65’536 Emission Reduction Pathways in Latvia’s LULUCF Sector

Ģirts Bohvalovs, Valērija Kosteviča, Andra Blumberga, Dagnija Blumberga

Riga Technical University, Institute of Energy Systems and Environment

Contact information:

e-mail: girts.bohvalovs@rtu.lv

Only 5 policies are required to reach negative cumulative GHG emissions in Latvia’s LULUCF sector by 2050.

The system dynamics model forecasts in Fig. 1. that **without any LULUCF policies** the cumulative GHG are going to reach **79.3 $MtCO_2e$** by the year 2050. By selecting only **5 best policies** it is possible to reach **-2.58 $MtCO_2e$** cumulative GHG emissions. The minimum possible cumulative GHG emissions are reached **with 14 policies** at **-16.7 $MtCO_2e$**. Policies **P2 + P16** yield **0.3 $MtCO_2e$** increase in cumulative emissions.

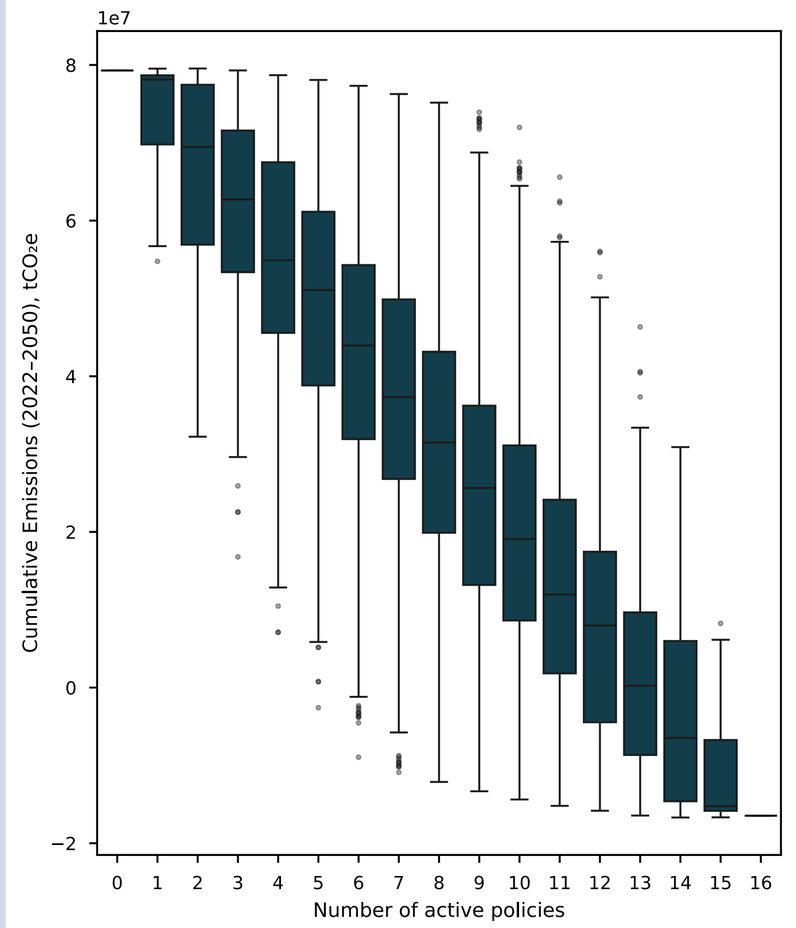

Fig. 1. Cumulative emission distribution by policy count.

Introduction & Methodology

Latvia’s National Climate and Energy Plan (NECP) states 16 policies to be implemented in the Land Use, Land Use Change, and Forestry (LULUCF) with the goal of reducing GHG emissions.

A system dynamics model of Latvia’s LULUCF sector has been developed by incorporating IPCC National Inventory Reporting methodology, data, and NECP’s policies.

The goal of this study was to perform an exhaustive sensitivity analysis across all 2^{16} = 65’536 binary policy combinations to quantify each policy’s effect on cumulative GHG emissions for years 2022 - 2050.

Table 1. NECP Policy name and it’s code.

Code	Policy Name
P1	Mineral fertilisation, dry/transitional forests
P2	Peatland soil amendment with wood ash
P3	Forest habitat restoration on organic farmland
P4	Afforestation of organic farmland
P5	Extracted peatland afforestation
P6	Afforestation of low-value farmland
P7	Hydrology improvement in wet forests
P8	Woody buffer strips
P9	Short-rotation coppice
P10	Tree groups in pastures
P11	Wood chemical / fibre factory
P12	Unproductive stand replacement
P13	Biochar in arable land
P14	Particleboard factory
P15	Young stand tending area expansion
P16	Targeted forest restoration area expansion

Results & Conclusions

Policies P2 and P16 increase emissions, but the rest of the policies reduce emissions in Fig. 2. For some tree species P2 reduces growth rate, and P16 increases forest litter in the short-term. Policies of transforming organic farmland to forests show largest reductions in cumulative emissions. Biochar and particleboard factory, and young stand tendering expansion also show a significant role in cumulative emission reduction.

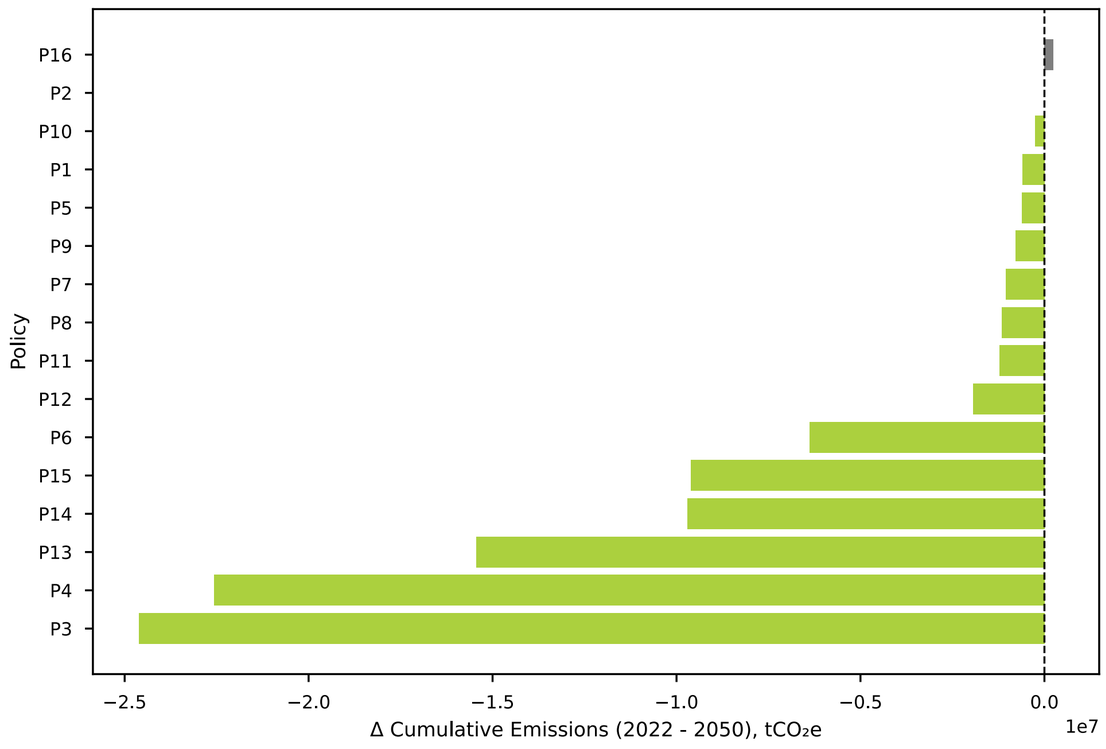

Fig. 2. Median cumulative emission change per Policy.

Exhaustive sensitivity analysis enables detection of systemic properties such as diminishing returns that single simulations or sampled sensitivity analyses may fail to identify. Policies P3, P4, P13, P14, P15, and P6 should be prioritized as they yield the largest emission reduction. This study treats each policy as binary, but each policy can be investigated and modified even further. Focus on emission expenses and investments could be investigated in the future to identify cost-efficient emission reduction frontiers.