China Council for International Cooperation on Environment and Development (CCICED)

Special Policy Study on Mercury Management in China
Beijing, June 1.-2., 2011

Possible Recommendations – Progress Report

- Coal Combustion
- VCM
- Products

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Structure

- Coal Combustion
- VCM
- Products

Coal Combustion

Global anthropogenic mercury emissions in 2005 are estimated at 2000 Mg per year (UNEP, 2010). The largest mercury emissions to the global atmosphere occurred from combustion of fossil fuels (46 per cent of the total), mainly from coal fired in utility, industrial, as well as residential boilers, heaters, and stoves.

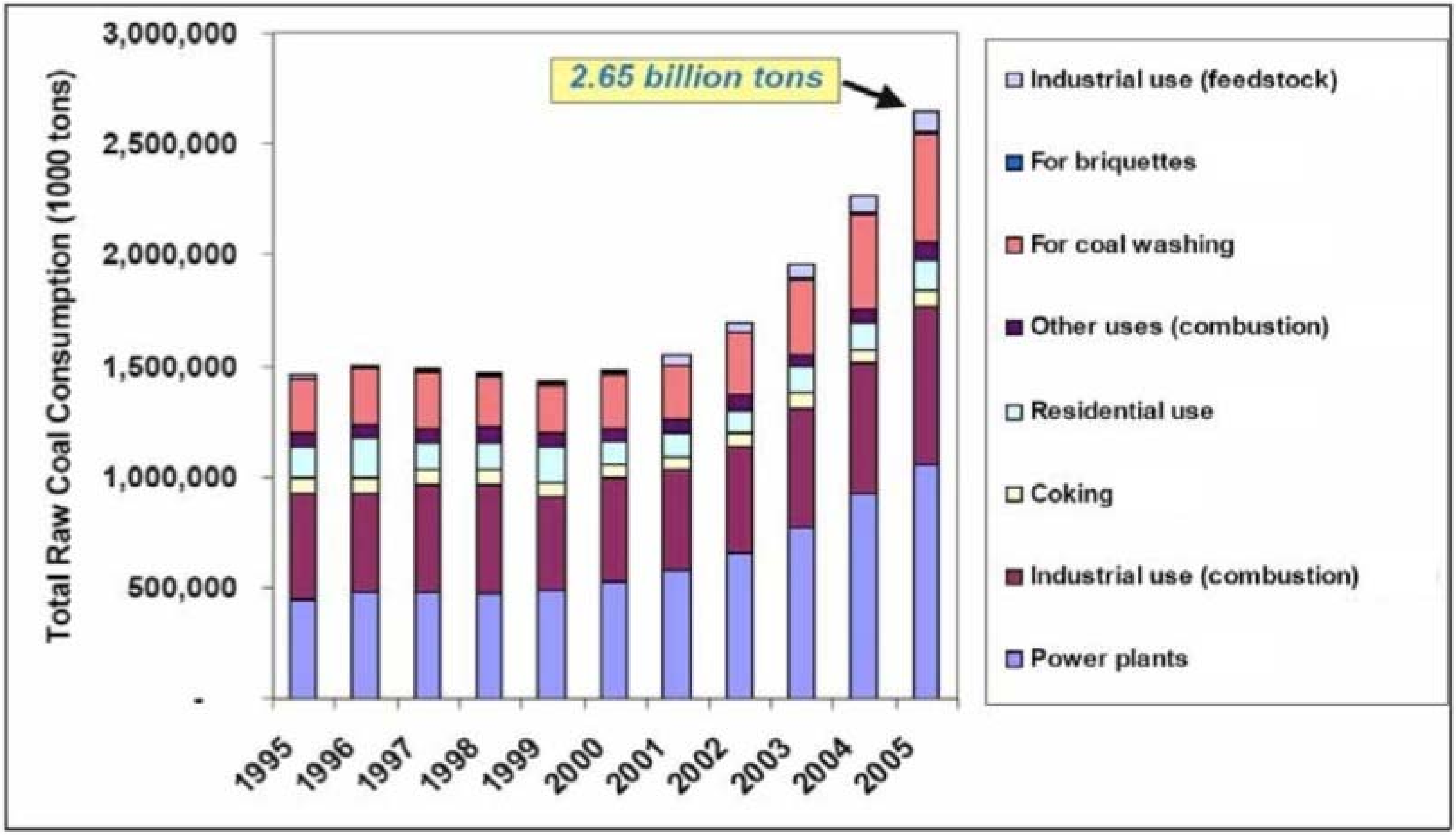
Mercury emissions from coal-fired power plants and industrial boilers constituted about 26 per cent of the global anthropogenic mercury emissions.

Coal Combustion

According to a recent study on anthropogenic mercury emissions in China (Streets et al., 2008), the Peoples' Republic produces and consumes the largest quantity of coal in the world. In 2005, about 2.65 billion tons were consumed (see next slides). The nationwide electricity production from coal is expected to increase in China by the factor 2 over the next ten years; therefore, China will burn more coal than any other country in the world, today and in the foreseeable future.

The same study estimated that total mercury emissions from coal combustion in China in 2005 exceed 300 tons (megagram) per year, 120 Mg/a of which are due to coal-fired power plants.

Trends in raw coal consumption in China, 1995-2005



Source: David G. Streets, Argonne National Laboratory, and Jiming Hao, Shuxiao Wang, Ye Wu, Tsinghua University, Beijing: „Mercury Emissions from Coal Combustion in China“, International Conference of the UNEP, Rome, Italy, April 7-11, 2008

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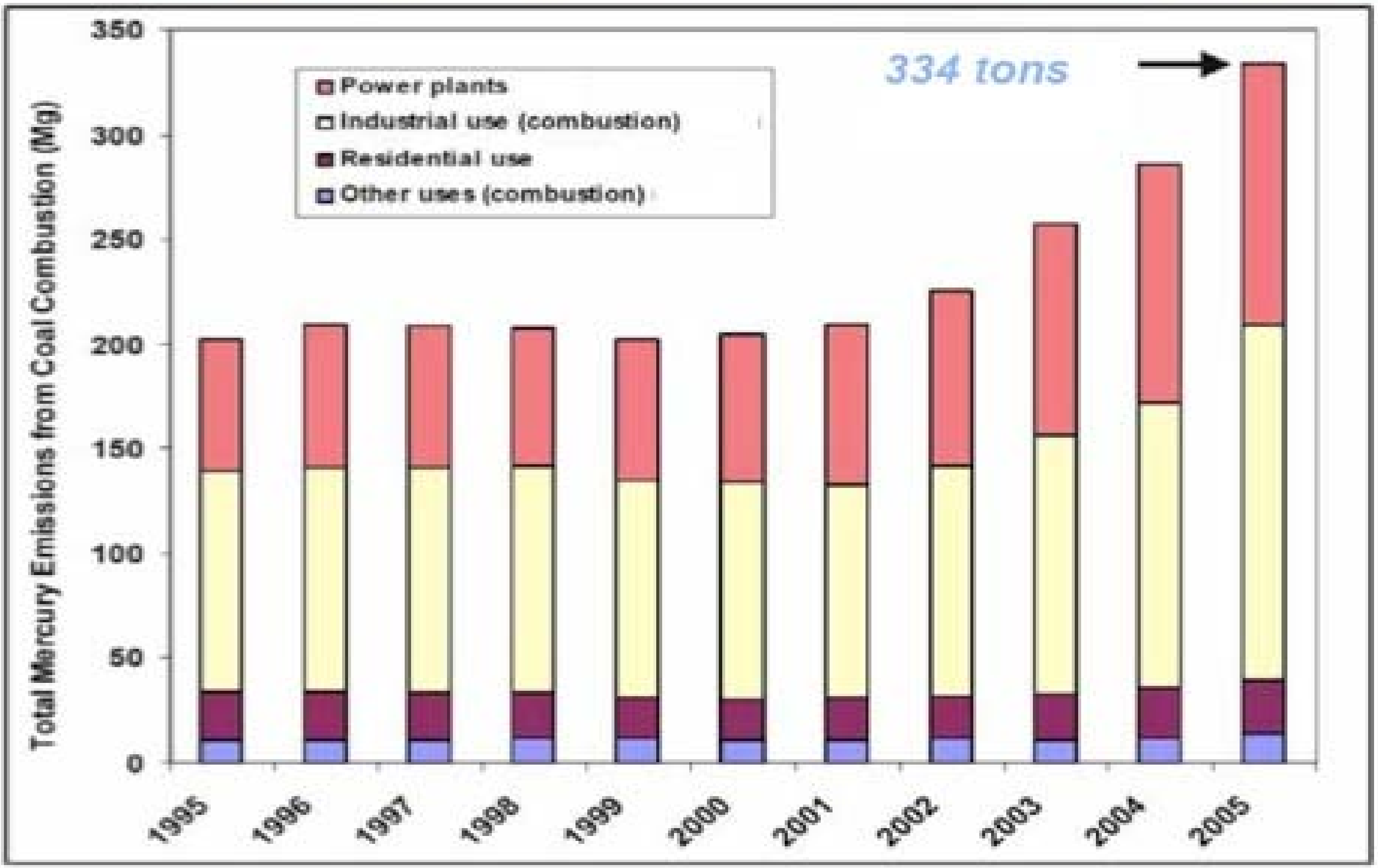
Trends in mercury emissions from coal combustion, 1995-2005



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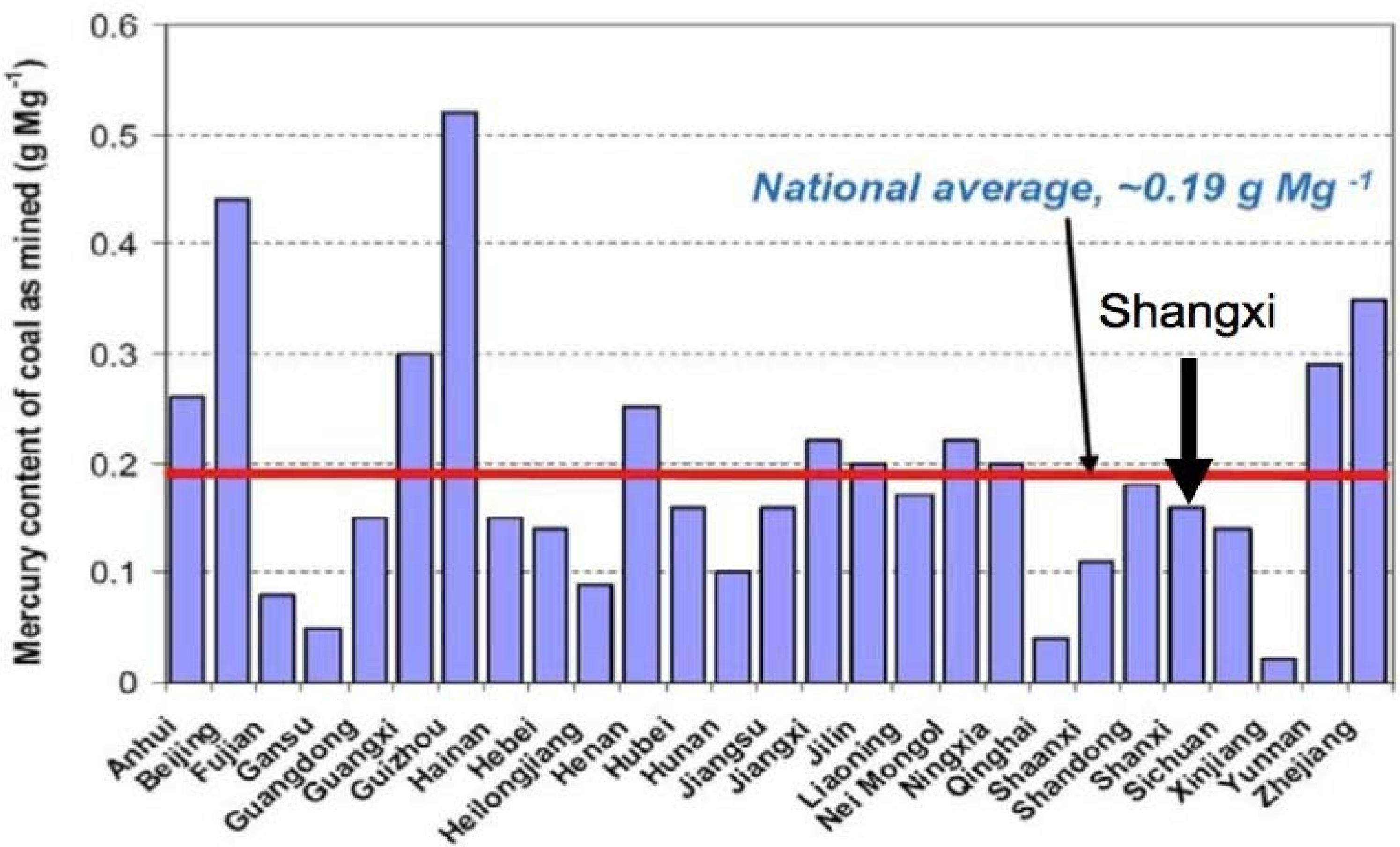
Mercury content of raw coal, as mined ($g\ Mg^{-1}$)



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Coal Combustion

Three forms of mercury species may typically be found in the flue gas derived from coal combustion:

a) the gas-phase oxidized form of mercury (named Hg_{ox}, Hg_{ion} or Hg^{2+})

b) the gas-phase elemental form of mercury (named Hg_{el}, Hg_{met} or Hg°), and

c) the solid-phase mercury associated with particulate matter (Hg_P) such as fly ash or unburned carbon (UBC).

Coal Combustion

In contrast to oxidized mercury Hg^{2+}, elemental mercury Hg° is (almost) insoluble in scrubber-water, and also hard to adsorb at fly ash particles, even if carbonaceous solids as UBC (unburned carbon) are present. Therefore, to improve both wet and dry mercury capture the Hg° should be completely oxidized while passing through the boiler, before the flue gas is entering any air pollution control system (APCS).

Native halogens in coal, especially its content of chlorine (in the form of chloride) and bromine (in the form of bromide), greatly affect mercury speciation in the boiler flue gas when passing through the boiler: High halogen content in coal → low Hg° or almost no Hg° in boiler flue gas (all mercury oxidized, as wanted)

Coal Combustion

High-dust SCR-DeNOx catalysts – if present – strongly promote mercury oxidation in the flue gas, by catalytically enhanced halogenation (but this requires that a minimum of halogens are present).

Afterwards, oxidized mercury Hg^{2+} is easily captured by adsorption at carbonaceous fly ash particles in electrostatic precipitator (ESP) or fabric filter (FF) – at unburned carbon (UBC) or injected pulverized activated carbon (PAC).

Last, but not least: Oxidized mercury Hg^{2+} is excellently captured – as a co-benefit of well designed SO_2 capture (DeSOx technologies) – by absorption into the scrubber-water of wet flue gas desulfurization (FGD).

Coal Combustion

Bromine is highly effective in mercury oxidation – far more than chlorine, see next slide.

Boiler Chemical Addition (BCA), especially in its highly effective form of **Pre-combustion Bromide Addition** to low chlorine coal (before its combustion) is a major and cost-effective option to enhance mercury pollution control, as commercially applied since January 2010 at installed capacity exceeding 5500 MW.

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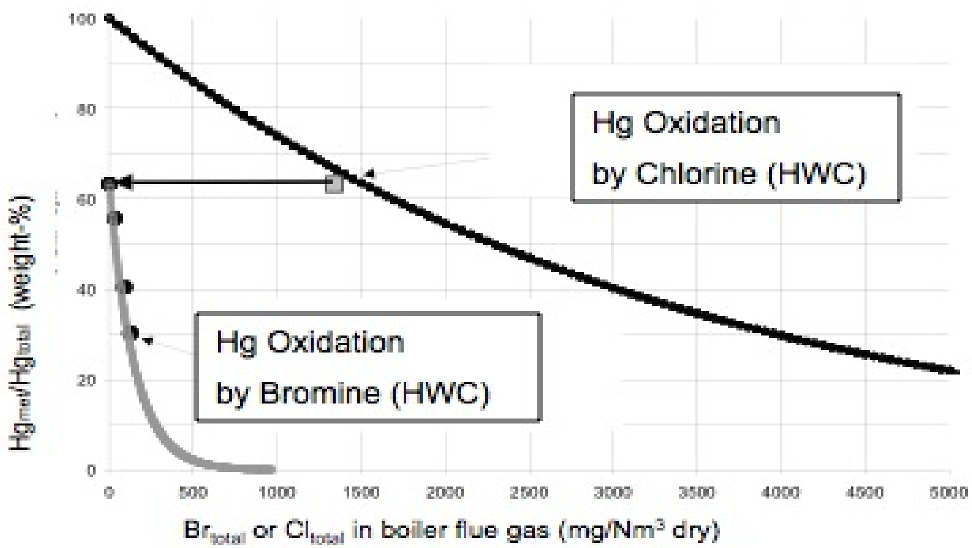
Mercury-Related Chemistry in Waste Incineration and Thermal Process Flue Gases

Bernhard W. Vosteen, Vosteen Consulting GmbH, Cologne (Germany)
Richard Ullrich, WastePro Engineering Inc., Kennett Square, PA



Bromine > 25 times more effective for Hg^{met} oxidation than chlorine, in waste incineration as well as in coal combustion

(BAYER patent applications pending world wide)

Source: Vosteen et al.: „Mercury-Related Chemistry in Waste Incineration and Thermal Process Flue Gases", Air Quality (VI) Conference, Arlington, VA, Sept. 2003

Coal Combustion

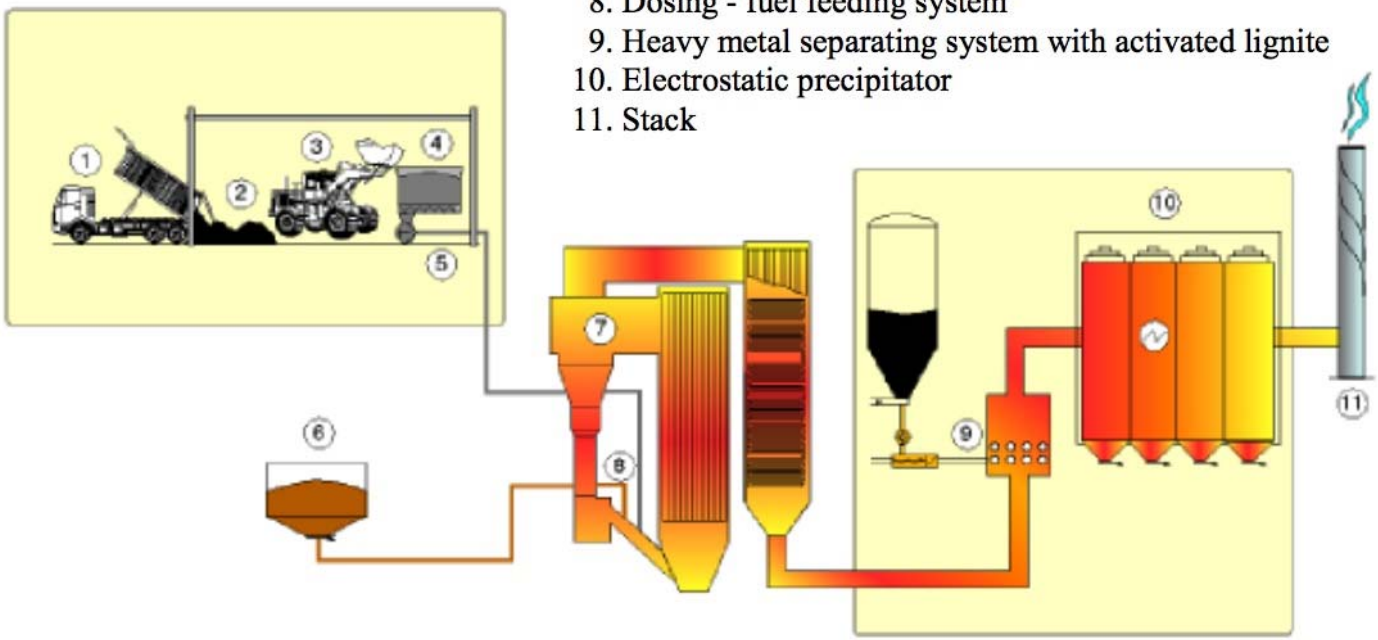
A second major and also available technique for mercury pollution control is the Activated Carbon Injection (ACI).

A very first industrial ACI application at a coal-fired power plant was developed and tested already in 1997 by RWE (Germany) at its lignite-fired CFB-boiler (circulating fluidized bed) in Berrenrath (270 MW_{therm}), co-combusting mercury-rich sewage sludges (see next slide).

The ACI sorbent applied there is a lignite derived pulverized activated carbon (PAC). This commercial ACI system, leading to one to two per cent UBC in fly ash, has been in continuous operation since 1999 (Wirling et al., 1999; Wirling et al., 2001).

Figure 4. Sewage sludge co-combustion in an industrial power plant

1. Sewage sludge transport (truck / container)
2. Sewage sludge storage
3. Wheel loader
4. Feeding hopper / discharging system with screw
5. Solids pump
6. Raw lignite bunker
7. Circulating fluidized-bed firing system
8. Dosing - fuel feeding system
9. Heavy metal separating system with activated lignite
10. Electrostatic precipitator
11. Stack



Source: Vosteen, 2011

Coal Combustion

Mercury is absorbed in the flue gas or at the ESP or the fly ash filter cake of the FF.

Other possible designs exist that do not enrich fly ash in carbon such as ACI behind ESP and capture at separate tail-end FF (e.g. TOXECON technology of US EPRI). ACI applied as tail-end technology, or integrated into existing APCS, requires hardware modification to accommodate the process into the existing ductwork and installations.

Modifications of different sorbent injection technologies have been developed over the years. These include not only ACI. Aside from PAC, other mineral sorbent types (non-carbonaceous sorbents) are used. Other variations include e.g. on-line grinding of the activated carbon (milling on-site), externally brominated PAC, different modes and locations of injection.

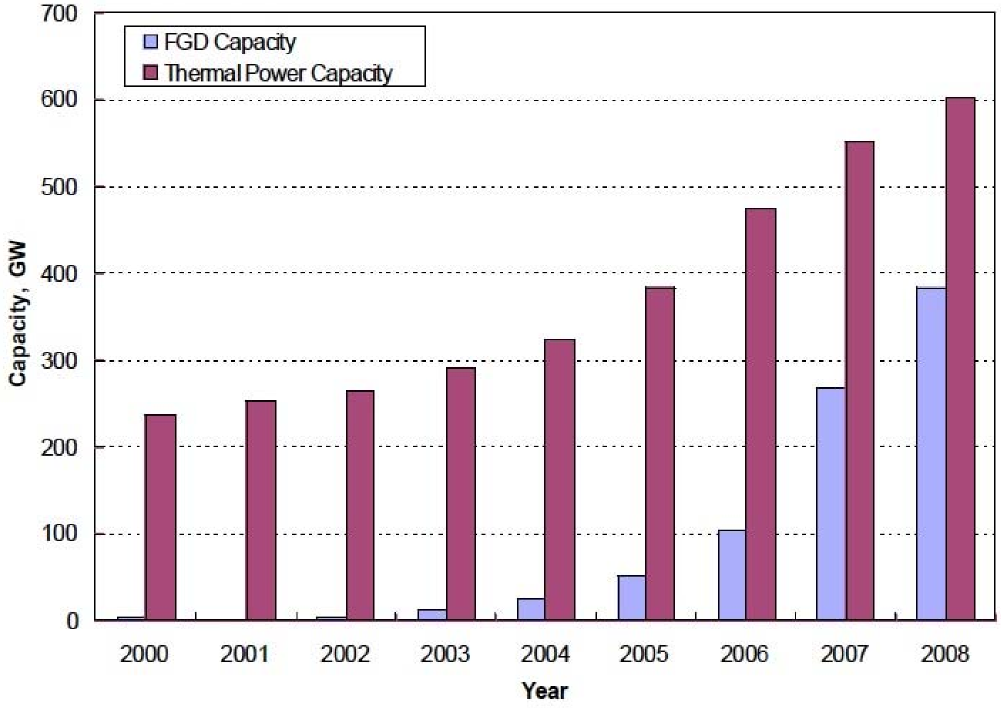
Coal Combustion

China has already equipped many coal combustion plants with flue gas desulfurization (FGD) and lately also with selective catalytic reduction of nitrogen oxides (SCR).

In the context of mercury pollution control, the halogen content of coal in China is of importance. If halogen concentration is high enough, mercury control can be sufficient (90 per cent removal or more) by FDG (accelerated by SCR). For low-halogen coal, the injection of bromide before combustion is a promising option.

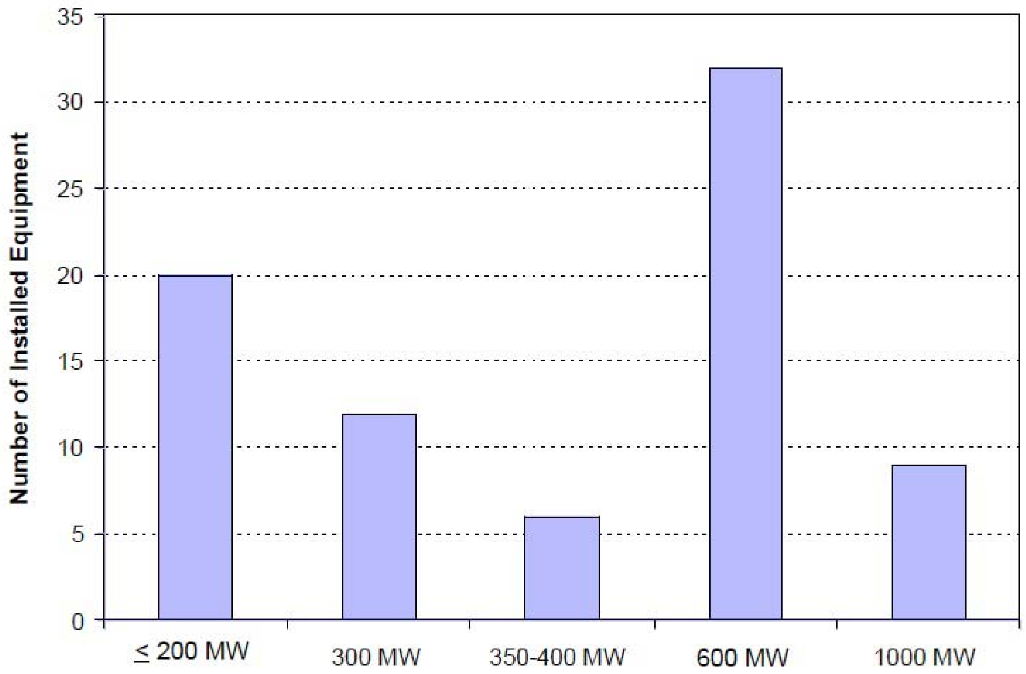
The comparison of installed FGD capacity with power generation capacity since 2000 (mainly wet limestone FGD)

by courtesy of Wojciech Jozewicz, Arcadis US (2010)



The deployment status of SCR technology against unit size

by courtesy of Wojciech Jozewicz, Arcadis US (2010)



Coal Combustion

Much of China's coal is low in halogens, similar to coal from many other regions of the world (Columbia, South Africa, or sub-bituminous US-coals), whereas bituminous coal from Europe or from the Appalachian mines in the US is halogen-rich. Some coals in China have a high halogen content; thus mercury emissions are expected to be low if FDG is used.

For tailoring the control strategy, representative data about halogen and mercury content of Chinese coals are needed.

Coal Combustion – Recommendations (1)

1. Mercury emissions from coal combustion should be reduced.

2. It is proposed to establish a command-and-control mercury emission regulations in two steps
   2.1 Monitoring Phase: Mercury Standards without punishment
   2.2 Binding Mercury Standard

3. The Standard should reduce the emissions of about 50 per cent and should be feasible for both options (ACI and BCA).

4. The operators should evaluate the option of pollution control according to economic soundness.

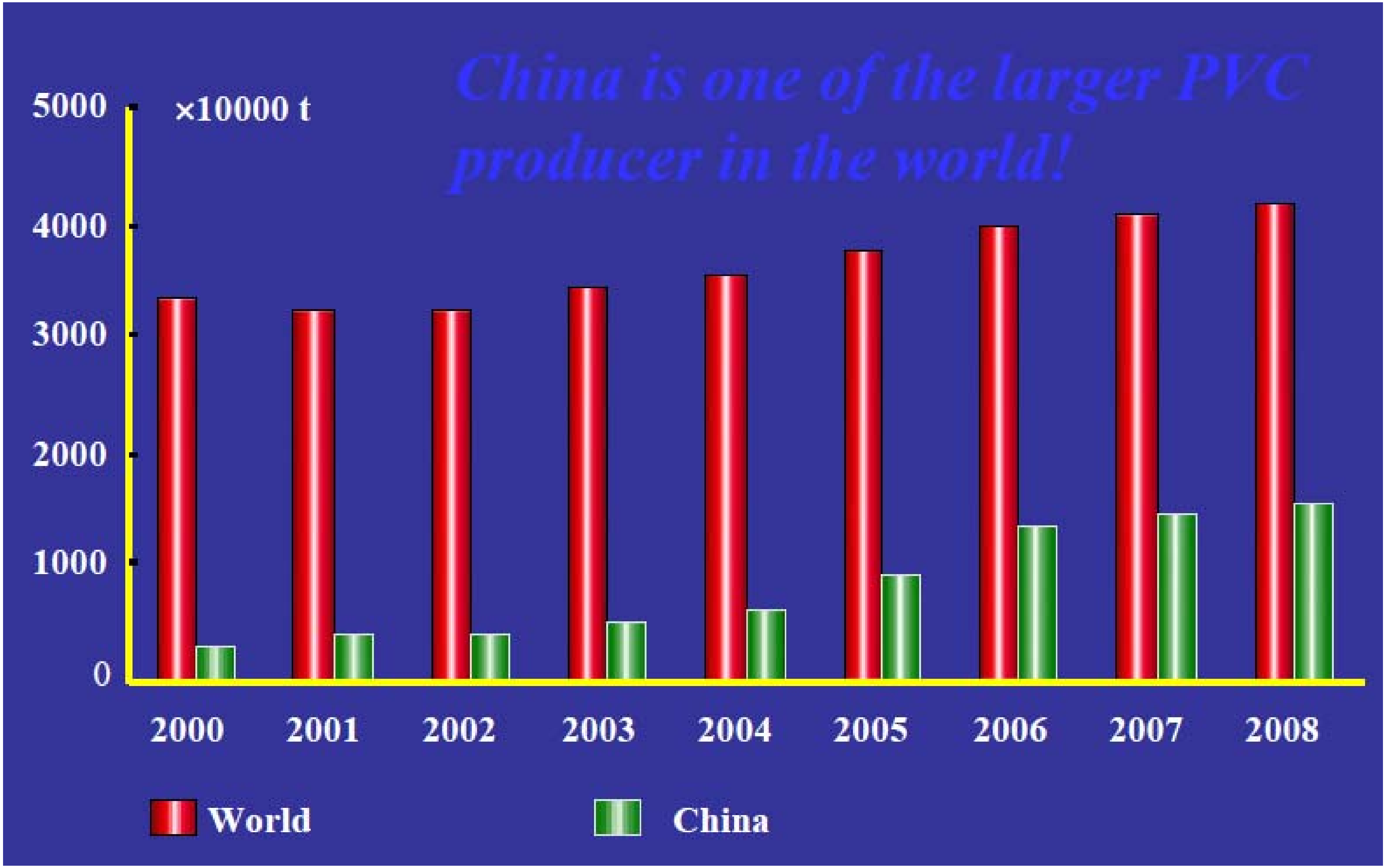
5. A Mercury Emission Standard needs to be developed and finally established for both existing and newly designed plants – e.g. in the range of 1.5 to 3 microgram per standard cubic meter (ug/Nm^3; dry, @ 6 % O_2) as 30 days **average**.

Coal Combustion – Recommendations (2)

6. The German standard (< 30 ug/Nm^3) is too weak.

7. The US-standard as proposed by US EPA on march 16, 2011 and as recently corrected for existing plants is 1.2 lb/TBTU – which corresponds to ~1.6 ug/Nm^3.
   This value is well supported by data and is in the range of recommendation (see 5).

8. The US-standard as recommended by US EPA on March 16, 2011 for newly designed plants lies in the order of magnitude of only 0.002 ug/Nm^3.
   This value is based on a very small data set and appears to be very ambitious – it cannot be recommended for decision-making in the SPS.



MEP, China 2009

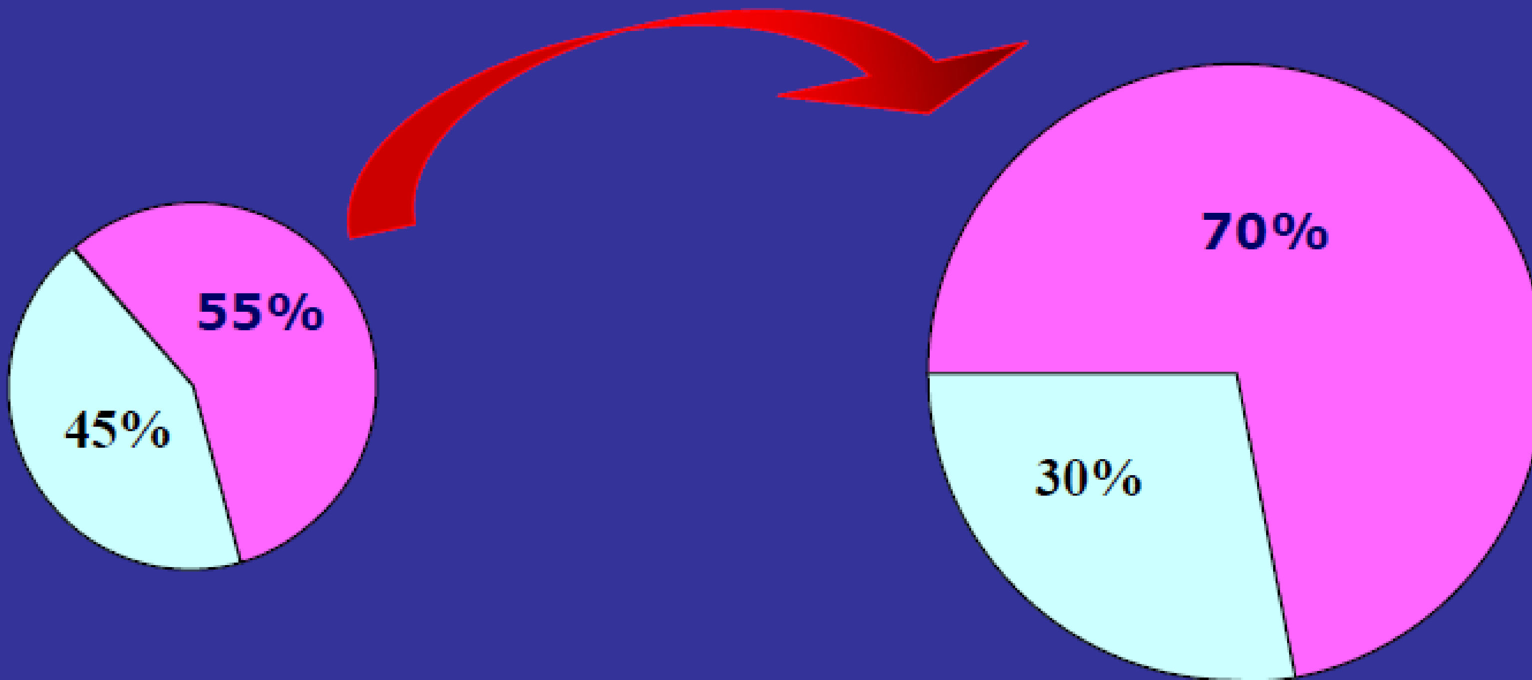
VCM

Table 2 Amount of PVC manufacturers using acetylene process and their capacity distribution in China (2008)

Capacity range (10,000 t)	Amount of enterprises	Production capacity (10,000 t)	Percent (%)
≥ 20	20	609	52.2
≥10 ~ < 20	31	387	33.2
≥5 ~ <10	20	123	10.5
<5	18	47.5	4.1
Total	89	1160.5	100

MEP: Project Report on the Reduction of Mercury Use and Emission in Carbide PVC Production, 2010

Ratio of acetylene-based process



2000yr 2008yr

MEP, China 2009

Reasons of existing of Hg-based VCM process

- Fast development with high demand of PVC
- More coal less petroleum
- Price of the petroleum
- Find a solution for the huge amount of SW

So the acetylene-based VCM process can not be phased out in short- term, low-mercury or mercury-free catalyst is a feasible way to solve mercury problem in PVC industries.

MEP, China 2009

VCM Reactor and Hg Catalyst, ZhongTai, Urumqi

VCM

MEP 2010: „At present, the mercuric chloride concentration of the mercury catalyst used by most enterprises usually is around 12.5%. When the mercuric chloride concentration drops to around 4.5%, the mercury catalyst tends to loose its function and be replaced by new ones. It is estimated that the average mercury catalyst consumption per ton PVC in China is about 1.0~1.4kg.

Based on the above-mentioned parameters and 2008 acetylene PVC output of about 6.2 million tons, the **annual use of mercury is about 574~803t** of which, about 206~289 t mercury remains in the waste catalyst and the rest is in the activated carbon, waste acid, emissions to the environment and other waste.“

Specific Hg use is about 0.11-0.13kg per Mg of PVC (ZhongTai Chemical Co., Urumqi)

Of the total mercury usage, about 30 to 35 per cent is returned to the catalyst producer in form of used catalyst.

About 65 to 70 per cent of the mercury stays in the process of which 50 per cent or more is collected behind the VCM reactor using activated carbon. **Verification** of this figure is the crucial point for further measurements and balancing work.

After this removal, 15 to 20 per cent of the mercury used stay in the production process and end up in different outputs (product, emissions to air and water and mainly in the sludge of the waste water treatment plant).

The emission of mercury into the air is not monitored (ZhongTai Chemical Co., DEP Xinjiang).

Comprehensive data for a verifiable balance are needed urgently.

VCM

In 2020, it is expected that the PVC production capacity in China reaches 20 million tons per year.

For acetylene route of production, the demand of mercury for catalyst is estimated to exceed 2000 tons per year.

Up to now, a verifiable balance of recycling rates of the used catalyst and the activated coal (VCM cleaning) could not be obtained.

Assuming a recycling rate of 80 per cent, a supply of new 400 tonnes of mercury per year would be needed. Will a new mercury mine be needed within this decade?

➔ Mercury demand from VCM production should be drastically reduced!

VCM

Three Possible Options:

1. Feedstock changing: Convert to petroleum or natural gas in VCM production like in most other parts of the world.

2. For existing plants using coal as feedstock: Increase the efficiency of the production and reduce the mercury content of the catalyst.

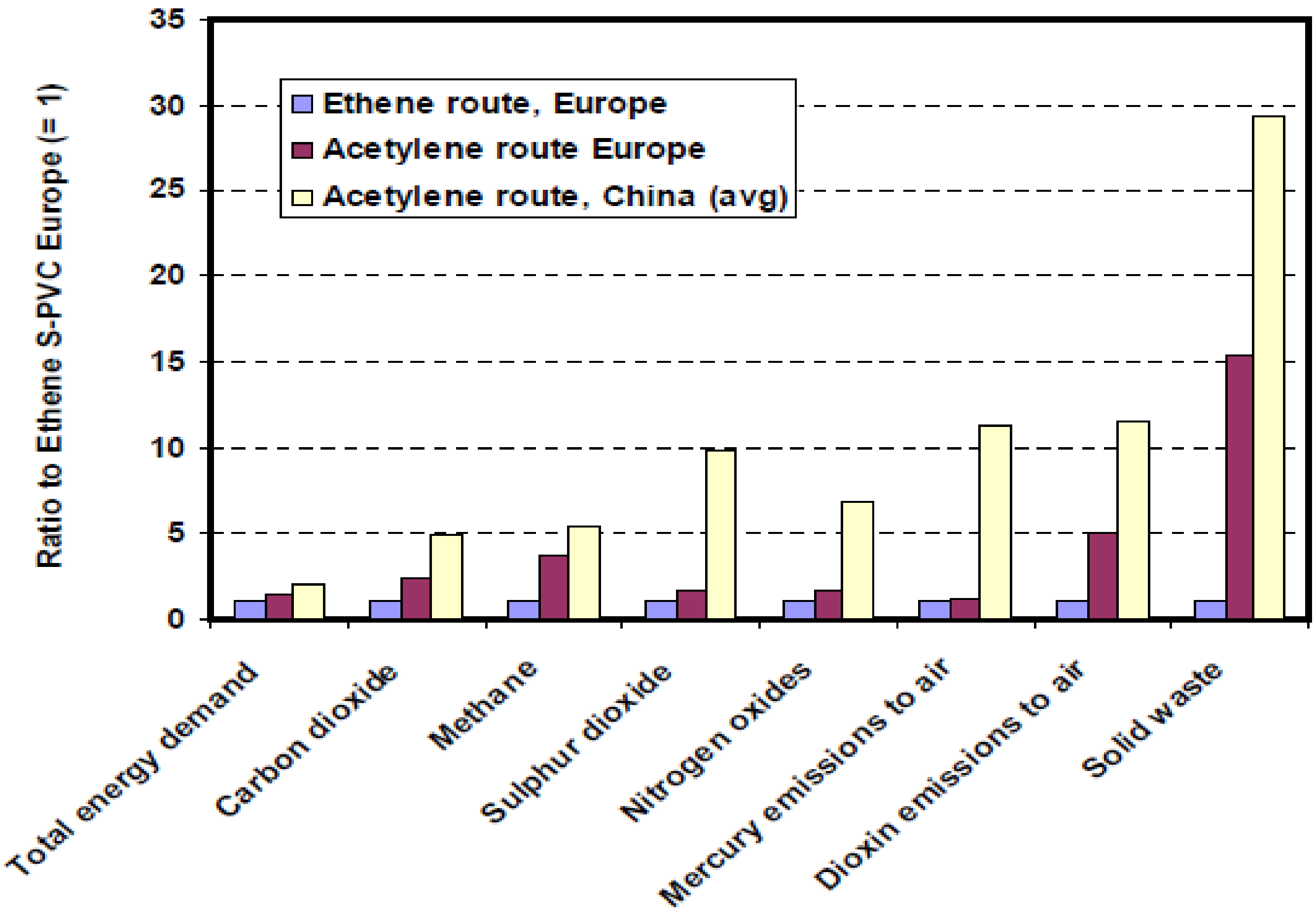
3. For existing plants using coal as feedstock: Develop and phase-in mercury-free catalyst.

One argument against the feedstock changing is that China is mainly relying on coal and that it would create logistic problems to bring petroleum to its western regions of the centers of VCM production.

Tianye PVC company in Xinjiang plans to increase the production capacity to about 5 Mio. Mg by 2020, **Sheng Xiong** to 2 Mio. Mg/a and **ZhongTai Chemical Co.** to about 3 Mio. Mg/a, relying mainly on coal for this expansion. All three companies are located in the west of China in the Xinjiang Uyghur Autonomous Region, one of Chinas important regions to extract petroleum and natural gas (about 10 per cent of current extraction in China).

In addition, there are pipelines from Kazakhstan and Uzbekistan to bring petroleum and natural gas to this region.

Comparison of eco-profile results for S-PVC; ethene route in Europe (=1) versus acetylene route in China



IFEU, Germany 2008

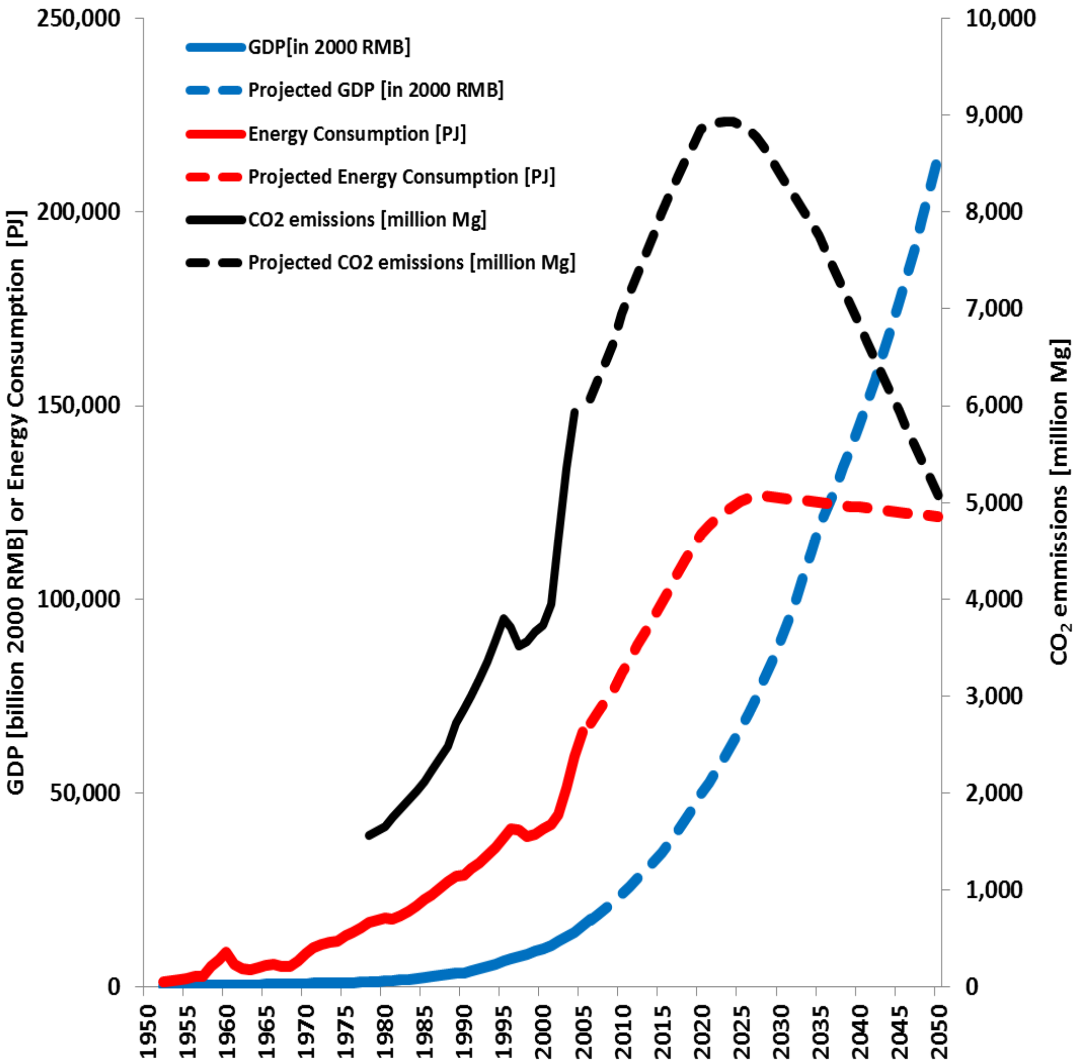
VCM Option 1

- On average, S-PVC production via the acetylene route in China requires approximately twice as much energy compared to the ethylene route in Europe.

- On average, the emission of the greenhouse gas carbon dioxide is about five times higher for acetylene S-PVC produced in China than for the S-PVC produced in Europe via the ethane route. The CO_2 credit from the use of calcium hydroxide in cement plants is comparably small.

- If S-PVC would be produced in Europe via the acetylene route using coal as feed-stock, carbon dioxide emissions would be about a factor 2.3 larger than for PVC via the ethane route. For all other parameters, the environmental impacts are larger as well.

GDP and Primary Energy Consumption (CAS Scenario)



Predicted Changes from 2010 to 2050

GDP	+ 800%
Energy consumption	+ 50%
CO_2 emissions	- 12%

... very ambitious goals!

Source:
Franke, IFEU 2011

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Energy Efficiency

Table 2.4: Comparing the Energy Consumption of Energy-Intensive Industrial Products (2007)

Energy consumption indicator	China			Advanced international level	2007 Gap	
	2000	2005	2007		Energy consumption	%
Coal consumption of thermal generators (grams of coal equivalent/kWh)	363	343	333	299	34	11.4
Comparable energy consumption of steel (large- and medium-sized enterprises) (kg coal equivalent/tonne)	784	714	668	610	58	9.5
AC power consumption of aluminium electrolysis (kWh/tonne)	15480	14680	14488	14100	388	2.8
Comprehensive energy consumption of copper metallurgy (kg coal equivalent/tonne)	1277	780	610	500	110	22.0

Source: China Development Report, Renmin University Beijing, 2010

	RMB/Mg PVC	MJ/kg	Mg SCE/Mg	Mg CO2/Mg	Mg SCE per 1000 RMB	Mg CO2 per 1000 RMB	Ratio Energy eff.	Ratio CO2 intensity
Ethylene	7500	57	1.9	1.8	0.26	0.24	45%	19%
Acethylene	7000	117	4.0	8.8	0.57	1.3	100%	100%

Source: Franke, IFEU 2011

VCM - Option 2

The basic idea of option 2 is to reduce the use and release of mercury, thus minimizing the generation and emission of mercury containing waste. For this, a low-mercury catalyst with only about 6 per cent Hg is proposed.

MEP 2010: „At present, this technology has been employed by some enterprises in China in the production and is under continuous improvement. Some enterprises will finish pilot testing and begin pre-production testing in September 2009. It is expected that they will enter trial-production stage in 2010. Once mature, the application of this technology will be extended to other appropriate enterprises."

VCM - Option 2

To our information (2011), the Xinjiang PVC companies **ZhongTai Chemical Co.** and **Tianye** have conducted several test with the low-mercury catalyst. These tests were abandoned because of low efficiency. Consequently, for newly built plants (e.g. **ZhongTai** in Fukan), the facility design is currently based on high-mercury catalyst usage.

We need to get a representative picture of the situation with respect to low-mercury catalysts for PVC plants in China in order to determine whether option 2 is a realistic one.

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IMPROVEMENTS IN CATALYTIC PROCESSES

The present invention concerns improvements in catalytic processes, and improvements in catalysts for such processes. More particularly, it concerns processes and catalysts for manufacturing vinyl chloride monomer ("VCM") from acetylene.

One of the current state-of-the-art process for manufacturing VCM combines ethylene, hydrogen chloride and oxygen in the presence of copper chloride to form ethylene dichloride, which is decomposed at high temperature to form VCM and HCl. In the original process, dating from the early part of the 20th century, ethyne (acetylene) from carbide is reacted with HCl over a mercury-based catalyst. This original process is still in use in China, where there is access to cheap ethyne via carbide from abundant coal resources. Despite low capital and operating costs, the original route has been largely abandoned in favour of the ethylene process outside China.

The mercury catalyst, usually 8-10% mercuric chloride on activated charcoal, used in the original process is highly toxic. Such toxicity creates problems arising from handling during manufacture of the catalyst as well as during loading of catalyst and removing catalyst after a campaign. A campaign is generally of six month duration. Deactivation of the mercury catalyst and loss of $HgCl_2$ by sublimation or volatilisation from the reactor in use can be significant problems. The ethyne process using mercury-based catalyst requires a lower capital investment in plant than the ethylene process; if a non-volatile and less toxic catalyst could replace the mercury catalyst without requiring significant plant alterations in existing plant designs, this would be a significant advantage.

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Conclusion

- Johnson Matthey and Aker Solutions new catalyst
  - Mercury free
  - HSE: catalyst components unclassified
  - Can be used in existing VCM plants
  - Higher yield compared to mercury catalyst
  - Low impact on total conversion costs
  - Can be recycled after use
- Pilot work in 1996 showed high catalyst performance
- Recent laboratory tests confirmed redesigned catalyst performance
- Pilot and demonstration test planned to start Q3 2009
- Commercial launch of catalyst planned in 2010
- **New catalyst provides both environmentally and economically sustainable solution to Chinese PVC industry**

Johnson Matthey

Slide 21

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part of Aker

Presentation 5. June 2009 by Matthey & Aker

Some other patents and scientific research, e.g.:

Kinetics of Acetylene Hydrochlorination over Bimetallic Au–Cu/C Catalyst

Shengjie Wang · Benxian Shen · Qinglei Song

Received: 14 September 2009 / Accepted: 2 November 2009 / Published online: 14 November 2009
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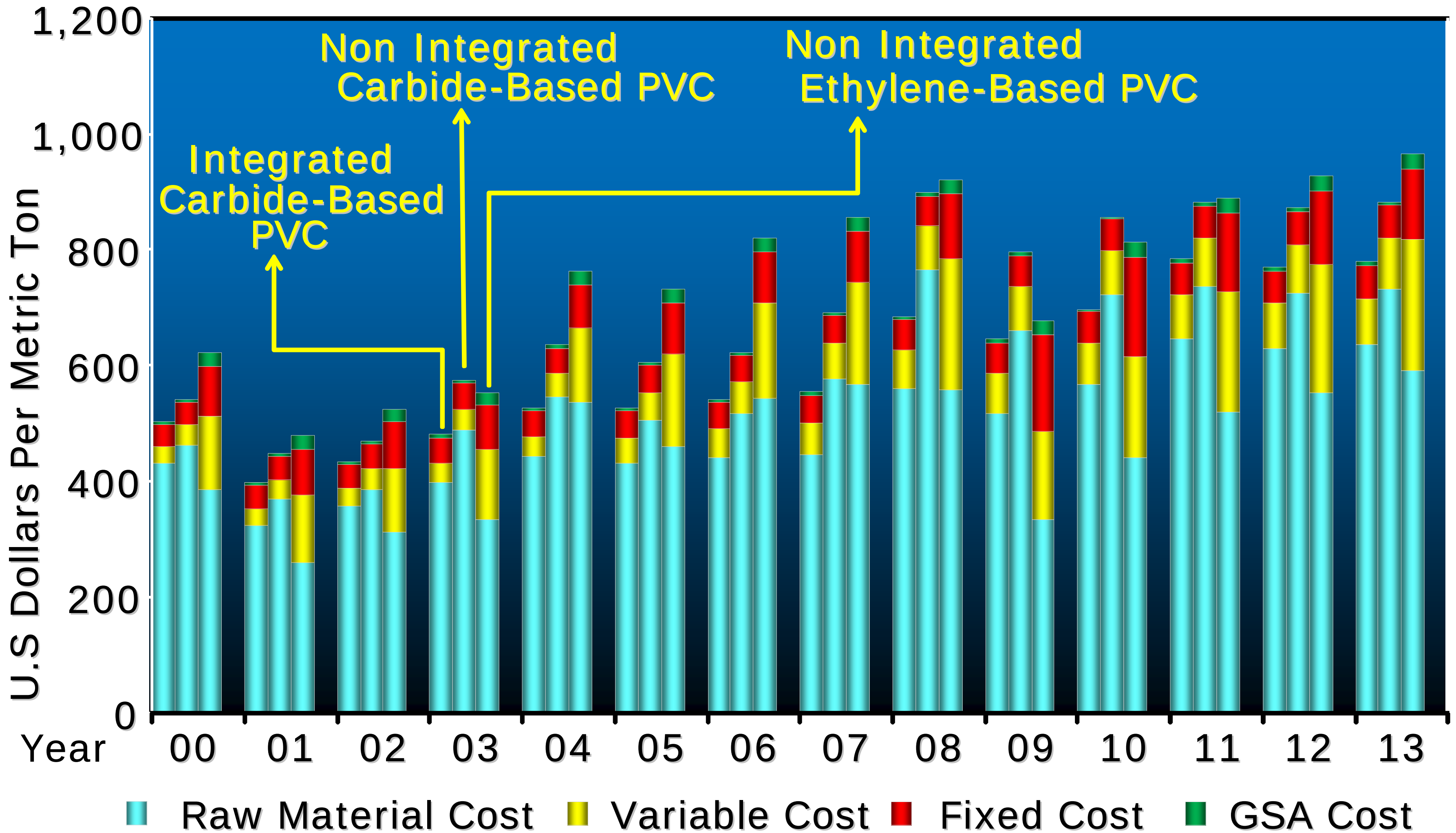
Abstract A kinetic model of the acetylene hydrochlorination over the bimetallic Au–Cu/C catalyst was obtained on the basis of kinetic data. DFT theoretical calculation and the kinetic model indicated the reaction probably proceeds via the Eley-Rideal mechanism in which gas phase HCl reacts with the adsorbed C_2H_2 to produce vinyl chloride. Reaction conditions were optimized according to kinetics analyses. Under the optimized reaction conditions obtained, the bimetallic Au–Cu/C showed excellent performances with more than 99.5% conversion and selectivity and did not deactivate in 200 h on stream.

Comparison of PVC costs



Eddie Kok, CMAI, 2009

VCM - Shortcomings

The pricing for acethylene-based PVC in China is not transparent. At about 7.000 RMB per tonne, it is just a bit lower than ethylene-based PVC in Europe priced at about 7.500 RMB per tonne, despite overall lower costs for coal, labor and electricity in China.

In particular, the price for carbide has to be more transparent.

Further input into the economic viability of feedstock changing is appreciated from the Chinese side. According to current data, feedstock changing would not cause a major price increase for PVC.

VCM - Shortcomings

Even though some emission factors are available, we need more and representative data regarding real emissions from the Chinese side.

In particular, a verifiable mercury balance based on representative data of VCM plants should be presented.

With respect to energy, CO_2 and costs from PVC production in China, a number of methodological questions have to be resolved (e.g. pre-chain, price setting).

Better data about the recycling of the catalyst are needed.

VCM - Recommendations MEP

Hg Life Cycle	Policy Demand	Specific Measures
Production, import and export of Mercury	Strictly regulate and control mercury import and export	1) Improve the existing import and export registration system for mercury and its compounds, trace the sources 2) Limit the supply of imported mercury $HgCl_2$ catalyst enterprises
	Strictly administrate mercury production and recycling enterprises	3) Implement mercury production license system 4) Implement mercury recycling license system (implemented) 5) Implement notification and registration system for the movement of manufactured or recycled mercury, limit the supply to $HgCl_2$ catalyst enterprises

MEP: Project Report on the Reduction of Mercury Use and Emission in Carbide PVC Production, 2010

VCM - Recommendations MEP

Production and supply of $HgCl_2$ catalyst	Restrict the production of $HgCl_2$ catalyst	1) Implement $HgCl_2$ catalyst enterprise license system 2) Carry out the total amount control of $HgCl_2$ catalyst production
	Restrict the supply of $HgCl_2$ catalyst	3) Implement notification and registration system for the movement of $HgCl_2$ catalyst
	Promote the use of low mercury catalyst	4) Develop low mercury catalyst product and production standard 5) Policy incentive to low mercury catalyst production projects
	Promote the research and development of mercury free catalyst	6) Increase the fund for R&D of mercury-free catalyst as a priority for PVC sector development in China, and implement research project 7) Encourage international cooperation on mercury-free catalyst technology

MEP: Project Report on the Reduction of Mercury Use and Emission in Carbide PVC Production, 2010

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VCM - Recommendations MEP

PVC Production	Reduce mercury utilization in PVC production	1) Integrate the application of low mercury catalyst and, no mercury catalyst when available, into clean production indicator system of PVC industry 2) Grant rational economic compensation to enterprises using low mercury catalyst
	Reduce mercury consumption and emission during PVC production	1) Develop and implement Hg atmospheric emission standard 2) Set up mercury atmospheric emission monitoring system 3) Carry out notification and registration system for mercury pollutant discharge 4) Establish clean production indicator system targeting on mercury use and emissions, and carry out compulsory clean production audit on PVC manufacturers by acetylene process 5) Encourage the R&D and application of Hg-reducing new technologies and measures 6) Integrate environmentally friendly storage and collection of Hg-containing materials and waste into corporate clean production audit

MEP: Project Report on the eduction of Mercury Use and Emission in Carbide PVC Production, 2010

VCM - Recommendations MEP

Treatment and disposal of mercury containing waste	Strict management of the treatment and disposal of mercury containing slag	1) Carry out annual report system for Hg-containing slag treatment enterprises 2) Monitoring and managing Hg-containing slag treatment and disposal process to avoid secondary pollution 3) Encourage the recycling and reuse of mercury in Hg-containing slag
Treatment and disposal of mercury containing waste	Strict management of the treatment and disposal of mercury containing waste acid	4) Carry out annual report system for Hg-containing waste acid treatment enterprises 5) Monitoring and managing Hg-containing waste acid treatment and disposal process to avoid secondary pollution

MEP: Project Report on the eduction of Mercury Use and Emission in Carbide PVC Production, 2010

VCM - Recommendations I

- 1. There is a need for an integrated future-plan for this sector
  - Integrated means:
    - resources, feedstock, crackers
    - economy,
    - CO_2-emission/carbon goals,
    - mercury, waste etc.
    - industry structure

  - MEP: „Develop more effective economic instruments and other policies to strictly control chaotic expansion of PVC industry by acetylene process;“

VCM - Recommendations II

- 2. Within this plan: Binding regulation (reduction target) for mercury use in VCM-production,
  - MEP: „Initiate the work of establishing the mercury emission inventory of PVC industry. Develop mercury reduction target and plan to guide the mercury prevention and control of China's PVC industry“

- 3. Mercury balances for all important VCM-plants,

- 4. Increase the efforts and the transparency to develop mercury-free catalysts
  - MEP: „Make more efforts in promoting the use of low mercury catalyst and development of mercury-free catalyst, continually reducing mercury utilization in PVC industry by the acetylene hydro chlorination process.“

Products - CFL

This following two tables give the actual standards in Europe.

These are the most ambitious one in the world.

Products – CFL

'ANNEX

Applications exempted from the prohibition in Article 4(1)

Exemption		Scope and dates of applicability
1	Mercury in single capped (compact) fluorescent lamps not exceeding (per burner):	
1(a)	For general lighting purposes < 30 W: 5 mg	Expires on 31 December 2011; 3,5 mg may be used per burner after 31 December 2011 until 31 December 2012; 2,5 mg shall be used per burner after 31 December 2012
1(b)	For general lighting purposes ≥ 30 W and < 50 W: 5 mg	Expires on 31 December 2011; 3,5 mg may be used per burner after 31 December 2011
1(c)	For general lighting purposes ≥ 50 W and ≤ 150 W: 5 mg	
1(d)	For general lighting purposes ≥ 150 W: 15 mg	
1(e)	For general lighting purposes with circular or square structural shape and tube diameter < 17 mm	No limitation of use until 31 December 2011; 7 mg may be used per burner after 31 December 2011
1(f)	For special purposes: 5 mg	

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:251:0028:0034:EN:PDF

Products – CFL

2(a)	Mercury in double-capped linear fluorescent lamps for general lighting purposes not exceeding (per lamp):	
2(a)(1)	Tri-band phosphor with normal lifetime and a tube diameter > 9 mm (e.g. T2): 5 mg	Expires on 31 December 2011; 4 mg may be used per lamp after 31 December 2011
2(a)(2)	Tri-band phosphor with normal lifetime and a tube diameter ≥ 9 mm and ≥ 17 mm (e.g. T5): 5 mg	Expires on 31 December 2011; 3 mg may be used per lamp after 31 December 2011
2(a)(3)	Tri-band phosphor with normal lifetime and a tube diameter ≥ 17 mm and ≤ 28 mm (e.g. T8): 5 mg	Expires on 31 December 2011; 3,5 mg may be used per lamp after 31 December 2011
2(a)(4)	Tri-band phosphor with normal lifetime and a tube diameter > 28 mm (e.g. T12): 5 mg	Expires on 31 December 2012; 3,5 mg may be used per lamp after 31 December 2012
2(a)(5)	Tri-band phosphor with long lifetime (≥ 25 000 h): 8 mg	Expires on 31 December 2011; 5 mg may be used per lamp after 31 December 2011
2(b)	Mercury in other fluorescent lamps not exceeding (per lamp):	
2(b)(1)	Linear halophosphate lamps with tube > 28 mm (e.g. T10 and T12): 10 mg	Expires on 13 April 2012
2(b)(2)	Non-linear halophosphate lamps (all diameters): 15 mg	Expires on 13 April 2016

CORRIGENDA

Corrigendum to Commission Decision 2010/571/EU of 24 September 2010 amending, for the purposes of adapting to scientific and technical progress, the Annex to Directive 2002/95/EC of the European Parliament and of the Council as regards exemptions for applications containing lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers

(Official Journal of the European Union L 251 of 25 September 2010)

On page 30 to 31, Annex, the following entries should read:

Exemption		Scope and dates of applicability
'1(c)	For general lighting purposes ≥ 50 W and < 150 W: 5 mg	
1(e)	For general lighting purposes with circular or square structural shape and tube diameter ≤ 17 mm	No limitation of use until 31 December 2011; 7 mg may be used per burner after 31 December 2011
2(a)(1)	Tri-band phosphor with normal lifetime and a tube diameter < 9 mm (e.g. T2): 5 mg	Expires on 31 December 2011; 4 mg may be used per lamp after 31 December 2011
2(a)(2)	Tri-band phosphor with normal lifetime and a tube diameter ≥ 9 mm and ≤ 17 mm (e.g. T5): 5 mg	Expires on 31 December 2011; 3 mg may be used per lamp after 31 December 2011
2(a)(3)	Tri-band phosphor with normal lifetime and a tube diameter > 17 mm and ≤ 28 mm (e.g. T8): 5 mg	Expires on 31 December 2011; 3,5 mg may be used per lamp after 31 December 2011
3(a)	Short length (≤ 500 mm)	No limitation of use until 31 December 2011; 3,5 mg may be used per lamp after 31 December 2011
3(b)	Medium length (> 500 mm and ≤ 1 500 mm)	No limitation of use until 31 December 2011; 5 mg may be used per lamp after 31 December 2011
4(b)-I	P ≤ 155 W	No limitation of use until 31 December 2011; 30 mg may be used per burner after 31 December 2011
4(b)-II	155 W < P ≤ 405 W	No limitation of use until 31 December 2011; 40 mg may be used per burner after 31 December 2011
4(c)-I	P ≤ 155 W	No limitation of use until 31 December 2011; 25 mg may be used per burner after 31 December 2011
4(c)-II	155 W < P ≤ 405 W	No limitation of use until 31 December 2011; 30 mg may be used per burner after 31 December 2011'

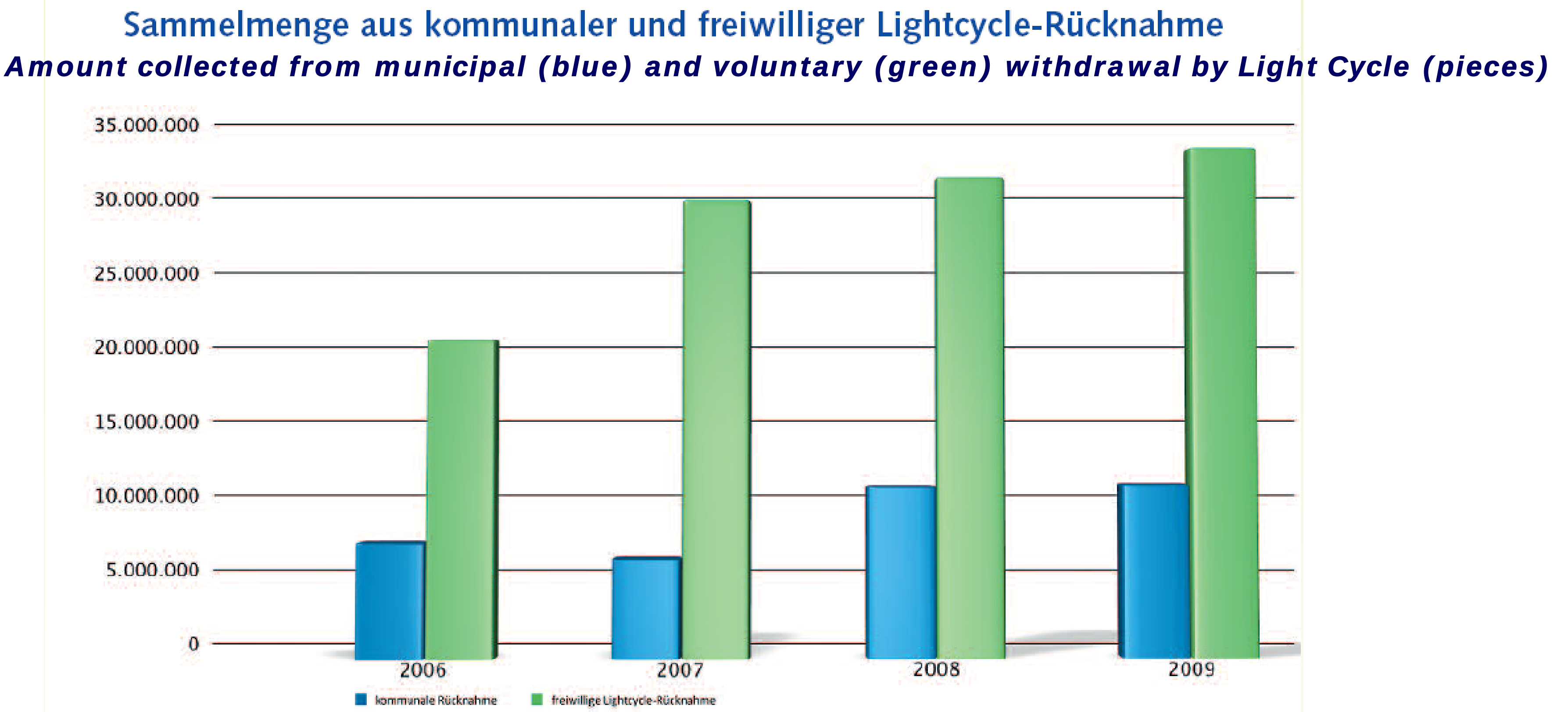
Products - CFL - post consume phase

In Germany, we have a high recycling rate. The high figures show, how much mercury is caught after a lamp has reached the recycling plant. Our problem is that people throw the old lamps in the garbage bin. They are not informed enough about the need for collecting these old lamps seperately. To tackle this issue, a new strategy was established in Germany: A voluntary agreement with the private sector for the post consume/end of life phase was developed.

Many infomations about the organisation of this voluntary agreements you can find on this site: www.lightcycle.de

Unfortunately, the annual reports are neither available in Chinese nor in English. But the figures and graphs are yet understandable.

Products – CFL – post consumer phase

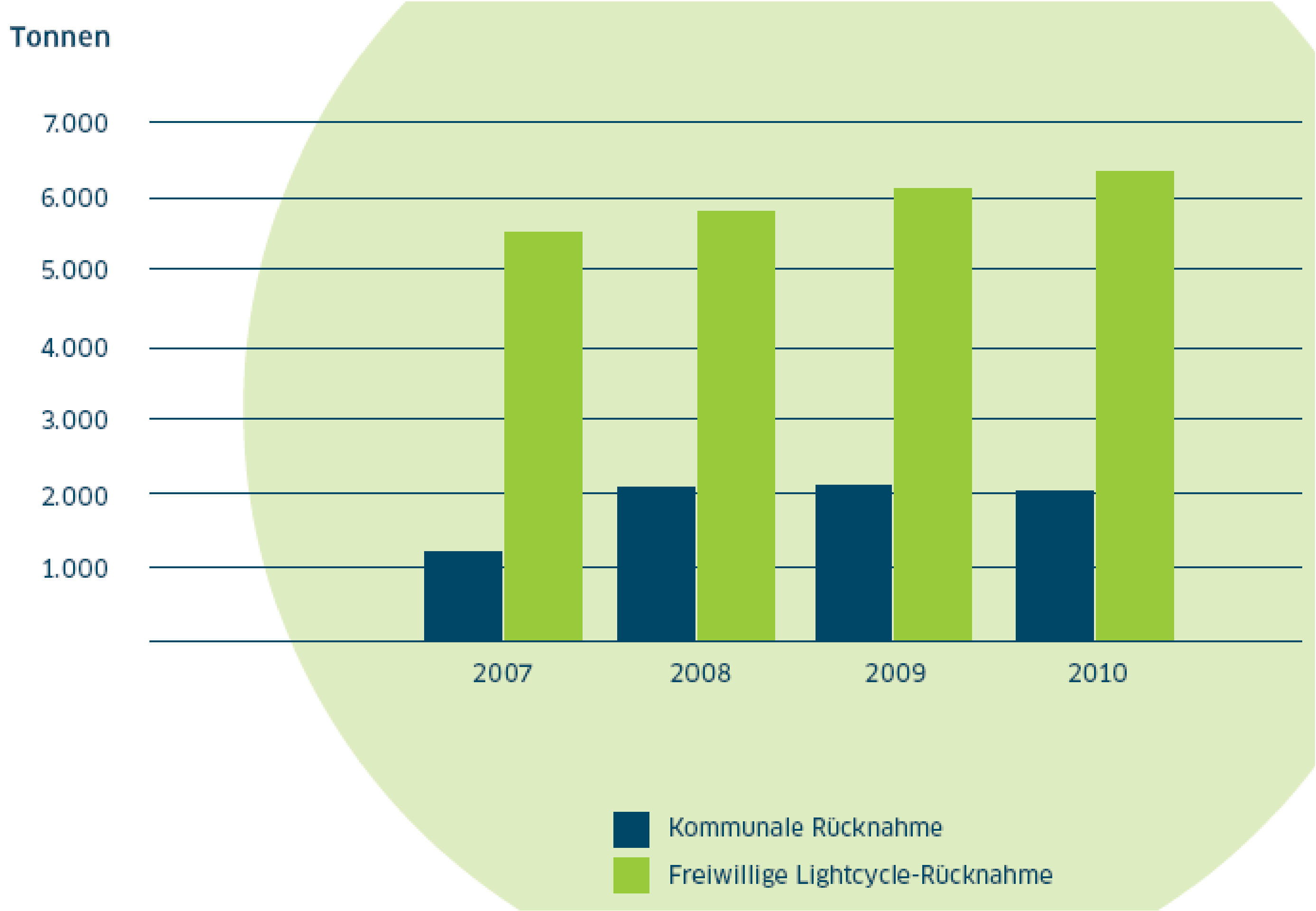


	2006	2007	2008	2009
kommunale Rücknahme	7.310.910 St.	6.321.435 St.	10.868.822 St.	10.994.208 St.
freiwillige Lightcycle-Rücknahme	20.231.621 St.	29.158.718 St.	30.655.392 St.	32.557.356 St.

http://www.lightcycle.de/fileadmin/user_upload/PDF/Jahresberichte/Jahresbericht_2009.pdf

Products – CFL – post consumer phase

Mass collected from municipal (blue) and voluntary (green) withdrawal by Light Cycle (Mg/a)



http://www.lightcycle.de/fileadmin/user_upload/PDF/Jahresberichte/LC_Jahresbericht_2010.pdf

Products – CFL – Recommendations

China is producing about 90 per cent of CFL worldwide:

1. The EU Standard should be introduced worldwide within the next 5 years.

2. It is not reasonable to have a different Chinese Standard.

3. A system for separate collection and mercury recycling of used CFLs should be established in China.

Products

To be continued

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