

Procedure and first results

A PM2.5 inventory for Europe

TNO | Knowledge for business



Outline

- Background
- Approach
- First Order Draft Results
- Next steps



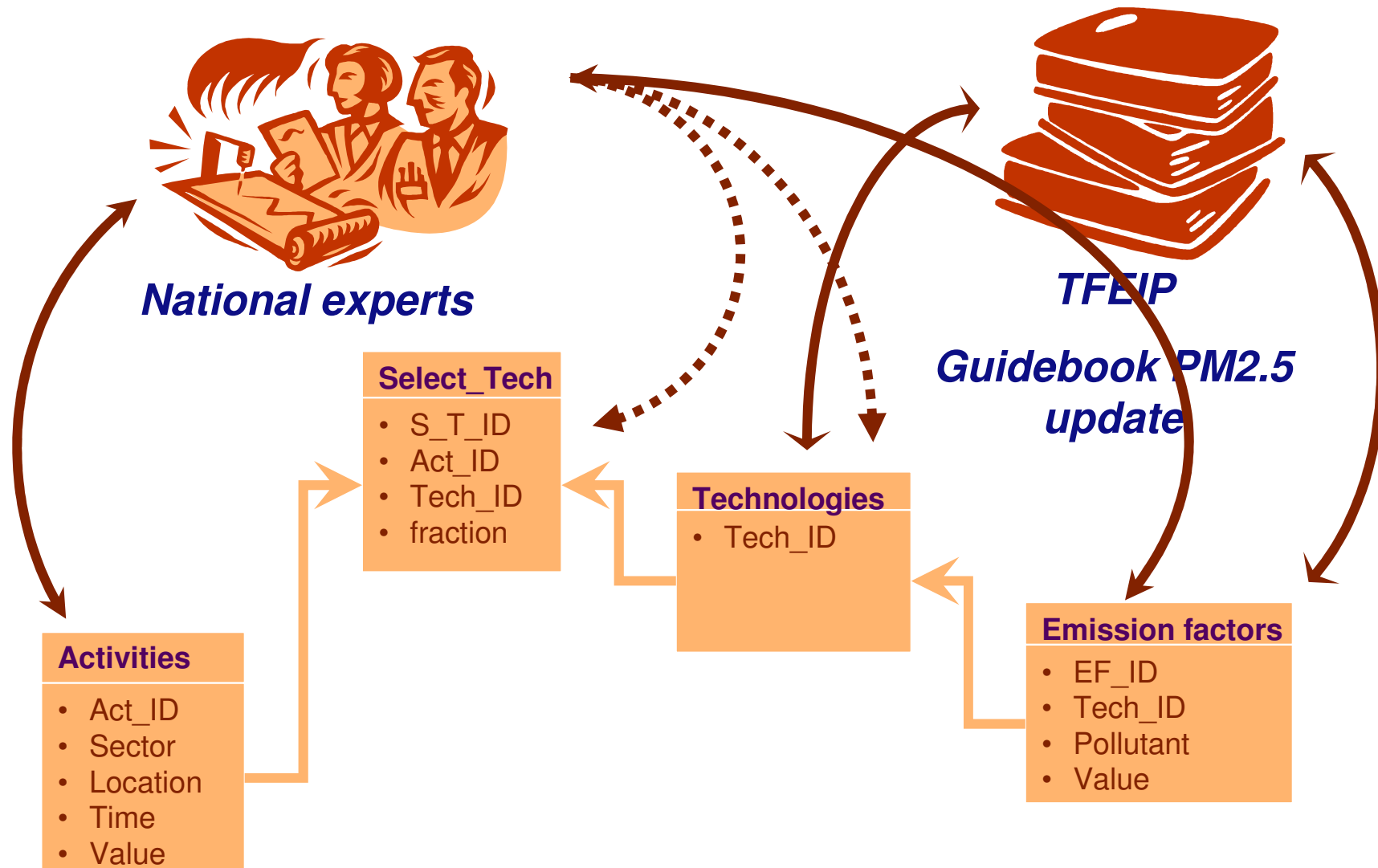
Background: Objective

- To provide a sound foundation for the establishment of national emission ceilings for PM2.5
- Support Member States to develop PM2.5 inventories of sufficient quality
- Quality requirements:
 - **Transparency** means that the assumptions and methodologies used for the inventory should be clearly explained
 - **Comparability** means that estimates of emissions should be comparable among Member States
 - **Completeness** means that an inventory covers all sources
 - **Accuracy** is a relative measure of the exactness of an emission or removal estimate
- Commissioned by DG Environment Unit C5
- Partners:
 - TNO (NL, lead),
 - AEA-T (UK)
 - IVL (SE)

AEA Technology plc
IVL Swedish Environmental
Research Institute

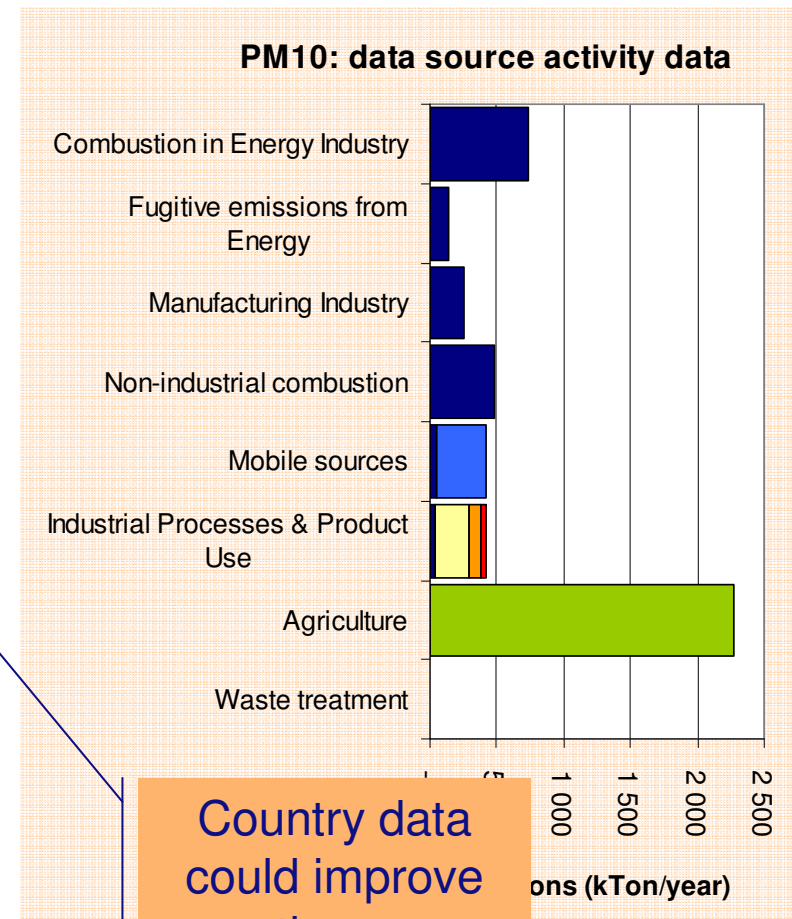
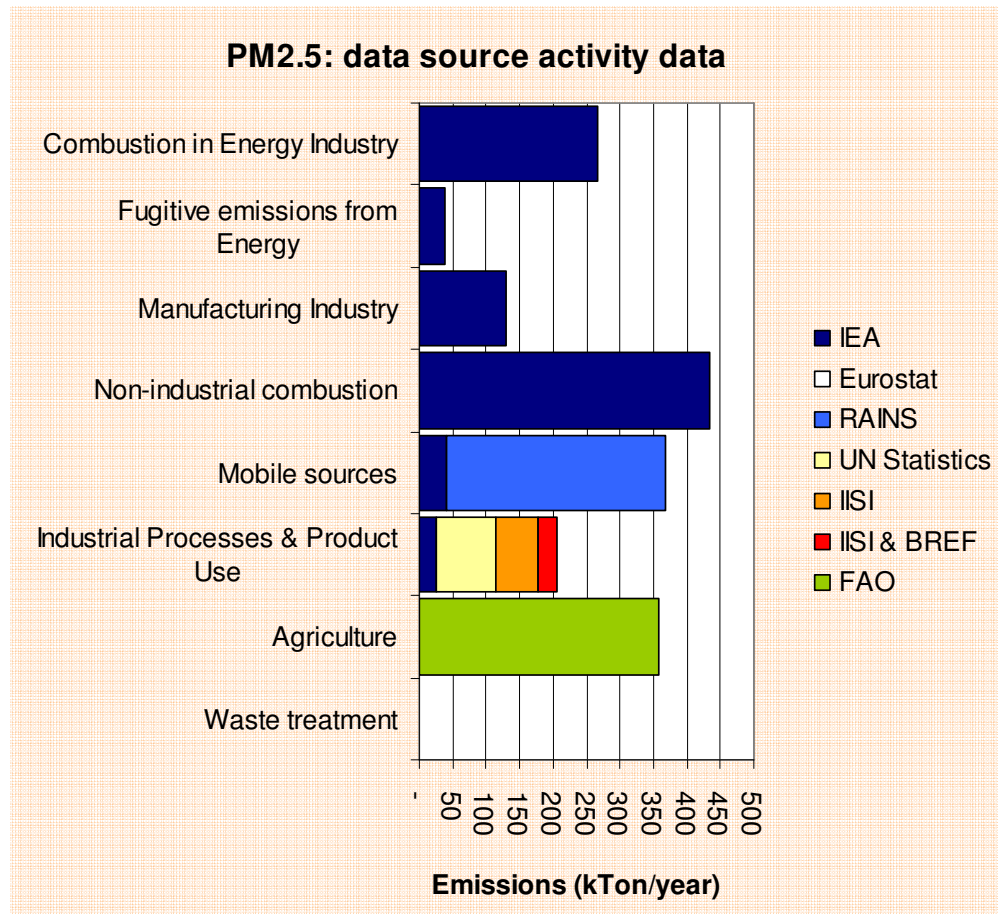


Background: Two related projects



Data sources *First Order Draft*

Activity data



Country data could improve these



Data sources *First Order Draft*

Emission Factors from CEPMEIP: power plants

Sum of EF				Pollutant		
CRF/NFRCode	FuelName	Technology	EF_Unit	PM2.5	PM10	TSP
1.A.1.a	Heavy Fuel Oil	Autoproducer electricity, heat and CHP plants, and public heat plants: Low S-fuel with optimized burner or ESP	g/GJ	27.5	33	33
		Autoproducer electricity, heat and CHP plants, and public heat plants: Low-medium S-fuel, conventional installation	g/GJ	108	180	240
		Autoproducer electricity, heat and CHP plants, and public heat plants: Medium S-fuel, conventional installation	g/GJ	120	240	480
	Lignite/Brown Coal	Autoproducer electricity, heat and CHP plants, and public heat plants: Conventional ESP (removal efficiency around 98%)	g/GJ	180	720	1440
		Autoproducer electricity, heat and CHP plants, and public heat plants: Efficient 3 or 4-field ESP only (removal efficiency about 99.5%)	g/GJ	70	150	200
		Autoproducer electricity, heat and CHP plants, and public heat plants: FGD or fabric filter; <20 mg/Nm3 stack PM concentration; BAT	g/GJ	24	32	36
	Natural Gas	Autoproducer electricity, heat and CHP plants, and public heat plants: Burner with optimized combustion	g/GJ	0.9	0.9	0.9
		Autoproducer electricity, heat and CHP plants, and public heat plants: Conventional installation	g/GJ	4.2	4.2	4.2
	Other Bituminous Coal & Anthracite	Autoproducer electricity, heat and CHP plants, and public heat plants: Conventional ESP (removal efficiency equal or better than 98%)	g/GJ	68	280	560
		Autoproducer electricity, heat and CHP plants, and public heat plants: Efficient 3 or 4-field ESP only (removal efficiency about 99.5%)	g/GJ	108	225	315
		Autoproducer electricity, heat and CHP plants, and public heat plants: FGD or fabric filter; <20 mg/Nm3 stack PM concentration; BAT	g/GJ	50	60	60
	Wood and wood waste	Public electricity and CHP plants: Uncontrolled conventional	g/GJ	880	1120	1600

Data sources *First Order Draft*

Emission Factors from CEPMEIP: technology selected

Power Plants on Other Bituminous Coal & Anthracite

- Per country one technology selected
- Based on the CEPMEIP 1995 inventory
- Country data needed to improve:
 - EF measurements?
 - Technologies used?

Sum of Emission(kTon)		Technology		
CRF/NFRCode	CountryName	Autoproducer electricity, heat and CHP plants, and public heat plants: FGD or fabric filter; <20 mg/Nm3 stack PM concentration; BAT	Autoproducer electricity, heat and CHP plants, and public heat plants: Efficient 3 or 4-field ESP only (removal efficiency about 99.5%)	Autoproducer electricity, heat and CHP plants, and public heat plants: Conventional ESP (removal efficiency equal or better than 98%)
1.A.1.a	Austria			0.19
	Belgium		1.28	
	Czech Republic	1.37		
	Denmark			0.77
	Finland			0.43
	France		3.17	
	Germany			4.52
	Greece		0.00	
	Ireland		0.78	
	Italy		3.04	
	Netherlands			1.07
	Poland	15.81		
	Portugal		1.61	
	Slovak Republic	0.52		
	Spain		7.78	
	Sweden			0.07
	United Kingdom		13.32	
Grand Total		17.70	30.98	7.05



PM2.5 emissions in Europe

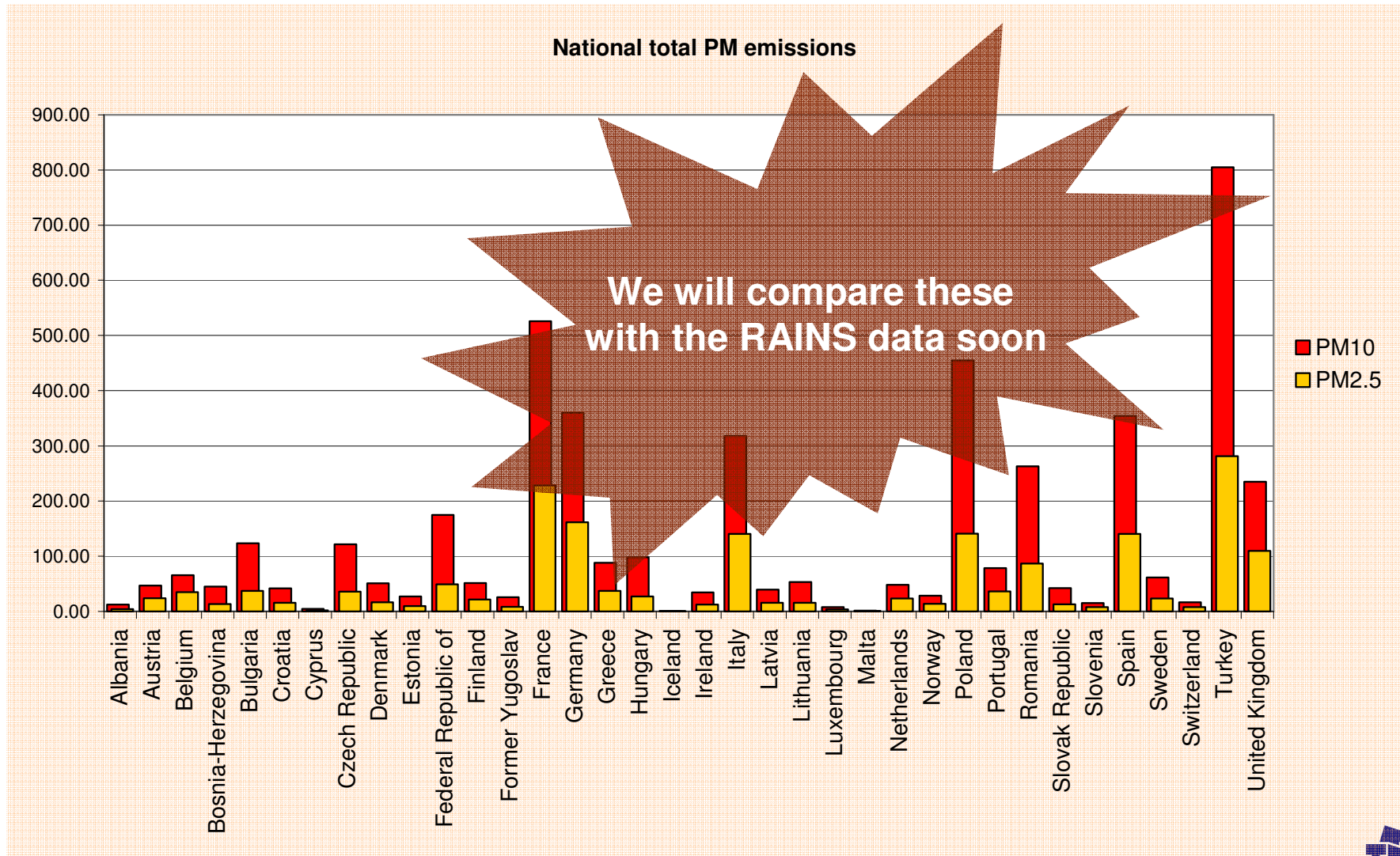
National totals

- Total PM2.5 emissions in the EU25: 1300 kTon.
- The other countries in this study add about 500 kTon
- Total PM2.5 emissions are about 40% of the PM10 emissions
- Larger countries contribute more to the total emissions than smaller countries.
- Some discrepancies with RAINS estimates

Emission(kTon)		Pollutant	
CountryGroup	CountryName	PM2.5	PM10
EU25			
	Austria	23.92	46.66
	Belgium	34.67	65.59
	Cyprus	1.95	4.46
	Czech Republic	35.99	121.55
	Denmark	16.71	50.79
	Estonia	9.48	27.25
	Finland	21.35	51.16
	France	228.72	525.60
	Germany	161.77	359.90
	Greece	37.28	88.20
	Hungary	26.73	98.41
	Ireland	12.60	34.16
	Italy	140.07	318.11
	Latvia	15.53	39.38
	Lithuania	15.69	53.18
	Luxembourg	3.77	7.96
	Malta	0.68	1.35
	Netherlands	23.45	48.13
	Poland	141.06	454.58
	Portugal	36.30	78.58
	Slovak Republic	12.98	42.09
	Slovenia	7.78	15.25
	Spain	140.13	354.64
	Sweden	23.44	61.75
	United Kingdom	109.53	234.94
EU25 Total		1 281.57	3 183.69
CC			
	Bulgaria	37.02	123.38
	Romania	86.75	262.85
	Turkey	281.37	804.87
CC Total		405.14	1 191.10
AC			
	Albania	3.97	12.40
	Bosnia-Herzegovina	13.24	45.17
	Croatia	15.83	41.80
	Federal Republic of Yugoslavia (Serbia&Montenegro)	49.27	174.82
	Former Yugoslav Republic of Macedonia	8.28	25.74
AC Total		90.59	299.93
EFTA			
	Iceland	0.41	0.88
	Norway	13.58	28.41
	Switzerland	8.02	16.49
EFTA Total		22.01	45.78
Grand Total		1 799.32	4 720.50

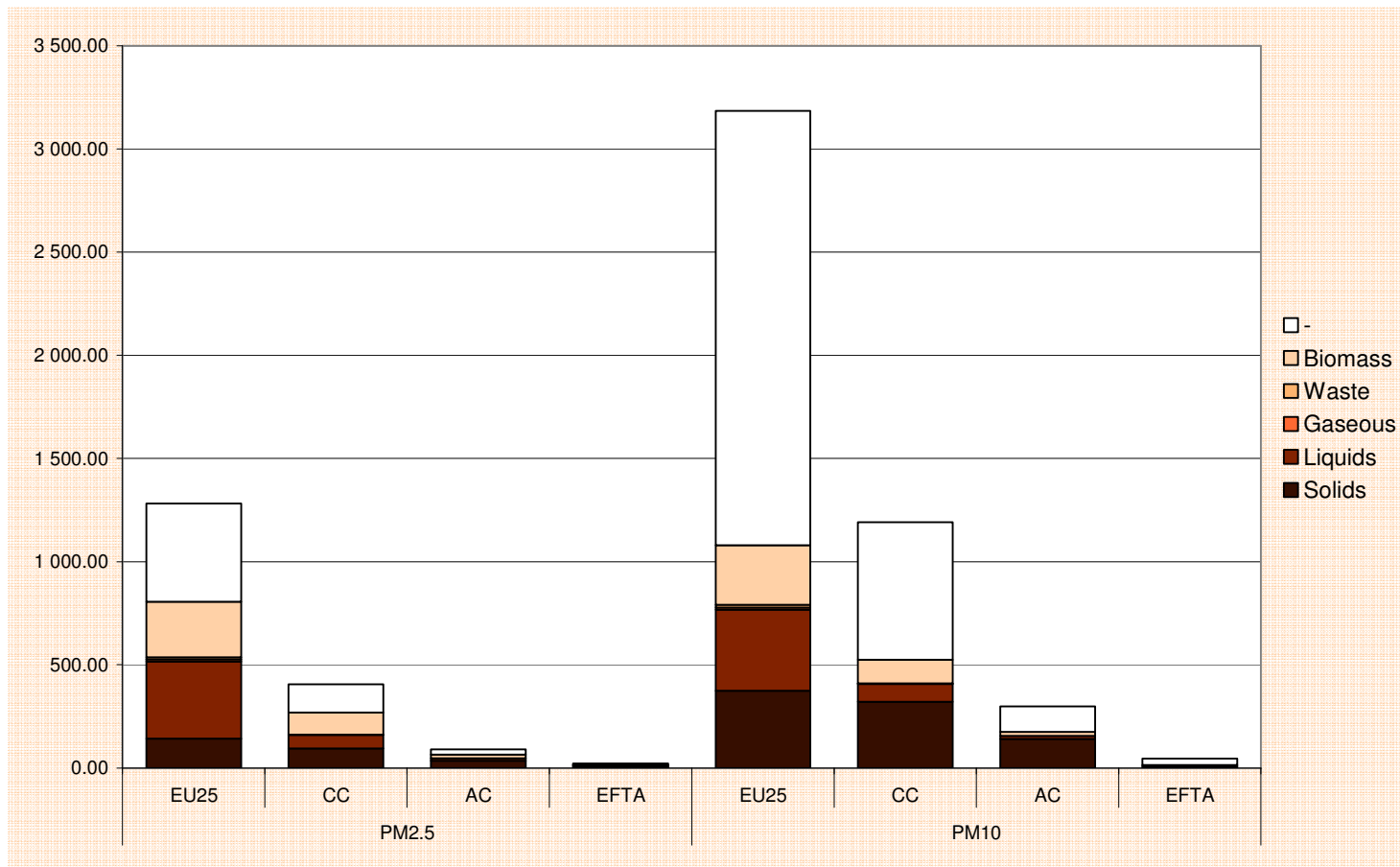
PM2.5 emissions in Europe

National totals



PM2.5 & PM10 emissions in Europe

Contributions by fuel



PM2.5 & PM10 emissions in Europe

Contributions by fuel

Emission(kTon)		FuelGroup						-	Grand Total
Pollutant	CountryGroup	Solids	Liquids	Gaseous	Waste	Biomass			
PM2.5	EU25	143.04	373.58	9.88	10.97	269.28	474.82	1 281.57	
	CC	94.88	65.70	1.02	0.67	106.92	135.96	405.14	
	AC	36.14	12.27	0.11		17.75	24.32	90.59	
	EFTA	0.12	8.33	0.23	0.14	5.26	7.93	22.01	
PM2.5 Total		274.18	459.88	11.24	11.78	399.21	643.03	1 799.32	
PM10	EU25	373.84	393.34	9.88	14.12	287.89	2 104.62	3 183.69	
	CC	320.77	86.78	1.02	1.12	114.84	666.57	1 191.10	
	AC	141.02	15.46	0.11		19.07	124.27	299.93	
	EFTA	0.28	8.55	0.23	0.19	5.27	31.27	45.78	
PM10 Total		835.91	504.13	11.24	15.42	427.06	2 926.73	4 720.50	

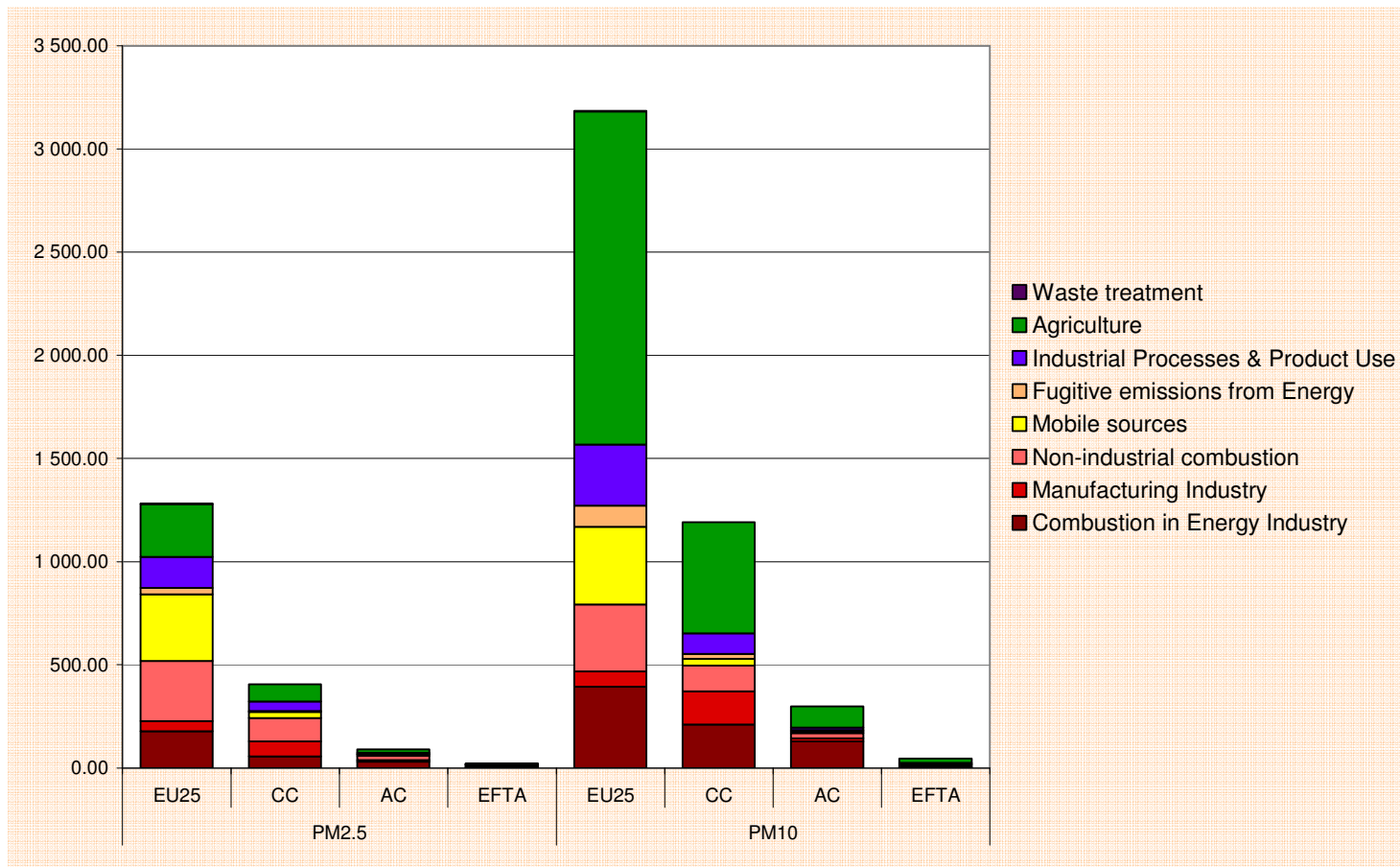
- Non-combustion sources contribute
 - more than 1/2 of the PM10 emissions in Europe; more than 2/3 in EU25
 - one third to the PM2.5 emissions.

The very large share to PM10 emissions is due to the inclusion of wind blown dust in agriculture.

- Solid fuels are by far the largest combustion source for PM10, followed by Liquids and Biomass.
- For PM2.5 the largest combustion source is Liquids, followed by Biomass and Solids.

PM2.5 & PM10 emissions in Europe

Contributions by source sector



PM2.5 & PM10 emissions in Europe

Sub-sectors in Agriculture

Emission(kTon)		CountryGroup				Grand Total
Pollutant	Subsector	EU25	CC	AC	EFTA	
PM2.5	Arable land - wind erosion	154.52	55.07	10.50	1.95	222.05
	Arable land - soil tilling	39.15	13.95	2.66	0.50	56.25
	Arable land - pesticide application	8.55	3.05	0.58	0.11	12.29
	Arable land - harvesting	7.73	2.75	0.53	0.10	11.10
	Arable land - fertilizer	7.01	2.50	0.48	0.09	10.07
	Cattle	8.36	1.32	0.30	0.24	10.21
	Pigs	12.07	0.58	0.47	0.15	13.28
	Chickens	9.72	2.68	0.34	0.08	12.83
	Turkeys	5.85	0.28	0.11	0.00	6.25
	Ducks	2.11	0.31	0.06	0.00	2.49
	Geese	0.23	0.32	0.08		0.64
	PM2.5 Total		255.29	82.81	16.12	3.22
PM10	Arable land - wind erosion	1 030.16	367.10	70.03	13.03	1 480.32
	Arable land - soil tilling	257.54	91.78	17.51	3.26	370.08
	Arable land - pesticide application	56.66	20.19	3.85	0.72	81.42
	Arable land - harvesting	51.51	18.36	3.50	0.65	74.02
	Arable land - fertilizer	46.36	16.52	3.15	0.59	66.61
	Cattle	37.56	5.93	1.33	1.06	45.88
	Pigs	53.46	2.58	2.10	0.68	58.82
	Chickens	43.34	11.95	1.53	0.38	57.20
	Turkeys	26.61	1.27	0.52	0.00	28.40
	Ducks	9.61	1.41	0.28	0.00	11.30
	Geese	1.04	1.48	0.37		2.89
	PM10 Total		1 613.84	538.56	104.17	20.36

PM2.5 & PM10 emissions in Europe

Sub-sectors in Road Transport

Emission(kTon)			CountryGroup				
Pollutant	CRF/NFRCode	CRF/NFRName	EU25	CC	AC	EFTA	Grand Total
PM2.5	1.A.3.b.ii	road transport, light duty vehicles	98.22	7.03	1.87	1.00	108.12
	1.A.3.b.iii	road transport, heavy duty vehicles	152.60	16.24	3.88	2.85	175.57
	1.A.3.b.iv	road transport, mopeds & motorcycles	8.64	0.06	0.61	0.17	9.48
	1.A.3.b.vi	road transport, automobile tyre and brake wear	29.70	1.78	0.45	0.88	32.81
	1.A.3.b.vii	road transport, automobile road abrasion	0.00	0.00	0.00	0.00	0.00
	1.A.3.c	railways	14.10	2.51	0.32	0.13	17.07
	1.A.3.d.ii	national navigation	19.69	1.39	0.22	2.65	23.94
	1.A.3.e	other (please specify in a covering note)	0.28		0.28		0.56
PM2.5 Total			323.23	29.02	7.63	7.68	367.56
PM10	1.A.3.b.ii	road transport, light duty vehicles	98.22	7.03	1.87	1.00	108.12
	1.A.3.b.iii	road transport, heavy duty vehicles	152.60	16.24	3.88	2.85	175.57
	1.A.3.b.iv	road transport, mopeds & motorcycles	8.64	0.06	0.61	0.17	9.48
	1.A.3.b.vi	road transport, automobile tyre and brake wear	47.14	2.83	0.72	1.39	52.08
	1.A.3.b.vii	road transport, automobile road abrasion	31.91	1.79	0.47	0.98	35.15
	1.A.3.c	railways	15.47	2.75	0.35	0.15	18.72
	1.A.3.d.ii	national navigation	20.88	1.49	0.23	2.80	25.39
	1.A.3.e	other (please specify in a covering note)	0.30		0.30		0.61
PM10 Total			375.16	32.19	8.43	9.34	425.12

How to continue

So far 13 countries responded:

- 8 countries provided comments
- 3 countries prefer that we use IIASA's estimate
- 4 countries requested support

We will

- compare our estimate with IIASA
- Support/discuss with national experts from countries that request us to do so

Side event at this meeting

	Comments	Use IIASA	Support requested
Albania	X		
Austria	X		
Belgium			
Bosnia-Herzegovina			
Bulgaria			X
Croatia			
Cyprus			
Czech Republic	X		
Denmark			
Estonia	X		
Federal Republic of Yugoslavia (Serbia&Montenegro)			
Finland			
Former Yugoslav Republic of Macedonia			
France			
Germany	X		
Greece			
Hungary	X		
Iceland			
Ireland			
Italy			
Latvia	X		X
Lithuania			
Luxembourg			X
Malta			
Netherlands			
Norway	X	X	
Poland			
Portugal		X	
Romania			
Slovak Republic			
Slovenia			
Spain		X	
Sweden			
Switzerland			
Turkey			
United Kingdom			

