Towards widening the application of integrated assessment for abatement costs and benefits modelling in EECCA: case study Belarus

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Rationale:

- up to now application of IAM in EECCA is limited;
- potential of wider application of IAM in these regions and at a local scale on the whole exists;
- what should be done for its realization?

Starting points:

- IAM modelling results for application in scientific provision of national and local air abatement policies need to be of a certain level of accuracy and detail;
- testing of accuracy of IAM estimates and model parametrization using all available information may act as a method of verification.

Such analysis is made for Belarus on example of PM emission sources.

Methodology:

- statistical etc. national data plus assessments made using RAINS/GAINS: analysis and comparisons.

Included in this presentation:

- emission abatement efficiency and costs statistics for Belarus;
- marginal and specific operational costs;
- facilities data (cast iron & cement);
-RAINS/GAINS efficiencies and costs for key technologies;
- comparisons and conclusions.

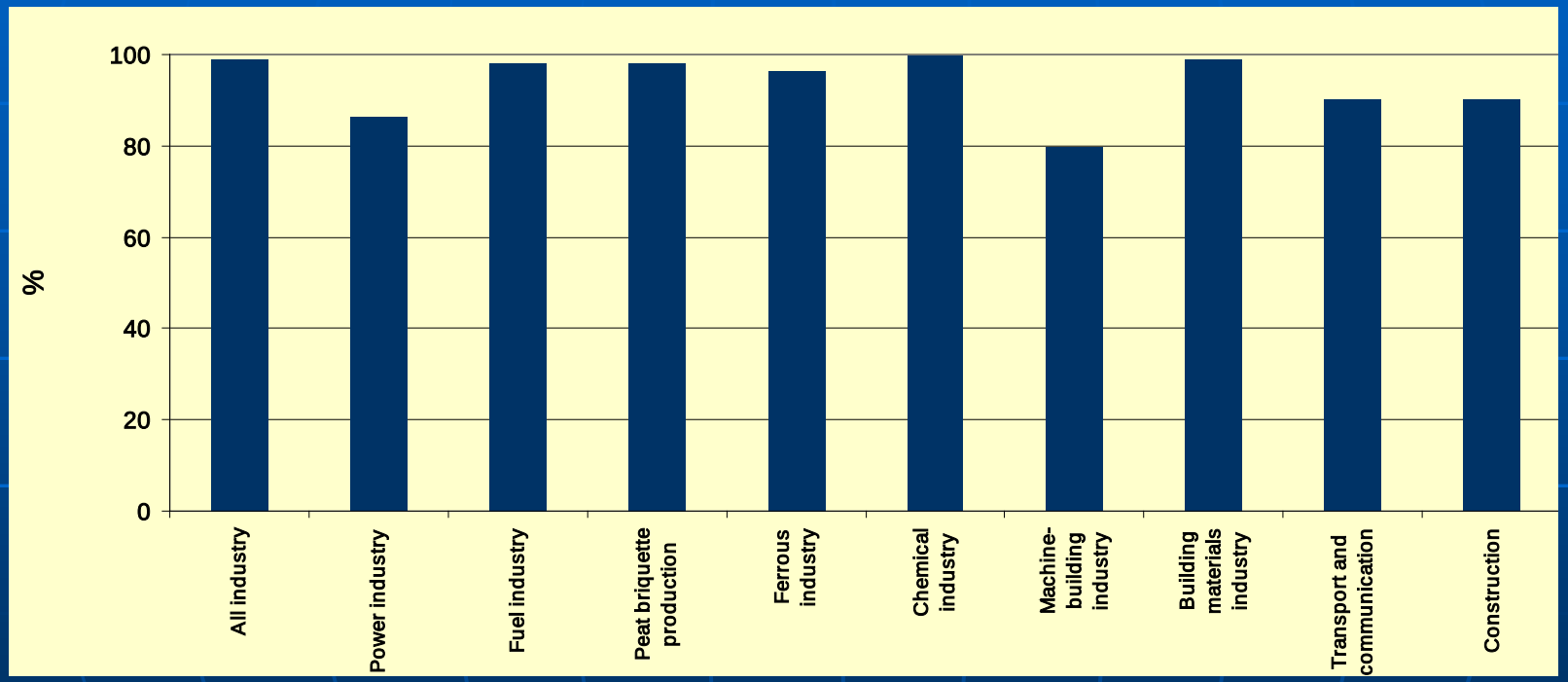
1. Abatement efficiency by sector in Belarus

Average emission abatement efficiency in Belarus in 2007 according to statistics comprised 87%; waste gases from fuel combustion abatement amounted 5%, from technological processes - 90%. PM (TSP) is mainly controlled: for PM efficiency comprised 35% and 98% accordingly.

Among economy sectors highest level of PM abatement is typical for industry – about 99%. In steel production PM abatement level is about 99%, in cast iron production – 80%, in cement production – 97%.

Average efficiency of PM abatement from fuel combustion in industry comprise 68%, in residential-communal sector – 17%. No recorded emission abatement in domestic sector.

Average PM abatement efficiency by sector in Belarus



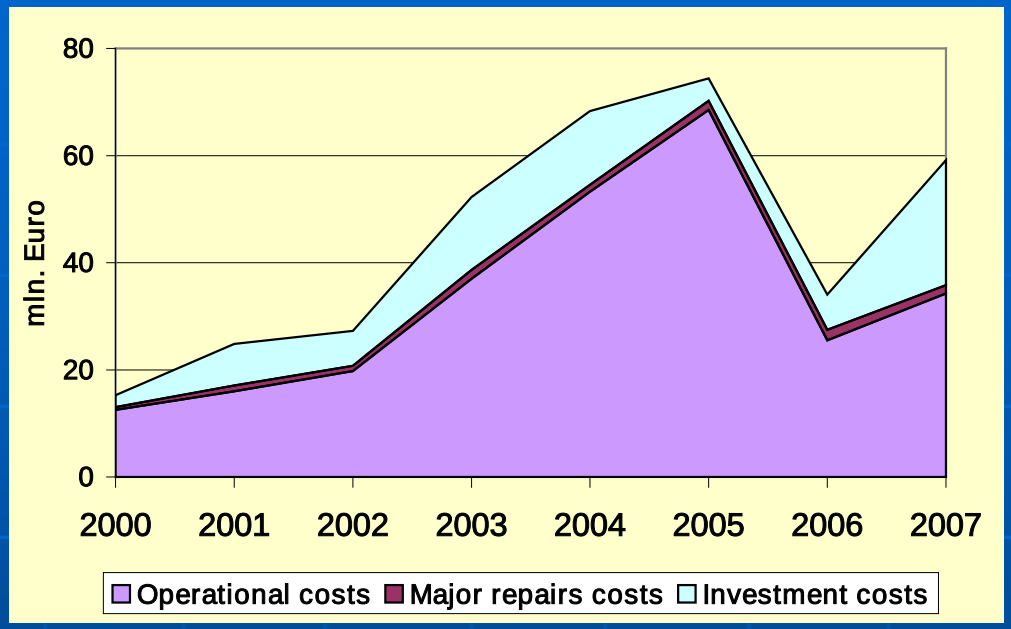
2. Total abatement costs

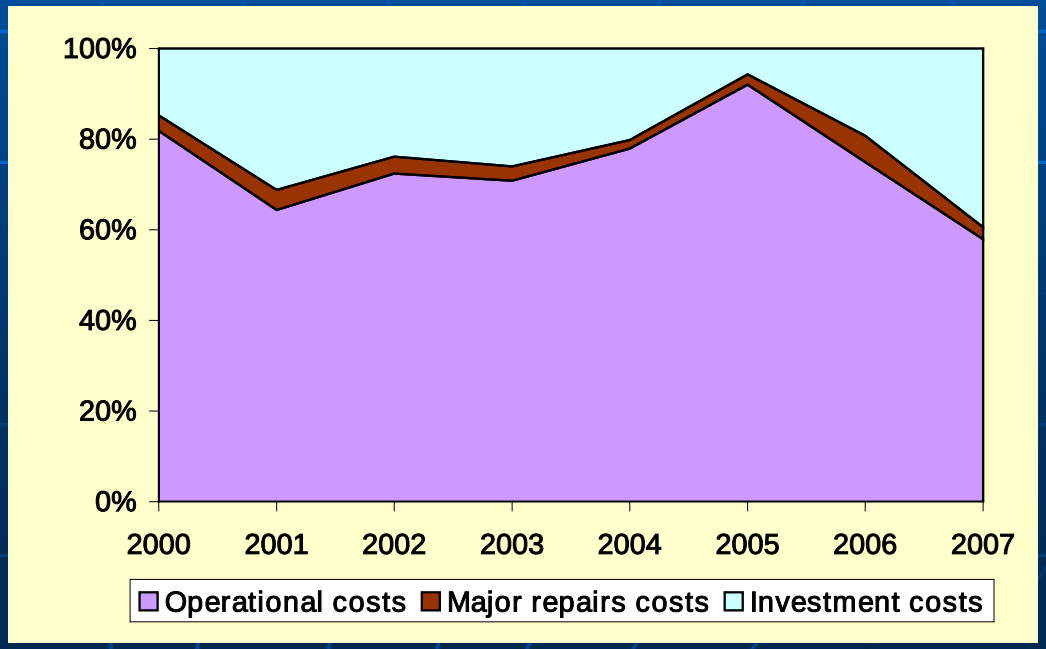
Total air and climate protection costs in 2007 in Belarus amounted (in recalculation from national currency) 59 mln Euro; operational costs comprised 58%, major repair costs - 3%, investment costs - 39%.

Share of operational costs in the costs structure is the greatest and vary last 8 years from 58 to 91%.

Investment costs share vary from 9% to 53%.

Structure and trends of air protection costs in Belarus





3. Abatement costs by sector

95% of total costs on air protection are spent in industry. Share of transport and residential-communal sectors were about 2% each; costs in agriculture by statistics were much lower than 1% of total air protection costs, accounted by statistics.

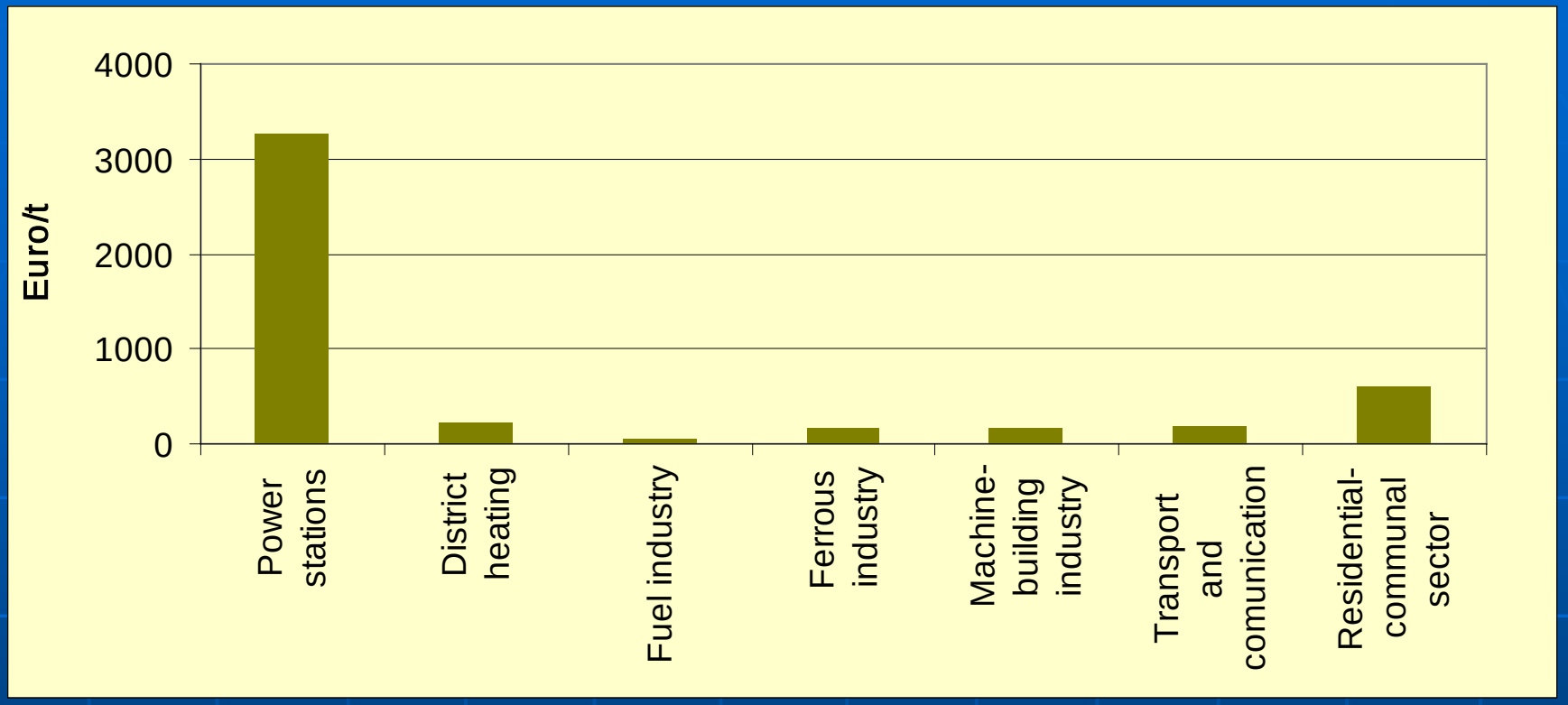
In industry greatest operational costs were in chemical and petrochemical industries (10.8 mln. Euro) - 34% of total costs, in fuel industry - 21% of total costs. In cement industry costs amounted 0.87 mln Euro, in ferrous industry – 3.9 mln. Euro, in machine building – 2.9 mln Euro.

4. Specific costs by sector

Volumes of collected PM were estimated by sector; these values were used for specific abatement costs per ton of pollutant rough estimation.

Highest specific operational costs are in energy sector (about 3.3 thous. Euro per ton).

In machine-building industry specific costs are 0.16 thous. Euro/t; in ferrous industry – 0.17 thous. Euro/t, in fuel industry – 0.05 thous. Euro/t, in chemical industry – 0.008 thous. Euro/t; lowest operational costs are in cement industry – 0.001 thous. Euro/t.

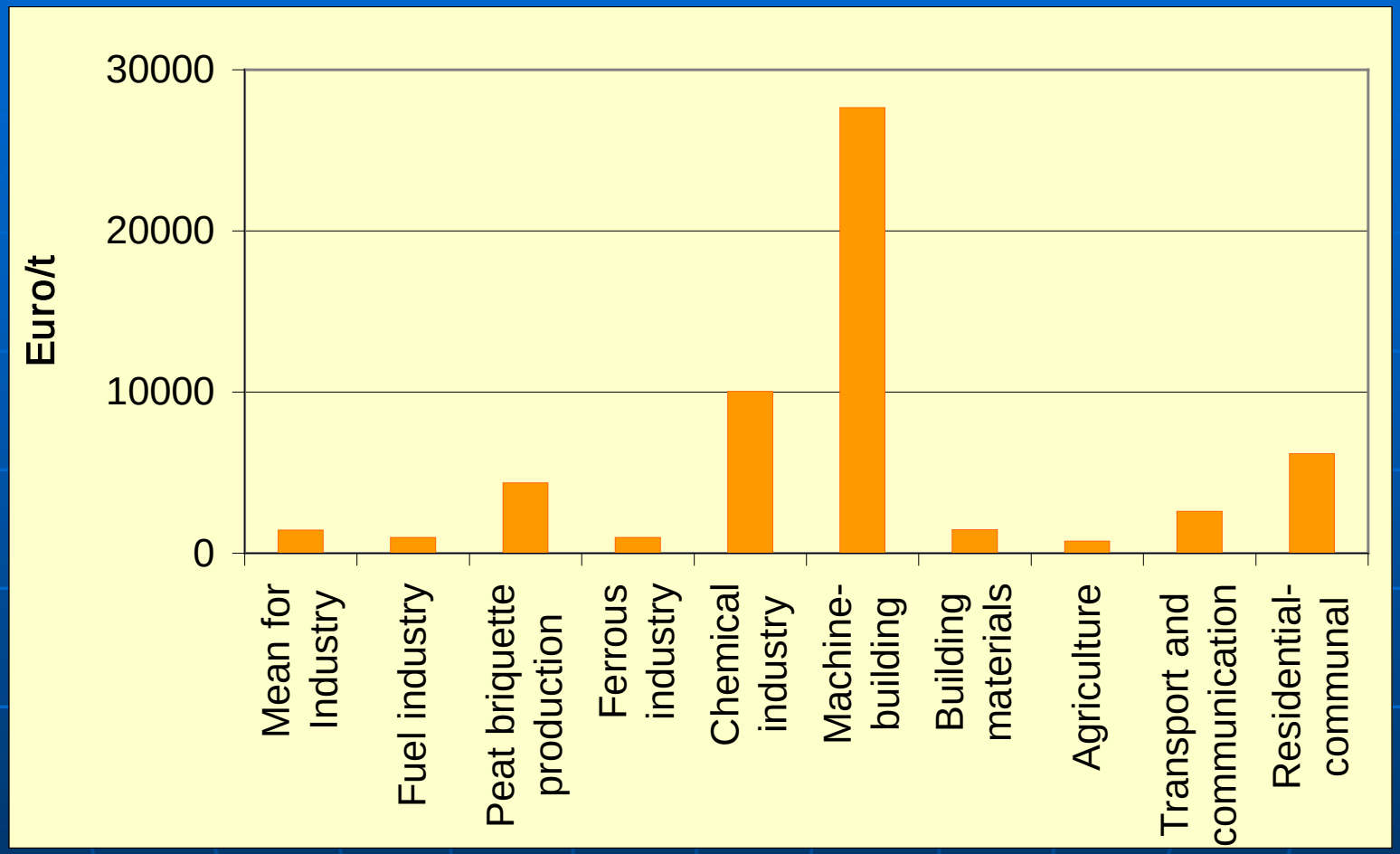


Specific operational air protection costs in Belarus

5. Costs of additional abatement measures

These costs were estimated according to data on measures costs and projected emission reduction. Methodology of calculation of expected emission reduction is not sophisticated so results are very preliminary.

Average cost of additional measures in 2008 – 1.5 thous. Euro/ton of expected additional pollution reduction. Level of marginal costs vary greatly: 10 thous. Euro/t in chemical industry, 1 thous. Euro/t in ferrous and fuel industries, 0.9 thous. Euro/t in cement industry, 6.2 thous. Euro/t in agriculture etc.

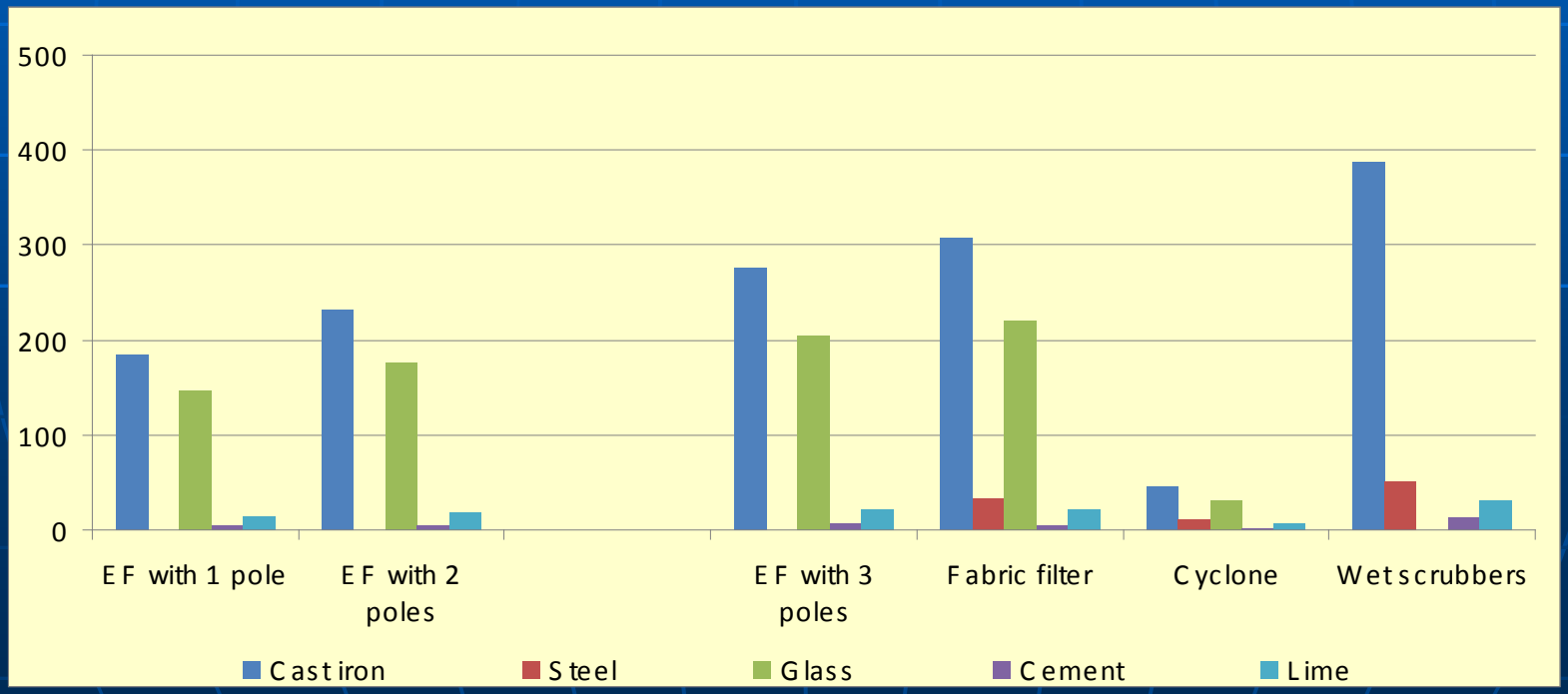


Average costs of additional abatement measures by sector

6. Specific and marginal costs of PM abatement in Belarus according to RAINS/GAINS (industrial processes)

GAINS/GAINS databases on abatement costs were analyzed; marginal costs for different options were assessed.

Specific costs of PM emission abatement in Belarus (technological processes) estimated using RAINS*, Euro/t



* - at 4% interest rate

Case studies with in-depth analysis – cast iron and cement

Cast Iron production

TSP emission from cast iron production – about 900 t/year

Open cupolas and induction furnaces are used in cast iron production in Belarus

Open cupola – predominant technology for cast iron production in Belarus and EECCA.

Marginal costs for PM abatement in cast iron production in Belarus estimated using RAINS*, Euro/t PM

New abatement unit Initial abatement unit	Wet scrubber	EF with 1 pole	EF with 2 poles	EF with 3 poles	Fabric filter
Cyclone	745.4	304.5	384.1	455.3	512.2
EF with 1 pole	**	-	1640.8	1834.6	2411.3
EF with 2 poles	**	**	-	2101.4	3472.0

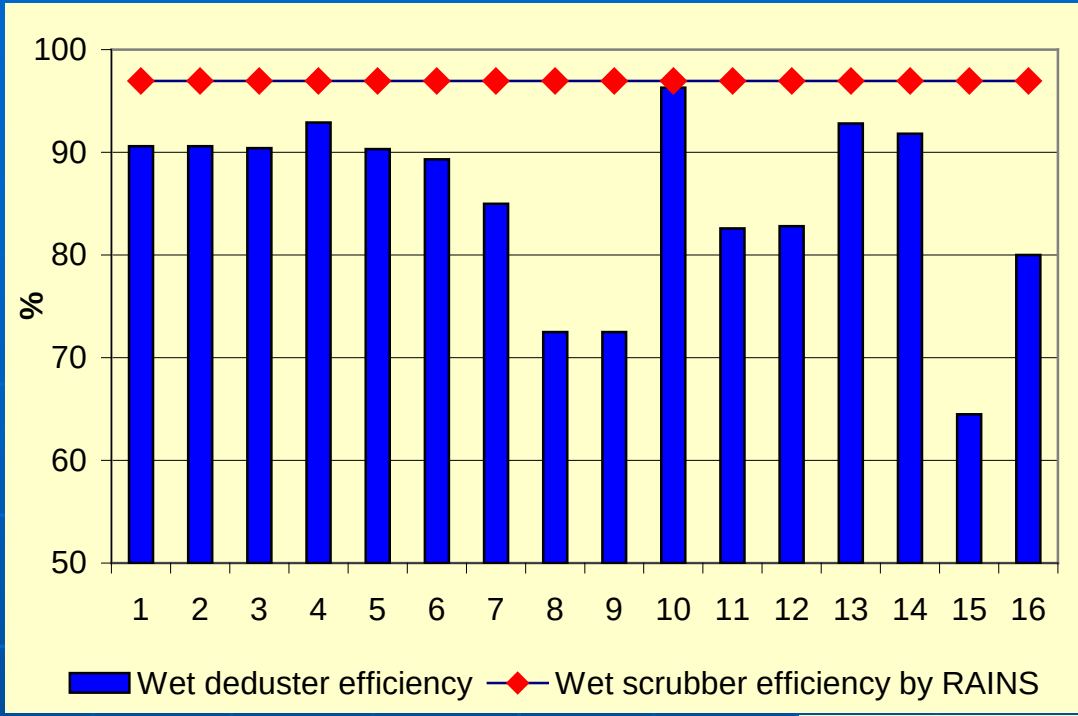
* - at 4% interest rate

** - value is negative

According to calculations for instance shift from cyclones to wet scrubbers in cast iron will cost 745 Euro/t additional PM emission reduction, to EF with 1 pole – 305 Euro, to EF with 2 poles – 384 Euro etc. But all this options are hardly applicable for open cupolas. Cost of abatement by wet scrubbers seems too high compared to other options. Additional abatement options need to be investigated.

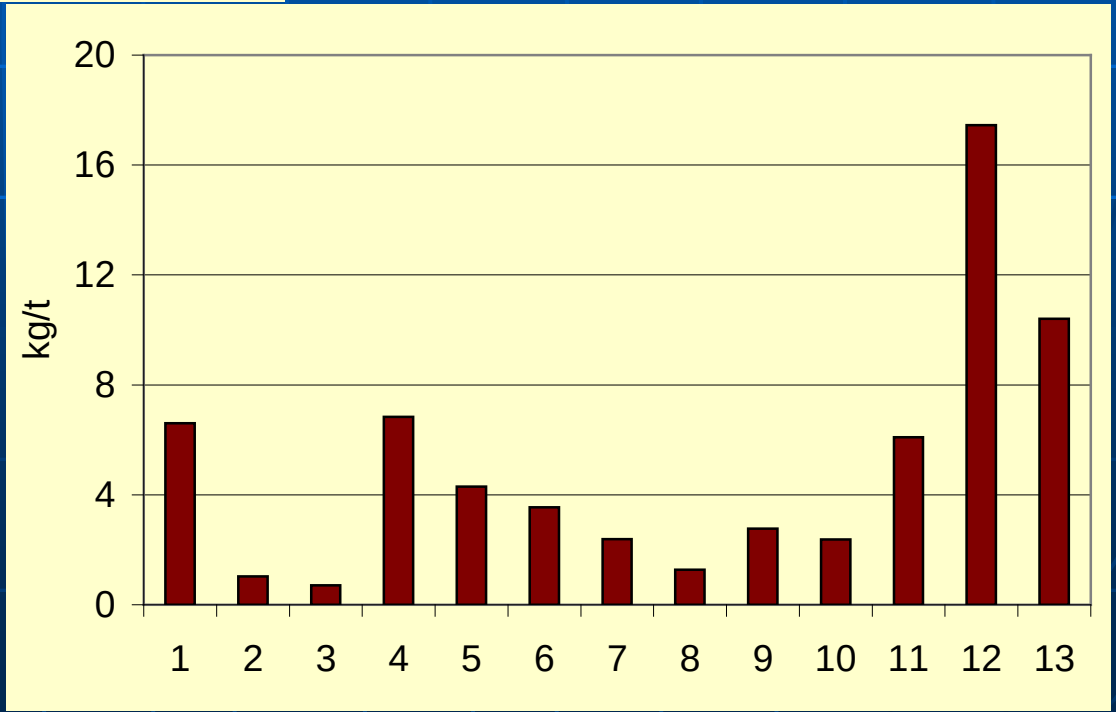
- Wet dedusters (scrubbers) with CO afterburning are used for emission abatement from open cupolas;
- Abatement systems are usually projected and produced specially for certain cupola;
- TSP abatement efficiency for open cupolas in Belarus vary from 50 to 92% with average about 80-85%.

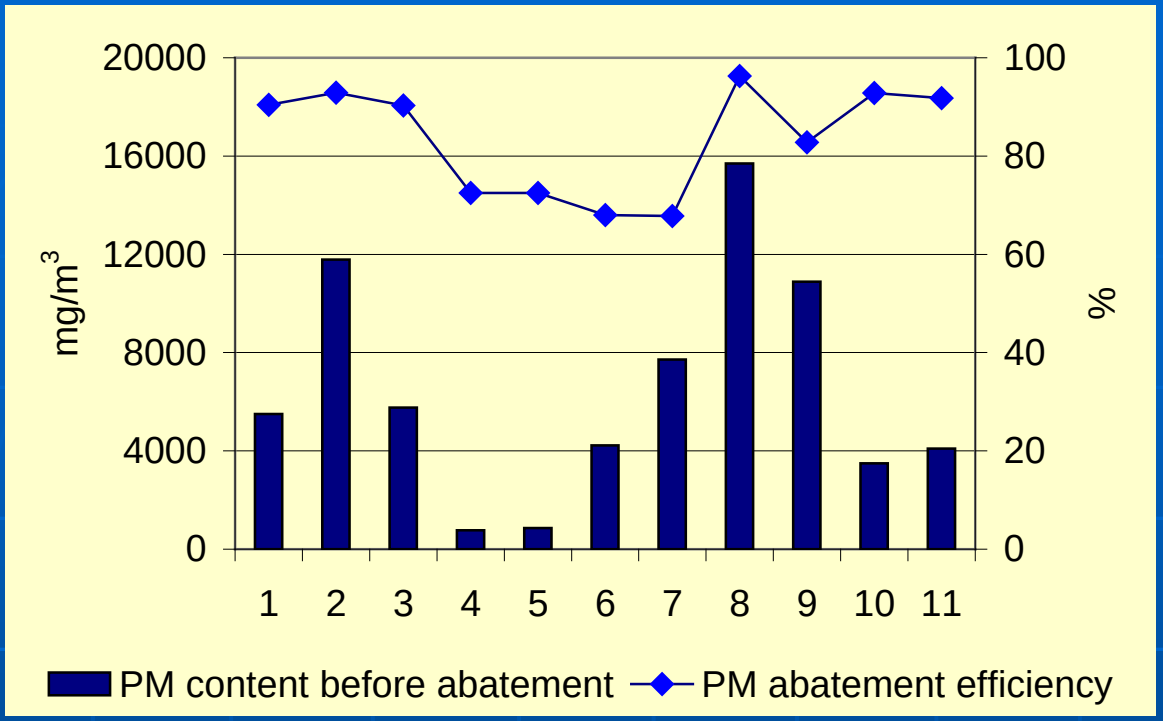
Wet dedusters at open cupolas



Variability of wet deduster efficiency by facilities

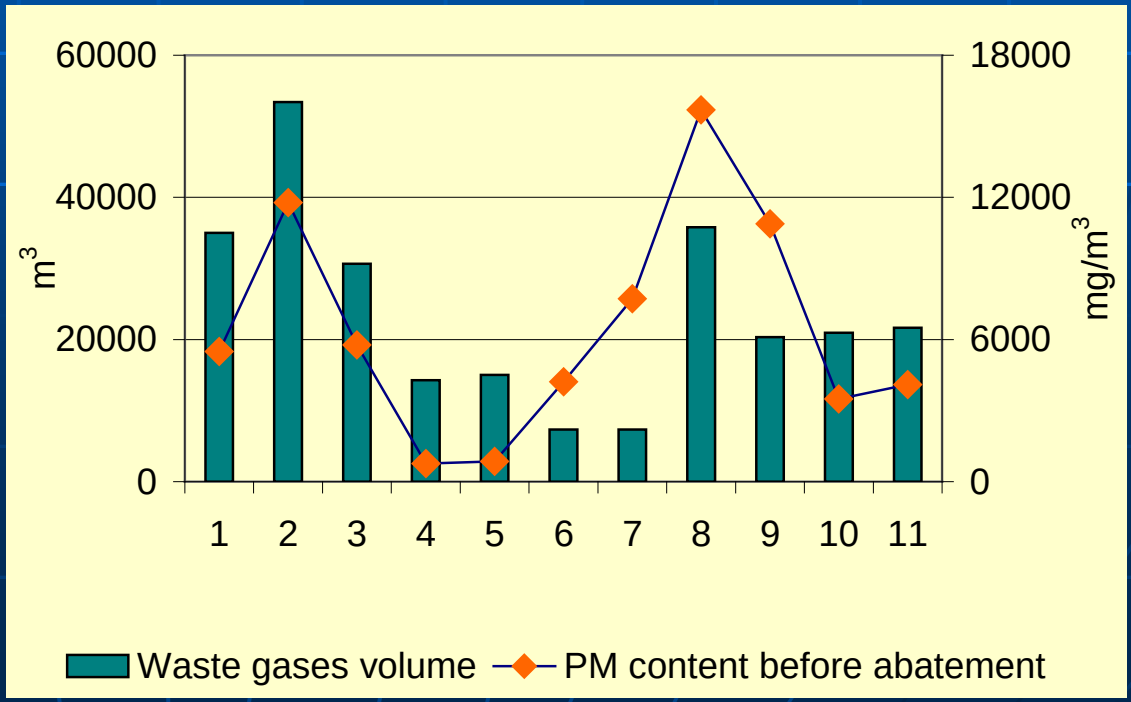
Variability of TSP emission factors from cast iron production by facilities





Correlation of PM content in waste gases and wet dedusters efficiency for open cupolas

Correlation of PM content in waste gases and volume of waste gases from open cupolas

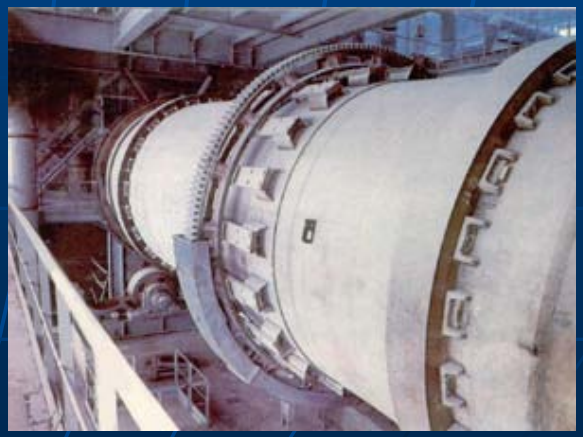


Cement production

Cement production is among key PM emission source in Belarus: about 3.4 thous. tons PM is emitted annually;

Dry and wet technologies are used in cement production;

TSP abatement efficiency for cement production in Belarus vary from 88.5 to 99.5% with average around 97%.



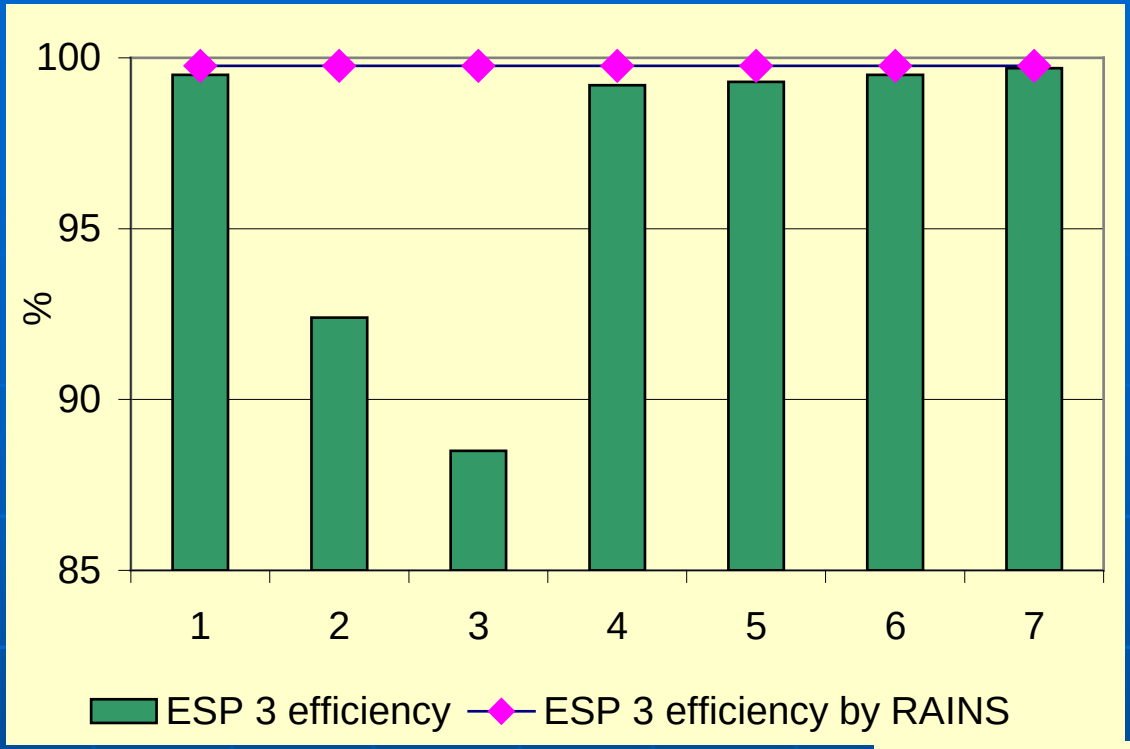
Marginal costs for PM abatement in cement production in Belarus according to estimates using RAINS*, Euro/t PM

New abatement Initial abatement	EF with 1 pole	EF with 2 poles	Wet scrubber	EF with 3 poles	Fabric filter
Cyclone	11.6	14.6	43.6	17.4	16.3
EF with 1 pole	-	34.4	259.2	48.5	41.3
EF with 2 poles	**	-	**	105.4	68.5

* - at 4% interest rate

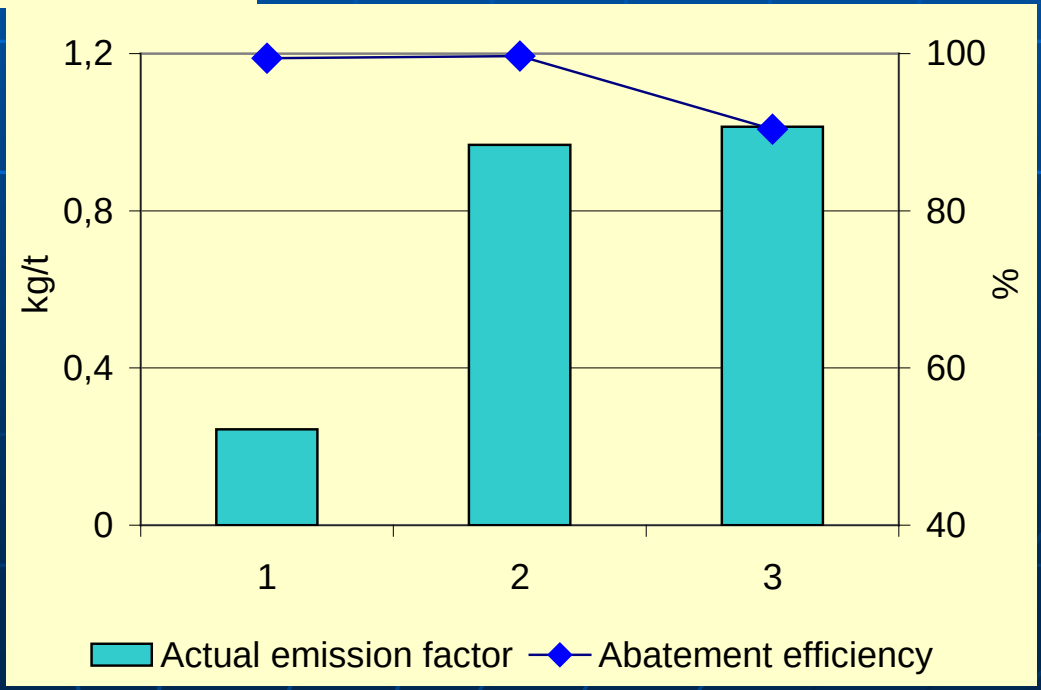
** - value is negative

Estimates showed that shift from EF with 1 field in off-gases abatement from clinker kilns to EF with 2 fields will increase PM abatement efficiency onto 3% with additional costs 34,4 Euro/t PM, to fabric filters - 4% and 41.3 Euro/t accordingly etc. All clinker roasting furnaces at cement plants in Belarus are equipped by EFs but their efficiencies are different. Options of abatement improvement by switching to another type of abatement system are limited but_analysis shows possibilities of wider application of methods like ‘good practice’ for control increase…



Variability of PM abatement efficiency by cement kilns

Correlation between PM emission factors and abatement efficiency by cement facilities



Conclusions and further steps

- first steps were made in IAM in Belarus; sources of available data were tested;
-case sectors (cast iron, cement) were analised (PM); list of other sectors scheduled for analysis include agriculture (NH3), energy (PM, NOx);
-further improvement of abatement efficiencies and costs in IAM model databases (localization) are needed for their effective application in preparation of national and regional air protection programs in EECCA; national statistics and inventory data may be widely used for their elaboration and also for verification of model calculates;
-more detailed classificators of abatement options and technologies are desired and planned for preparation;

- adding of additional flexibility in the IAM models, for instance possibility of emission scenario assessment from emission projections data will be useful;
-as a result of analysis guidelines on integrated assessment modelling application in preparation of national and regional air protection programs in Belarus will be issued.

Thanks you for your attention!