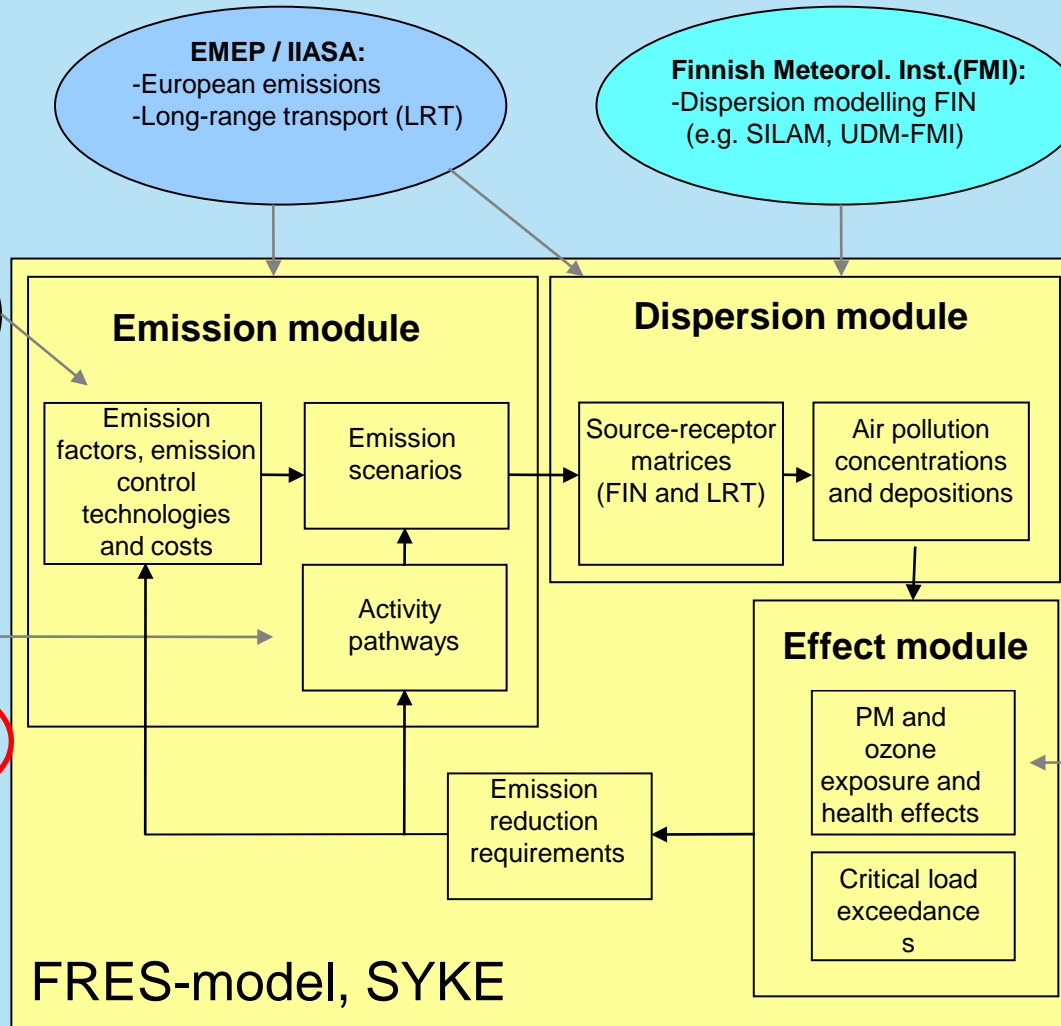


A hockey player in a blue jersey is celebrating with a trophy in front of a cheering crowd. The player is seen from behind, wearing a blue jersey with "KORIN" and the number "10" on the back. He is holding a large silver and gold trophy above his head. The crowd is dense, with many people wearing white and blue clothing, some holding Finnish flags. The scene is set in a stadium or arena.

Attainability of the 2020 national emission ceilings for Finland

Mikko Savolahti
Finnish Environment Institute

FRES - Model (Finnish Regional Emission Scenarios)



Finnish Meteorol. Inst.(FMI):
-Dispersion modelling FIN
(e.g. SILAM, UDM-FMI)

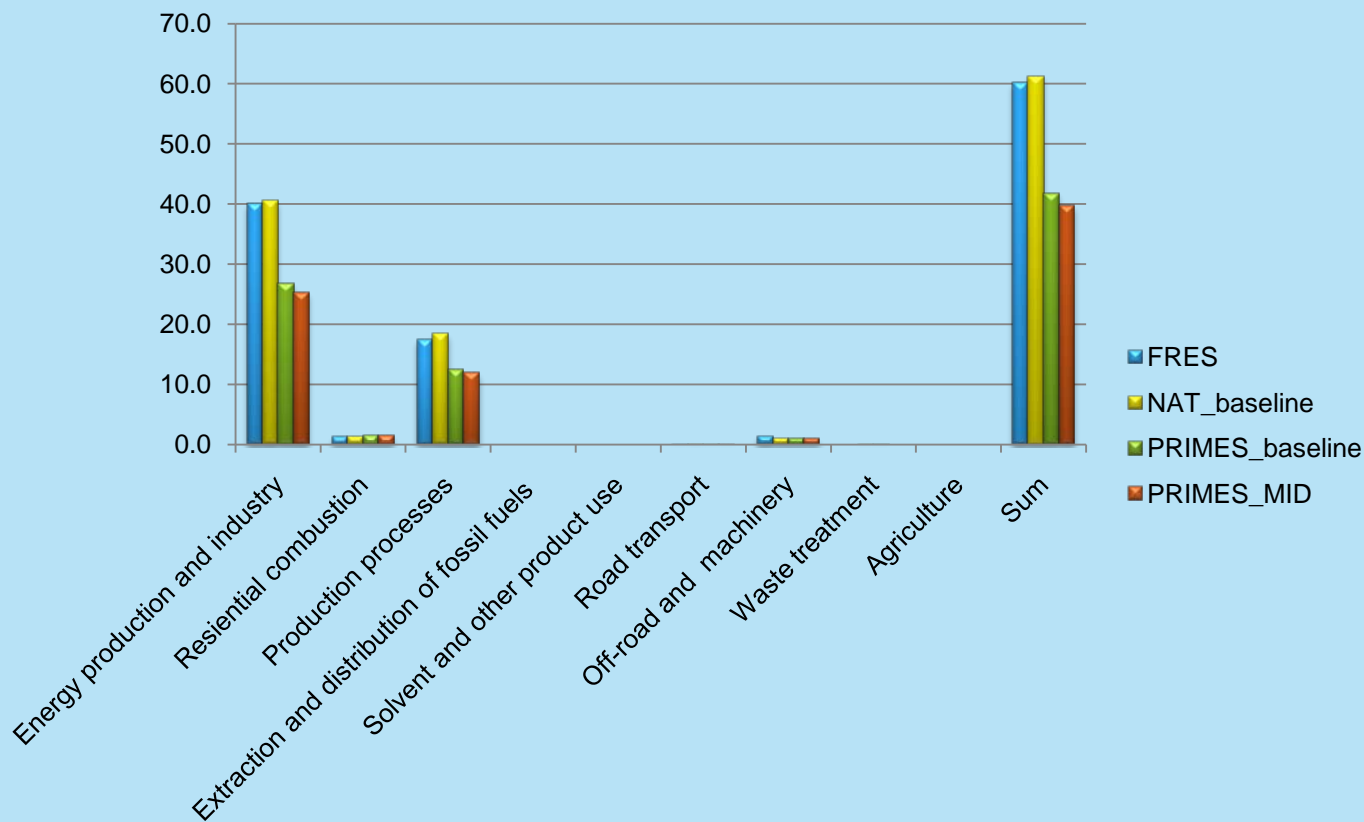
EMEP / IIASA:
-European emissions
-Long-range transport (LRT)

Kuopio university, VTT etc.
-Emission measurements

Technical Research Center of Finland (VTT) + Ministry of Employment and the Economy (TEM)
-Climate change and energy strategy 2008

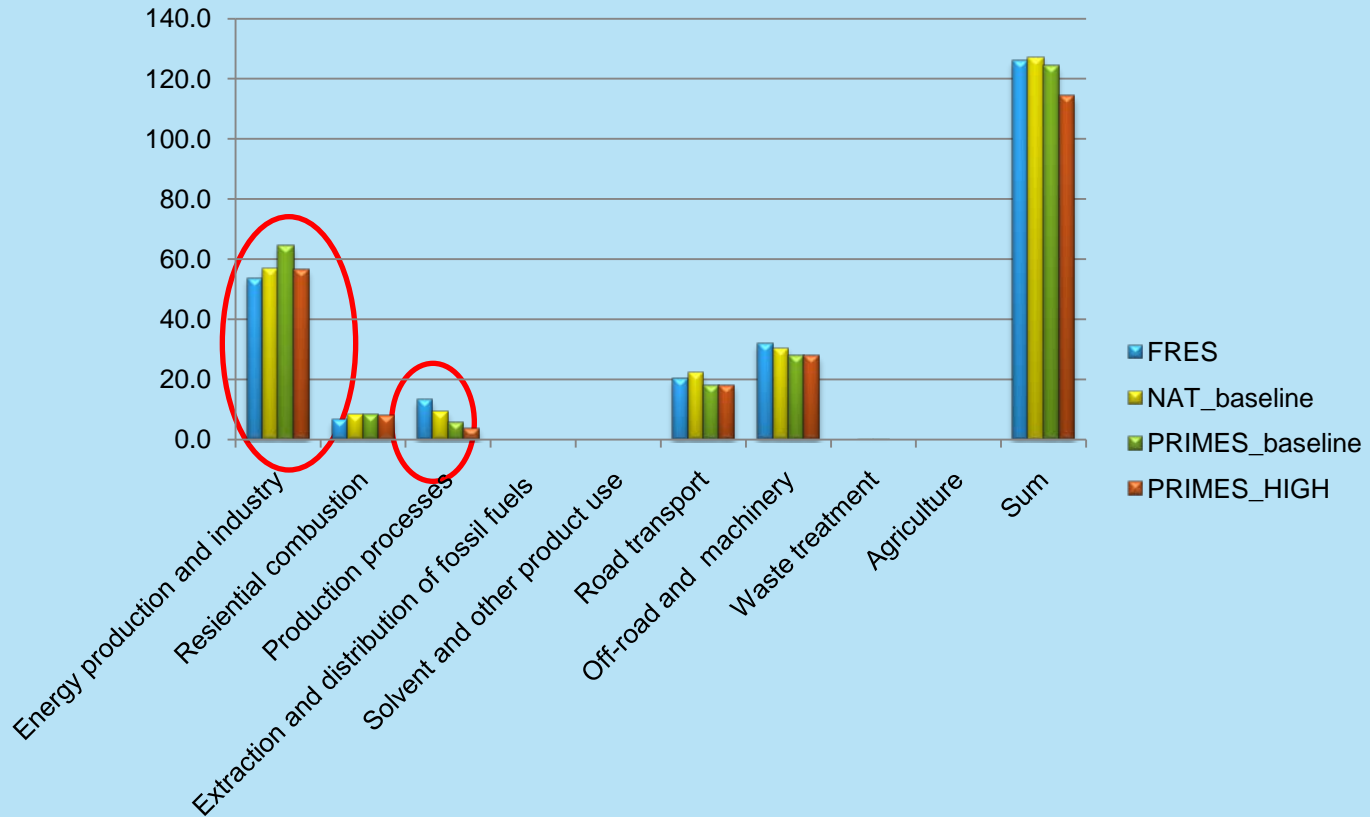
Finnish Nat. Institute for Health and Welfare (THL):
-Health risk assessment PM

Emission comparisons - SO2



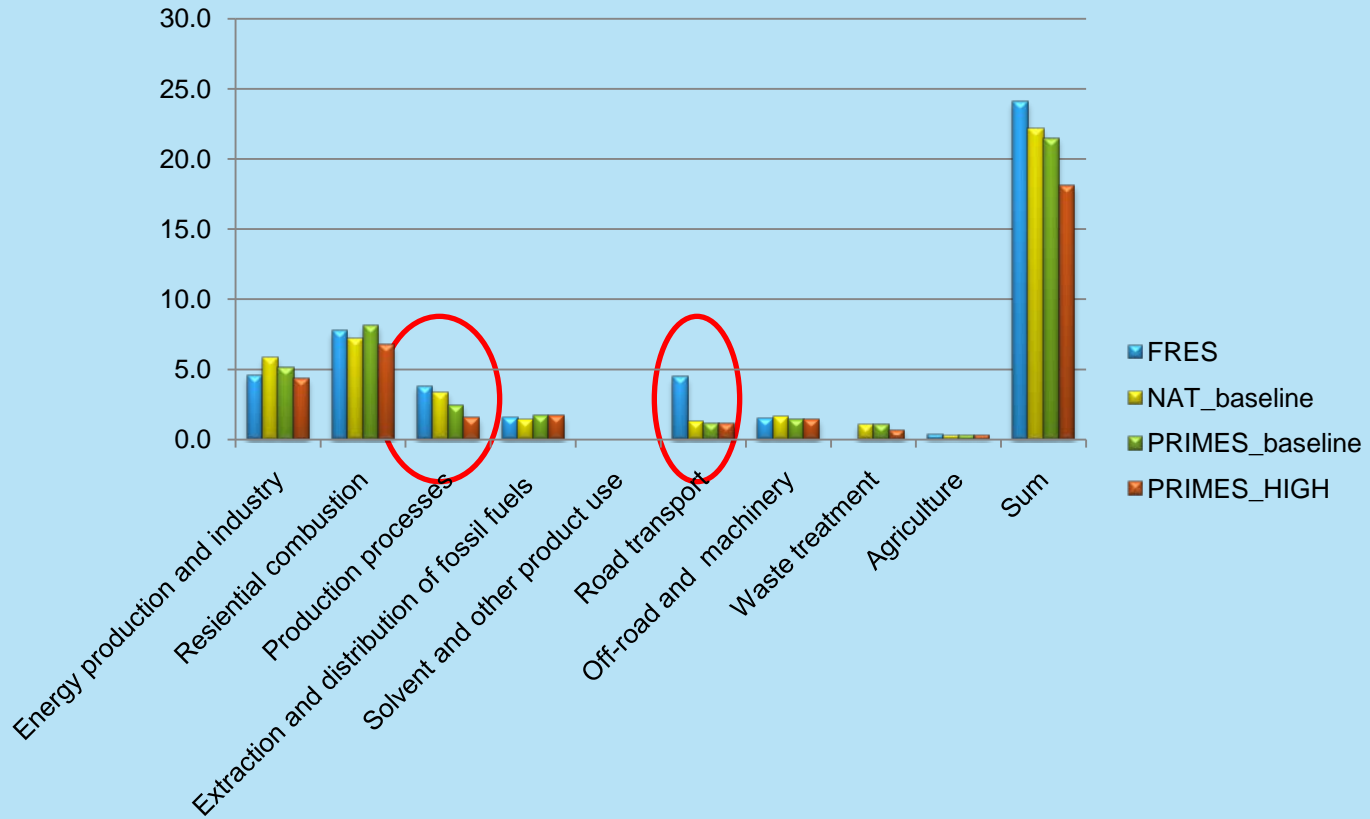
SO2 emissions in 2020 [kt]

Emission comparisons - NOx



NOx emissions in 2020 [kt]

Emission comparisons – PM2.5



PM2.5 emissions in 2020 [kt]

Emission comparisons – All compounds

2020 emission estimates [kt]	SO ₂				NO _x				PM _{2.5}			
	FRES	NAT_bas	PRIMES_bas	PRIMES_MID	FRES	NAT_bas	PRIMES_bas	PRIMES_HIGH	FRES	NAT_bas	PRIMES_bas	PRIMES_HIGH
Energy production and industry	40.1	40.6	26.8	25.2	53.7	56.8	64.4	56.6	4.6	5.8	5.1	4.4
Residential combustion	1.3	1.3	1.6	1.5	6.6	8.4	8.3	7.9	7.8	7.2	8.2	6.8
Production processes	17.4	18.4	12.4	12.0	13.4	9.3	5.8	3.8	3.8	3.4	2.4	1.6
Extraction and distribution of fossil fuels	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	1.4	1.7	1.7
Solvent and other product use	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Road transport	0.1	0.1	0.1	0.1	20.4	22.3	18.1	18.1	4.5	1.3	1.2	1.2
Off-road and machinery	1.4	1.0	1.0	1.0	31.8	30.3	27.9	27.9	1.5	1.6	1.5	1.5
Waste treatment	-	0.0	0.0	0.0	-	0.1	0.1	0.0	-	1.1	1.1	0.7
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.3	0.3
Sum	60.2	61.3	41.8	39.7	125.9	127.2	124.5	114.3	24.1	22.2	21.5	18.1
	VOC				NH ₃							
	FRES	NAT_bas	PRIMES_bas	PRIMES_HIGH	FRES	NAT_bas	PRIMES_bas	PRIMES_MID				
Energy production and industry	0.6	5.6	3.5	3.5	0.0	0.9	1.2	1.2				
Residential combustion	20.6	19.9	20.8	16.3	0.0	0.6	0.4	0.4				
Production processes	26.1	16.6	15.0	12.6	0.0	0.5	0.5	0.5				
Extraction and distribution of fossil fuels	2.1	2.1	2.3	2.3	0.0	0.0	0.0	0.0				
Solvent and other product use	21.8	28.7	28.7	22.3	0.0	0.0	0.0	0.0				
Road transport	5.2	4.9	4.8	4.8	1.7	0.3	0.3	0.3				
Off-road and machinery	24.6	13.9	13.9	13.9	0.0	0.1	0.1	0.1				
Waste treatment	-	1.5	1.5	1.4	0.0	0.9	0.9	0.9				
Agriculture	-	0.2	0.2	0.2	29.0	26.6	26.7	21.6				
Sum	100.8	93.3	90.4	77.2	30.7	29.7	30.0	24.5				

Production processes - activity changes

		NAT				PRIMES			
		2000	2020	ratio	increase [Mt]	2000	2020	ratio	increase [Mt]
PR_ALPRIM	Mt	0.000	0.000		0.00	0.000	0.000		0.0
PR_ALSEC	Mt	0.044	0.067	1.52	0.0	0.045	0.043	0.95	0.0
PR_BAOX	Mt	3.132	4.232	1.35	1.1	3.131	2.713	0.87	-0.4
PR_BRIQ	Mt	0.000	0.000		0.00	0.000	0.000		0.0
PR_BRICK	Mt	0.220	0.170	0.77	-0.1	0.000	0.000		0.0
PR_CAST	Mt	0.118	0.166	1.41	0.0	0.134	0.205	1.53	0.1
PR_CBLACK	Mt	0.002	0.003	1.48	0.0	0.002	0.002	1.23	0.0
PR_COKE	Mt	0.898	1.204	1.34	0.3	0.898	0.699	0.78	-0.2
PR_EARC	Mt	0.968	1.571	1.62	0.6	0.965	1.979	2.05	1.0
PR_GLASS	Mt	0.179	0.277	1.55	0.1	0.173	0.221	1.28	0.0
PR_HEARTH	Mt	0.000	0.000		0.0	0.000	0.000		0.0
PR_NIAC	Mt	0.608	0.801	1.32	0.2	0.608	0.592	0.97	0.0
PR_OTHER	Mt	0.068	0.102	1.50	0.0	0.068	0.073	1.08	0.0
PR_OT_NFME	Mt	0.338	0.552	1.63	0.2	0.338	0.393	1.16	0.1
PR_PELL	Mt	0.000	0.000		0.0	0.000	0.000		0.0
PR_PIGI	Mt	2.892	5.053	1.75	2.2	2.892	2.507	0.87	-0.4
PR_PULP	Mt	12.126	14.691	1.21	2.6	12.198	11.020	0.90	-1.2
PR_REF	Mt	11.166	16.545	1.48	5.4	12.594	9.963	0.79	-2.6
PR_SINT	Mt	3.406	3.930	1.15	0.5	3.406	2.952	0.87	-0.5
PR_SUAC	Mt	1.326	2.033	1.53	0.7	1.326	1.512	1.14	0.2
Sum	MT	37.5	51.4		13.9	38.8	34.9		-3.9

Primary energy consumption in 2020

	NAT	PRIMES
BC1	1	0
BC2	71	62
HC1	104	110
HC2	0	0
HC3	0	0
DC	22	19
OS1	198	315
OS2	159	20
HF	109	67
MD	158	161
GSL	104	111
LPG	14	34
GAS	208	183
H2	0	0
REN	40	11
HYD	48	47
NUC	382	412
ELE	0	28
HT	0	0
Sum	1618	1580

Emissions from combustion of HF [kt]

2020	SO2	NOx	PM2.5
Energy production	17,5	13,2	0,7
Residential combustion	0,7	0,2	
Traffic	1,2	2,9	0,4
Sum	19,4	16,3	1,1

Significant emission sectors in 2020

Percentage of total annual emissions. Sectors that are not covered by international or national law are bolded.

SO ₂		NO _x		PM _{2.5}	
Industry – boilers	35 %	Off-road traffic	30 %	Residential combustion	31 %
Electricity and district heating	30 %	Industry – boilers	27 %	Industry – boilers	17 %
Industrial processes	29 %	Road traffic	16 %	Road dust	16 %
Industry – other combustion	4 %	Industrial processes	10 %	Industrial processes	16 %

Conclusions

- Uncertainty in activity pathways the most important variable
- National estimates higher than PRIMES for all emissions
- The role of additional technical measures likely to be insignificant
- Differences between estimations are percentually notable in some cases, but small in absolute terms

Attainability of emission ceilings (PRIMES MID)

- SO₂ limit impossible to reach with current activity estimate
- NH₃ MID uncertain, baseline OK
- Other limits seem possible as differences are small
- Road dust resuspension?

Thank you

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