Overview of Domestic Heating Appliances Sector




C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Marco Palazzetti

Chairman of Biomass Commission in CEFACD

Chairman of Bioenergy Europe Domestic Heating Working Group
Located in Brussells Bioenergy Europe is committed to develop a sustainable bioenergy market based on fair business conditions. Through the EPC network manages worldwide the ENPlus Certification.

Member of the board of AIEL Domestic Appliances Commission
Italian Association representing the whole value chain from the forest management to the energy conversion of wood. Owner of AriaPulita® Certification, BiomassPlus® Certification and license for Italy of ENPlus® certification.

CEO of Palazzetti Lelio SpA
Stoves and fireplaces manufacturing company, located in North Est of Italy, selling worldwide with the brand PALAZZETTI.

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Introduction to CEFACD

Who is CEFACD?

- The CEFACD is the international trade organization for local space heating appliances for all fuels. We represent biomass, gas and electric products.
- Our members are manufacturing companies and national trade organizations.
- CEFACD has been re-founded end of 2017, members and governance scheme are completely new
- We have one common goal and that is to assure a market for our products also in the future. Therefore we have to make sure that our products fit into the energy transition that Europe is going through with a long term view.

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

CEFACD Network

Current members

- DRU (NL)
- Glen Dimplex Europe (NL)
- MCZ (IT)
- NIBE-stoves (SE)
- Palazzetti (IT)
- RIKA (AT)
- STUV (BE)

- HKI (German trade organization)
- SHR (Dutch trade organization)
- SIA (UK trade organization)

CEFACD is member of

- AEBIOM (European Biomass Association)
- ORGALIME (EU electronic and metal articles industries association)

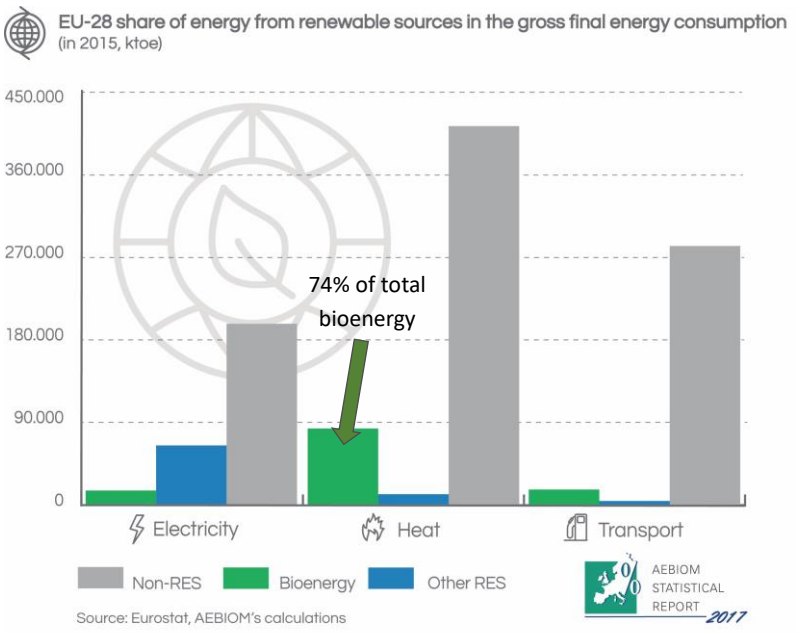
C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

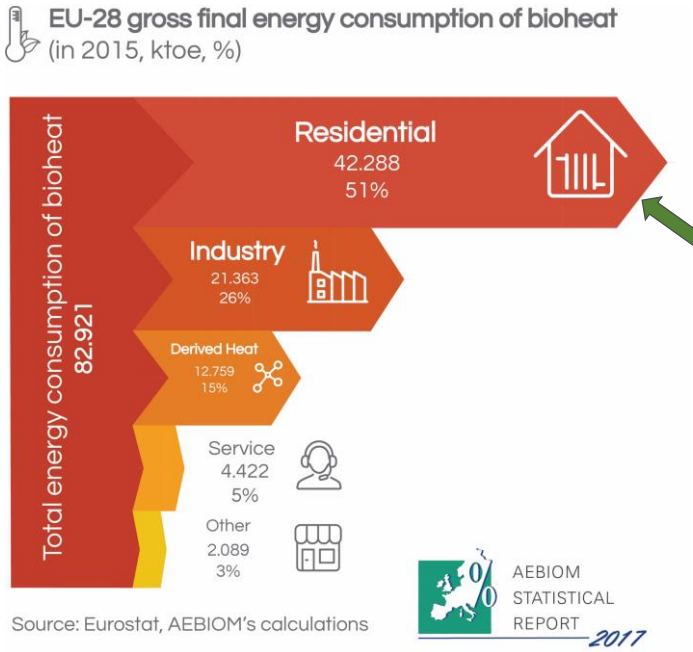
C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Residential heating with biomass in EU




C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques



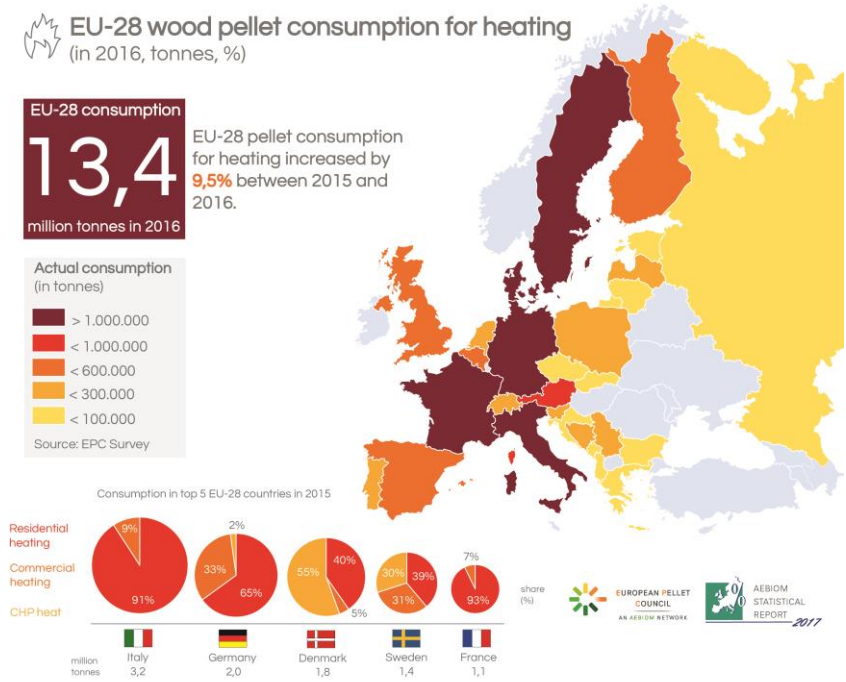


Almost 100%
is Wood or Pellet

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Differences between EU Countries

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques



C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Distributed µGeneration of Heat from Renewable Energy Sources (Wood or Pellet) is a modern model
(compatible with lower energy need of buildings, heat production can be regulated, doesn't need any grid, short range sourcing, regional economy, etc.)

↓

Those appliances are mostly combined with other heating appliances:
Optimized Energy Mix Concept

↓

which is strongly linked with the cost of energy sources that is very heterogeneous in EU and rarely linked to Environmental concerns

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

The pillars of quality and performance




C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

The three dimensions of a domestic appliance

1. IT'S A HEATING APPLIANCE

- POWER OUTPUT
- **EFFICIENCY**
- SINGLE ROOM VS WHOLE HOUSE
- COST PER KWH

2. IT'S PART OF THE ROOM'S FURNITURE

- **DESIGN**
- MATERIALS
- CLEANNESS
- USABILITY
- COZINESS

3. IT'S A TECHNOLOGICAL, ECOLOGICAL AND SUSTAINABLE **CHOICE**

- EMISSIONS
- RENEWABLE ENERGY
- SMART
- **INDEPENDENCE**

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Quality pillars:

In order to grant performance and emission reduction we relay to those 5 principles:

1. good **appliance**: **technology**, real life/emission certification (best practices: AT BeReal®, FR Flamme Verte®, IT Aria Pulita®, etc…)
2. good **fuel**: supply chain sustainability, certification (best practices: EU ENPlus®, IT BiomassPlus®, etc…)
3. good **installation**: regulations (best practices: DE, AT , IT: CURIT Lombardia region, etc…)
4. good **maintenance**: regulations (best practices: DE, AT, IT: CURIT Lombardia region, etc…)
5. user **best practices**: awareness, knowledge (best practices: UNECE Burn Right Campaigns, IT www.energiadallegno.it, etc…)

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

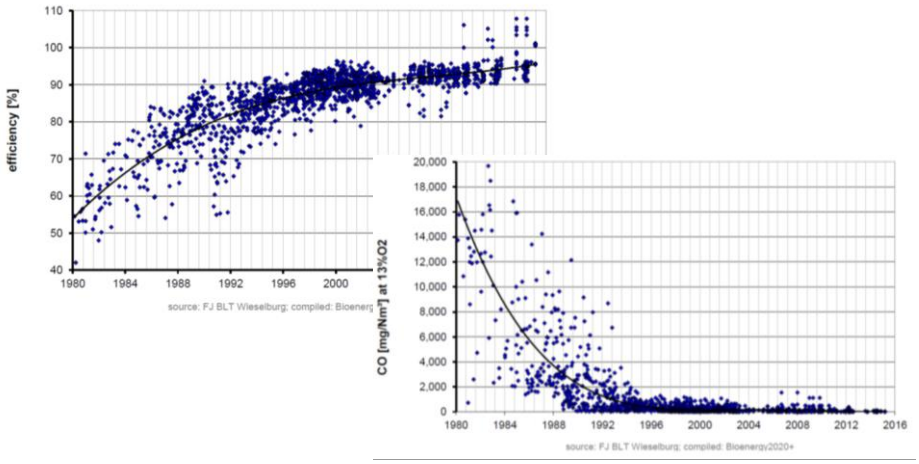
Emissions and the role of technology




C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Differences between old an new appliances are relevant



But Ecolabelling is not giving evidence of it

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Emissions of small scale residential heating appliances is an issue → different reactions

Certification schemes

- Aria Pulita (IT)
- Flamme verte (FR)
- DEFRA (UK)
- Nordic Swan Ecolabel (Nordic countries)
- Optimaz (BE)
- P-Mark (SE)
- SEI (IE)
- Blue angel (DE)
- Residential space heating appliances fired by wood pellets with low-pollution combustion (DE)
- BAFA (DE)
- BImSchV (DE)
- EPA wood stove certification (USA)
- MCS certified products (UK)
- UZ37 (AT environmental label)
- TUV Rheinland 15A B-VG (AT)
- PCT (RU)
- EKO SKLAD (SL)
- AEFECC (ES)
- Etc.

Standards

- EN 13229 – Fireplaces
- EN 15250 – Mass stove
- EN 13240 - Wood stoves
- EN 14785 - Pellet stoves
- ISO 303-5 – Solid fuel boiler

- Royal Decree 12 October 2010 (BE)

→ need for a standard

Figures on the topic are difficult to evaluate

Different Emission Factors for the same technology

No harmonization in EU for the Emission Inventory calculations

Source	Technology	Total Suspended Particle gGJ^{-1}	PM 10 gGJ^{-1}	PM 2.5 gGJ^{-1}
EU Guidebook, 2016 [8]	Biomass combustion appliances < 50 kW	800	760	740
EU Guidebook, 2016 [8]	Biomass combustion appliances > 50 kW	150	143	140
ISPRA, Italy 2015 [9]	Italian emission inventory, EF for residential biomass combustion		407	402
AIEL, 2016 Italian Association of Biomass Value Chain [7]	Average EF for small scale residential combustion in Italy		173	
IIASA, RAINS database [10]	Average EF for small scale residential combustion Western Europe	150-300	150-290	145-280
IIASA, RAINS database [10]	Average EF for small scale residential combustion Eastern Europe	500	480	465
Ökopol GmbH - German Ministry for Environment, 2010 [11]	Range of EF for small scale residential combustion (different technologies)	21-142		
BeReal project, EF of logwood stoves, 2016 [12]	Range of EF of 9 new logwood stoves, measurements according to BeReal test	27-65		
BeReal project, EF of Pellet stoves, 2016 [12]	Range of EF 7 new pellet stoves, measurements according to BeReal test	16-33		
Ökopol GmbH - German Ministery for Environment, 2010 [11]	EF expected in 2030, average of small scale residential combustion (Actual politic scenario)	49	48	45

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Emissions characterization

The main components are :

- Dust (PM)
- Organic Gas Compounds (OGC)
- Carbon Monoxide (CO)
- Nitrogen Oxide (NOx)

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Technological areas of intervention

- **PRIMARY MEASURES**
  - Burning Pot
  - Combustion Chamber
  - Heat Exchanger
  - Flues Collector
  - Electronic Combustion Control (+ feeding system)
- **SECONDARY MEASURES**
  - Active Systems
  - Passive Systems
- **BIG DATA ANALYSIS**
  - IOT enabled appliances (Pellet but also Wood)

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Best Practices: Pellet Appliances

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Burning pot

The **material** of burning pot and a good **combustion bed** allows temperature to rise → complete combustion → less Carbon based emissions

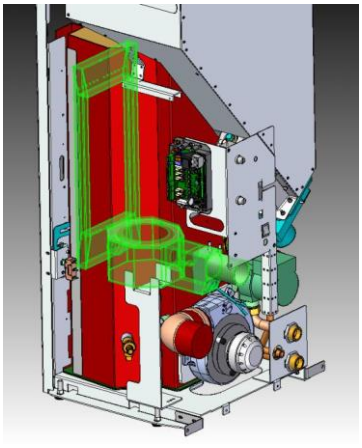
The shape of the burning pot and the inclination of secondary air inlet need to be engineered to reduce dust dragging

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Electronic combustion control – sealed appliances

"**CLOSED LOOP AIR INPUT REGULATION**"

Definition: "*A micro-manometer fitted on the control board connected with the speed sensor of exhaust fan create the perfect control and regulation in order to maintain the exact ratio between fuel and fresh air.*"



Those systems reduce the pollutant emissions in each combustion phase. Usually during the transitional phases uncontrolled combustion produce a huge quantity of Carbon Monoxide (**ignition** and **power modulation**)

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

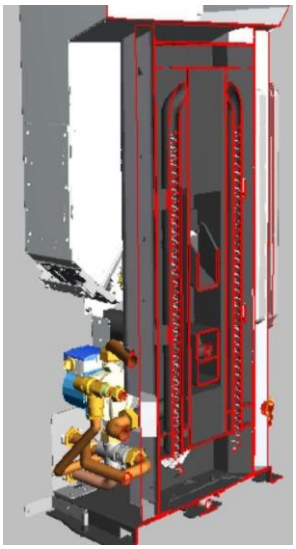
Combustion chamber

The **volume** of the combustion chamber helps to reduce the speed of the exhaust → minimize dust carry out.

Refractory materials increase the temperatures of combustion chamber → higher and complete oxidation of combustion emissions.

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Heat exchanger

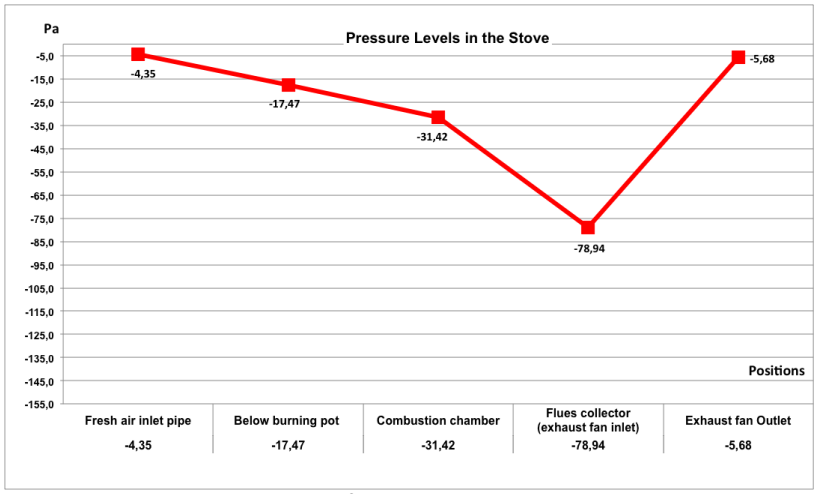


The exhaust path into the heat exchanger, turbulence and speed effect dust dragging.

The geometry of the heat exchanger has to allow smooth and progressive cooling of the exhaust to prevent pollutant agglomerations.

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Flues collector

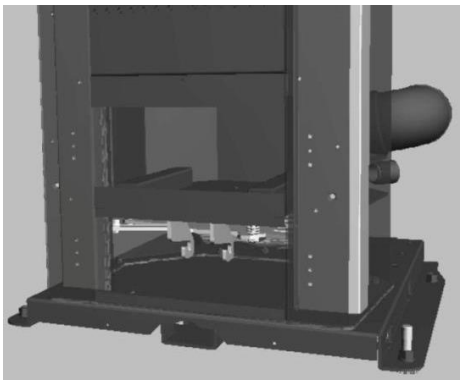


The closest point to the exhaust fan inlet is the point with minimum pressure → dragging risk

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Flues collector

The flues collector has to reduce the turbulence of the exhaust in order to prevent drag out of the dust in the flue ways.



C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

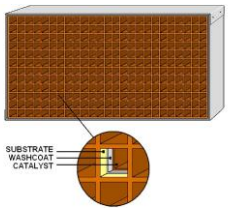
Achievable Results

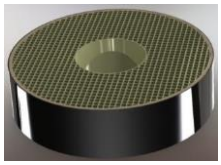
9 kW Pellet	Efficiency [%]	Flue Temperature [C°]	CO [mg/Nm3]	NOx [mg/Nm3]	CxHy [mg/Nm3]	Dust [mg/Nm3]
EcoDesign	89	--	250	200	40	20
Wood Ref.	81	262	813	107	59	18
Pellet OLD	90	204	167	121	5	11
Pellet New*	**92**	**162**	**49**	**131**	**2**	**8**

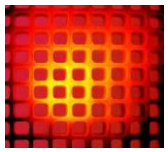
***those results were achieved adopting <u>only primary</u> measures and measured using EN 14785 standard**

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Secondary measures







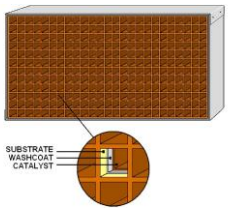
ACTIVE SYSTEMS

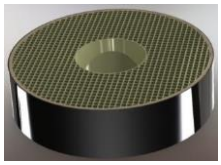
Definition: "*An active system changes the shape/composition of the dust and pollutants. It thus appears that an active system is much more functional than a passive system, if properly calibrated, because it can effect not only the amount and shape of the dust but also other elements that can be oxidized again (additional combustion) in order to reduce the emission of harmful elements.*

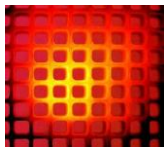
Depending on the type of molecules it can be a complete oxidation reaction of abnormal combustion or cracking process to reduce complex molecules."

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Secondary measures







ACTIVE SYSTEMS

Key Factors (3T):

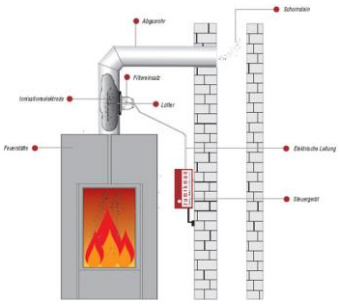
Time
Turbulence
Temperature

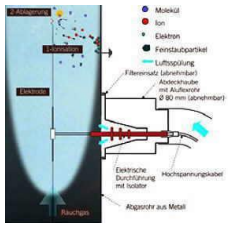
3T + Stove characteristics
lead to the choice of the correct

CPSI and filter positioning

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Secondary measures





PASSIVE SYSTEMS

A passive system can only collect the dust emitted from the burner.

These systems have an **higher efficiency on particle** collection compared with the catalytic systems but they have no influence in others molecules and you need electricity, air to purge the electrode and a higher maintenance to remove the PM deposited on the flue pipe.

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

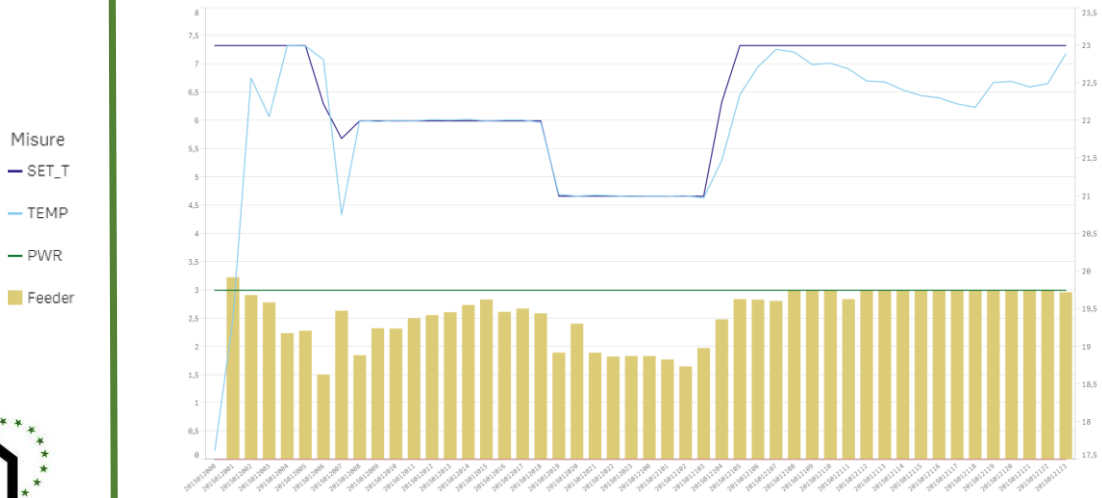
Big Data Analysis to rise user awareness




C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

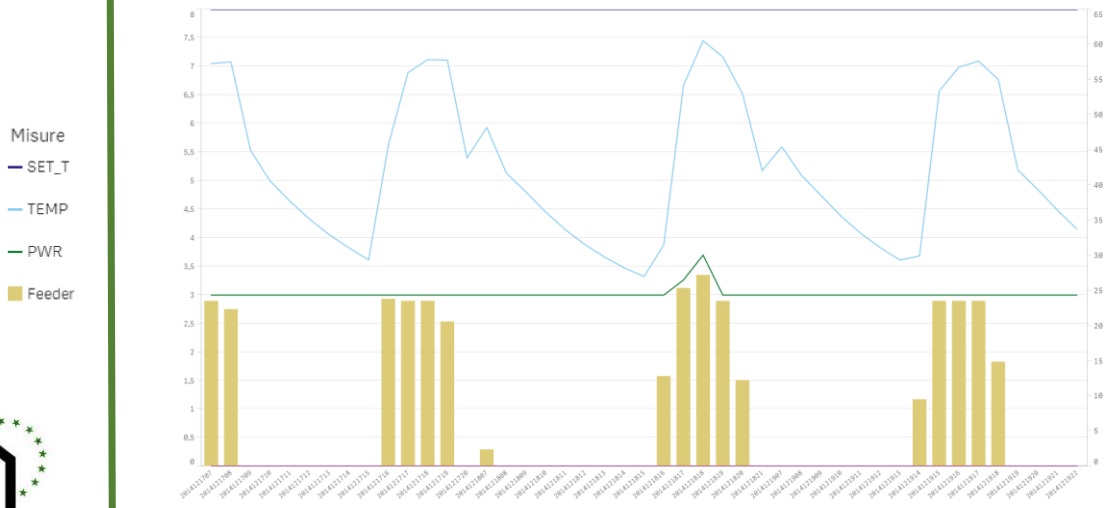
Big Data Analysis:

Case#1 - Air heating stove



Big Data Analysis:

Case#1 - Water heating stove



C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Conclusions

- **Bioenergy** is a great opportunity for EU in terms of **cost** (it's part of the forest circular economy), EU **energy dependency** mitigation, **jobs** and global **CO_2** emissions **reduction**
- **Technology** is in constant evolution there's a **big potential**:
  - big difference between old and new appliances
  - secondary measures are at very **early stage of application**
  - **big data** analysis can notify users for best practices
- We're working for an harmonized EU wide (at least) **quality label to classify** the appliances throughout all kind of emissions
- Need to issue quality oriented policies to **renew the stock of appliances**
- **Emissions inventories** need to be **updated** to measure the effectiveness of the policies and be coherent with the evolution of the technology
- Industry long term commitment to keep on **investing** in R&D and full support to **quality oriented initiatives**
  (IT: framework agreement with the Ministry of the Environment for emissions reduction up to 70% by 2030)
- Quality pillars: good **appliance**, good **fuel**, good **installation**, user **best practices** , good **maintenance**.

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques

Thank you

C.E.F.A.C.D
Comité Européen des Fabricants de Chauffage et de Cuisine Domestiques