Italian Agency for New Technology
Energy and the Environment

Harmonization of national inventory and projections of multi-pollutant emission scenarios

The Italian experience within the European context and the UN-ECE Convention on Long Range Transboundary Air Pollution

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Overview

1. Introduction
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3. Integrated Assessment Models
4. Harmonization between Inventory and Model emission calculations
5. Emission scenarios in Italy, within the UN-ECE and the EU framework

Introduction

The main objective of this work is to emphasize the need of high quality emission inventories and projections, to be achieved by analyses carried out jointly by experts in inventories and experts in modelling

The joint analysis may result in mutual quality improvement for inventories and projections

Inventories and projections ultimately determine the compliance with the targets in enviromental policies

The European and Italian contexts

The EU Community's Sixth Environmental Action Programme (*6th E.A.P.*) claims to achieve:

"*levels of air quality that do not give rise to significant negative impacts on, and risks to human health and the environment*"

That means in scientific terms:

No exceedance of Critical Loads & Levels for the environment and Risk Assessment and Cost-Benefit Analysis for minimum impact on human health

The European and Italian contexts (2)

The *6th EAP* ultimate objectives are pursued by extensive emission/impact scenario analyses underpinning the policy development (TSPA, Thematic Strategy on Air Pollution)

Similar objectives and methodology are adopted under the UN-ECE Convention on Long Range Transboundary Air Pollution (CLRTAP)

The scenario analyses are carried out by Integrated Assessment Models (RAINS/GAINS Methodology)

The European and Italian contexts (3)

In the frame of the EU Directive ***2001/81/EC*** **(NEC)** and for the purposes of the ***Gothenburg Protocol*** *under* the ***UN-ECE-LRTAP*** Convention on Long Range Transboundary Air Pollution (***LRTAP***)….

At national level, in the frame of the techno-scientific support to the Italian Ministry for the Environment, and Local Authorities, for environment policy development….

ENEA, in cooperation with other national agencies (***APAT***) and experts, develops emission scenarios and environment/health impact analyses.

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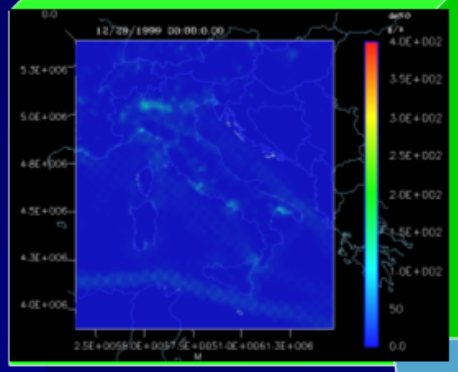
Integrated Assessment Modelling Tool

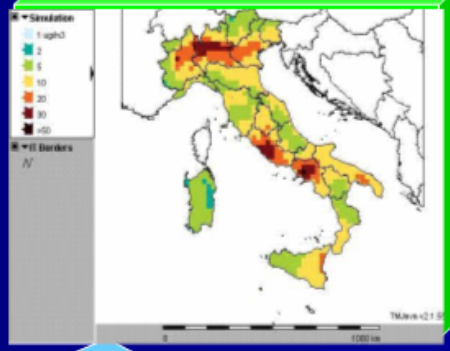
MINNI Modelling System

Emission Projections

AMS-Italia



RAINS-Italy



Atmospheric Transfer Matrices

AMS: *Atmospheric Modelling System*

RAINS: *Regional Acidification INformation Simulation*

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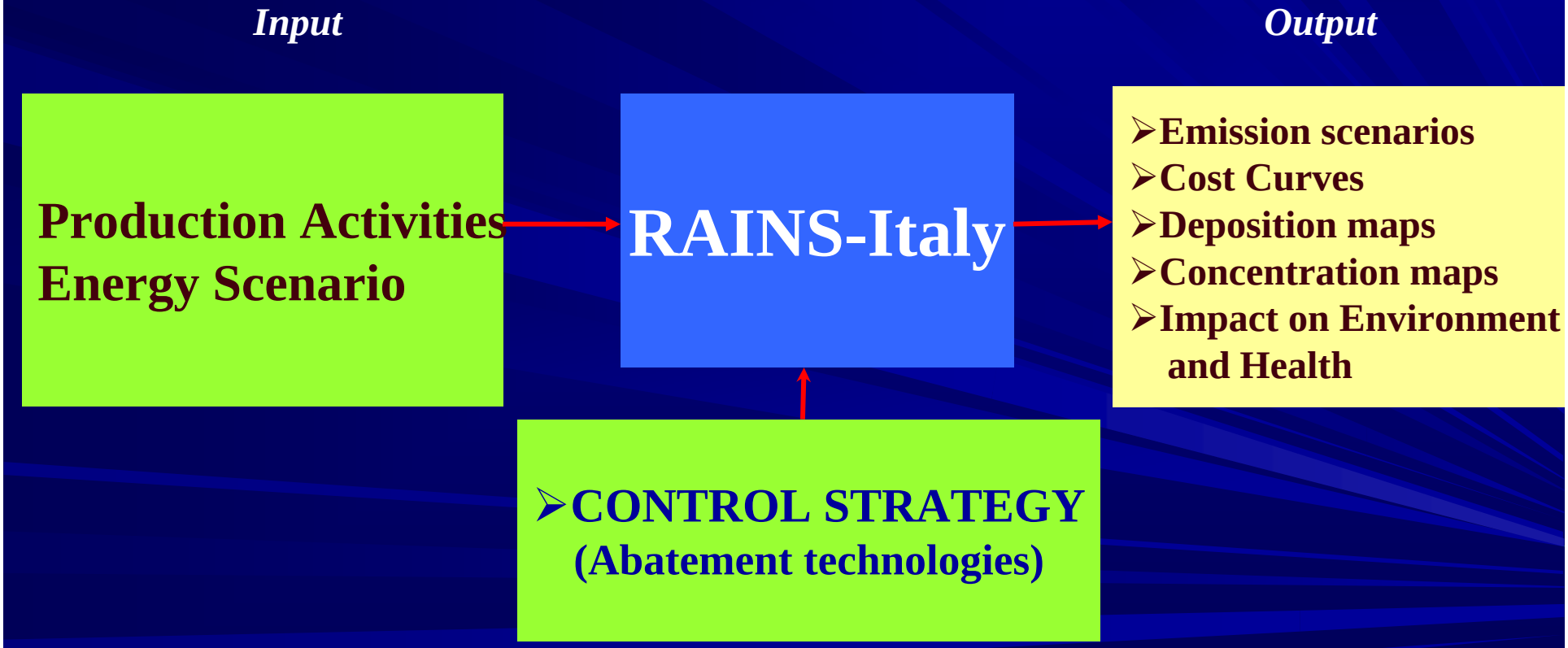
Rains-Italy Model

Simplified flow chart



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Harmonization between Inventory and Model calculations

Harmonization means:

Emissions calculated, at the reference year (2000), in Inventory and in the Model analysis, must be consistent

The need for harmonization is due to:

The Model must be validated through comparison with an independent reference.

The robustness of the model projections is strictly related with the consistency, within an acceptable uncertainty margin, between inventory and model calculation.

The harmonization is a common practice in the frame of the EU and UN-ECE analyses, for comparison purposes, the harmonization is therefore opportune.

Harmonization Methodology: Differences in Emission Calculation

Emission Calculation in the RAINS-Italy Model

$$E = \Sigma_j \Sigma_k \, Act_j * Ef_j * (1 - \eta_{jk}) * Af_{jk}$$

Act_j = *Activity level in sector j (e.g. fuel cons.)*

Ef_j = *Unabated Emission Factor per unit of activity level, in sector j*

η_{jk} = *Removal efficiency of techonology k, in sector j*

$(1 - \eta_{jk}) * Af_{jk}$ = *Term for residual emissions after abatement, by technology k in sector j*

Harmonization Methodology: Differences in Emission Calculation

Emission Calculation in Inventory:

$$E_j = Act_j * EF_j$$

EF_j = Total Emission Factor (abatement included) in sector j

Act_j = *Activity level in sector j*

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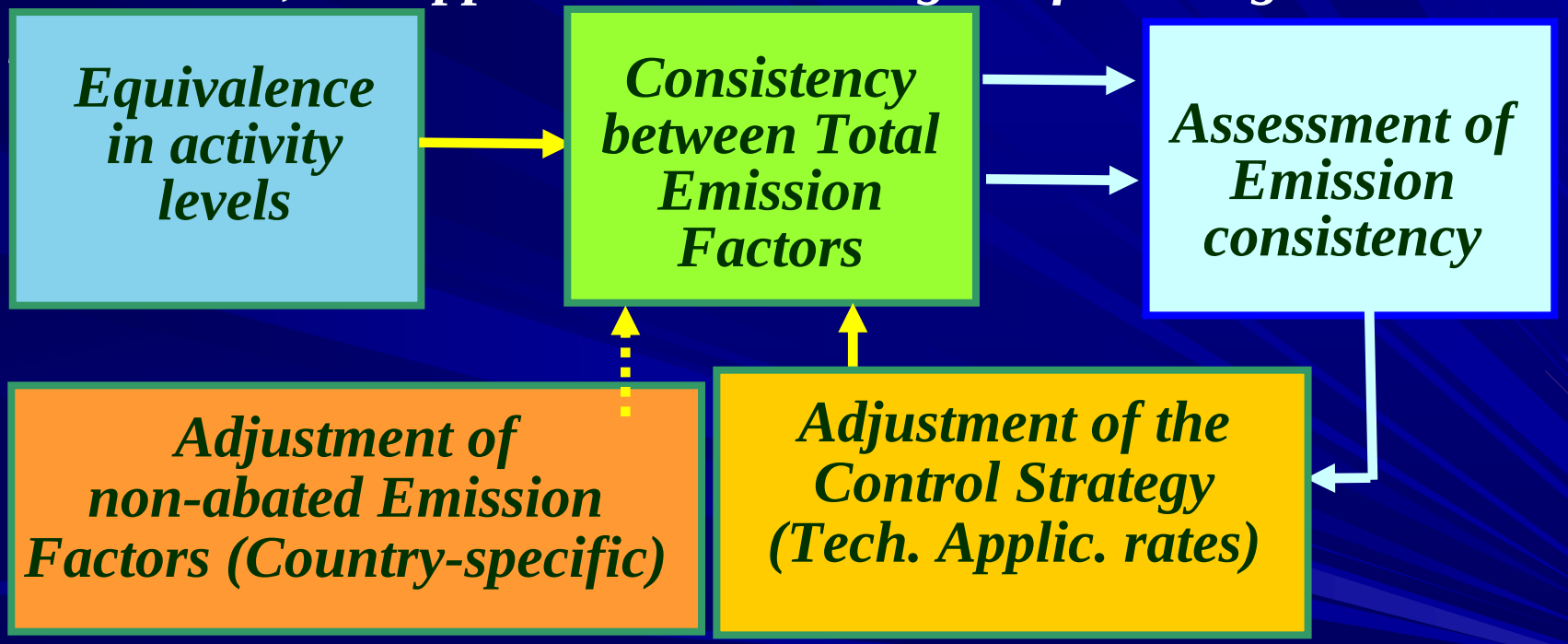
Harmonization Process

The emission gap, between inventory and model estimations, are approached according the following



Applied to those sectors with higher mismatches, up to an acceptable gap is achieved (usually <5~6% on total emissions)

Harmonization Methodology (1)

Differences between Inventory and Model methodology

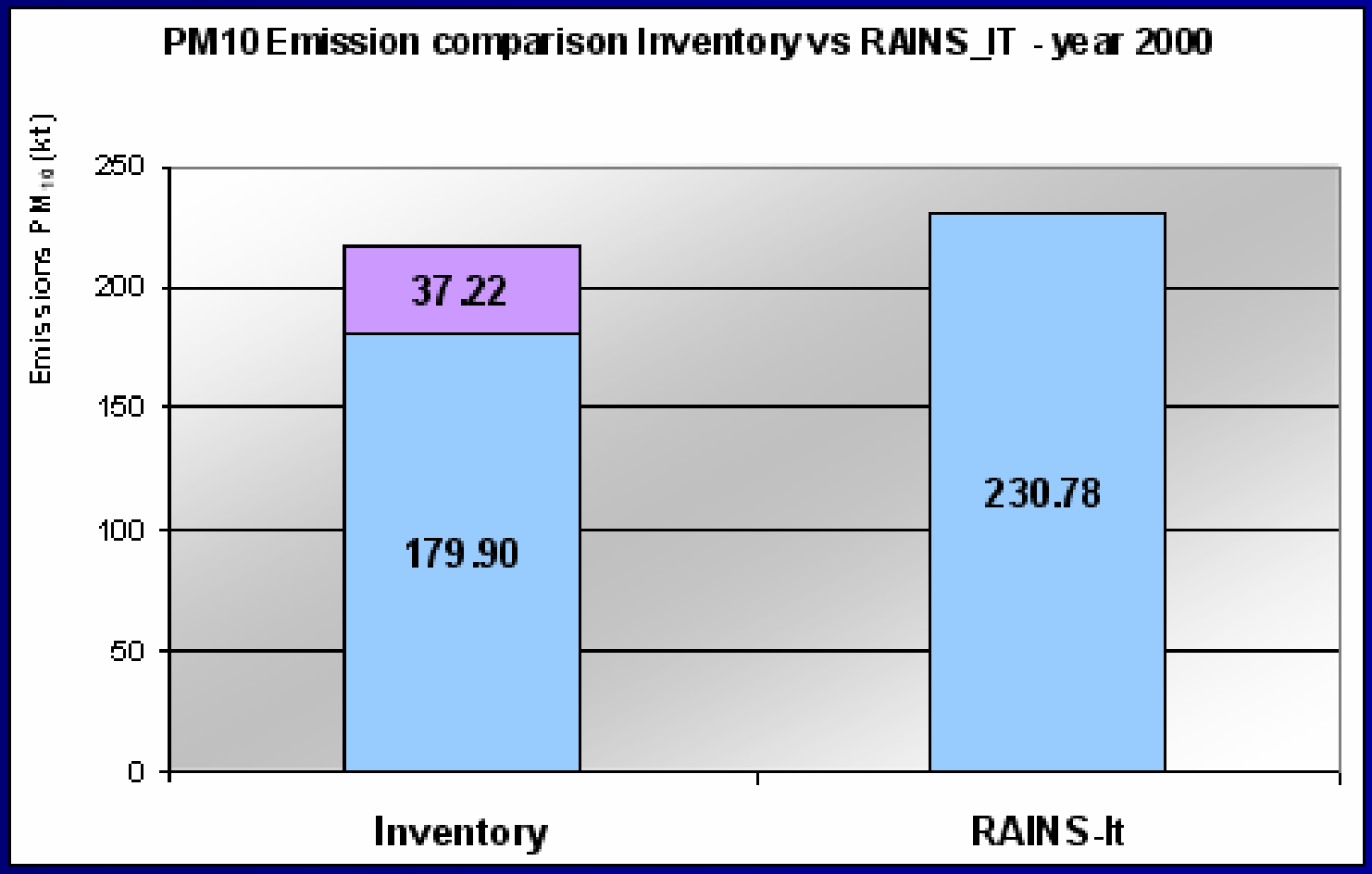
*1) RAINS sectors have a **higher level of aggregation** with respect the **SNAP Codes** and very often there is no **correspondence** (e.g. INDUSTRIAL COMBUSTION sector: 2 sub-sectors in RAINS for the whole SNAP03 code).*

*2) Some **sources** are considered in RAINS and **NOT** in the Inventory (or viceversa).*

Livestock emissions: rabbits were considered in the national inventory but not in the RAINS-IT model

Harmonization Methodology (2)

Differences between Inventory and Model methodology



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Harmonization Methodology (2)

Differences between Inventory and Model methodology

Sources NOT included in the PM_{10} Inventory (kton):

Handling & Storage	*1,8*
Agriculture	*14,9*
Small Industry	*9,1*
Other (BBQ, Constr., Firew.)	
Smoking)	*11,2*
Total	*37,2*
Invent.+Sources NOT incl.	*217,12*
Difference (5,9%)	*13,66*

Harmonization Methodology (3)

Differences between Inventory and Model methodology

3) In some cases for the same source a different activity level is considered in the RAINS model with respect the national inventory *(ex. the DRY CLEANING sector for NMVOC emission calculation: the RAINS activity level is the ktons of clothes while the national inventory activity level is the number of dry cleaning machines).*

4) In few cases RAINS sectors have a higher level of details with respect the SNAP Codes and a compromise is not always easy achievable *(ex. the PRINTING sector for NMVOC emission calculation).*

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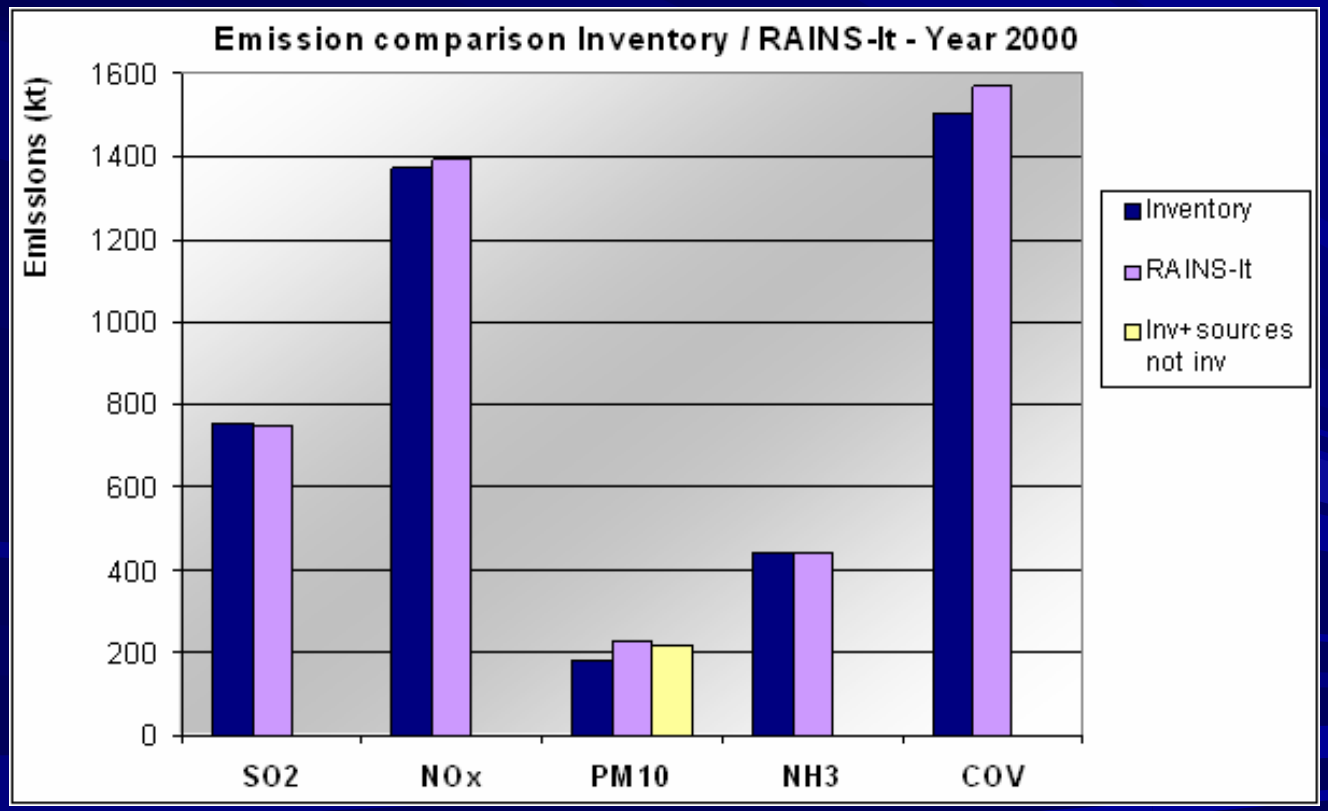
Harmonization results for Italy at the year 2000

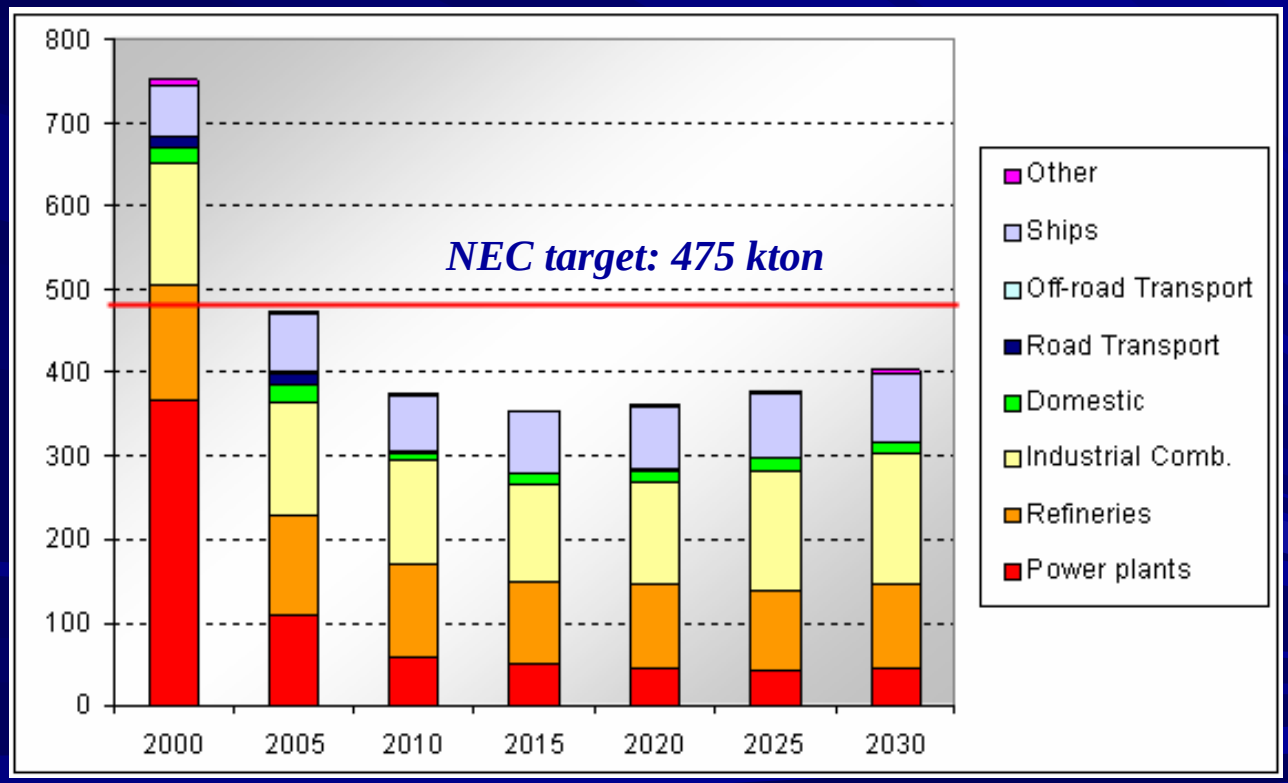
Differences in emissions between Inventory and Model calculations



Max gap
(PM_{10}) = 5,9 %

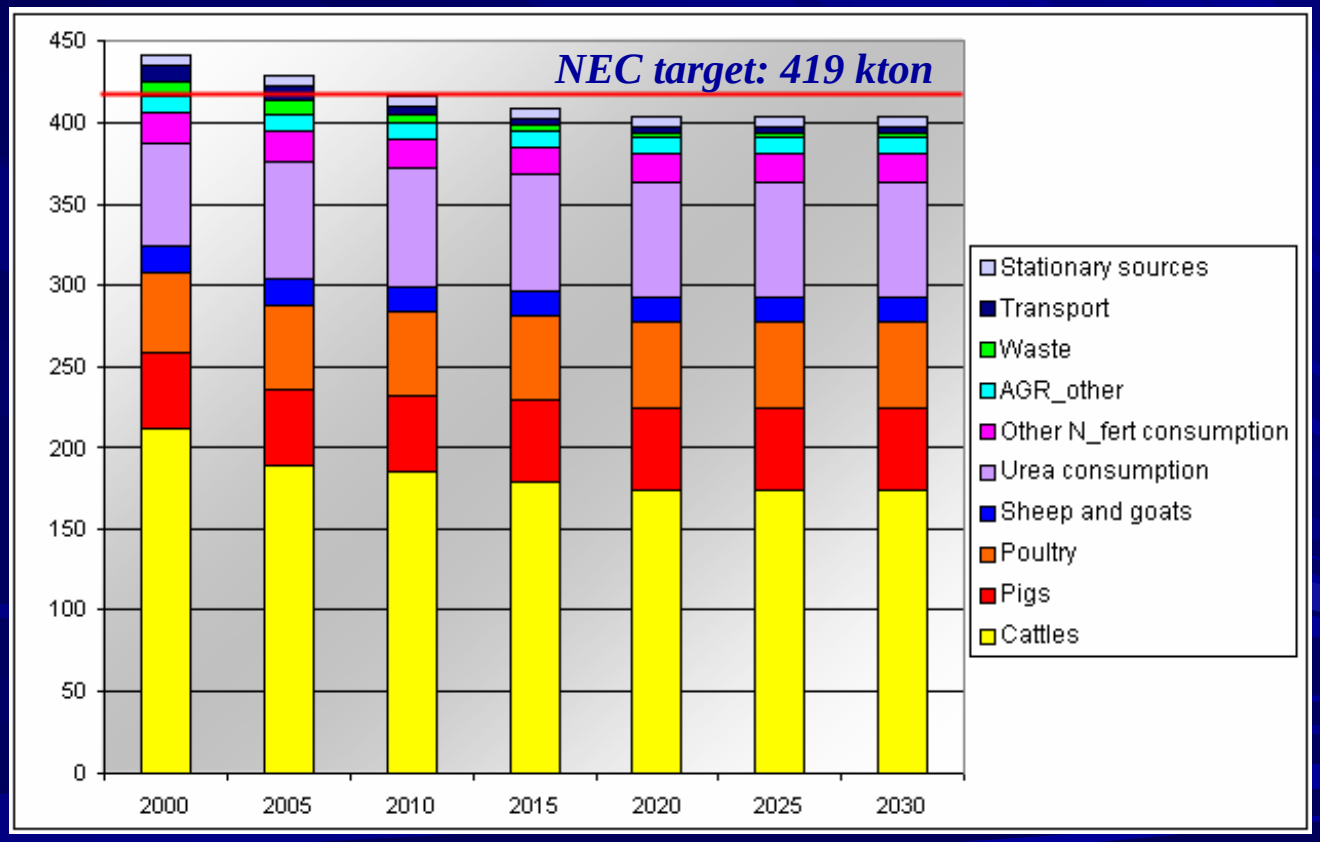
NEC Directive Review Process
National Emission Scenarios by RAINS-IT

SO_2 CLE Emission Scenario (kt/year)



NEC Directive Review Process
National Emission Scenarios by RAINS-IT

NH_3 CLE Emission Scenario (kt/year)



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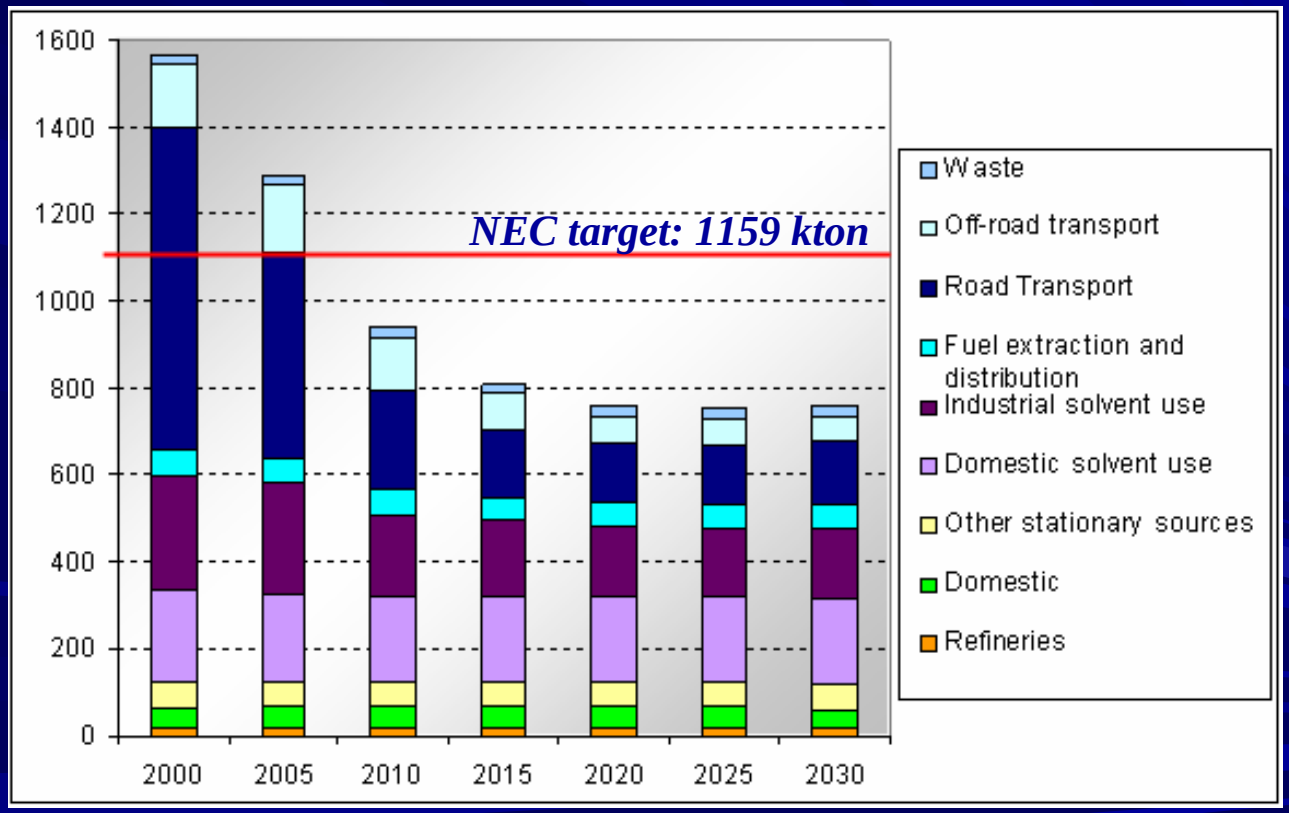
NEC Directive Review Process
National Emission Scenarios by RAINS-IT

VOC CLE Emission Scenario (kt/year)



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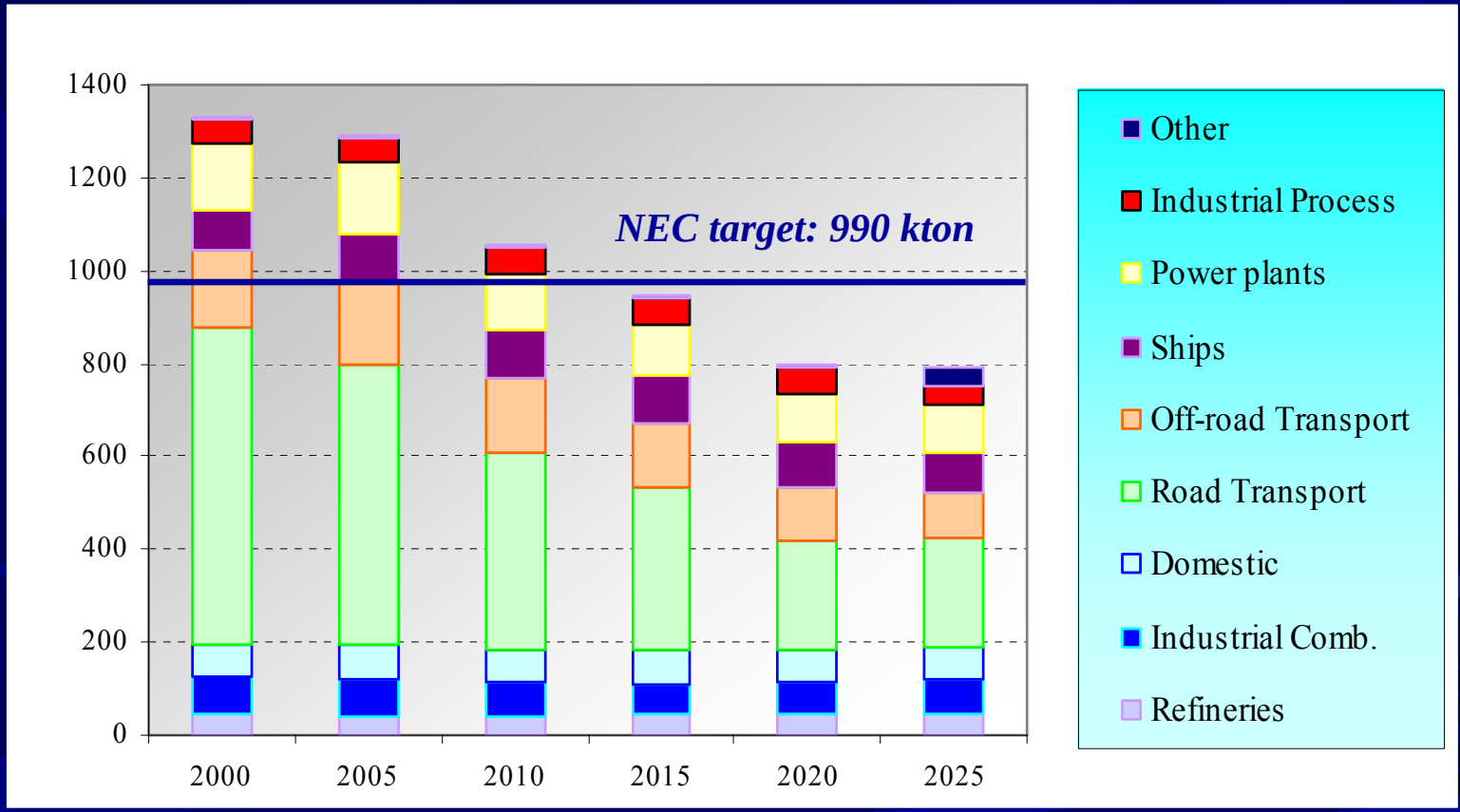
NEC Directive Review Process
National Emission Scenarios by RAINS-IT

NO_x CLE Emission Scenario (kt/year)



Conclusions (1)

1) *The harmonization between Inventory and Model emission calculations is needed for the purposes of the international and national policy analyses, to ultimately increase the robustness of the projections*

2) *Methodological differences exist between Inventory and Model calculations (e.g. CORINAIR and RAINS). A careful comparison analysis, sector by sector, helps to achieve an acceptable level of consistency.*

3) *The comparison process provides useful indications to improve the quality of both the Inventory and the Model output.*

Conclusions (2)

4) *Once the harmonization is successfully completed, the scenario analyses, based upon emission projections, are developed for the assessment of the compliance with the established environment/health targets*

5) *The Emission Projection Analysis, in Italy, shows a compliance with the NEC provisions for SO_2, NH_3, VOC, at 2010, and highlights possible incompliance for NO_x, pending issues concerning the improved knowledge of calculation parameters,*

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Thank you for your attention

More info on the Italian Integarted Assessment Modelling Project at:

http://www.minni.org

http://www.minni.org/rains/rains_italia.htm (*English*)