CITEPA

Emission projections and decision aid for elaborating the French National Air Pollutant Emission Reduction Plan (PREPA)

Methodology Applied

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STRUCTURE OF THE PRESENTATION

- Organisation of the projection exercise in France

- Objectives of the Reduction Plan

- Assessment Method Used

- Example of Results

- Conclusions

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WHY PROJECTIONS OF EMISSIONS?

➢ **Meeting obligations and commitments under International and EU frameworks**

GHG

✓ UNFCCC/Kyoto Protocol : Biennal report (BUR), National Communications (NC), Nationally Determined Contribution (NDC),

✓ EU / MMR : Projection without measures (WOM), with existing measures (WEM) and with additional measures (WAM)

Air pollu-tants

✓ Gothenburg protocol (1999 and 2012)

✓ National emission ceiling Directive (2001) and directive on emission reduction (2016)

➢ **Assessment under national frameworks**

Both GHG and Air pollu-tants

✓ Act on Energy transition for the Green Growth (2015)

✓ Low carbon strategy (2015)

✓ Local plans : SCRAE,

✓ Other plans

✓ French national plan for emission reduction (PREPA) (2017)

✓ Local plan for air Protection (PPA) (Continuous process)

✓ ….

NATIONAL ORGANISATION FOR PROJECTIONS

CITEPA

Under the **General Directorate for Energy and Climate responsibility
(Ministry of Environment, Energy and the Sea)**

Stakeholders and experts		Activities / Policies and Measures definition	Emissions

Stakeholders and experts

- General directorates of the Ministry of Environment involved in transports, housing, risk prevention (industry), energy saving, air quality…
- Other ministries : agriculture, finance…
- State Agencies or Bodies
- Industry experts
- NGOs

Technical committees
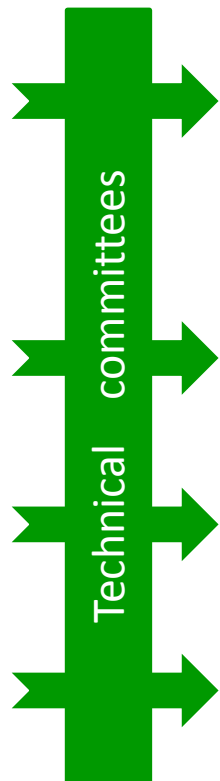
Activities / Policies and Measures definition

- Energy demand by sector : Buildings, Transport, Industry, Agri&Forest, Energy Production *Using Medpro and other models (Enerdata, Energies Demain)*
- Electricity mix modelling: *Using POLES mode (Enerdata, ADEME)*
- Waste & HFC/SFC : (CITEPA, Armines)
- Agriculture & forest: *Clim'Agri model* (ADEME + *CITEPA)*

Emissions

GHG & Air pollutants (CITEPA)

Done every two years

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THE DOUBLE OBJECTIVES OF THE FRENCH PREPA *

→ **Reduce air pollutant emissions to improve air quality**

  → comply with emissions reduction commitments for $PM_{2,5}$, SO_2, NOx, NH_3 and NMVOC

  → comply with air quality (AQ) concentration requirements for PM_{10}, $PM_{2,5}$, NO_2 and O_3 (limit values)

How?

→ Considering all sources of emissions

→ Taking into account the reduction potentials of measures as well as the associated economic, health, legal and societal challenges

→ Assessing measures in consultation with stake holders

(*) PREPA = National Plan for Reduction of Emissions of atmospheric pollutants (PREPA)
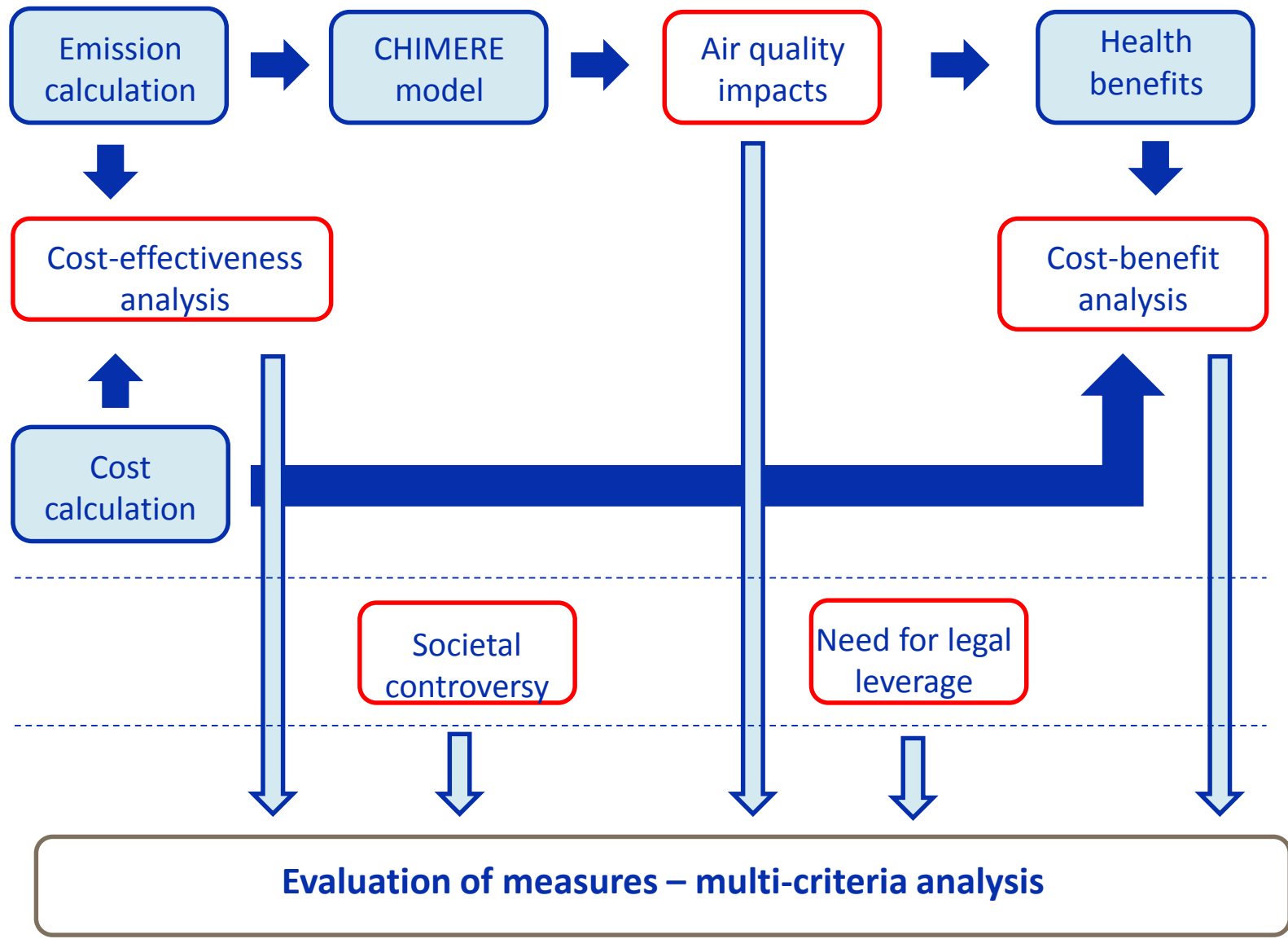Project duration: September 2014 – July 2016 – January 2017

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METHOD - SELECTION OF MEASURES TO BE ASSESSED

✓ Emissions reduction potential per activity type

✓ Existing regulation, recent regulation (which will impact the emissions in the coming future) and regulations under development

✓ Measures introduced in a new French Act on Energy Transition and Green Growth (LTECV) (new framework Act engaging France for its GHG commitments, renewable energy and pollutant emission reduction)

✓ Measures used at the local level in plans for protection of the Atmosphere (PPA)

✓ Measures have to be assessable

**50 measures selected in industry, residential, transport, agriculture have been assessed**

CiTEPA

✓ **EU directive / Gothenburg Protocol pollutants - PM$_{2.5}$, NOx, SO$_2$, NH$_3$, VOCs**

    ➤ **emission reductions** per measure expressed in absolute value (kt) in 2020 , 2030

    ➤ **emission reduction** as percentage of EU dir. emission reduction target for 2020, 2030

        ❖ *Calculated for each pollutant*

        ❖ *Percentages then summed over 5 pollutants to **appreciate the measure's impact on all 5 pollutants in one number***

✓ **Impacts on 2 groups of co-pollutants – PAH/heavy metals/benzene & GHGs**

    ➤ qualitative assessment for impact on each group (synergy, no effect, trade-off)

    ➤ transformation in only one overall qualitative discrete indicator (1 = trade-off for both groups, … 5 = synergy for both groups)

METHOD - IMPACT ON EMISSIONS - EXAMPLE

kt of NH3 reduced per year for different measures in agriculture
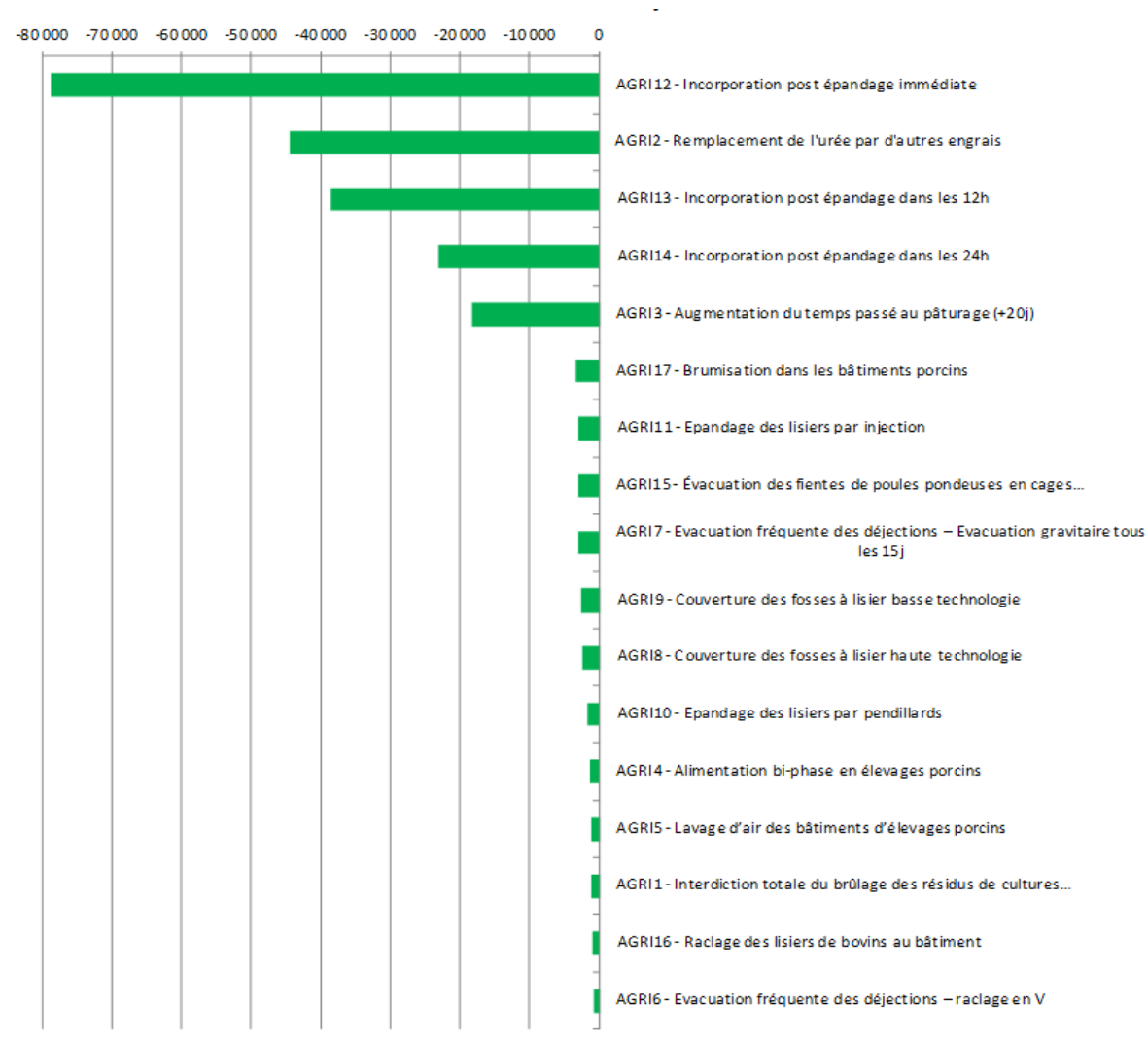
Need for very good knowledge of:
- ✓ Activities/sources
- ✓ Rate of application of measures currently and what is technically feasible

kt of pollutant reduced par year

METHOD - COST ESTIMATION OF MEASURES

Total costs

For one measure, expressed in € 2013/year,
- o Public and private investment
- o Public and private operating costs
- o Total costs to implement the measures in France

used to calculate the cost-effectiveness ratio used in the multi-criteria analysis

METHOD – RATIO COST EFFECTIVENESS OF MEASURES

✓ **Costs of measures allocated to one principal pollutant** (pollutant that motivates the reduction measure or policy)

✓ Costs of measures motivated by GHG reduction objectives set at 0

   ✓ costs of these measures are linked to energy & climate policy and not to air quality policy

✓ Cost-effectiveness expressed as costs per tonne of emission reduction of principal pollutant **(€/t principal pollutant abated)**

✓ **Cost-effectiveness ratios for different pollutants made comparable** through weighting with damage per tonne values for each pollutant (EEA, 2014) (criteria environmental effectiveness)

EEA (2014), Costs of air pollution from European industrial facilities: 2008 – 2012, EEA Technical Report No 20/2014, European Environmental Agency.

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METHOD - AIR QUALITY IMPACT

Impact of measure on emissions
% reduction associated with measure M / total national emissions

> 3% for at least one pollutant (14 measures)

< 3% for all pollutants

Emission data: national data for the measure, spatialized based on the geographic distribution of emissions in INS (National spatialized inventory)

2010 meteorological data

CHIMERE

Initial and boundary conditions

1) **identification** of a measure simulated with CHIMERE concerning comparable activity sectors (comparable geographic impact)

2) **linearization** of impacts simulated with CHIMERE, proportionally to the ratio between the emissions of this measure and those of measure M

Concentrations estimated in each grid cell of the model (7×7 km) at an hourly resolution for a complete year => AQ maps, calculation of population exposure
Calculation of indicator for air quality limit value exceedances = PM daily, NO_2 & O_3 hourly

METHOD – Health impacts and benefits

- **Calculation based on** :

  ➢ population exposure to pollutants (obtained through CHIMERE modelling)

  ➢ concentration-response functions

- **Monetization of avoided health effects** (= benefits) per measure using tangible costs (e.g. for medical treatment) and intangible costs (e.g. for life years lost)

- Presentation of results for core estimate of **health benefits** (YOLL, median)

Methodology according to WHO 2014, HRAPIE project (Health Risks of Air Pollution in Europe)

Translated into the ARP-FR model

- **Presentation of net benefits**

  - ➢ for each measure : monetized health benefits minus costs, in € 2013

  - ➢ preferable to benefit/cost ratio as for some measures benefits = 0 and costs < 0 (no impact on air quality, financial savings)

  - ➢ the higher the value of this criterion, the higher the benefit to society

- **Identification of a societal acceptability level for each measure**
  - ➤ 1-low acceptability
  - ➤ 2 -moderate acceptability
  - ➤ 3-high acceptability

Specific literature survey, consultation of experts and stakeholders

- **Legal leverage (legal analysis of measures and facility to implement)**
  - ➤ Level 1 - strong need for leverage - the measure requires the development of regulatory leverage to avoid it working counter to what is foreseen in existing regulatory texts
  - ➤ Level 2 - moderate need for leverage - the measure requires regulatory adaptations but there is no major risk of conflict with existing regulation
  - ➤ Level 3 - no need for leverage - the measure requires no update of regulation

Method - Multi-criteria Assessment

Criteria	Scale
Environmental impacts	
C_{env1}: Emission reduction impact (relative to NEC "ceiling")	Decreasing, percentage
C_{env2}: Air quality impact - impact on number of exceedances	Continuous, increasing, values < 0 or > 0
C_{co}: Impact on co-pollutants (2 groups: a) GHGs, b) heavy metals, PAH, benzene)	Discrete, increasing, 5 levels, 5 being the most favourable (1 = trade-off for both groups, … 5 = synergy for both groups)
Economic efficiency	
C_{eco1}: Cost-effectiveness ratio, weighted by damage costs	Continuous, decreasing
C_{eco2}: Cost-benefit assessment (net benefits)	Increasing, expressed in €
Acceptability	
C_{acc}: Social acceptability and level of controversy	Increasing, qualitative scale, 3 levels, 1=low, 2=moderate, 3= high acceptability
C_{jur}: Legal acceptability and need for regulatory leverage	Increasing, qualitative scale, 3 levels, 1=strong, 2=moderate, 3= low need for leverage

Juri-Socia

1	●		
2			
3			
4			

4   3   2   1   **Envi-Eco**
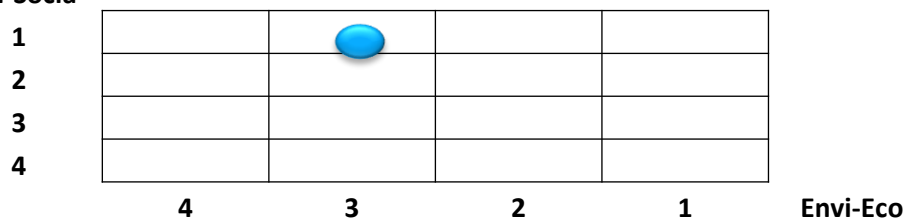
- Method : outranking, multi-criteria assessment based on an aggregation procedure with the Tool: ELECTRE III
- 2 partial multi-criteria analyses - ranking over two dimensions
  - Social & legal acceptability
  - Environmental & economic efficiency
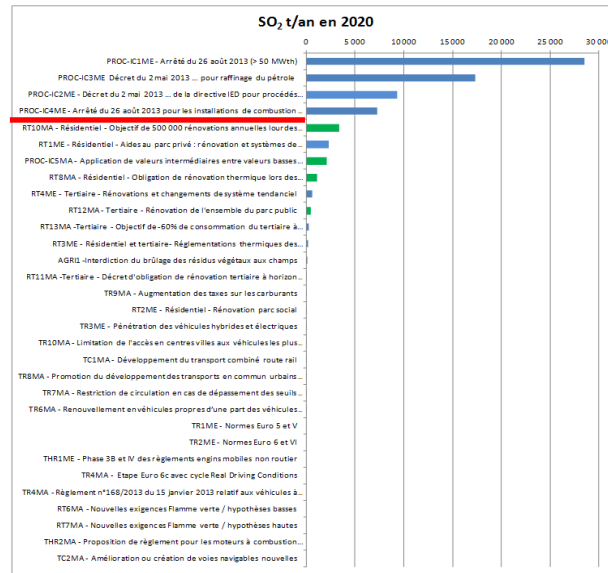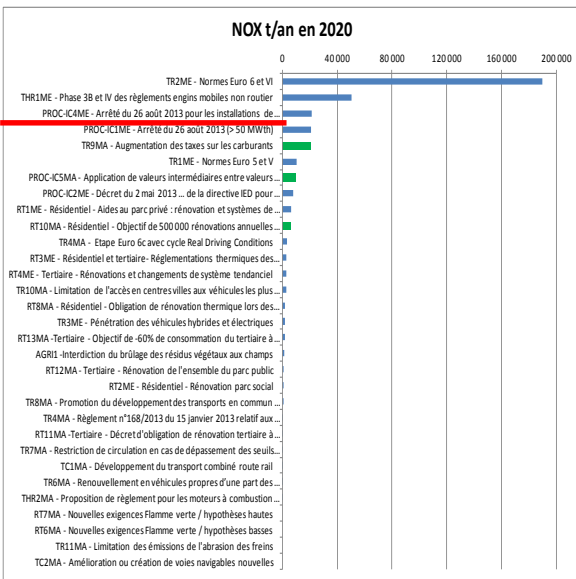
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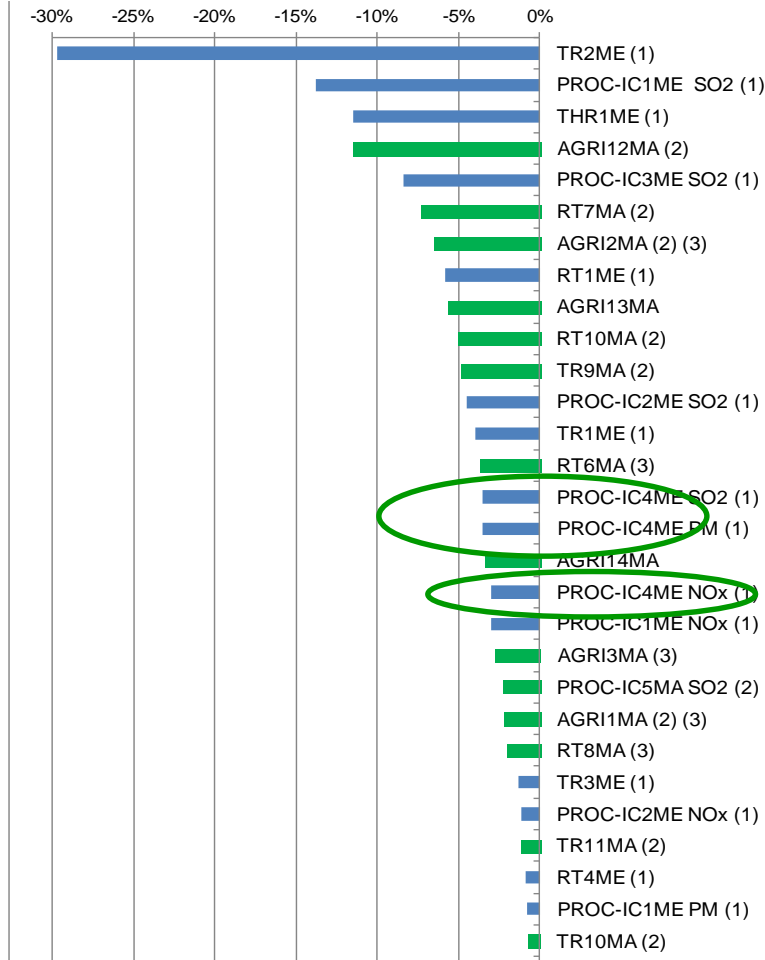Emission reduction as percentage of NEC emission reduction target *

Dates for compliance with new emission limit values from 2016 to 2018
Impact on SO_2 , NOx and PM

PROC-IC4ME

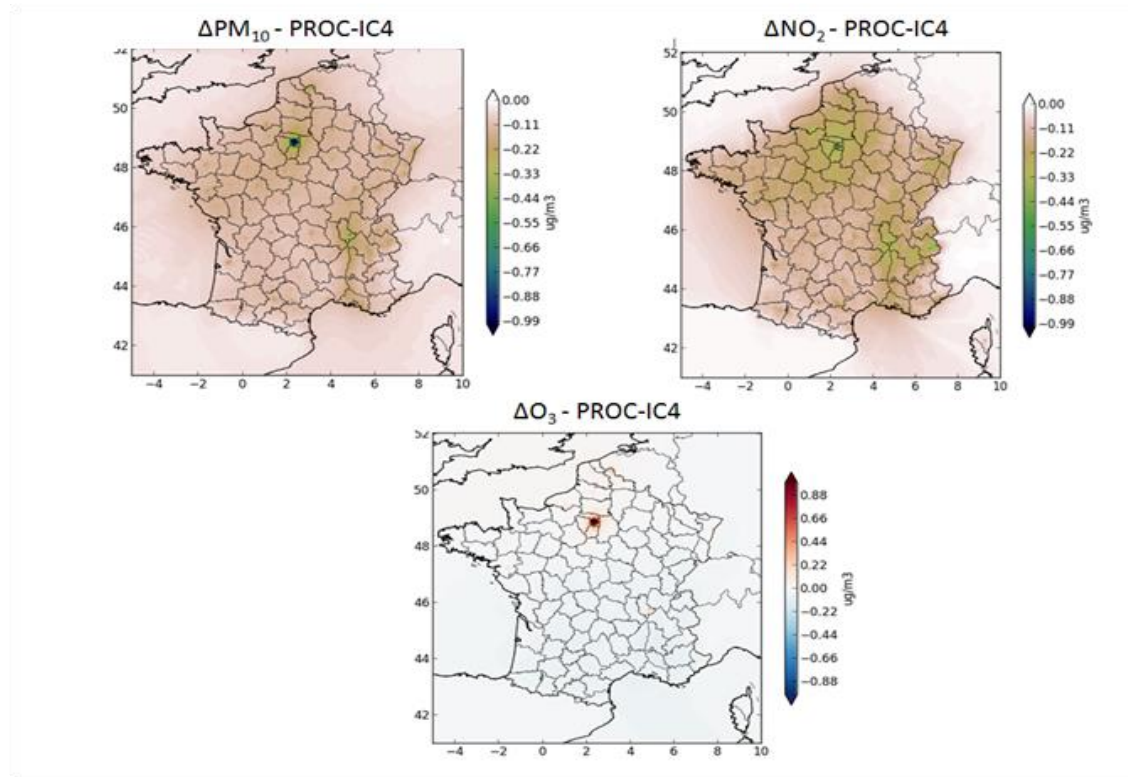*Potential of emission reduction in 2020 (kt/year)*

*the higher the value of this criterion, the higher the measure has an important role in 2020 compared to the Gothenburg protocol targets
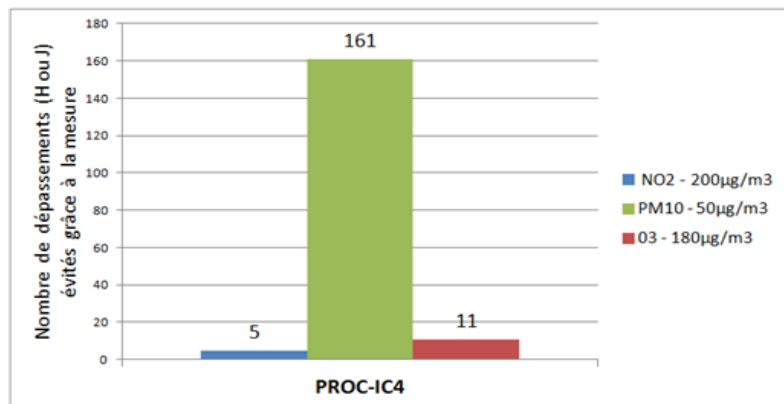
Significant impact on PM_{10} and NO_2 concentrations

Impacts on average annual concentrations in 2020 due to the measure (compared to a situation without the measure)
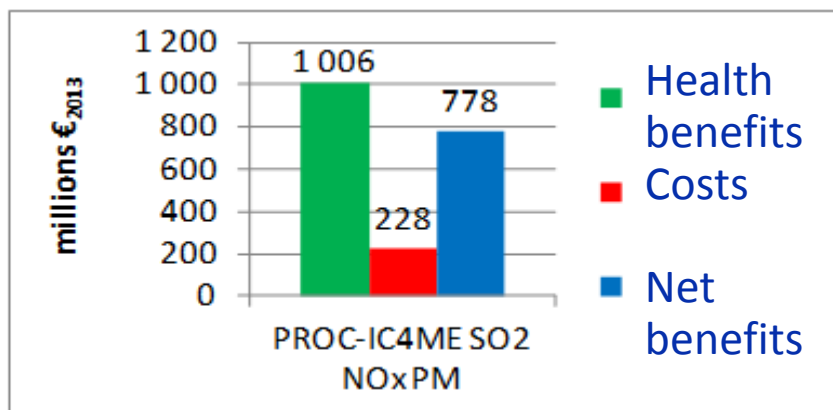
Significant reduction in the exceedances of PM_{10} daily average limit value (50 µg/m³)

Number of exceedances of the daily mean value for PM10 and information and recommendation values for NO_2 and O_3 (hourly value) avoided by the measure

Costs of the measure lower than benefits
Large net benefit

Performance benefit costs

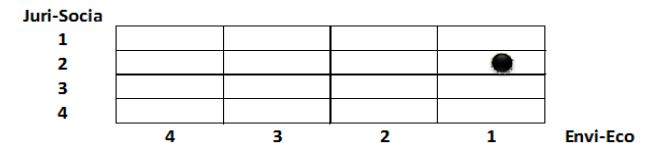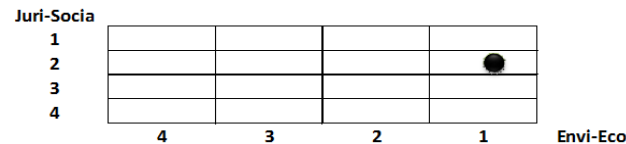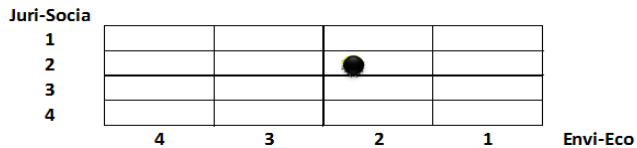|	
Legal leverage	No special needs (3)
Level controversy and acceptability	Controversy noted (1) but less correct today as the act has been implemented
Operationnality in 2020	The deadlines for compliance ranges from 2016 and 2018 according to size plants and fuels used. The reduction techniques are available

SO$_2$ NOx   PM$_{10}$

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CONCLUSIONS

- Decision support project providing stakeholders and decision makers with comprehensive information

- **In depth knowledge of sectors required (high tier method of inventories necessary)**

- Comprehensive assessment of emission reduction strategies and individual measures according to multiple evaluation criteria

- Transparent presentation of evaluation results

  - ➢ Hypotheses communicated

  - ➢ Criteria ranking results presented individually

  - ➢ Overall multi-criteria results presented for two dimensions

- Stakeholder meetings confronting assessment results to stakeholder views

- Final decision of measures to be included into the National Air Pollutant Emission Reduction Plan lies with the Environment Ministry

- PREPA decree to be published soon

THANK YOU FOR YOUR ATTENTION!

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Thanks also to the
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=> All documents related to the PREPA (study & legal text) published at:
http://www.developpement-durable.gouv.fr/politiques-publiques-reduire-pollution-lair

EVOLUTION OF EMISSIONS

NOx

Legend:
- 2020 PREPA sans mesures ME évaluées
- 2020 PREPA avec mesures ME évaluées
- 2020 PREPA avec mesures existantes évaluées + MA haut
- Protocole 2020
- DIrective 2030, compromis