

GAINS emission scenarios for GP review

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Content

- Story of the past - GP review scenarios
- Harmonizing development of new scenario for GP revision
- Key scenarios (preliminary)
- How will they be used?
- Further developments beyond 2024
- If time allows...few words about methane
- Timeline

GAINS scenarios from GP review

- The emission dataset for GP review scenarios (key air pollutants and CH₄) are available from: <https://zenodo.org/records/10366132>

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Dataset

Open

Global gridded anthropogenic emissions of air pollutants and methane for the period 1990-2050

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- a baseline that is referred to as current legislation case (**LRTAP Baseline**),
- a scenarios exploring technical mitigation potential for all pollutant species (**LRTAP MTRF**), and
- a scenario that combines climate policy, behavioral changes, and strong technical mitigation of all pollutants (**LRTAP LOW**)

Netcdf files include several layers; monthly results, format consistent with CMIP6

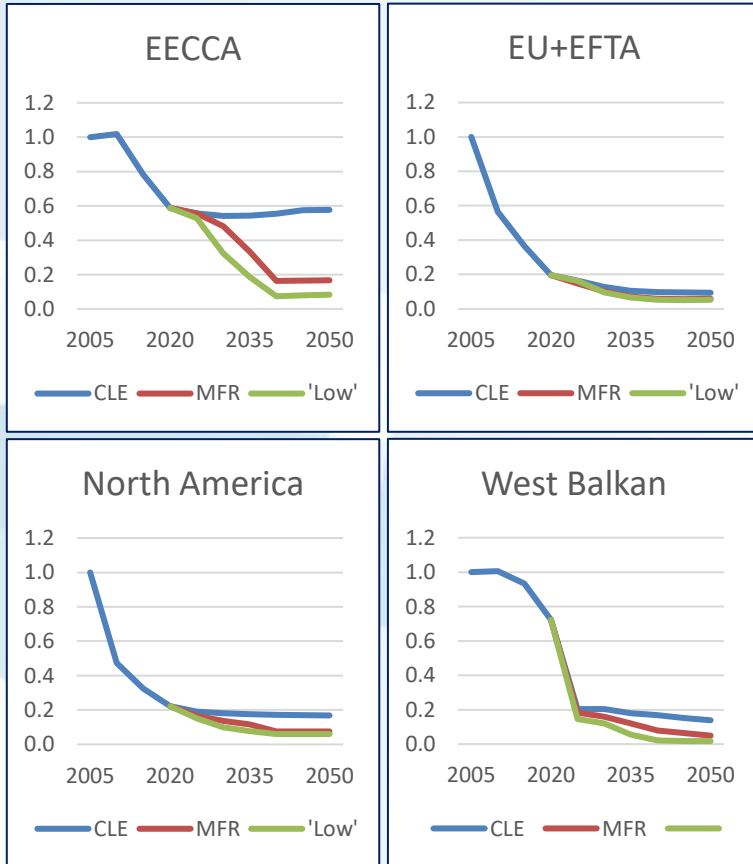
The sectors for which gridded data are provided (might vary by pollutant, i

- Energy sector
- Residential combustion (cooking and heating)
- Transportation
- Industry (combustion and processes)
- Solvent use
- Waste management
- Agriculture (livestock and fertilizer application)
- Open burning of agricultural residues
- International shipping

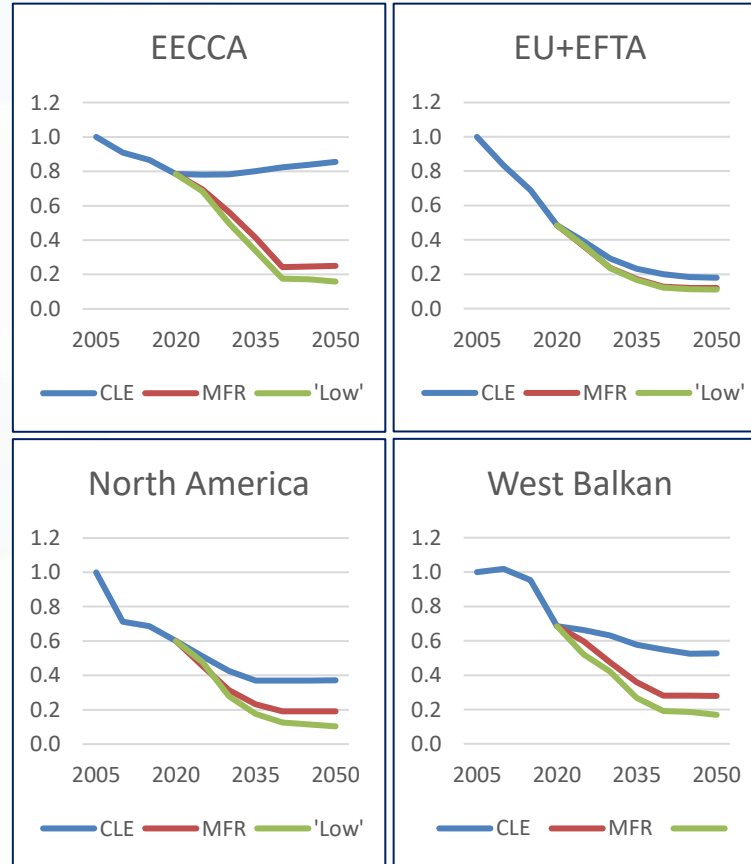
GP review scenarios

Identifying further mitigation potential

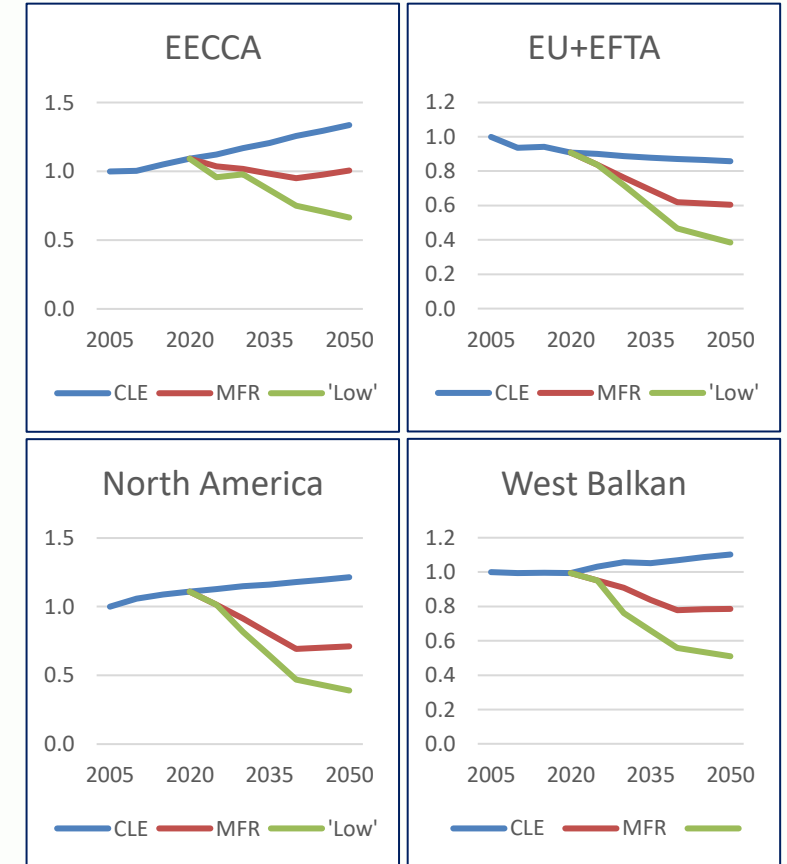
SO₂



NO_x



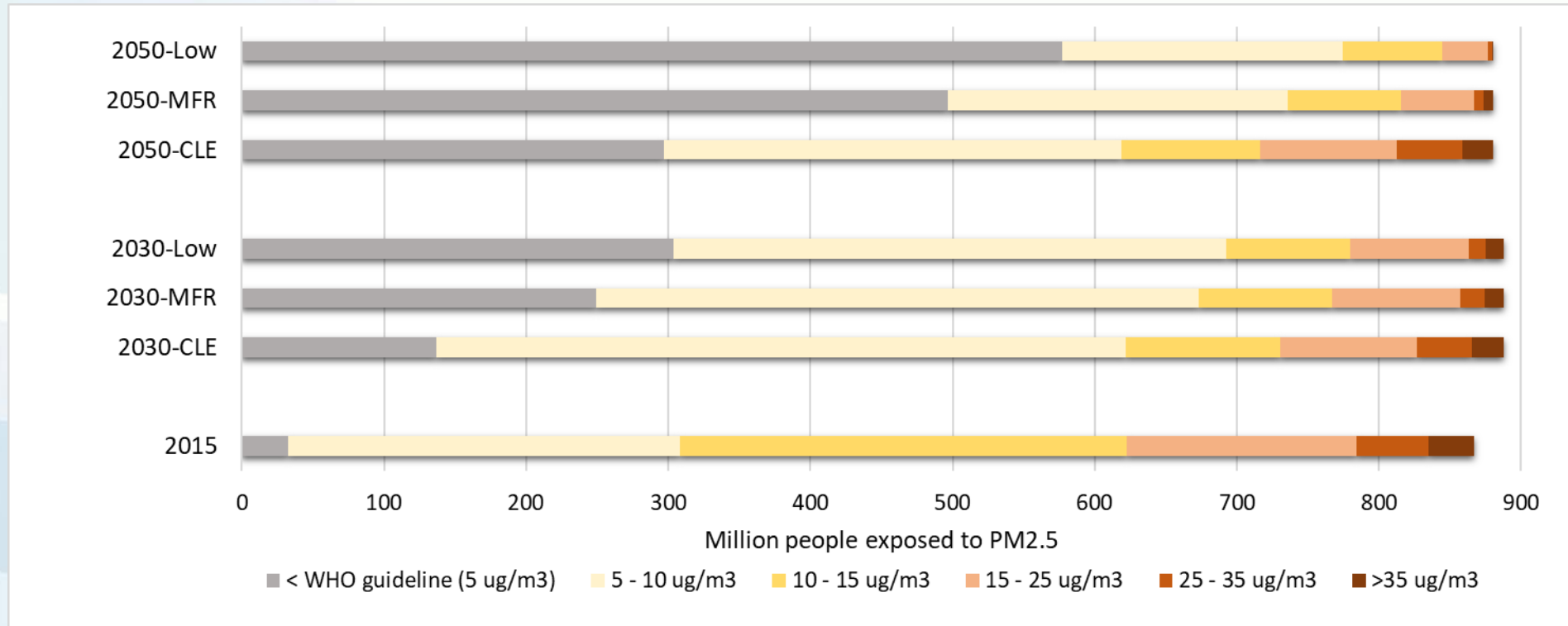
NH₃



EECCA – here includes also Turkey

GP review scenarios

Population exposure in the UNECE domain, excl North America



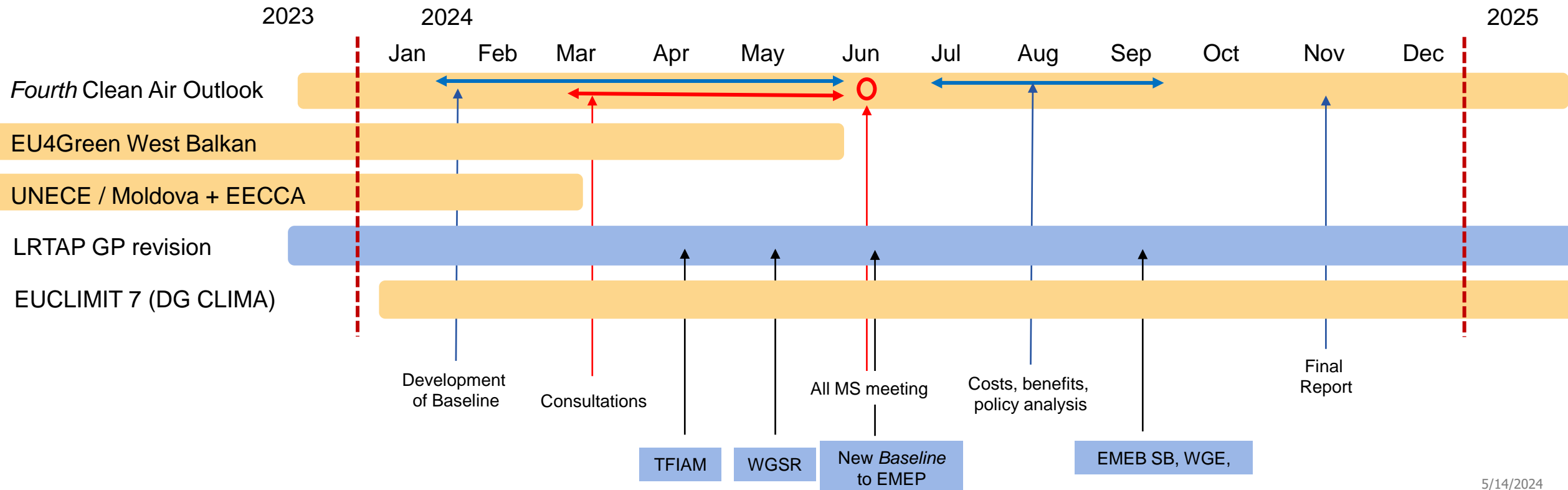
- Steady improvement in the *Baseline*,
- Not very large improvement in the *MFR* by 2030 but much more in 2050
- *Low* scenario provides further benefits, more than 70% of population exposed to PM2.5 levels below WHO guideline

Forthcoming updates for the GP revision

Links to other ongoing policy processes and projects

Explore synergies between various ongoing activities in 2024 and beyond

- Harmonizing, to the possible extent historical data, methodologies, model parameterization, to the extent possible other assumptions relevant for projections



Development of scenarios for GP revision

All scenarios for air pollutants and methane up to 2050

- **Baseline** (*update compared to the scenario used for the GP review*)
 - Energy, industry, and agriculture
 - EU27 – European Green Deal, including Fit for 55 package and RePowerEU initiatives, consistent with the 90% GHG reduction by 2040, revision of the IED, results of the MS consultation during CAO4
 - West Balkan – new scenarios developed with the same modelling tools as for EU, including decarbonization targets and compliance with the Energy Community agreements, results of the consultations with all countries
 - Selected EECCA (Moldova, Ukraine, Georgia) using the same modelling tools as for EU, consultations with Moldova
 - UK, Switzerland, Norway – IEA and FAO, continue consultation meetings
 - Remaining countries – IEA &FAO

Development of scenarios for GP revision

All scenarios for air pollutants and methane up to 2050

- ***MTFR (Maximum Technical Feasible Reduction)***
 - Ongoing review of costs of control measures
 - Reassessment of applicabilities (maximum penetration rates of a given measure for specific years), especially for the near term
- ***LOW (MTFR and transformation in energy and agriculture – behavioural changes)***
 - Update needed to consider new developments (new fuels, hydrogen economy) – GAINS being updated but lack of respective driver scenarios yet
 - Revision needed for West Balkan and EECA as the Baseline changes
- ***LOW-MTFR+ (include further non-tech measures)***
 - Initial discussion

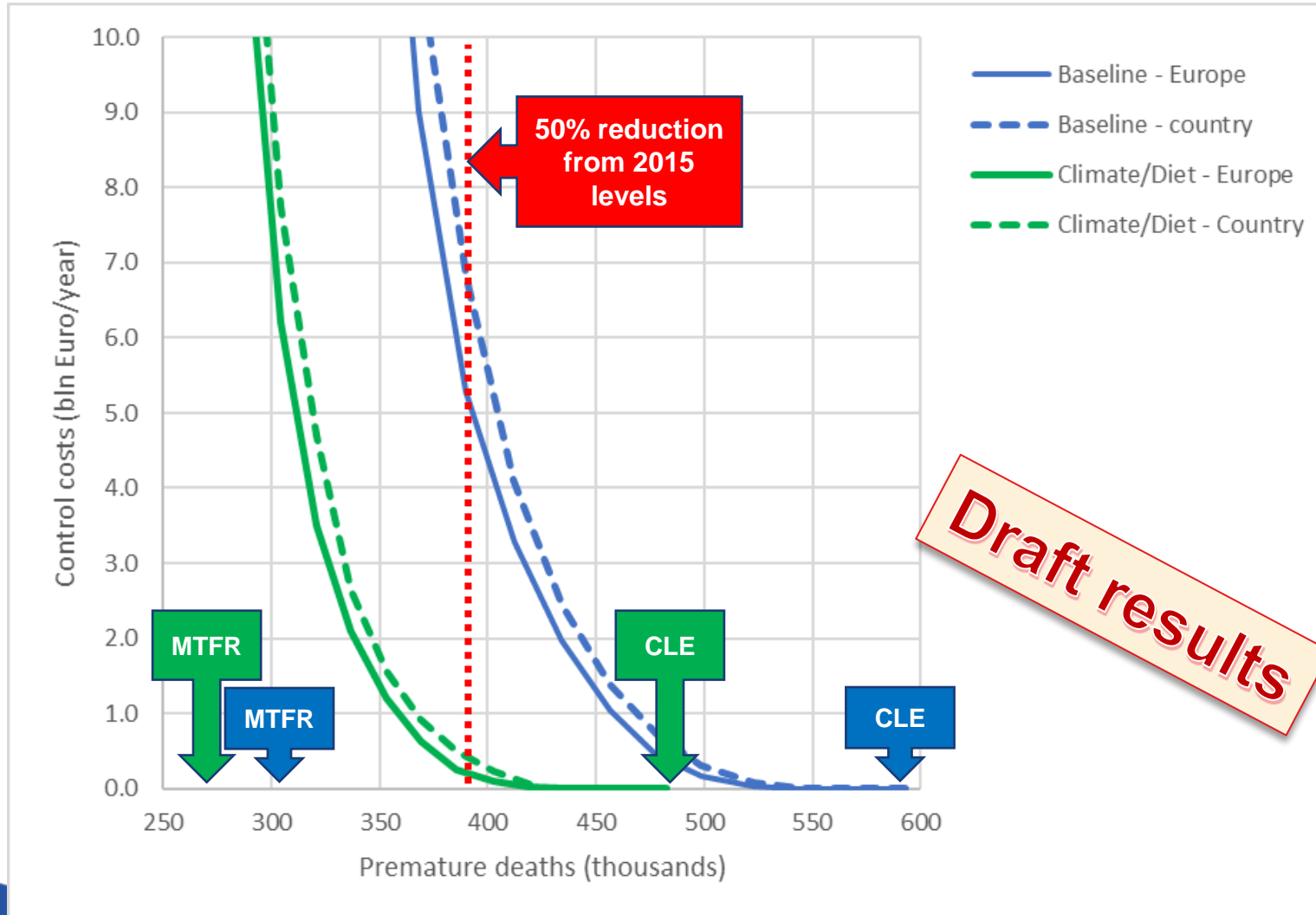
Designing preliminary staged/phased cases

Sector intervention scenarios for West Balkan, EECCA, Turkiye

- 4 sector specific intervention scenarios were defined as variants of the Baseline
- These originate from the 2030 EU *IED+Transport* emission controls implemented in the GAINS model to comply with the EU policies and are applied for specific sectors in all non-EU/EFTA countries
 - Power & Heating Plants
 - Industrial combustion and processes
 - Road and off-road transport
 - Residential combustion
- All other sectors remain as in the *Baseline*

Least-cost reduction of PM health impacts in UNECE (excl. North America) by 2050

Optimization results for UNECE-wide improvements (—)
 Optimization results for equal improvement in all countries (.....)



The analysis considers population growth and aging

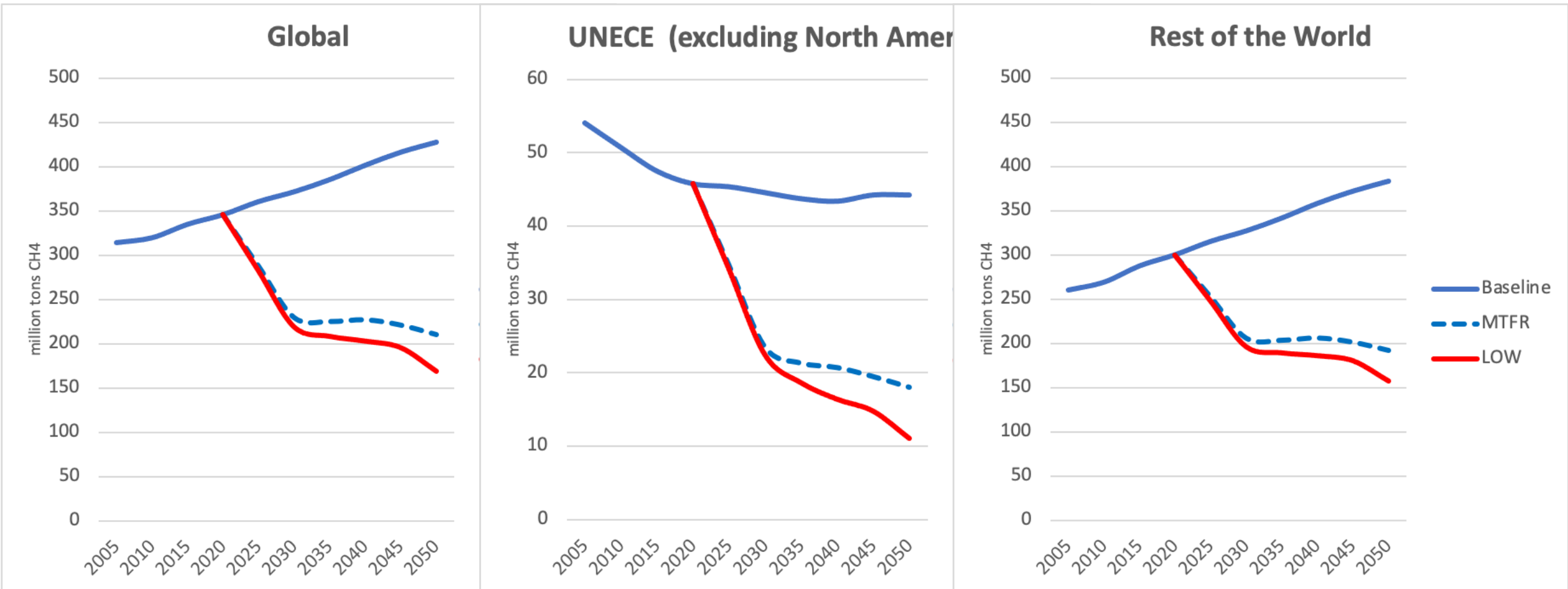
Draft results

- Full enforcement of *Baseline* policies achieves by 2050 over 40% of the target goal
- The 70% reduction of the feasible range ('gap closure') allows to achieve the 50% health target
- Preliminary estimates indicate nearly 30% higher costs for the case where equal improvements in all countries are achieved
- Introduction of **climate and dietary change policies** could achieve over half of the necessary reduction to reach the 50% health target, compared to the *Baseline scenario*
- Additional air pollution control costs would be over ten times lower, however, the case with equal country improvements would be twice as expensive as European target case
- In either case, some countries are not achieving 50% target or even show increase in premature mortality compared to 2015

New fuels

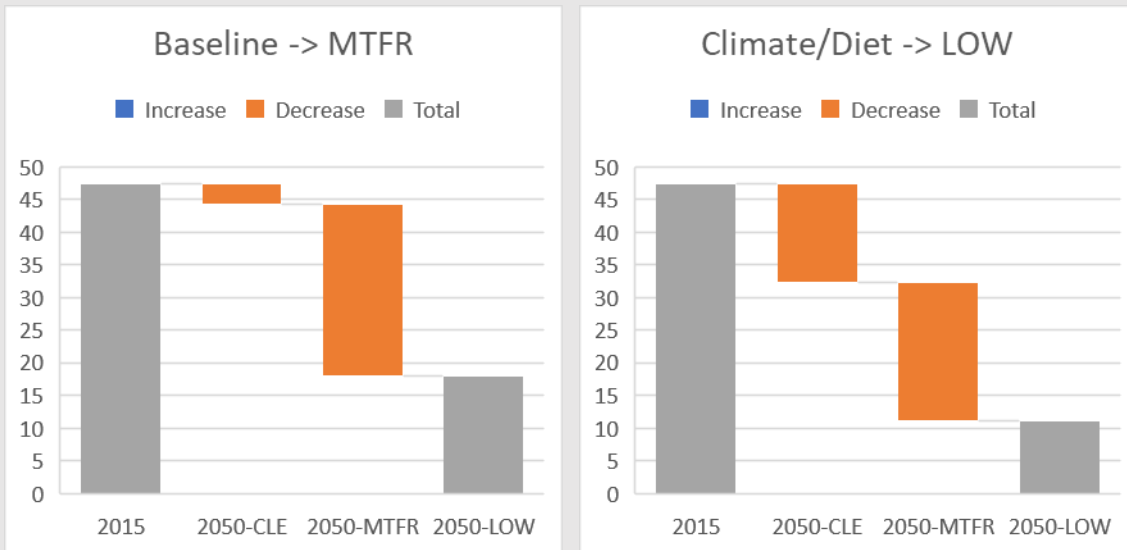
- Ammonia, hydrogen
- Working on introduction/update of both fuels in GAINS
 - Ammonia – shipping, stationary combustion
 - Hydrogen – is already in (stationary and transport - pure H₂ combustion)
 - Extension - Hydrogen blending and impact on NO_x
 - Extension - various production and storage/transport options
 - Extension/update – emission factors for all stages
- When?
 - Structural adjustments by September 2024
 - First scenarios in 2025 (linked to Horizon HYWAY project)

Anthropogenic emissions of methane



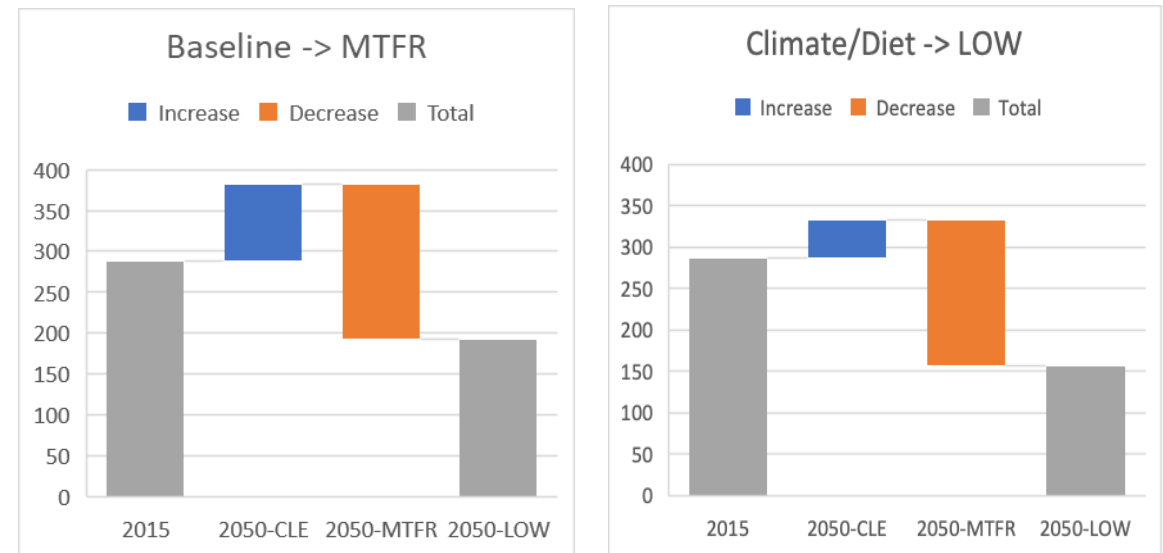
Baseline and mitigation potential for methane emissions

UNECE 'Europe' (excluding North America)



- Slight decline in the *Baseline* (-7%) driven by European Green Deal offsetting increasing emissions in non-EU. Significant technical mitigation potential available resulting in overall reduction of 62%, compared to 2015
- Further *Climate/Dietary* measures result in about 32% reduction and considering further technical potential (MTRF) results in overall reduction of 77%, compared to 2015

Rest of the World



- Increase by 33% in the *Baseline* and large technical mitigation potential (MTRF) resulting in overall 33% reduction compared to 2015
- Even in the *Climate/Dietary* scenario baseline emissions increase by about 16%; considering available technical mitigation potential results in overall reduction of 45 %, compared to 2015

Note the UNECE region emissions are nearly 10 times smaller than the rest of the world

Next steps

- Completion of the *new* Baseline for UNECE (June 2024)
- Validation and improvement of cost and applicability estimates for measures -> development of the MTR scenario (July 2024)
- Preliminary new LOW case [not including further non-tech measures] (Sept 2024)
 - Scenario with new fuels (NH₃), hydrogen economy, etc. (2025)
- Optimization including biodiversity targets (first results Sept 2024)
- Implementing optimization for combined PM and biodiversity impacts (2024), and ozone (2025)
 - Introducing %GDP spending constraints (2024)
- Updated staged scenario(s) including residential sector (draft for discussion in Sept 2024)
- Acidification and eutrophication assessment for the whole UNECE domain (2024)
- Hot spots – analysis how the pollution hot spots (often cities in some regions) are affected in the optimized scenarios ?