ECAMED: A FEASIBILITY STUDY TO ASSESS THE IMPACT OF THE IMPLEMENTATION OF AN ECA IN THE MEDITERRANEAN SEA

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on behalf of the project team from:

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

Cerema

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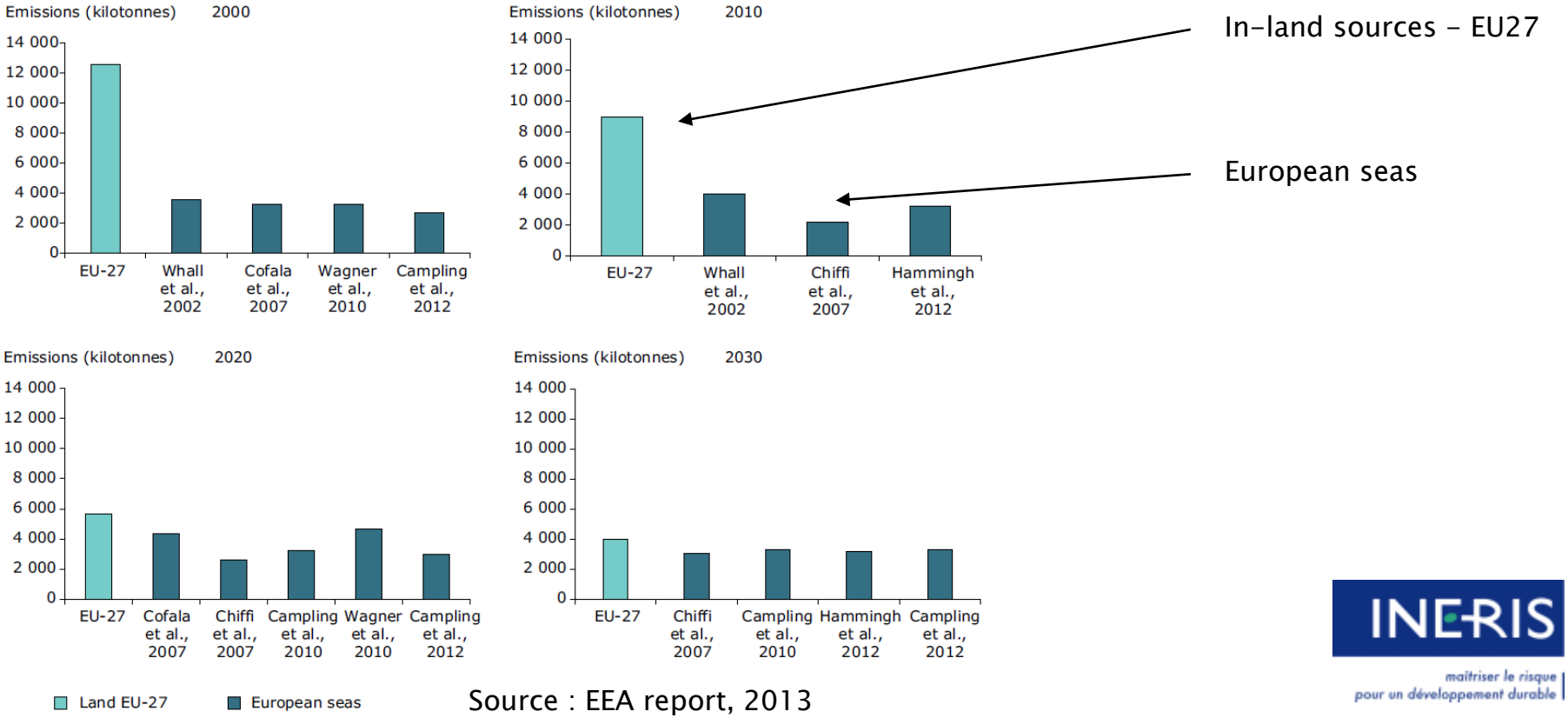
Context

- Air pollution (AP) remains one of the most sensitive environmental issues in Europe
  - Sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3) and particulate matter (PM_{10} and $PM_{2.5}$) have harmful impacts on human health and ecosystems
  - > 500,000 premature deaths due to air pollution in Europe (428,000 due to PM) according to EEA's 2017 report on air quality in Europe
- Anthropogenic sources of AP are numerous : industry, residential heating, agriculture, road and off-road transportation … and shipping
- By 2030 shipping emissions might be as large as inland EU emissions

NOx emissions



Source : EEA report, 2013

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Context

- The French National Air Pollutant Emission Reduction Plan (PREPA) adopted in 2017 envisages the implementation of new low emission zones in the Mediterranean Sea
  - French Ministry for Ecology interested in assessing the feasibility and the effects of the implementation of emission control areas (ECAs) in the Mediterranean Sea
  - Feasibility study carried out by INERIS (coordinator), CITEPA, CEREMA and Plan Bleu

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Objectives

- Develop emission scenarios for the implementation of a NECA (NOx emissions control area) or/and SECA (SOx emissions control Area) in the Mediterranean Sea
- Assess these scenarios with respect to
  - benefits for air quality
  - benefits for human health
  - costs & cost-benefit performance

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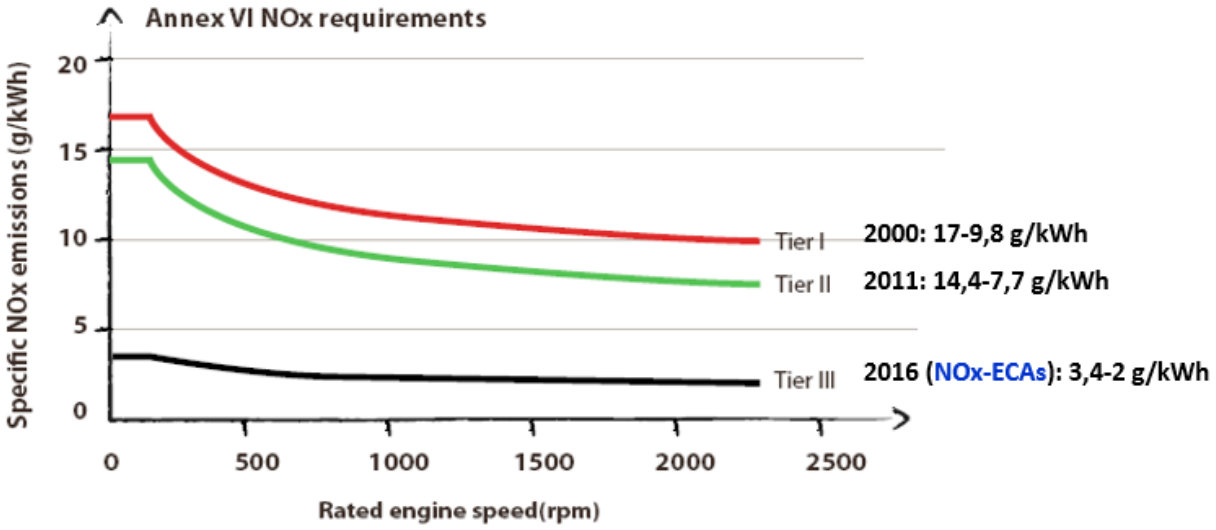
Emissions scenarios investigated

- Reference situation in 2015 (=> REF 2015)
- Global Sulphur Cap (MARPOL) imposing a 0.5% Sulphur content in 2020 (=> REF 2020)
- SECA/NECA (=> SECA/NECA) implying
  - Reducing SOx emissions by reducing sulphur content to 0.1% (SECA)
  - Reducing NOx emissions by applying SCR or alternative techniques respecting TIER III cleaner technologies (NECA)
  - SECA-NECA scenarios assume that 50% or 100% of vessels have Tier III engines (results presented for 100%)



NOx emission factors for the tier 1, 2 and 3 technologies

- Shipping activity data kept constant at 2015/16 level
  - No projection about future traffic, fleet or engine renewal rates
- Meteorological conditions kept constant as well (2015)

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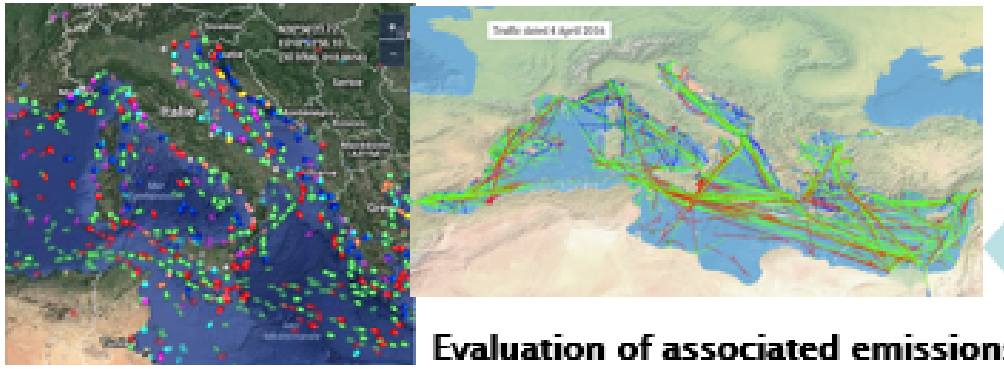
ECAMED set-up

Detailed description of ship traffic



In-land emissions from other activity sectors
(road, off-road, industry, residential, agriculture…)
for 2015:
Official emissions reported according to the UN Convention on long range Transboundary Pollution

Reference years: 2015-2016 **with 0,5%S**
Projections :

- 0,1% S rate in fuel used
- Tier3 engines to reduce NOx emissions

Evaluation of associated emissions

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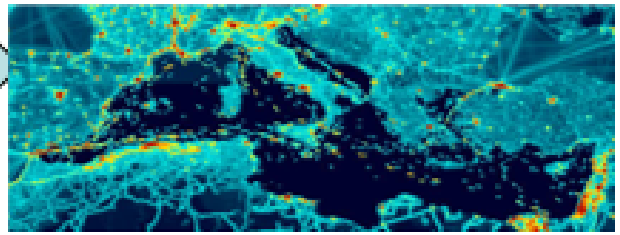

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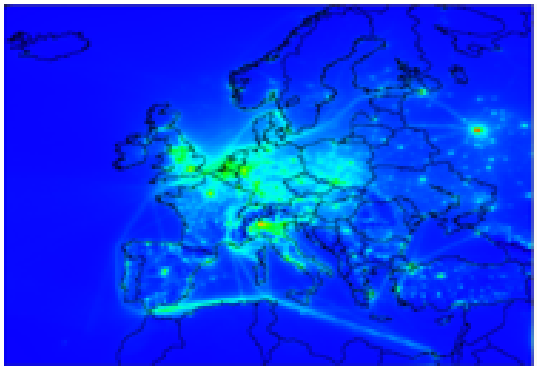
Cost–benefit analysis

Simulated Air pollutant concentrations and deposition



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Communication and networking
with stakeholders to share methodologies and results

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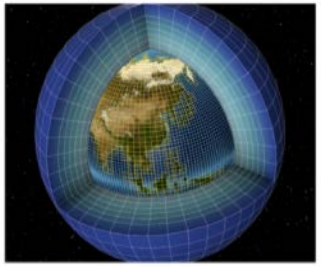
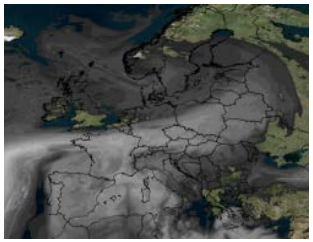
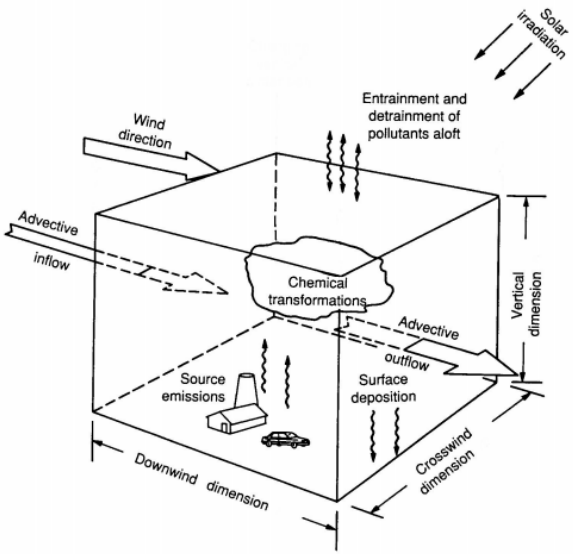
Establishment of emission scenarios and modelling of air quality

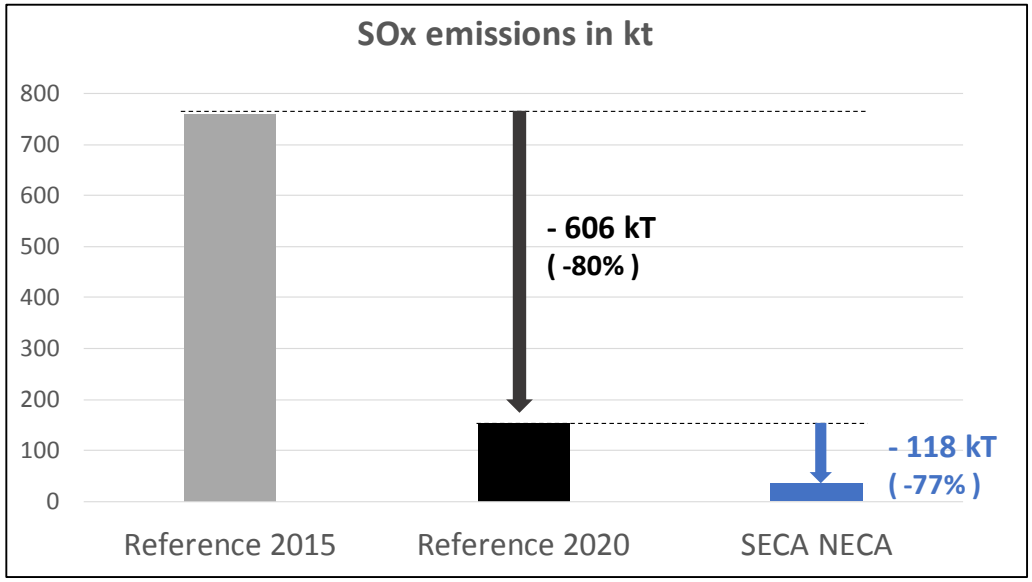
- Description of maritime traffic in the Mediterranean sea in 2016 and 2016 based on AIS (Automatic identification System) databases combined with Lloyd's register FAirPlay
- Emissions are calculated by coupling traffic data with emission factors
  - For the 3 scenarios REF 2015, REF 2020, SECA NECA
- Concentrations and deposition are simulated by the French CHIMERE air quality model
  - developed by the national research Centre and INERIS since 2001
  - used for policy support purposes and to run the national air quality forecasting system

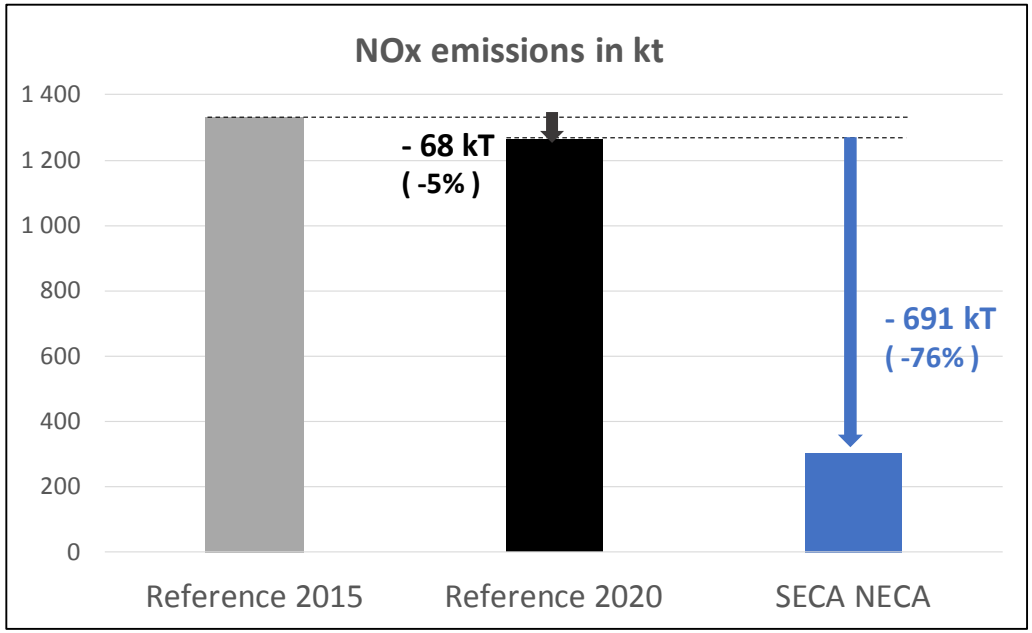


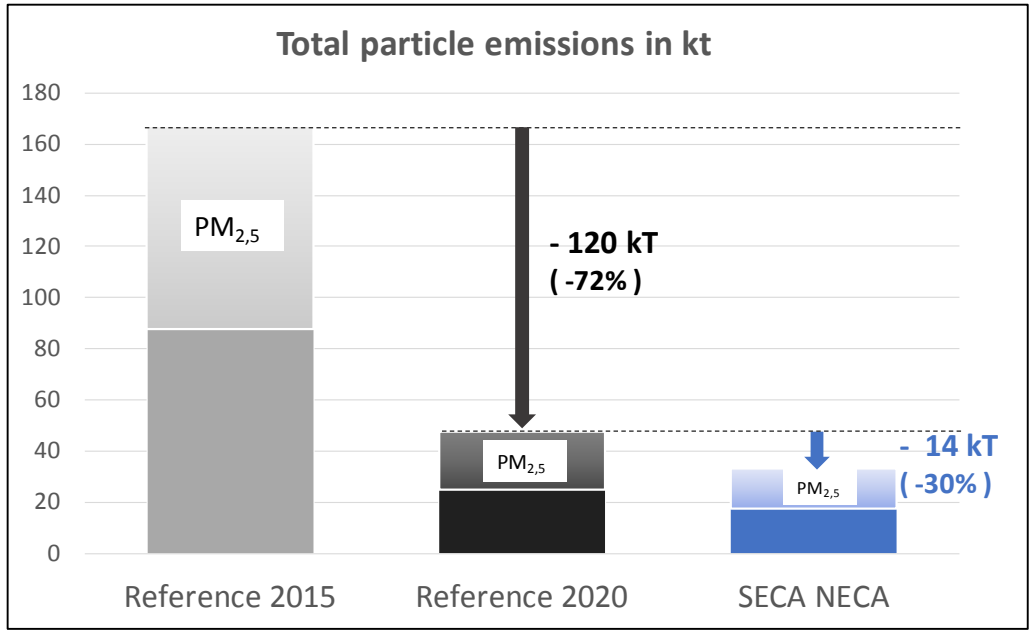




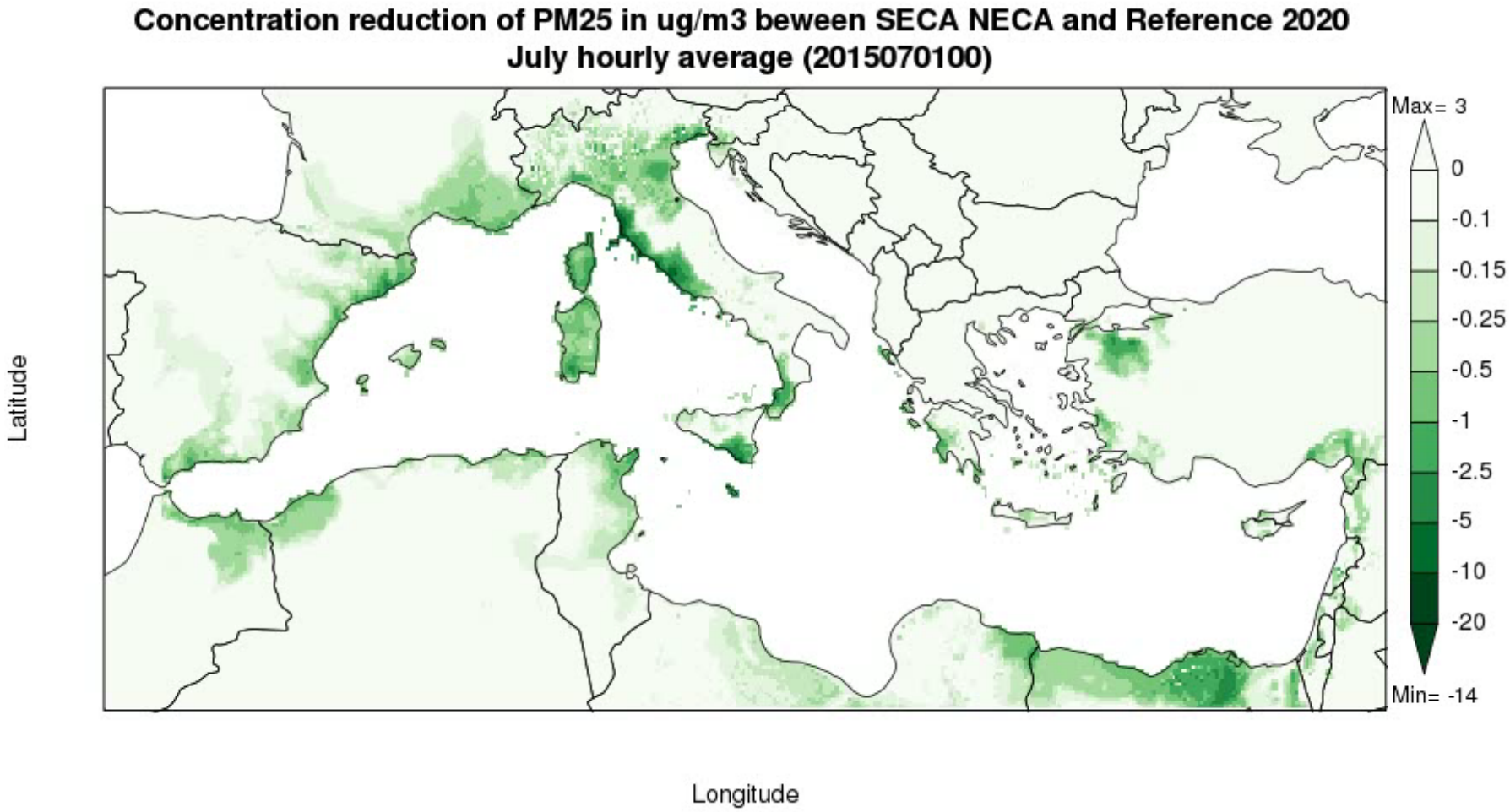
Emissions by scenario







Daily evolution of reductions in PM2.5 concentrations (in-land) – July 2015



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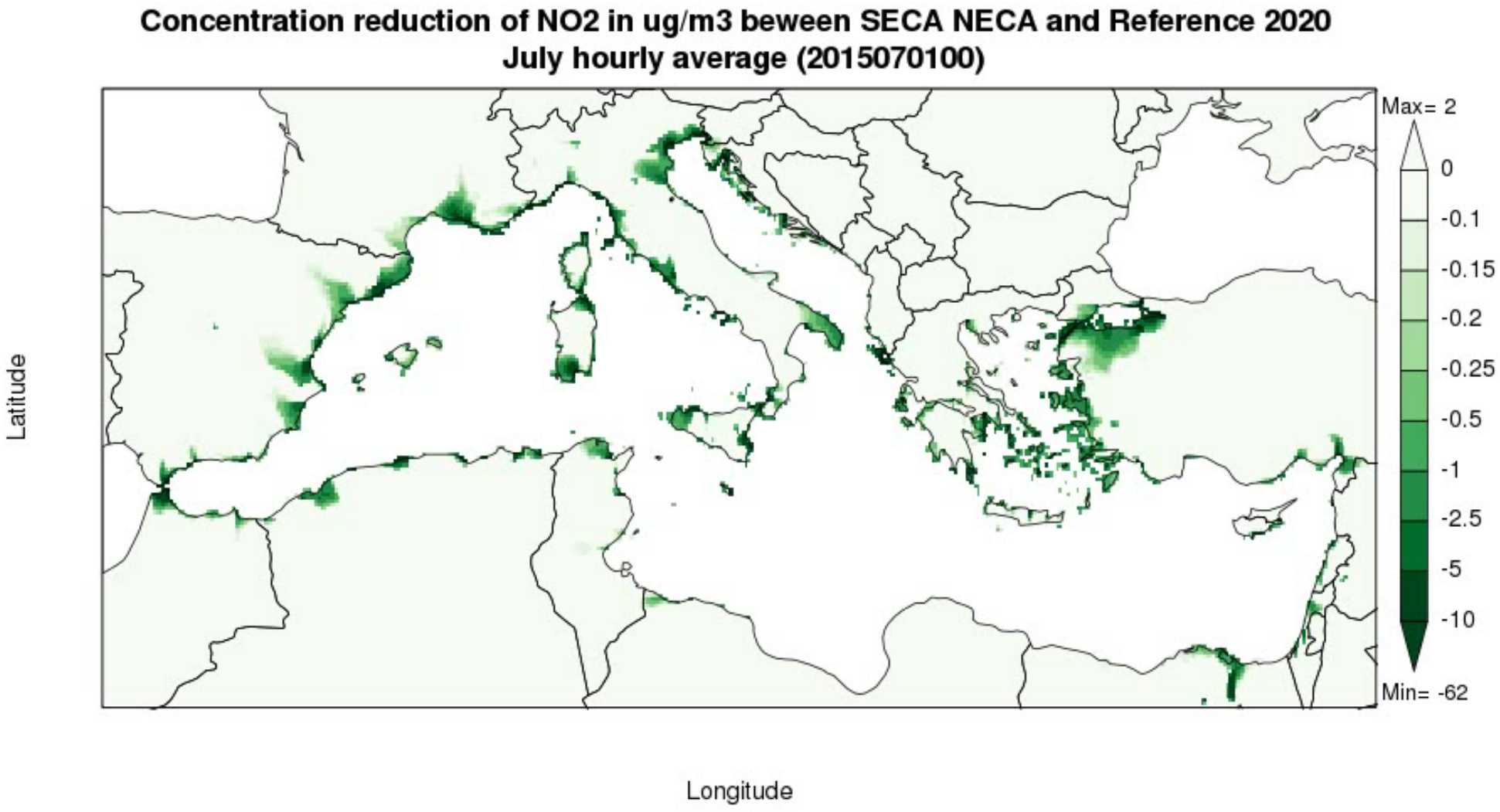

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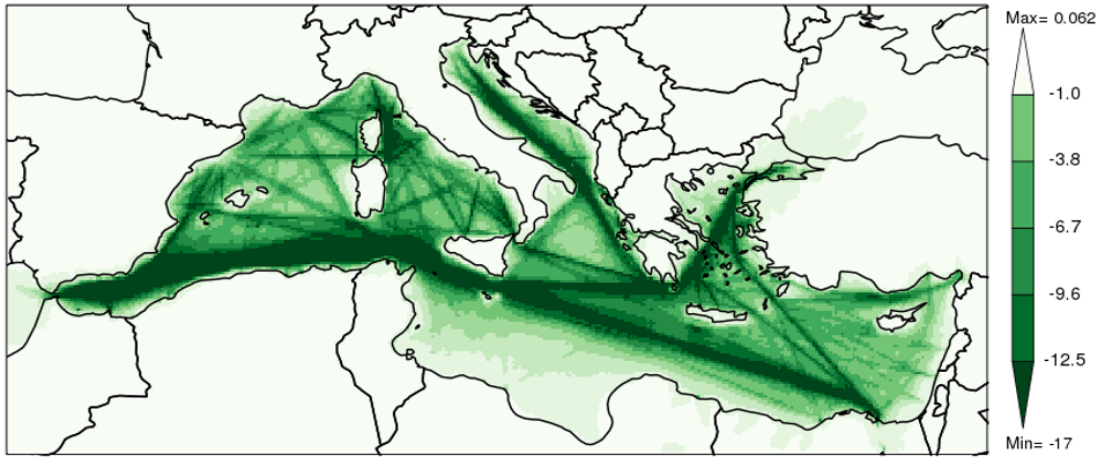
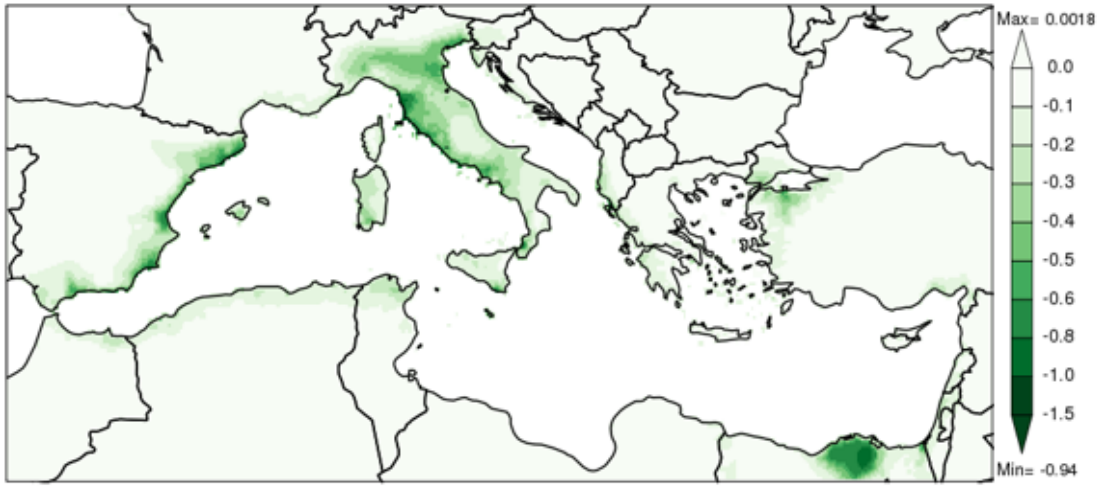
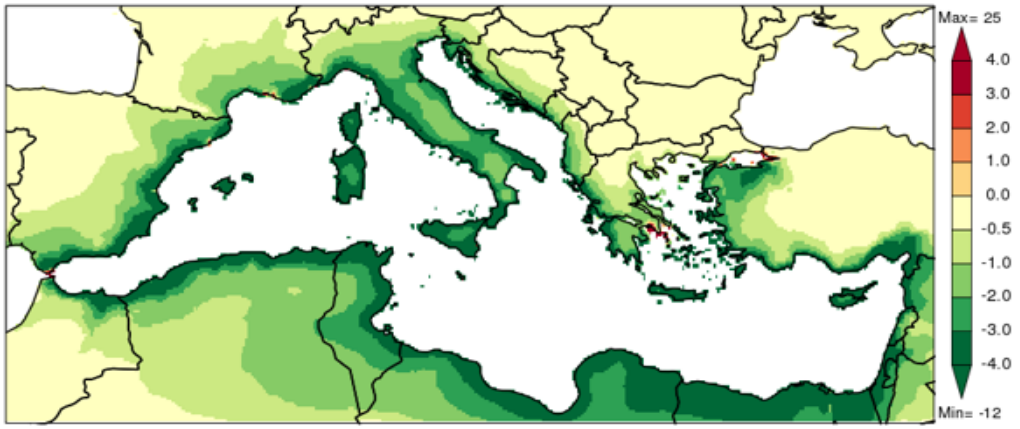
Impacts on annual means: differences between SECA-NECA & REF 2020



Absolute differences of NO_2 annual mean concentrations ($\mu g/m^3$)



Absolute differences of $PM_{2.5}$ annual mean concentrations ($\mu g/m^3$)



Absolute differences of O_3 summer mean concentrations ($\mu g/m^3$)

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Health Impacts

Health impacts considered and associated monetary unit values

Health impact	Impact unit	Pollutant	Unit valuation (€ price base 2015)
Acute Mortality (All ages) median VOLY*	Premature deaths	O_3	66 728
Respiratory hospital admissions (>64)	Cases		2 567
Cardiovascular hospital admissions (>64)	Cases		2 567
Minor Restricted Activity Days (MRADs all ages)	Days		49
Chronic Mortality (All ages) LYL median VOLY	Life years lost	$PM_{2.5}$	66 728
Chronic Mortality (30yr +) deaths mean VSL**	Premature deaths		2 567 364
Infant Mortality (0-1yr) mean VSL	Premature deaths		3 851 047
Chronic Bronchitis (27yr +)	Cases		61 987
Bronchitis in children aged 6 to 12	Cases		680
Respiratory Hospital Admissions (All ages)	Cases		2 567
Cardiac Hospital Admissions All ages)	Cases		2 567
Restricted Activity Days (all ages)	Days		106
Asthma symptom days (children 5-19yr)	Days		49
Lost working days (15-64 years)	Days		150
Bronchitis in children aged 5 to 14	Cases	NO_2	680
Respiratory Hospital Admissions (All ages)	Cases		2 567
Chronic Mortality (All ages) LYL median VOLY	Life years lost		66 728
Chronic Mortality (30yr +) deaths mean VSL	Premature deaths		2 567 364

(*) VOLY = Value of Life Year ; (**) VSL = Value of Statistical Life ; values for the willingness to pay by society to reduce the risk of premature mortality.

Concentrations response functions according to WHO/Europe (2013) - HRAPIE study - Health Risks of Air Pollution in Europe. 67% of NO_2 chronic mortality accounted for in monetary cost (benefit) to avoid risk of double counting with $PM_{2.5}$ chronic mortality.

Alpha-RiskPoll tool used – developed by EMRC (Mike Holland) for use in evaluation of health benefits of European air policy Directives

Use of identical monetary values in all countries for the ECAMED study

All results presented are for 2015

All monetary values expressed in € price base 2015

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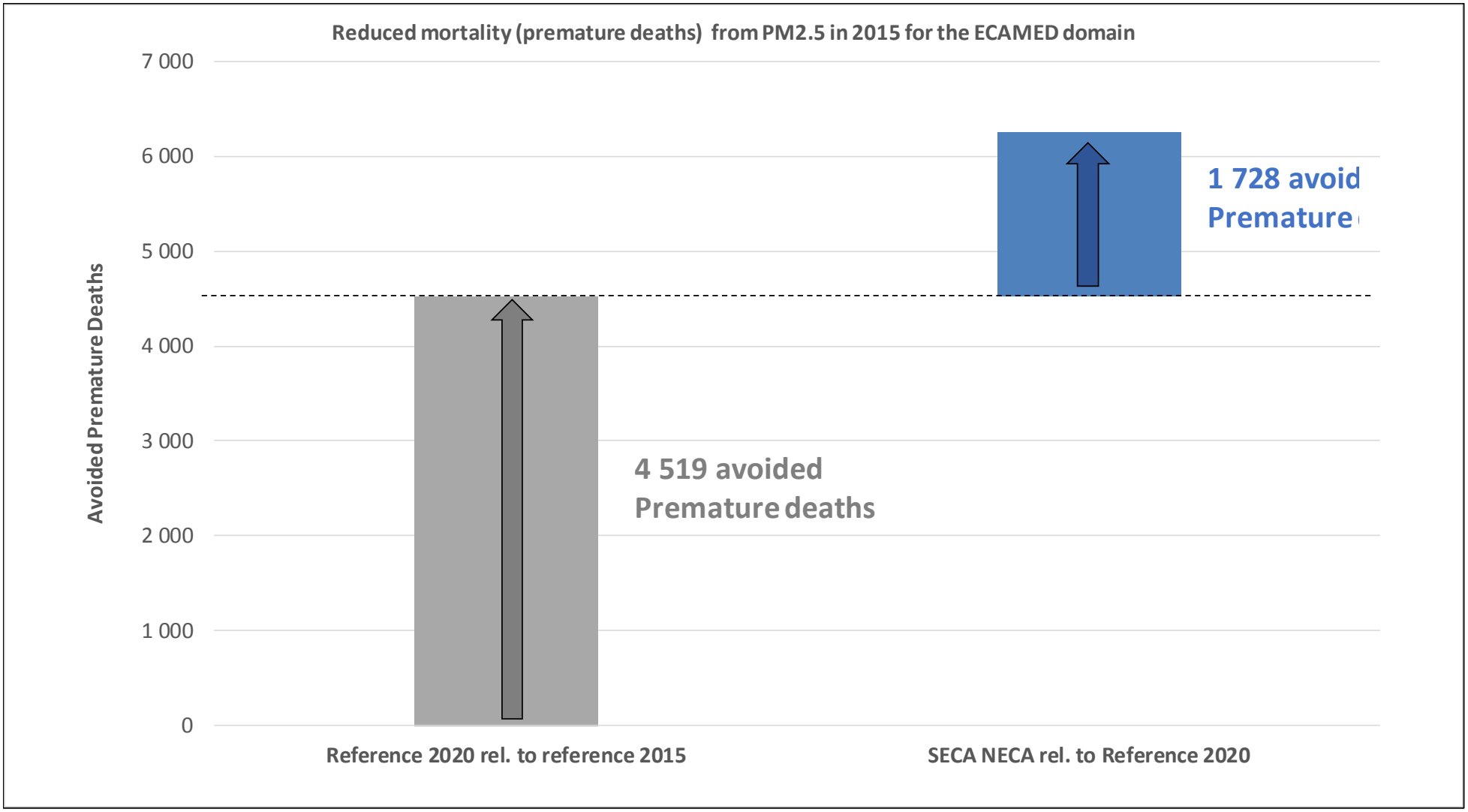
Reduction in $PM_{2.5}$ premature deaths – overall ECAMED domain



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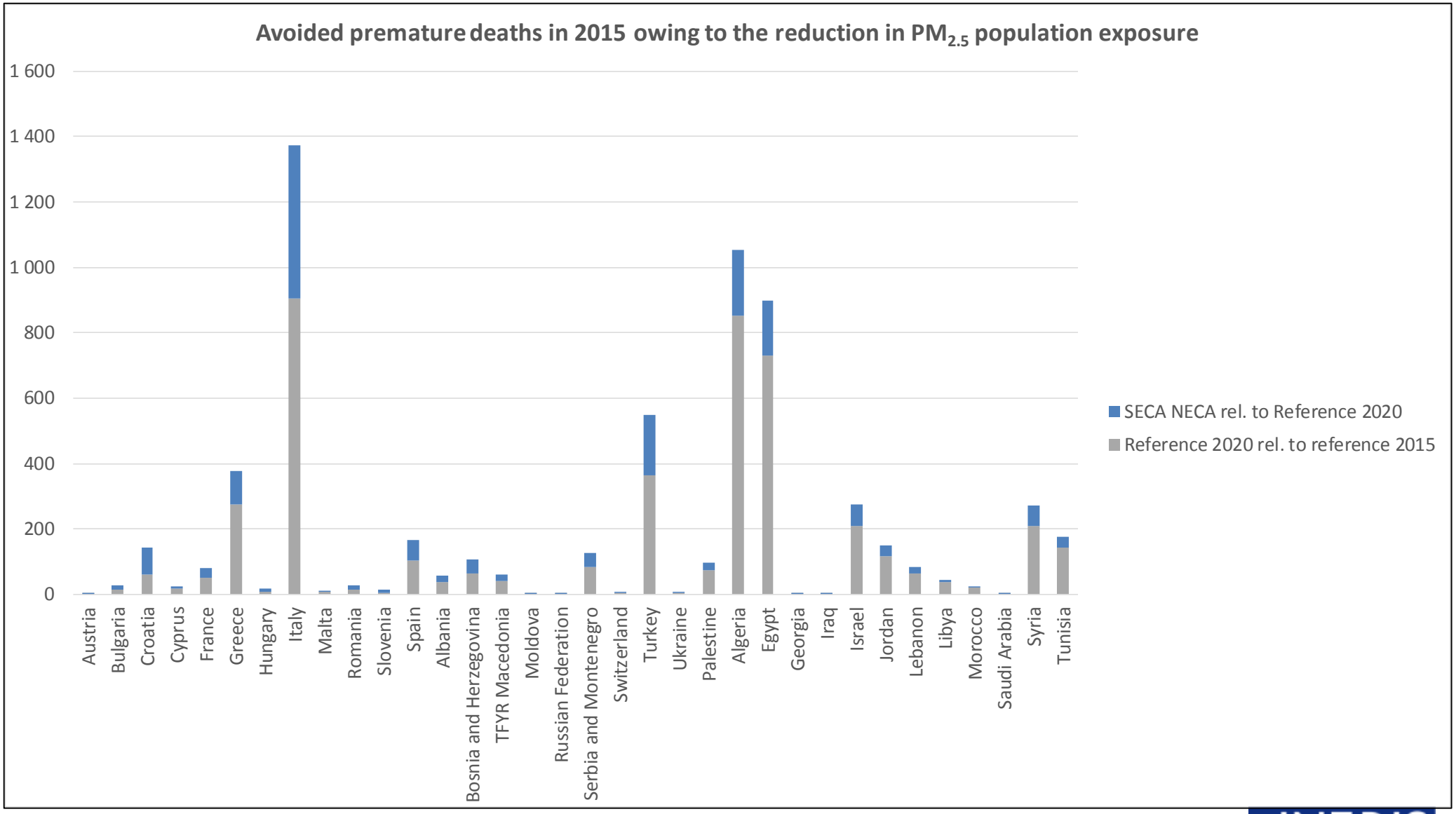
Reduction in $PM_{2.5}$ premature deaths – ECAMED domain per country



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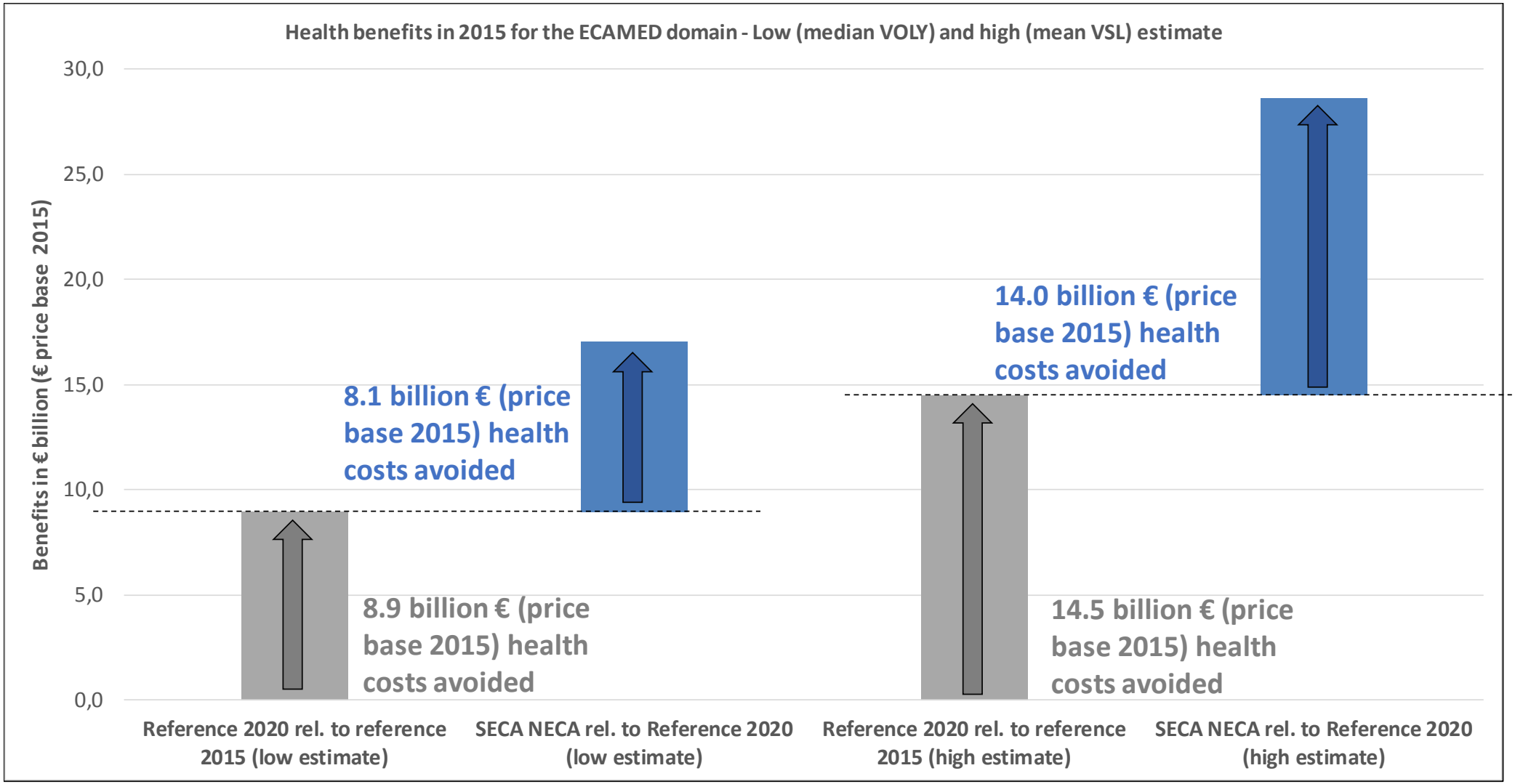
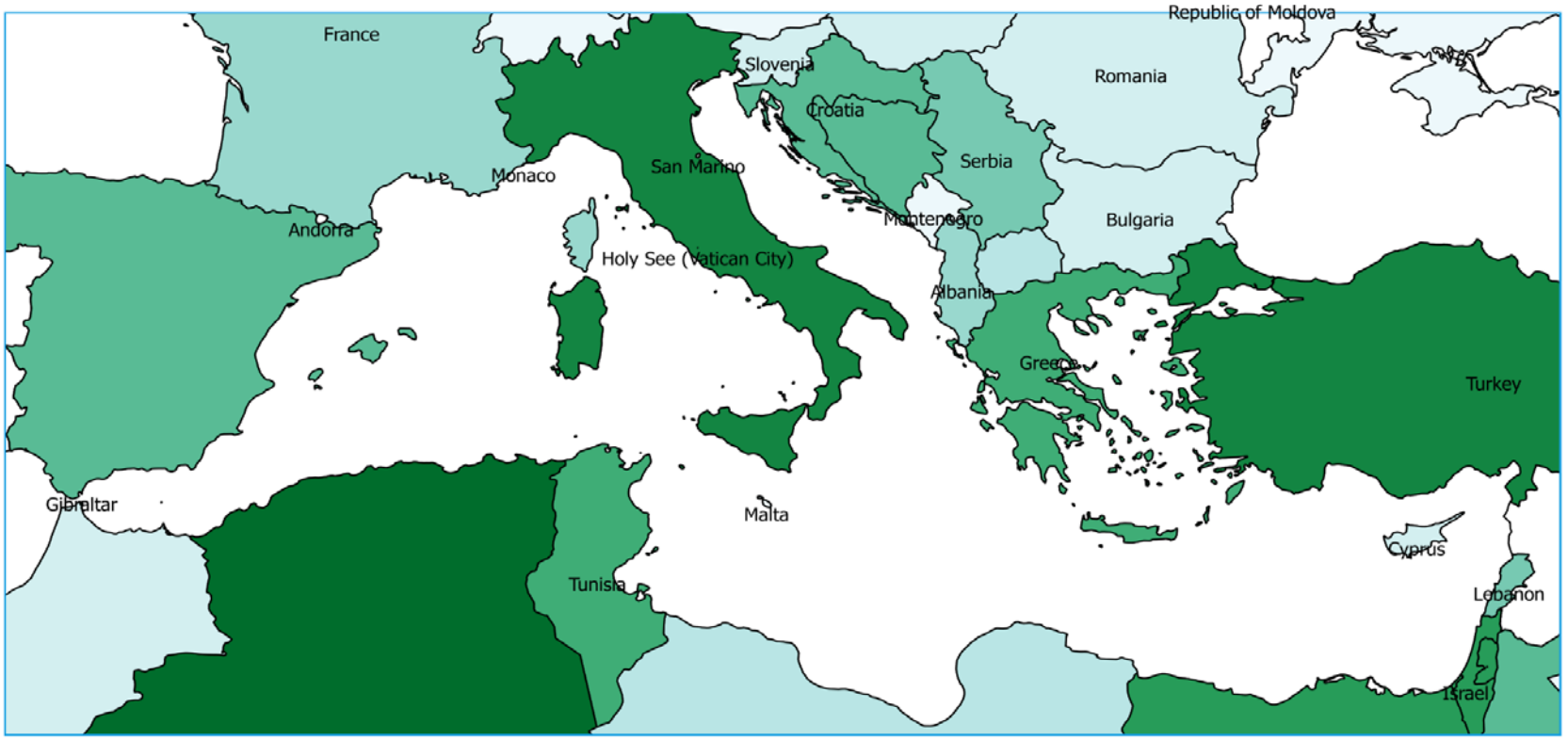
Aggregate health benefits – overall ECAMED domain



Health benefits in M€ - SECA NECA relative to REF 2020



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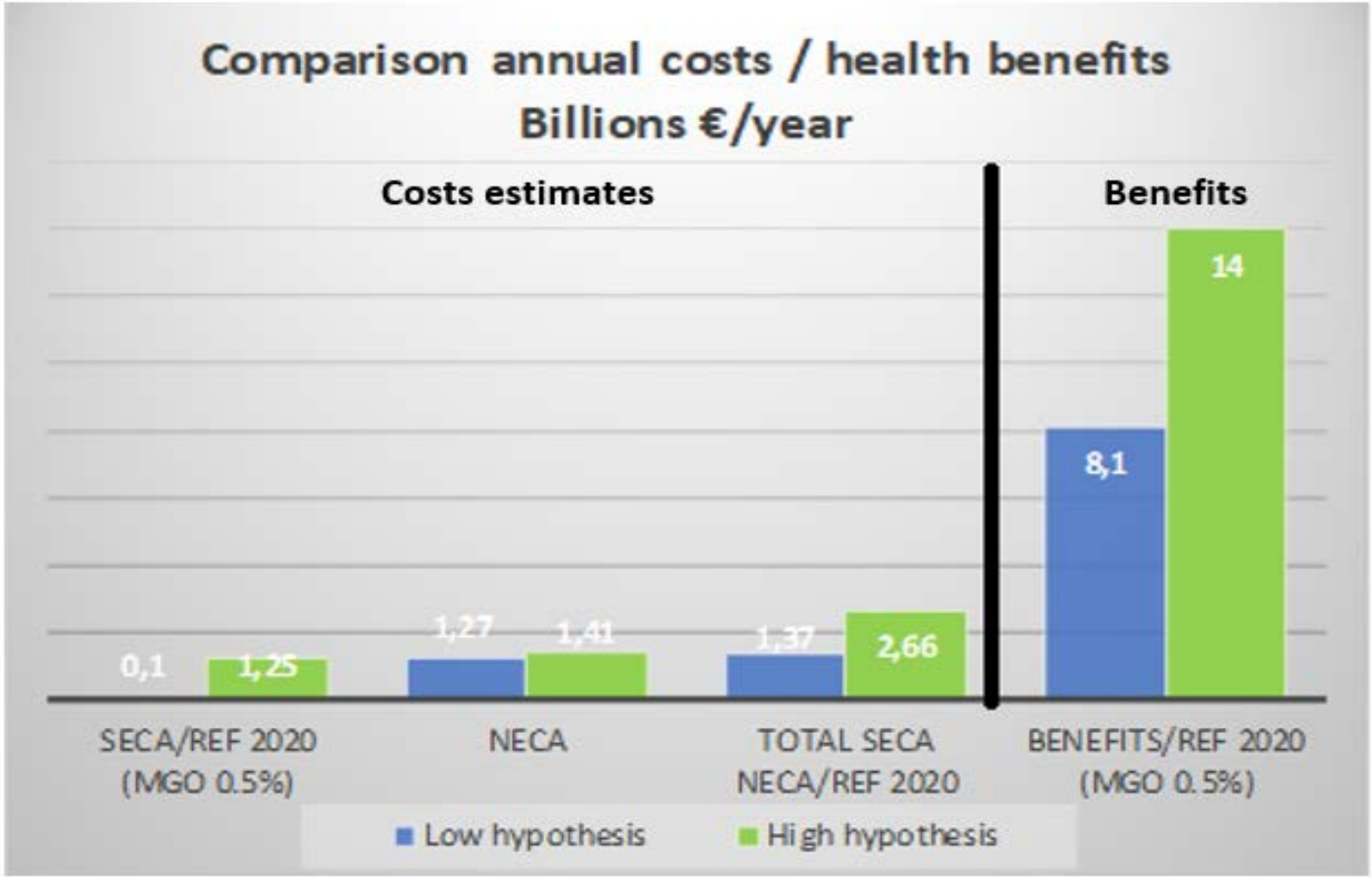
Comparing costs and health benefits - SECA NECA relative to REF 2020



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Thank you for your attention !

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