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Energy and the Environment

The use of bio-mass: synergies and trade-offs between Climate Change and Air Pollution, in Italy

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

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Overview

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Introduction

Bio-masses have recently gained an important role, at international and national level, in the European Union also, as a relevant option to combat the Climate Change.

In Italy, energy experts have developed energy projections, assuming an increasing share of bio-mass, according to the requests from the EU Commission

This study is aimed at exploring the potential effects of increased use of bio-mass, in Italy, in terms of emissions of CO2 and other air pollutants (NOx, PM_{10}), highlighting sinergies and trade offs.

The EU context

At the European Coucil Meeting, held in Brussels on March, 8-9, 2007, Head of States and Government have expressed the will to pursue the following targets, as EU, within 2020:

1) 20% reduction in CO2 emissions
2) 20% share of renewable energies in overall EU energy consumptions
3) Increase in energy efficiency to achieve 20% saving in overall EU energy consumptions
4) 10% share of biofuels in overall EU Transport sector

The UN-ECE context

In the frame of the UN-ECE Convention on Long Range Transboundary Air Pollution (LRTAP), the Gothenburg Protocol is under revision to establish new stricter ceilings on emissions of SOx, NOx, NH3, VOC and (new) on PM

The new emission limits would be the result of modelling analyses, based upon the Integrated Approach and aimed at furtehr reducing the impact on the environment and the human health

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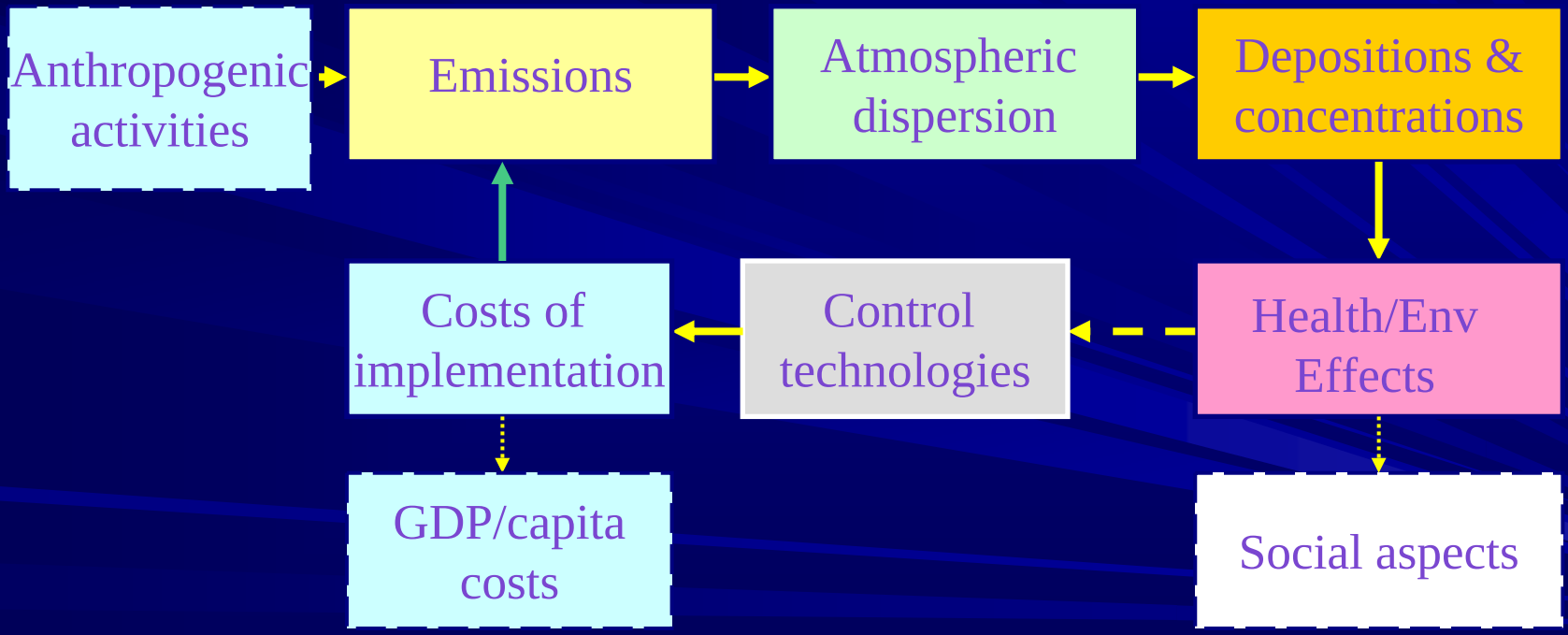
The Integrated Assessment Modelling

At EU level, as well as at national level, in several Member States, the analyses on the emission projections and their impact on the environment and human health are based upon the the integrated approach:



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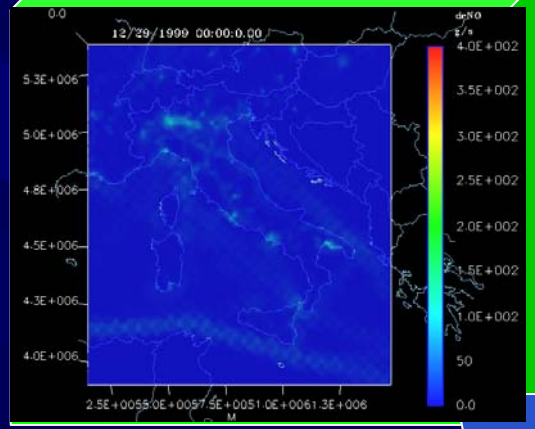
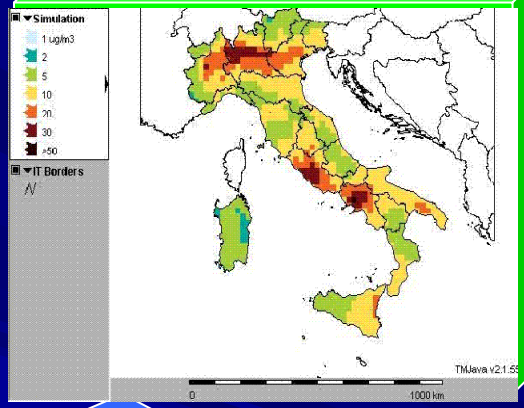
Integrated Assessment Modelling Tool

Emission Projections

AMS-Italia



GAINS-Italy



Atmospheric Transfer Matrices

AMS: ***Atmospheric Modelling System***

GAINS: ***Greenhouse Gas and Air Pollution Interactions and Synergies***

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GAINS-Italy Model

Simplified flow chart

Input

Production Activities
Energy Scenario

GAINS-Italy

Output

- **Emission scenarios**
- **Cost Analysis**
- **Deposition maps**
- **Concentration maps**
- **Impact on Environment and Health**

- **CONTROL STRATEGY**
  (Abatement technology Penetration)

Analysis assumptions

Two emission sceanrios are compared. The Baseline Scenario (Tend_02) and the Alternative Scenario

The Baseline Scenario takes into account the b.a.u. energy projections and the Abatement Control Technologies, as in the Current Legislation (CLE)

The Alternative Scenario takes into account lower coal share, higher share of renewable energies, specifically +10% bio-mass, increased energy efficiency in engines and appliances. Developed to pursue the objectives, set at international level. The penetration of the abatement technologies is the same as in the baseline scenario .

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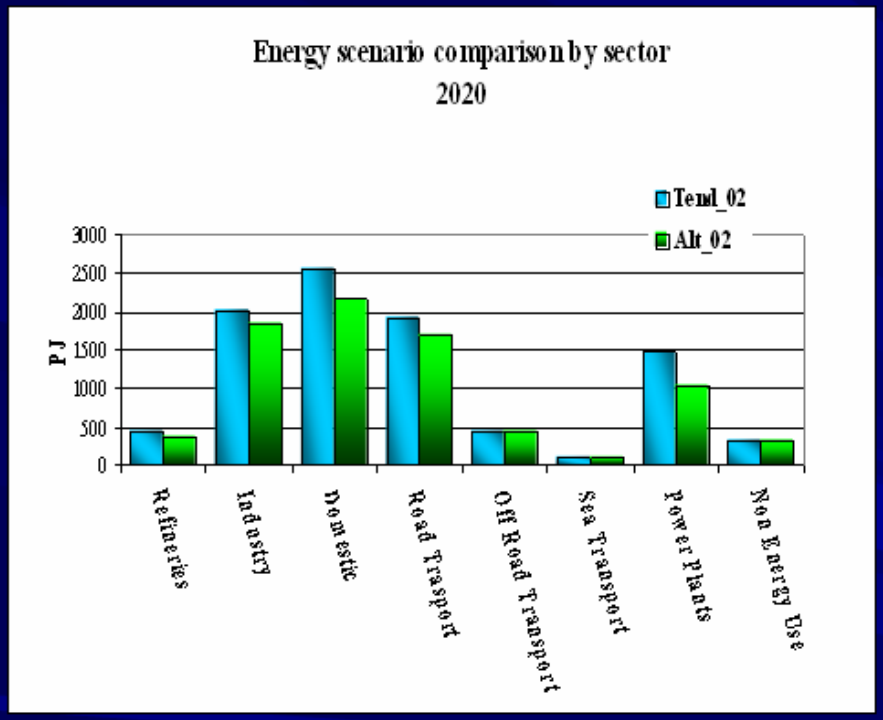
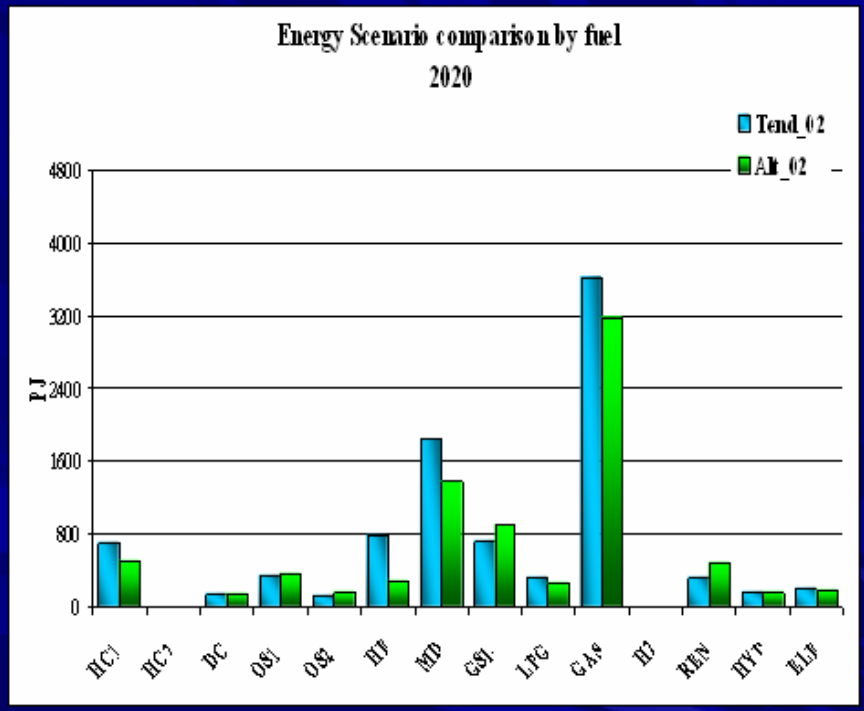
Energy Input Data

Energy Scenario Comparison (2020)



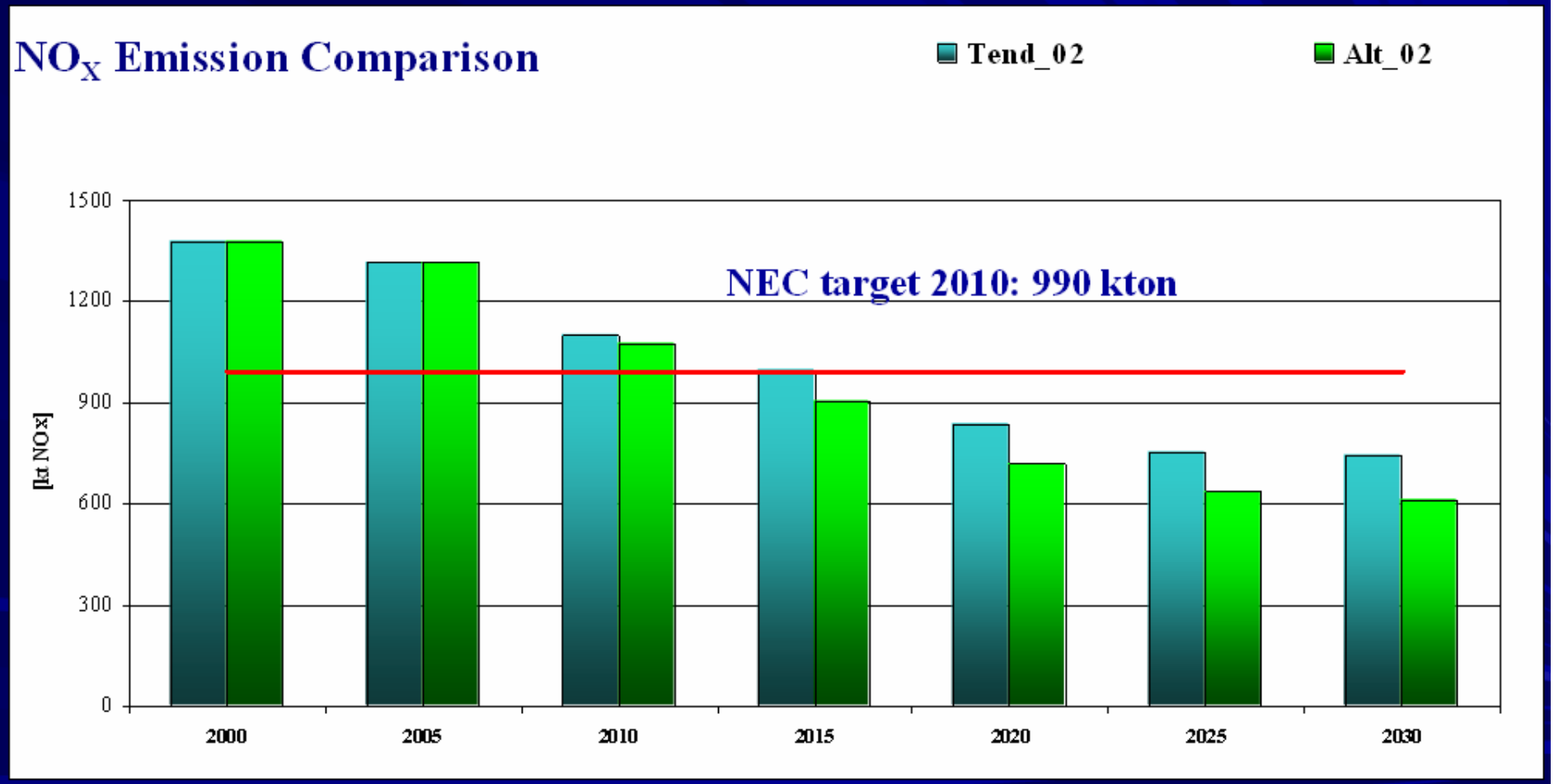


Energy consumption by sector

Energy consumption by fuel

Analysis Results

NOx Emission comparison (total, kt)



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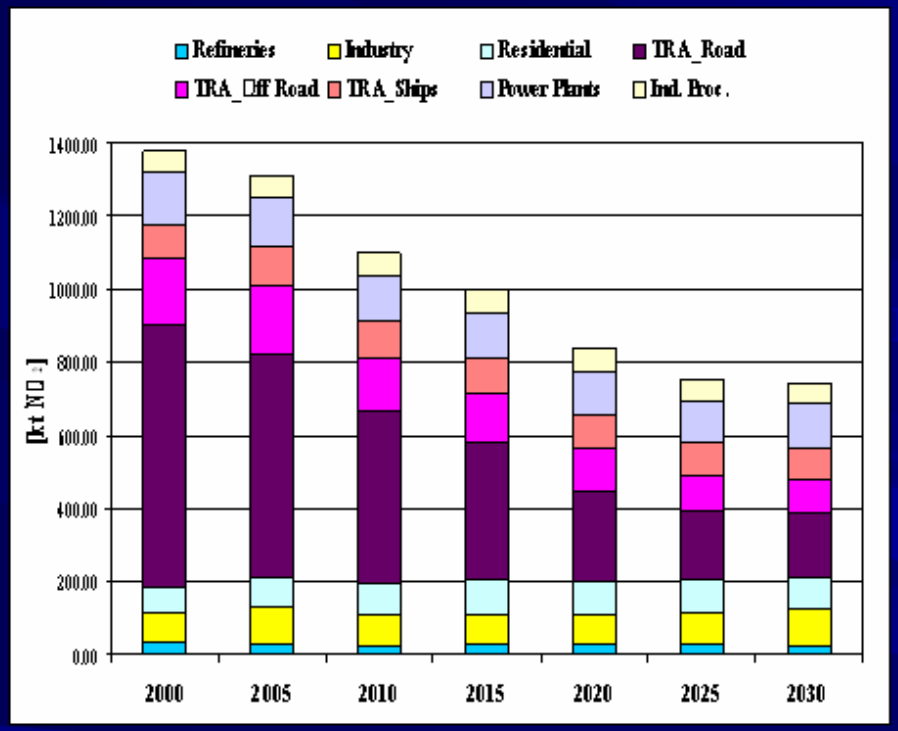
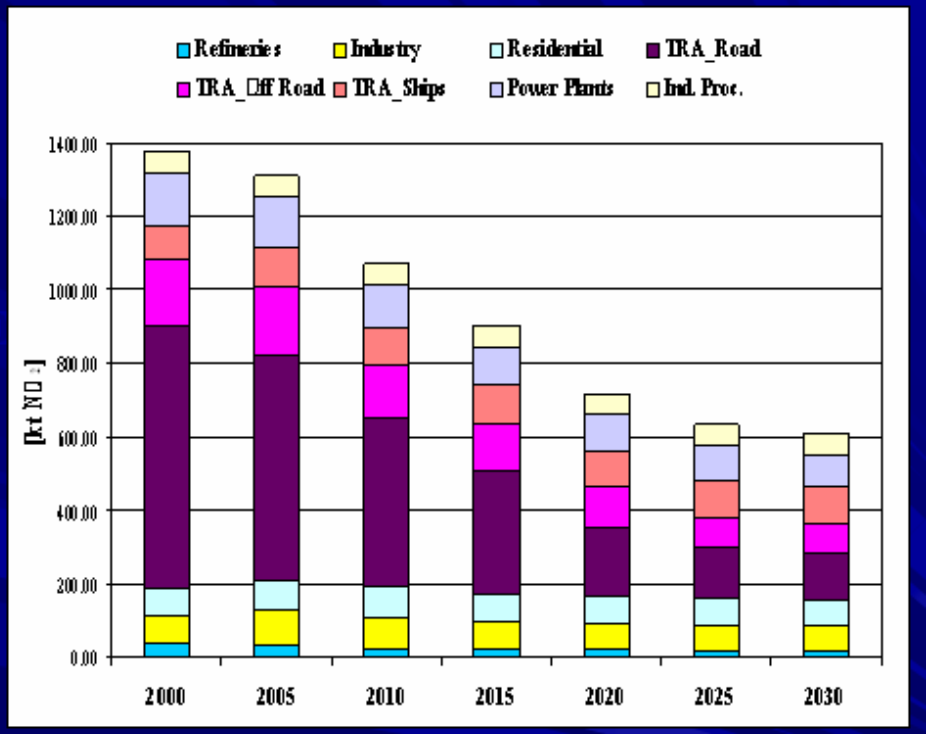
Analysis Results

NOx Emission Comparison by sector (kt)



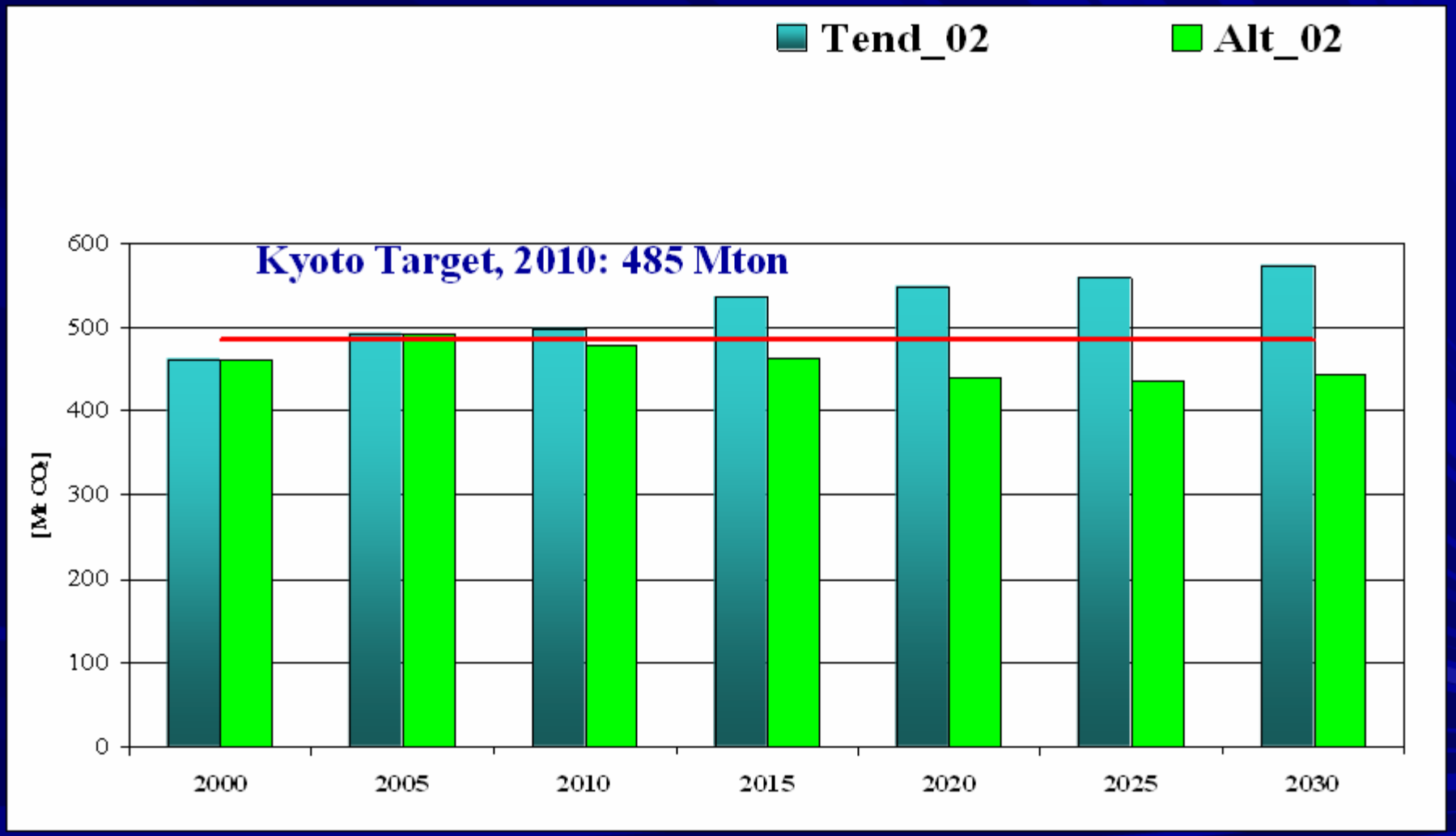
Baseline



Alternative

Analysis Results

CO_2 Emission comparison, total (Mt)



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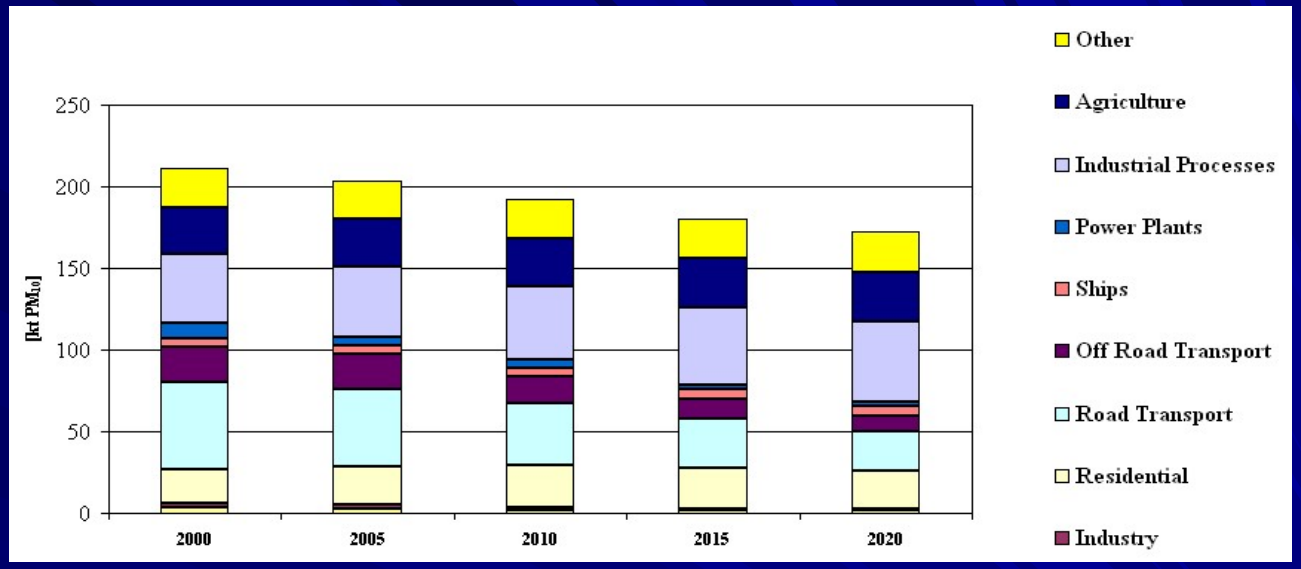
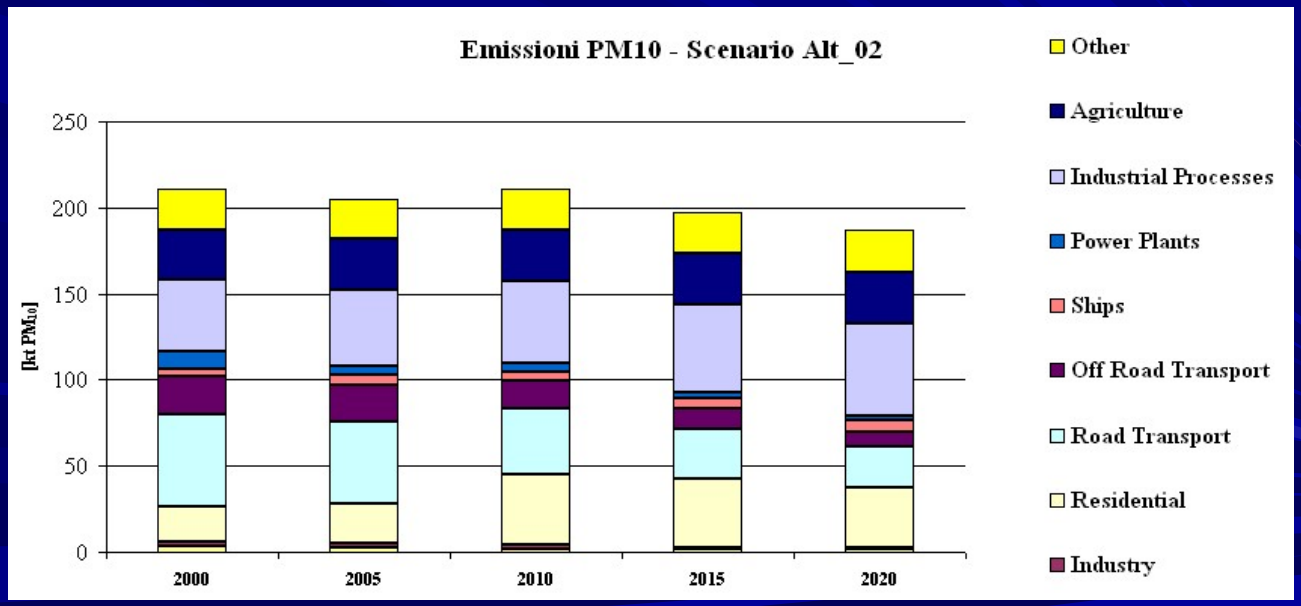
PM Emission Comparison

Baseline



Alternative



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PM Emission Effects on Human Health and the Environment

The Thematic Strategy on Air Pollution (TSAP, doc COM(2005) 446 final) developed by the European Commission, establishes the overall targets in EU

1. Reduce health impact from particulate matter by 47 %;
2. Reduce acute mortality from ozone by 10 %;
3. Reduce acidification in ecosystem forest areas by 74%;
4. Reduce acidification in ecosystem freshwaters areas by 39 %;
5. Reduce eutrophication ecosystem areas by 43 %
6. Reduce ozone impact on forest areas by 15 %.

In order to achieve the target # 1 primary PM2,5 emissions should be reduced by 59%, in overall EU, with respect the year 2000

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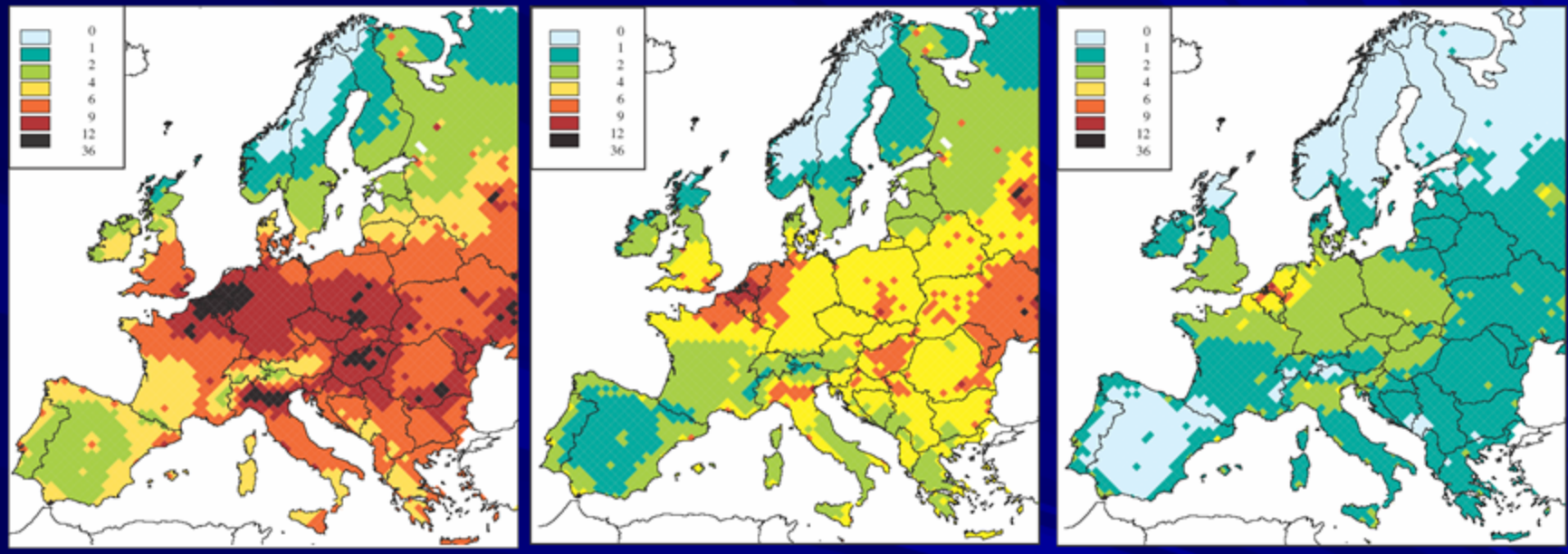
PM Emission Effects on Human health

Improvement in Life Expectancy Reduction (TSAP)



2000 | 2020 Current legislation | 2020 Max. feas. reductions

Loss in average statistical life expectancy due to identified anthropogenic PM2.5. Calculations for 1997 meteorology . Provisional estimates with generic assumption on urban increment of PM (from IIASA official documents)

Conclusions

1) In Italty, biomass plays an increasing role in energy scenarios, due to its intrinsic advantage in reducing GHG emissions

2) While an increased share of bio-mass in energy scenarios contributes to achieve the desired GHG reduction targets (Kyoto Protocol) it results in higher PM emissions

3) As a consequence, an increase in PM emissions causes higher impact on human health, due to people exposure to higher $PM_{2,5}$ concentrations.

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Conclusions (2)

4) Energy scenarios based upon higher shares of biomass could ultimately hamper, in Italy, the achievement of the targets envisaged by the EU Commission and by UN-ECE LRTAP Convention, concerning the reduction of $PM_{2,5}$ impact on human health

5) In Italy, the increased use of biomass is mainly due to increase in wood burning in stoves, not equipped with advanced abatement technology

6) In order to limit the trade off effect of wood burning, while keeping the positive effects on GHGs, a faster penetration, of the best abatement technologies, in Italy, would be encouraged by adequate policy measures, in the residential sector (e.g. through fiscal subsidies).

Thank you for your attention !

More info on the Italian Integrated Assessment Modelling Project at:

http://www.minni.org

http://www.minni.org/rains/rains_italia.htm

More info on the GAINS_Europe Project at:

http://www.iiasa.ac.at