Coal Ash Utilisation

over the world and in Europe

Hans-Joachim Feuerborn

European Coal Combustion Products Association
ECOBA - European Coal Combustion Products Association represents Power Plant Operators producing CCPs and CCP marketing companies in Europe

ECOBA´s mission is

- to encourage the development of the use of CCPs
- to promote the mutual interests of their members within the framework of the European Organisations
- to develop the legal/regulatory measures for the recognition, acceptance and promotion of CCPs in Europe
ECOBA members

- Established in 1990
- 21 members from 13 European countries
- Represents more than 86% of European CCP production
- Combines knowledge and experience within Europe
ECOBA affiliated members

- American Coal Ash Association (ACAA)
- Canadian Industries Recycling Coal Ash (CIRCA)
- Japan Coal Energy Center (JCOAL)
- National Coal Ash Board of Israel (NCAB)
- United Kingdom Quality Ash Association
1. Introduction – role of coal in energy mix

2. Production and utilisation of CCPs
   - over the world
   - in Europe

3. Selected examples of CCP utilisation

4. Environmental benefits of CCP utilisation

5. Concluding Remarks
Introduction – role of coal in energy mix

World – Energy consumption 2004

- Oil: 37%
- Gas: 24%
- Nuclear: 6%
- Coal: 27%
- Others: 6%

Total: 14.6 bn tce

Source: BP Statistical Review of World Energy
Introduction – role of coal in energy mix

Primary energy consumption of fossil fuels - 2003

Source: BP – 2004, EU Commission
Introduction – role of coal in energy mix

Coal reserves of the world

Source: WCI
Introduction – role of coal in energy mix

Hard coal maritime traffic 2004: 685 million tonnes

Source: VDKI, Hamburg
Introduction – role of coal in energy mix

About 490 mill. t/a and 550 mill t/a lignite in Europe

Source: EURACOAL
Introduction – role of coal in energy mix

Cross power generation - 2002

Source: EURACOAL
Introduction – role of coal in energy mix

Development of electricity generation in the EU 25 between 2000 and 2030

- **Wind**: 1%
- **Others (Oil, wood, waste)**: 8%
- **Gas**: 18%
- **Hard coal/lignite**: 31%
- **Nuclear energy**: 32%
- **Hydro-power**: 10%

Growth 1 400 TWh
Replacement 1 000 TWh

Source: EU – Energy and Transport Outlook
Introduction – role of coal in energy mix

Clean Coal Technology

- Improvement of efficiency of power generation
- Reduction of CO₂ emissions
- Abatement of emissions of pollutants to air and water
- Production (and utilisation) of minerals (CCPs)
Introduction – role of coal in energy mix

750 MW_{el} Coal-Fired Power Plant 6000 Hours Full Load

- Furnace
  - 1 Million Tonnes Coal
    - Bottom Ash 16,000 Tonnes
    - NH$_3$
      - DENOX
        - Fly Ash 84,000 Tonnes
        - Lime
          - FGD
            - FGD Gypsum 54,000 Tonnes
            - Chimney

NCAB_workshop_Nov. 23/24, 2005
2. Production and utilisation of CCPs

Fly Ash

Bottom Ash

Boiler Slag
# 2. Production and utilisation of CCPs

![2004 Coal Combustion Product (CCP) Production and Use Survey](image)

<table>
<thead>
<tr>
<th>CCP Categories (Short Tons)</th>
<th>Fly Ash</th>
<th>Bottom Ash</th>
<th>FGD Gypsum</th>
<th>FGD Material Wet Scrubbers</th>
<th>Boiler Slag*</th>
<th>FGD Material Dry Scrubbers*</th>
<th>FGD Other*</th>
<th>FBC Ash*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCP Production Category Totals**</td>
<td>70,800,000</td>
<td>17,200,000</td>
<td>11,950,000</td>
<td>17,500,000</td>
<td>2,202,296</td>
<td>1,829,830</td>
<td>115,596</td>
<td>867,397</td>
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<tr>
<td>CCP Production Total</td>
<td>122,465,119</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>CCP Used Category Totals***</td>
<td>28,068,970</td>
<td>8,152,469</td>
<td>9,044,959</td>
<td>1,195,877</td>
<td>1,973,385</td>
<td>177,480</td>
<td>3,291</td>
<td>473,391</td>
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<tr>
<td>All CCP Used Total</td>
<td>49,099,818</td>
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<td>0</td>
<td>0</td>
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</table>

<table>
<thead>
<tr>
<th>CCP Use By Application****</th>
<th>Fly Ash</th>
<th>Bottom Ash</th>
<th>FGD Gypsum</th>
<th>FGD Material Wet Scrubbers</th>
<th>Boiler Slag*</th>
<th>FGD Material Dry Scrubbers*</th>
<th>FGD Other*</th>
<th>FBC Ash*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Concrete/Concrete Products/GROUT</td>
<td>14,121,868</td>
<td>789,071</td>
<td>291,439</td>
<td>0</td>
<td>0</td>
<td>37,343</td>
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<tr>
<td>2. Cement/Raw Feed for Clinker</td>
<td>2,345,754</td>
<td>615,192</td>
<td>449,063</td>
<td>39,378</td>
<td>33,505</td>
<td>0</td>
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<td>3. Flowable Fill</td>
<td>179,735</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>11,274</td>
<td>0</td>
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<tr>
<td>4. Structural Fills/Embankments</td>
<td>4,685,091</td>
<td>3,064,773</td>
<td>0</td>
<td>266,851</td>
<td>7,268</td>
<td>0</td>
<td>61,989</td>
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<tr>
<td>5. Road Base/Sub-base/Pavement</td>
<td>485,214</td>
<td>1,092,606</td>
<td>0</td>
<td>0</td>
<td>7,070</td>
<td>0</td>
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<tr>
<td>6. Soil Modification/Stabilization</td>
<td>500,630</td>
<td>21,117</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>190,426</td>
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<td>7. Mineral Filler in Asphalt</td>
<td>90,033</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>39,942</td>
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<td>8. Snow and Ice Control</td>
<td>5,563</td>
<td>830,320</td>
<td>0</td>
<td>0</td>
<td>87,711</td>
<td>0</td>
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<tr>
<td>9. Blasting Grit/Roofing Granules</td>
<td>0</td>
<td>70,312</td>
<td>0</td>
<td>0</td>
<td>1,747,238</td>
<td>0</td>
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<tr>
<td>10. Mining Applications</td>
<td>1,113,361</td>
<td>39,682</td>
<td>0</td>
<td>282,032</td>
<td>0</td>
<td>122,580</td>
<td>0</td>
<td>134,649</td>
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<tr>
<td>11. Wallboard</td>
<td>0</td>
<td>8,148,078</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>12. Waste Stabilization/Solidification</td>
<td>2,441,513</td>
<td>267,375</td>
<td>0</td>
<td>338</td>
<td>4,615</td>
<td>0</td>
<td>70,722</td>
<td>0</td>
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<tr>
<td>13. Agriculture</td>
<td>52,314</td>
<td>19,272</td>
<td>131,059</td>
<td>10,593</td>
<td>0</td>
<td>2,778</td>
<td>0</td>
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<tr>
<td>14. Aggregate</td>
<td>7,995</td>
<td>409,362</td>
<td>0</td>
<td>0</td>
<td>38,000</td>
<td>3,499</td>
<td>0</td>
<td>0</td>
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<tr>
<td>15. Miscellaneous/Other</td>
<td>2,036,899</td>
<td>943,976</td>
<td>25,317</td>
<td>596,884</td>
<td>8,036</td>
<td>0</td>
<td>3,291</td>
<td>15,610</td>
</tr>
<tr>
<td>CCP Category Use Totals</td>
<td>28,068,970</td>
<td>8,152,469</td>
<td>9,044,959</td>
<td>1,195,877</td>
<td>1,973,385</td>
<td>177,480</td>
<td>3,291</td>
<td>473,391</td>
</tr>
<tr>
<td>Application Use To Production Rate</td>
<td>39,65%</td>
<td>47,40%</td>
<td>75,69%</td>
<td>6,83%</td>
<td>89,61%</td>
<td>9,70%</td>
<td>2,85%</td>
<td>54,58%</td>
</tr>
</tbody>
</table>

* As submitted based on 60 percent coal burn.
** CCP Production totals for Fly Ash, Bottom Ash, FGD Gypsum, and Wet FGD are extrapolated estimates rounded off to nearest 50,000 tons.
*** CCP Used totals for Fly Ash, Bottom Ash, FGD Gypsum, and Wet FGD are per extrapolation calculations (not rounded off).
**** CCP Uses by application for Fly Ash, Bottom Ash, FGD Gypsum, and Wet FGD are calculated per proportioning the CCP Used Category Totals by the same percentage as each of the individual application types’ raw data contributions to the as-submitted raw data subtotal total (not rounded off).
## 2. Production and utilisation of CCPs

**Production and Utilisation of CCPs in 2003 in Europe (EU 15) [kilo tonnes (metric)]**

<table>
<thead>
<tr>
<th>CCP Production</th>
<th>Fly Ash</th>
<th>Bottom Ash</th>
<th>Boiler Slag</th>
<th>FBC-Ash</th>
<th>Other</th>
<th>SDA-Product</th>
<th>FGD-Gypsum</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCP Total 1 - 7</td>
<td>44.217</td>
<td>6.045</td>
<td>2.110</td>
<td>1.089</td>
<td>75</td>
<td>490</td>
<td>11.276</td>
</tr>
<tr>
<td>Subtotal 1 - 6</td>
<td>66.687</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal 6 - 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total 1 - 7</td>
<td>66.687</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CCP Utilisation</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement raw material</td>
<td>5.645</td>
<td>8.4</td>
</tr>
<tr>
<td>Blended cement</td>
<td>2.377</td>
<td>3.8</td>
</tr>
<tr>
<td>Concrete addition</td>
<td>5.872</td>
<td>8.9</td>
</tr>
<tr>
<td>Aerated concrete blocks</td>
<td>8.45</td>
<td>1.3</td>
</tr>
<tr>
<td>Non-aerated concrete blocks</td>
<td>380</td>
<td>2.9</td>
</tr>
<tr>
<td>Lightweight aggregate</td>
<td>93</td>
<td>0.7</td>
</tr>
<tr>
<td>Bricks + ceramics</td>
<td>1.33</td>
<td>0.2</td>
</tr>
<tr>
<td>Gritting</td>
<td>481</td>
<td>0.7</td>
</tr>
<tr>
<td>Asphalt filler</td>
<td>159</td>
<td>0.2</td>
</tr>
<tr>
<td>Subgrade stabilisation</td>
<td>184</td>
<td>0.4</td>
</tr>
<tr>
<td>Pavement base course</td>
<td>387</td>
<td>0.6</td>
</tr>
<tr>
<td>General engineering fill</td>
<td>1,777</td>
<td>10.8</td>
</tr>
<tr>
<td>Structural fill</td>
<td>1,987</td>
<td>12.0</td>
</tr>
<tr>
<td>Soil amendment</td>
<td>37</td>
<td>0.2</td>
</tr>
<tr>
<td>Infill</td>
<td>668</td>
<td>1.0</td>
</tr>
<tr>
<td>Blasting grit</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Plant nutrition</td>
<td>3</td>
<td>0.0</td>
</tr>
<tr>
<td>Retarder for cement</td>
<td>1.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Projection plaster</td>
<td>18</td>
<td>0.3</td>
</tr>
<tr>
<td>Plaster boards</td>
<td>19</td>
<td>0.3</td>
</tr>
<tr>
<td>Gypsum blocks</td>
<td>68</td>
<td>0.9</td>
</tr>
<tr>
<td>Self leveling floor screeds</td>
<td>22</td>
<td>0.3</td>
</tr>
<tr>
<td>Other uses</td>
<td>30</td>
<td>0.5</td>
</tr>
<tr>
<td>Reclamation, Restoration</td>
<td>8,064</td>
<td>12.4</td>
</tr>
<tr>
<td>Temporary stockpile</td>
<td>3,527</td>
<td>10.0</td>
</tr>
<tr>
<td>Disposal</td>
<td>1,267</td>
<td>1.9</td>
</tr>
<tr>
<td>Total utilisation 1 - 25</td>
<td>21,116</td>
<td>32.1</td>
</tr>
<tr>
<td>Utilisation rate in %</td>
<td>47</td>
<td>73</td>
</tr>
<tr>
<td>Average utilisation rate in %</td>
<td>47</td>
<td>73</td>
</tr>
</tbody>
</table>

Average utilisation rate in % | 47 | 73 | 28.1 | 42 |
| Total production 1-26 | 44,784 | 68.3 |
| Reuse of stockpiled CCPs | 677 | 1.0 |
| Total production 1-26 incl. reuse | 45,461 | 100.0 |
2. Production and utilisation of CCPs

### Table: CANADA: TOTAL COAL COMBUSTION PRODUCTS (CCPs) - PRODUCTION AND USE - 2001 1/2/

<table>
<thead>
<tr>
<th></th>
<th>Fly Ash</th>
<th>Bottom Ash</th>
<th>FGD Gypsum</th>
<th>Other 3/</th>
<th>Total CCPs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Produced</td>
<td>4815</td>
<td>1592</td>
<td>382</td>
<td>111</td>
<td>6900</td>
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<tr>
<td>Disposed/stored</td>
<td>3881</td>
<td>1535</td>
<td>0</td>
<td>111</td>
<td>5526</td>
</tr>
<tr>
<td>Removed from disposal</td>
<td>97</td>
<td>123</td>
<td>0</td>
<td></td>
<td>220</td>
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<tr>
<td><strong>Use (domestic):</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td>420</td>
<td>202</td>
<td>0</td>
<td>0</td>
<td>822</td>
</tr>
<tr>
<td>Concrete/grout</td>
<td>408</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>408</td>
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<tr>
<td>Mining applications</td>
<td>145</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>145</td>
</tr>
<tr>
<td>Roadbase/subbase</td>
<td>8</td>
<td>46</td>
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<td>0</td>
<td>54</td>
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<tr>
<td>Wallboard</td>
<td>0</td>
<td>0</td>
<td>530</td>
<td>0</td>
<td>530</td>
</tr>
<tr>
<td>Other 4/</td>
<td>71</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>84</td>
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<tr>
<td><strong>Total use</strong></td>
<td>1052</td>
<td>261</td>
<td>530</td>
<td>0</td>
<td>1843</td>
</tr>
<tr>
<td><strong>Individual use percentage</strong></td>
<td>22%</td>
<td>16%</td>
<td>139%</td>
<td>0%</td>
<td>n.a.</td>
</tr>
<tr>
<td><strong>Cumulative use percentage</strong></td>
<td>22%</td>
<td>20%</td>
<td>27%</td>
<td>27%</td>
<td>27%</td>
</tr>
</tbody>
</table>

1/ Reported production of coal combustion products (CCPs) may include both dry and ponded categories.
2/ Use (domestic), as reported, includes amounts imported (assumed to be HS codes 2621.00 relating to fly ash, and HS 2520.10 relating to gypsum.
3/ Cfb (circulating fluidized bed) fly ash and bottom ash.
4/ Includes waste stabilization and specialty uses such as mineral filler and flowable fill.

Note: Total reported cross-border trade in fly ash (exports plus imports) amounted to about 370 000 tonnes.

**Sources:**
Compiled by Natural Resources Canada (Minerals and Metals Sector), in cooperation with Canadian Industries Recycling Coal Ash (CIRCA)
### 2. Production and utilisation of CCPs

<table>
<thead>
<tr>
<th>Year</th>
<th>Ash Production $t \times 10^3$</th>
<th>Beneficial Ash Usage $t \times 10^3$</th>
<th>Total Ash Sales $t \times 10^3$</th>
<th>Cementitious Ash Sales $t \times 10^3$</th>
<th>% of Cement Sales</th>
</tr>
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<tbody>
<tr>
<td>1975</td>
<td>nr</td>
<td>nr</td>
<td>303</td>
<td>257</td>
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<td>1976</td>
<td>nr</td>
<td>nr</td>
<td>335</td>
<td>286</td>
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<tr>
<td>1977</td>
<td>nr</td>
<td>nr</td>
<td>357</td>
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<tr>
<td>1978</td>
<td>nr</td>
<td>nr</td>
<td>394</td>
<td>335</td>
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<tr>
<td>1979</td>
<td>nr</td>
<td>nr</td>
<td>452</td>
<td>384</td>
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<tr>
<td>1980</td>
<td>nr</td>
<td>nr</td>
<td>512</td>
<td>435</td>
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<td>1981</td>
<td>nr</td>
<td>nr</td>
<td>559</td>
<td>475</td>
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<tr>
<td>1982</td>
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<td>nr</td>
<td>530</td>
<td>451</td>
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<tr>
<td>1983</td>
<td>nr</td>
<td>nr</td>
<td>497</td>
<td>422</td>
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<td>1984</td>
<td>nr</td>
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<td>1985</td>
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<td>1988</td>
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<td>nr</td>
<td>740</td>
<td>604</td>
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<td>1989</td>
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<td>1990</td>
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<td>1991</td>
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<td>592</td>
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<td>1992</td>
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<td>709</td>
<td>603</td>
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<td>1993</td>
<td>8,510</td>
<td>850</td>
<td>780</td>
<td>661</td>
<td>10.2</td>
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**Ash production and sales in Australia**
2. Production and utilisation of CCPs

Ash production and sales in Australia
2. Production and utilisation of CCPs

Ash production and utilisation in Japan
2. Production and utilisation of CCPs

Utilization fields in 2003

Ash utilisation in Japan
2. Production and utilisation of CCPs

World-wide Annual Production of Ashes
Estimation 3/2002, Based on Figures Published by O. Manz)

Total 480 million tonnes

- India: 80
- Russia: 50
- China: 100
- Japan: 83
- North America: 37
- South Africa: 30
- Eastern Europe: 45
- European Union: 47
- Others: 30
- Japan: 8

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2. Production and utilisation of CCPs

Worldwide Coal Combustion Product Network

….., The name, Worldwide Coal Combustion Ash Network, embodies the essential elements of the expected results – opportunities for organizations throughout the world to increase the exchange of information about coal ash, or CCPs.

The role of the Worldwide Coal Combustion Product Network will be to create opportunities for international stakeholders to exchange information with peers not only through face-to-face meetings, but, and perhaps primarily, through electronic networking.
2. Production and utilisation of CCPs

Production of CCPs:
63 million tonnes in Europe (EU 15)

Production of CCPs:
about 30 million tonnes in new EU member states

- Estonia
- Latvia
- Lithuania
- Poland
- Czech Republik
- Slovakia
- Hungary
- Slovenia
- Malta
- Cyprus
2. Production and utilisation of CCPs

About 490 mill. t/a and 550 mill t/a lignite in Europe

Source: EURACOAL
2. Production and utilisation of CCPs

Production of CCPs in Europe (EU 15) in 2003 [million tonnes]

- Fly Ash: 44.2 million tonnes
- Bottom Ash: 6.0 million tonnes
- Boiler Slag: 2.1 million tonnes
- FBC Ash: 1.1 million tonnes
- SDA Product: 0.5 million tonnes
- FGD Gypsum: 11.3 million tonnes

(total production: 65 million tonnes)
2. Production and utilisation of CCPs

Utilisation and disposal of CCPs in Europe (EU 15) in 2003 [million tonnes]

- Utilisation in Construction Industry and Underground Mining: 34.6 million tonnes
- Temporary Stockpile: 5.3 million tonnes
- Disposal: 2.4 million tonnes
- Restoration of Open Cast Mines, Quarries and Pits: 23.7 million tonnes

(total production: 65 million tonnes)
2. Production and utilisation of CCPs

Utilisation of fly ash in the construction industry and in underground mining in Europe (EU 15) in 2003

(total utilisation 21.1 million tonnes)
3. Development of CCP utilisation in Europe

Development of the utilisation rate of fly ash and bottom ash in the construction industry in Europe (EU 15) from 1993 to 2003
3. Development of CCP utilisation in Europe

Utilisation of Fly Ash in the cement and concrete industry in Europe (EU 15) from 1993 to 2003

- Clinker raw material
- Blended cement
- Concrete
2. Production and utilisation of CCPs

Demands of the construction market

- availability of huge amounts of material
- constant quality (continuous process)
- sufficient product properties (grain size distribution, surface, long term availability
- meeting of technical requirements
- environmental compatibility

- research work and pilot projects
- teaching of CCP properties, education
- installation of silo capacity
- beneficiation of fly ash to increase availability in summer time (re-drying facilities)
2. Production and utilisation of CCPs

Technical regulations

- beneficial utilization of CCPs over decades led to
  - acceptance as construction materials by industries and authorities
  - standards and specifications for CCPs as construction materials

- specific requirements for CCPs as cement raw materials
  - EN 197-1 for fly ash as constituent in blended cement
  - EN 450 for fly ash for use as concrete addition
  - Quality criterias for FGD gypsum, published by (EUROGYPSUM)
2. Production and utilisation of CCPs

EN 450-1
„Fly ash for concrete“

Part 1: Definitions, specifications and conformity criteria

EN 450-2
„Fly ash for concrete“

Part 2: Conformity evaluation

AnyCo Ltd, PO Box 21, B-1050 05
01234-CPD-00234

EN 450-1
Fly ash for concrete

Fineness Category: N
Declared value of fineness in case of category N: 25 %
Loss on ignition Category: A
Particle density: 2300 kg/m³
Dangerous Substance: NL, F
3. Selected examples of CCP utilisation

The Puylaurant dam in France.
It was completed at the end of 1995.
Its maximum height is 73 meters over the foundation,
with a crest length of 220 meters.
3. Selected examples of CCP utilisation

Platanovryssi dam in Greece
3. Selected examples of CCP utilisation

Great Belt Bridge, Denmark
3. Selected examples of CCP utilisation

Construction of a bridge over Main-Donau canal / Germany
3. Selected examples of CCP utilisation

Use of fly ash and bottom ash in concrete blocks
3. Selected examples of CCP utilisation

Use of fly ash in road construction

- Soil stabilisation
- Landscaping
- Dams and embankments
- Hydraulically bound bearing layers
- Asphalt filler
- Additions to concrete
3. Selected examples of CCP utilisation

Soil amendment with calcereous fly ash
3. Selected examples of CCP utilisation

CCPs in road construction – Sochaczew Bypass road / Poland
Filler in Asphalt

- stabilises the mixture
- increases the viscosity of the bituminous binder
- reduces sensitivity of the mixture to temperature
- improves adhesion of bitumen to the aggregates
3. Utilisation of CCPs

Utilisation of **bottom ash in the construction industry and in underground mining in Europe (EU 15) in 2003**

![Pie chart showing utilisation of bottom ash](chart.png)

- **Concrete Blocks**: 48.2%
- **Concrete**: 10.4%
- **Cement**: 3.7%
- **Others**: 4.6%
- **Road Construction, Filling Application**: 33.1%

*Total utilisation 2.7 million tonnes*
3. Selected examples of CCP utilisation

Utilisation of Boiler Slag in the construction industry and as blasting grit in Europe (EU 15) in 2003

- Road Construction, Filling Application: 47.3%
- Blasting Grit: 31.3%
- Grouting: 6.0%
- Concrete: 7.6%
- Other Uses: 7.8%

(total utilisation 2.1 million tonnes)
3. Selected examples of CCP utilisation

Boiler Slag as a filling material for road construction
3. Selected examples of CCP utilisation

Use of processed Boiler Slag as blasting grit
Environmental considerations

- saving of natural resources
  - mining
  - processing
  - transport

- reduction of energy demand

- reduction of emissions (CO$_2$)
  needed for or result from
  manufacturing process of
  products which are replaced

- CCPs are fine grained
  raw materials

- CO$_2$ reduction in
  - cement production (0.7 to 1.2 kg CO$_2$ per kg
    clinker, dep. on fuel)
  - concrete when fly ash
    is used as conc. add.

- saving of drying energy
  when fly ash is used to
  dry wet raw materials
5. Conclusion (1)

- Coal will play an important role in future energy mix.

- About 480 million tonnes of Coal Combustion Products are produced in the world (estimate).

- In 2003, 65 million tonnes of CCPs were produced in Europe (EU 15).

- Including the 10 new EU member states the amount was increased to about 95 million tonnes (EU-25) from 2004.
5. Conclusion (2)

- CCPs are mainly utilized in building materials industry, in civil engineering, in road construction, for construction work in underground mining, for recultivation and restoration purposes.
- CCPs are produced to meet requirements for different fields of applications.
- Production and utilisation of CCPs is influenced by e.g. liberalization of electricity market, by European and national regulations and the construction market.
5. Conclusion (3)

- CCPs are used as a replacement for natural materials. Therefore, they contribute to sustainable development as they  
  - avoid the need to quarry or mine natural resources,  
  - help to reduce energy demand as well as emission to atmosphere during production  
  - replace part of the cement in blended cement and concrete.  
- CCPs will be available as valuable raw materials as coal will continue to play an important role as important source of primary energy.
Thank you for your attention!

Hans-Joachim Feuerborn

European Coal Combustion Products Association

www.ecoba.org