- A steadily increasing obligation since 2006

- $\text{Obligation}_{2018-2020} = 1.9 \times \text{Obligation}_{2015-2017} = 30 \times \text{Obligation}_{2006-2009}$
- Since 2016, a specific amount of WC has to be made in fuel poverty households



N.B. : WC are accounted in kWh « cumac » which represent final energy savings cumulated over solution lifespan and actualized at 4 %

WHAT ARE THE FRENCH WC ?

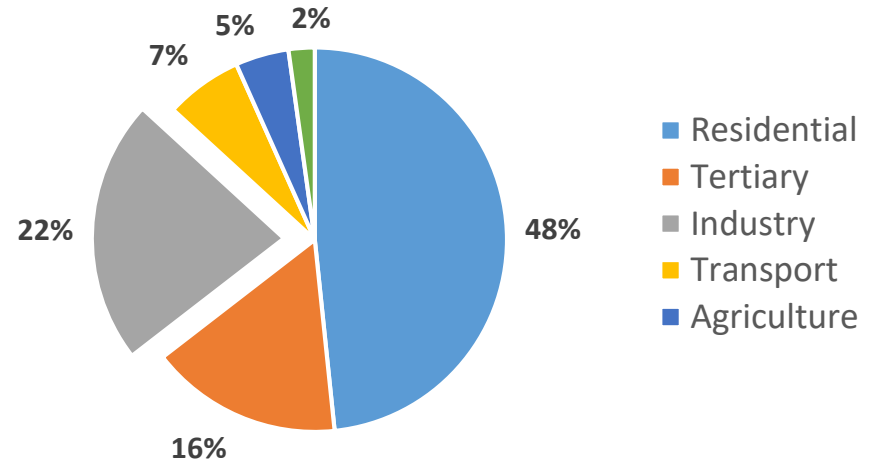
- To fulfill their obligation, obligated parties can:



- **2 ways of promoting energy savings operations**
 - Standardized operations → average amount of WC for operations which can be widely deployed (93 % of issued WC) ex: setting up an all-electric injection moulding machine instead of an hydraulic one)
 - Specific operations → savings are determined using real condition datas (4% of issued WC) ex: Replacement of a mercury electrolyzer with a membrane electrolyser for the electrolysis of sodium chlorine
- **WC Funding programs → ex : financing charging stations for electric vehicles (3% of issued WC)**

WHY FOCUSING ON AN INJECTION MOULDING MACHINE ?

- Standardized WC operations mostly targets residential and tertiary sectors



- Standardized WC operations for industry mostly target industrial utilities (cold production, boilers, compressed air...)
- One of the main challenge for the 4th WC period, which began in january 2018, is to increase the WC potential
 - 1600 TWhc represents around 1.5 times the Berlin inhabitants energy consumption in a year (28 MWh/inhab./year, discount factor = 10 → 160 TWh, 5.7 million inhabitants)

WC on industrial processes is a way to increase the total WC potential to reach the very ambitious goal of the 4th WC period

INJECTION PROCESS IN THE PLASTIC PRODUCT SECTOR

- Production parts for

- Packaging, motor vehicles, building construction, health, aeronautics, electric and electronic, sport and leisure,...

- **Size**

- 6th worldwide by sales
- 30 billion € sales in 2016
- 130 000 employees - 3 500 companies (SME)

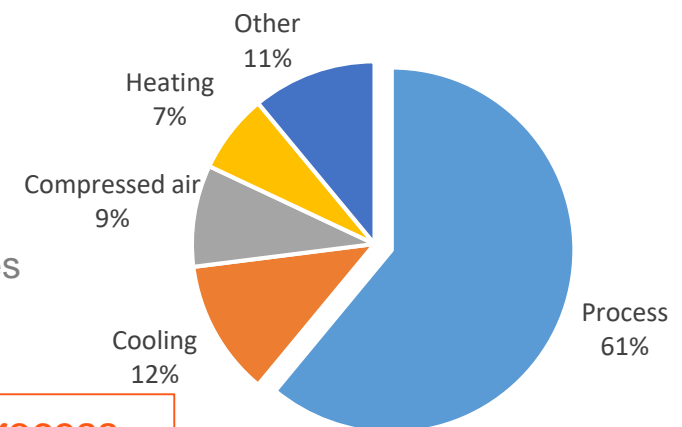


- **Prospective view**

- Plastic processing is one of the core business of the future through connected objects, traceability, implants,...
 - +23 % expenditure in R&D (2012-17)
 - 73 % of the companies are looking to go on investing
-
- | Category | Percentage |
|------------------|------------|
| Heating | 7% |
| Other | 11% |
| Unlabeled (Blue) | 82% |

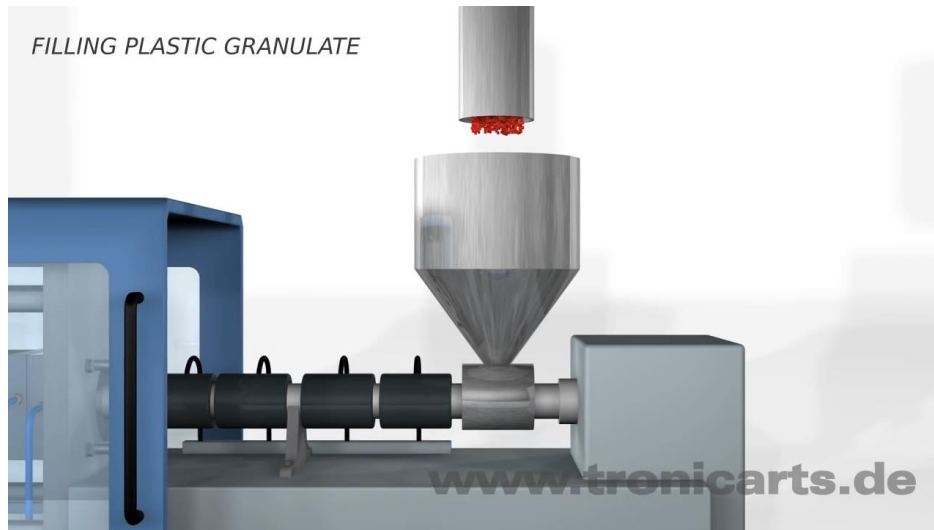
- **Energy**

- 8.2 TWh/y consumption which represent 3 % of the annual sales
- Breakdown consumption 70 % electric and 30 % fossil fuel



61 % of electricity is consumed in the injection process

INJECTION PROCESS IN THE PLASTIC PRODUCT SECTOR



The BAT:

The working principle remains the same between these 2 technologies.

In an hydraulic machine the movements are carried out with the help of hydraulic circuit: the oil is brought up into pressure to move the hydraulic cylinders (due to the power and the shearing forces the oil heated up and must then be cooled).

In an all electric machine the movement are carried out with direct servomotor drive (the power is lower and there is no or less oil to be cooled)

- **Moulding injection market**

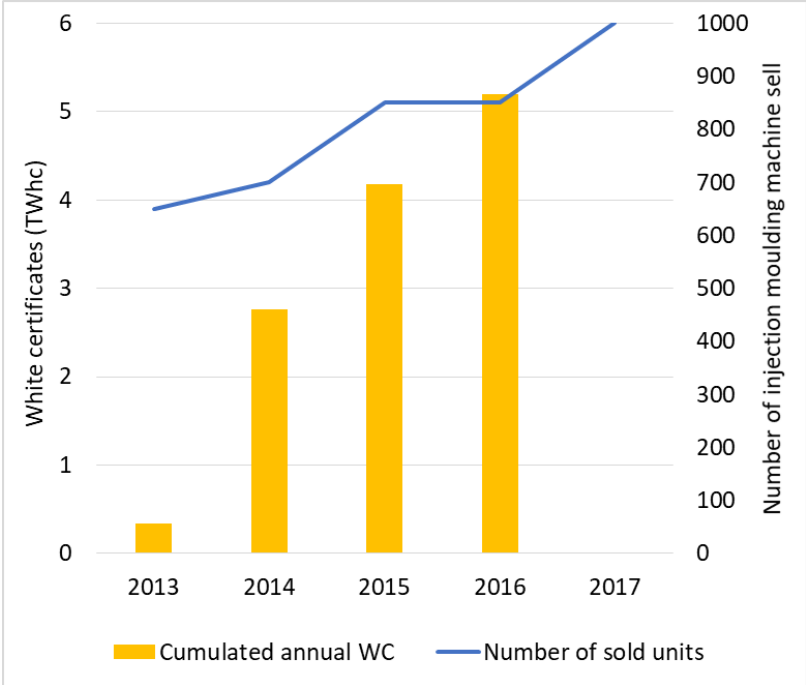
- French fleet around 18 000 machines
- 1 000 machines sold in 2017 (+100% more than 2009)

The replacement of hydraulic circuit by servomotors reduces the energy consumption by about 50%, gives a higher part quality, lower operating costs but is more expensive.

FEEDBACK ON WC ON ALL INJECTION MOULDING MACHINE

- Energy consumption is reduced by using direct electrical motor drive and by reducing or suppressing the oil cooling process
- To be eligible for standardized operation: 3 scenarios

Number for motorised electric movements	Energy savings
1 dosage (2018 ?)	27%
2 between injection, dosage and opening/closing	40%
3 or more at least injection, dosage and opening/closing	54%



Cumulated WC and cumulated number of units sold (Sources: EMMY and ACDI)

4.7 TWhc of WC approved and 3050 machines sold (35 % all electric and 15 % hydraulic)
 → In the top 5 of standardized WC industrial operations

COVERAGE RATE

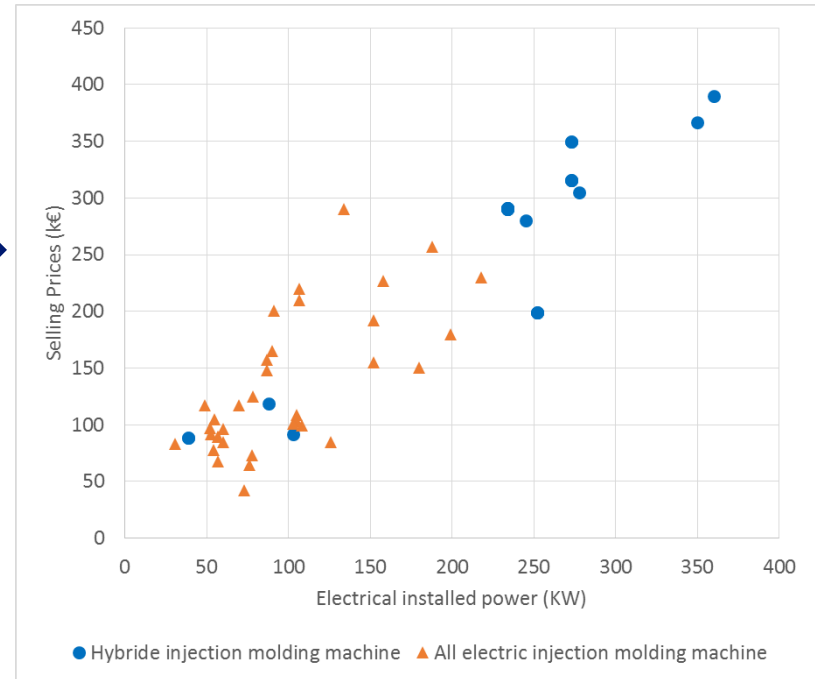
- The maximum installed power for the all electric one is 220 kW due to the maximum clamping force of around 500 tons
- Above 230 kW hybrid injection ones are used when a higher clamping force is needed



- WC coverage rate

$$\text{WC median coverage rate} = \frac{\text{Commercial Incentive (€)}}{\text{Selling Price (€)}}$$

- ❑ Median: 5.5%
- ❑ 1st decile 2.4 % and 9th decile 7.4%



Electrical installed power versus selling prices of the injection moulding machine WC operation (Source: EDF database)

Even a moderate coverage rate the WC incentive is important:

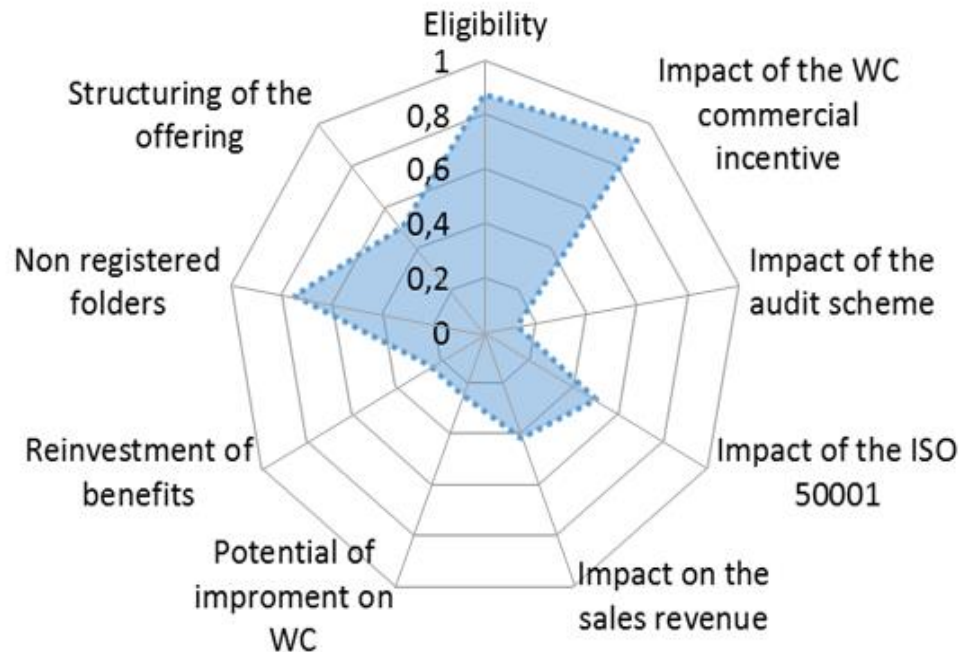
- reduces the gap price between all electric and hydraulic injection moulding machines
- gives a strong signal from the public authorities to the plastic product sector

OUTCOME OF MANUFACTURERS WC SURVEY

- Conducted by EDF in June 2017
- Around 70 manufacturers contacted (for the main standardized industry operations)
- 4 out of 7 injection moulding machine manufacturers answered
- Answers were analysed to obtain a concise evaluation of the third period

OUTCOME OF MANUFACTURERS WC SURVEY

▪ Evaluation of the 3rd WC period



Overall result of the WC scheme – injection moulding machines, normalized scale from 0 to 1. (Source: EDF)



Large part of business eligible for WC
High impact of the Commercial Incentive
High impact of ISO50001



Low impact of the audit scheme
Non registered folders

CONCLUSION

WC standardized operation of hybrid or all electric injection moulding machine is highly successful

- The commercial incentive helps to cover a portion of the extra cost
- WC is seen as a strong signal of public interest for this sector



Industrial processes can be successful targets for WC operations

- An encouragement to develop similar new standardized WC operation
- The importance of allowing WC creation in EU-ETS installations

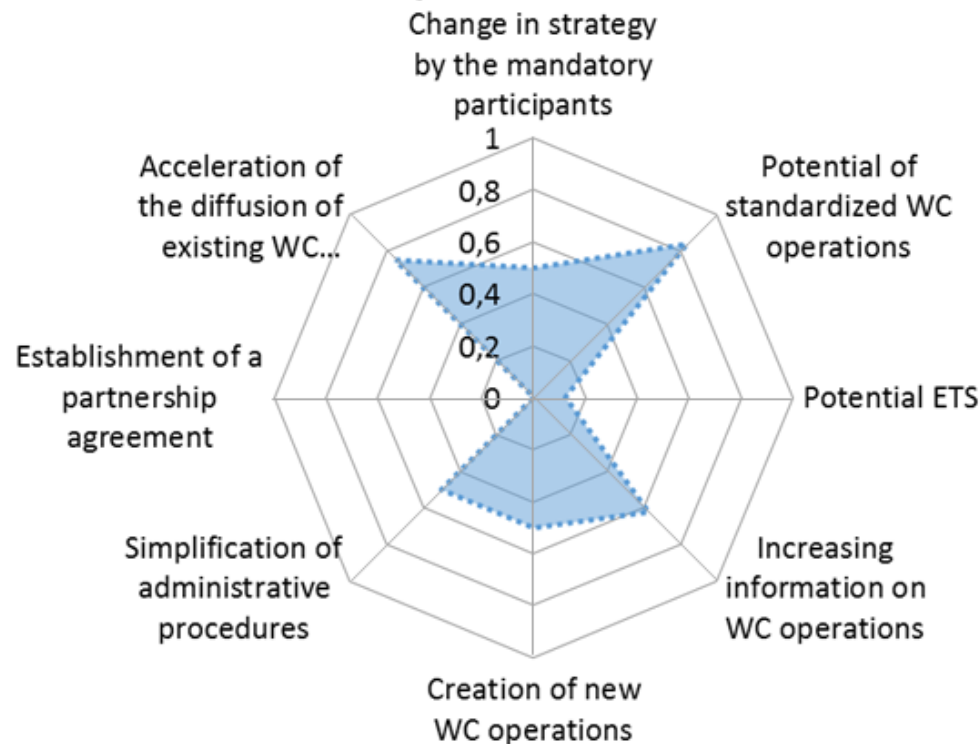
These actions increase the energy efficiency and encourage the industrial competitiveness



Now, let's tackle the seventh continent issue...

OUTCOME OF MANUFACTURERS WC SURVEY

Feedback on the 4th WC period goal



Revision of the WC scheme – injection moulding machines, normalized scale from 0 to 1. Source: EDF

- Eligible operations never summited
- An increase in the communication in WC operations
- Simplification of administrative procedures

For the 4th period the sales are expected to remain at the level of 2014-15