PM abatement technologies applied in EECCA countries: study and analysis

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Rationale:

1. IAM results are aimed at redistribution of abatement costs between sectors/countries, assessment of attainability of Gothenburg Protocol emission limits so uncertainties in IAM estimates (using GAINS and other models) affect policy.

2. Level of uncertainty of IAM estimates is different by region and for EECCA region is low.

3. Increase of emission/costs/impact assessment accuracy/reliability is necessary.

4. Current IAM parametrisation is made using basically WE technologies data/BAT; limited data for EECCA.
Goal of study:

- PM abatement techniques applicable in EECCA assessment for IAM models parametrization of PM in view of EECCA (on an example of Belarus).

Tasks:

- collection and analysis of data on PM control equipment production in EECCA;
- analysis of real and projected PM abatement efficiency;
- investment costs coefficients calculation.
Methodology:

- abatement equipment market study (analysis of costs of offers);
- facilities data study on abatement levels (actual and projected);
- calculation of investment costs coefficient (Cif).

Region:

Belarus (PM control equipment in operation and at market);
Russian Federation, the Ukraine (equipment market only).

Results:

Min/max abatement efficiencies and average investment coefficients per group of equipment and technology/sector.
Distribution of emission control equipment manufacturers in EECCA

- Russia: 80%
- Kazakhstan: 1%
- Ukraine: 11%
- Republic of Moldova: 1%
- Belarus: 7%

Small-scale production and implementation of projects under the order since 1925.

Over 150 manufacturers.
Greatest PM emission control equipment manufacturers in EECCA

Russia
• FINGO ENGINEERING, CJSC (all types)
• «Folter», SPE (cyclones, filters)
• IRIMEX, JSC (all types)
• “Giprogazoochistka” OJSC (all types)
• «Rankom-Energo», EPC (filters, electrostatic precipitators)
• STC «Zenith», Ltd. (cyclones, scrubbers)
• «SPA «Talnakh», JSC (cyclones, scrubbers, filters)
• «Siberian association of energy engineering», Ltd. (cyclones)
• «ALYUMATEK», GC (all types)

Belarus
• «BELKOTLOMASH», SPE LLC (cyclones)
• «Belenergoremnaladka», JSC (filters, electrostatic precipitators)

Ukraine
• «Berdichev Machine Building Plant «Progress», TH (cyclones, filters, electrostatic precipitators)
• ARTEMOVSKIY MASHINOSTRAITELINYY PLANT «PROMMASH», Ltd. (cyclones)
• «Gas Cleaning Equipment Plant» Ltd. (cyclones, scrubbers, filters)
PM control equipment standards

**USSR**

GOST 12.2.043-80. Dust equipment. Classification

GOST 25199-82. (CMEA Standard 2145-80) Dust equipment. Terms and definitions.

**Purposes of use**
- Air filter for forced ventilation
- Dust collector for emission

**Types and subtypes**
- **Dry**
  - Gravitational/inertial/filtration/electrostatic
- **Wet**
  - Gravitational/filtration/electrostatic

**Dust abatement efficiency for particles of different size groups (I-V)**

**Belarus**

«Rules of operation for gas treatment facilities»

**General types**
- Inefficiency criteria
### PM control equipment features and specific condition

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Design features</th>
<th>Specific conditions</th>
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<tbody>
<tr>
<td><strong>Cyclone</strong></td>
<td>Angles&lt;br&gt;Diameters&lt;br&gt;Ratio between the elements</td>
<td>Abrasive dust&lt;br&gt;Danger of explosion&lt;br&gt;Working outdoors</td>
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<tr>
<td><strong>Dry</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Inertial</strong></td>
<td></td>
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<tr>
<td><strong>Scrubber</strong></td>
<td>Angles&lt;br&gt;Diameters&lt;br&gt;Ratio between the elements</td>
<td>Abrasive dust&lt;br&gt;Danger of explosion&lt;br&gt;Working outdoors&lt;br&gt;Solvents</td>
</tr>
<tr>
<td><strong>Wet</strong></td>
<td></td>
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<tr>
<td><strong>Inertial</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Filter</strong></td>
<td>Regeneration&lt;br&gt;Materials</td>
<td>Abrasive dust&lt;br&gt;Danger of explosion&lt;br&gt;Working outdoors</td>
</tr>
<tr>
<td><strong>Dry</strong></td>
<td></td>
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<tr>
<td><strong>Filtration</strong></td>
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<tr>
<td><strong>Electrostatic precipitator</strong></td>
<td>Number of fields&lt;br&gt;Placement (horizontal/vertical)</td>
<td>Danger of explosion&lt;br&gt;Working outdoors&lt;br&gt;Productivity</td>
</tr>
<tr>
<td><strong>Dry</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Electrostatic</strong></td>
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</table>
Performances and costs range for main types of abatement equipment

**Cyclones**
Performance: up to 400 thousand m$^3$/h, cost ranges: up to 220 thousand US$

**Wet scrubbers**
Performance: up to 280 thousand m$^3$/h, cost ranges: up to 105 thousand US$

**Fabric filters**
Performance: up to 40 thousand m$^3$/h, cost ranges: up to 45 thousand US$

**Electrostatic precipitator**
Performance: up to 1020 thousand m$^3$/h, cost ranges: up to 285 thousand US$
Data on more than 700 models of control equipment from EECCA countries were compiled into database including: capacity, weight, efficiency, cost parameters etc.
Variability of unit costs of abatement depending on type of equipment

**Wet Scrubber**

- Unit cost, Euro
- Flow rate, 1000m³/hour

**ESP**

- Unit cost, Euro
- Flow rate, 1000m³/hour

**Cyclone**

- Unit cost, Euro
- Flow rate, 1000m³/hour

**Fabric Filter**

- Unit cost, Euro
- Flow rate, 1000m³/hour
Comparative investment costs coefficient $c_i^f$ variability by type of control equipment
Abatement efficiency variability by type of control equipment

Cement

Lime Production

Cast Iron

Electric Arc Furnace

- ESP3P
- FF
- CYC
- WSCRB

Min, Mean, Max
Types of PM equipment abatement efficiency

- **Nominal**
  - Maximum for type/subtype
  - New equipment
  - Taken from manufacturers offers

- **Projected**
  - Calculated for specific operation conditions
  - New equipment
  - Taken from equipment Installation projects

- **Real**
  - Estimated for the exploited control equipment
  - Operated: up to 15-20 years
  - Taken from equipment documentation
Derived TSP EFs and PM abatement efficiency by countries (WebDab, 2006)

Abatement efficiency, %
Conclusions:

- significant variability of PM control equipment characteristics produced in EECCA (efficiency, performance, design etc) detected;
- variability of control equipment investment cost parameters; not normal distribution (bias of means);
- lack of unified methodology for the calculation of investment cost parameters for IAM;
- different measures of PM abatement efficiency: nominal, projected, real; all can be used in IAM;
- possible application of different types of abatement efficiencies results in increase of uncertainties of emission/costs IAM assessments.
Further steps:

- preparation of analytical paper on PM abatement equipment in EECCA (on an example of Belarus);

- assessment of uncertainties of emission/costs estimation possible impact onto policy.
Thank you for your attention!