

Sino-German Collaboration to Improve the Energy Efficiency of Buildings and in Industry in Urumqi

中德合作提高乌市建筑和工业能效

A project of RECAST Urumqi - RECAST 乌鲁木齐项目

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Heidelberg, 13 July 2010 海德堡2010年7月13日



Overview 概况

- 1. Introduction**
介绍
- 2. The Energy and Air Pollution Challenge**
能源与空气污染挑战
- 3. Lighthouse projects: Improving Energy Efficiency in Buildings**
灯塔示范项目：提高建筑能效
- 4. Lighthouse project: Ecoprofile of Zhongtai Chemical Co.**
灯塔示范项目：中泰化学的生态特性说明书
- 5. Outlook**
前景

Chinese Academy of Sciences: Roadmap to 2050

中科院：2050能源发展路线图



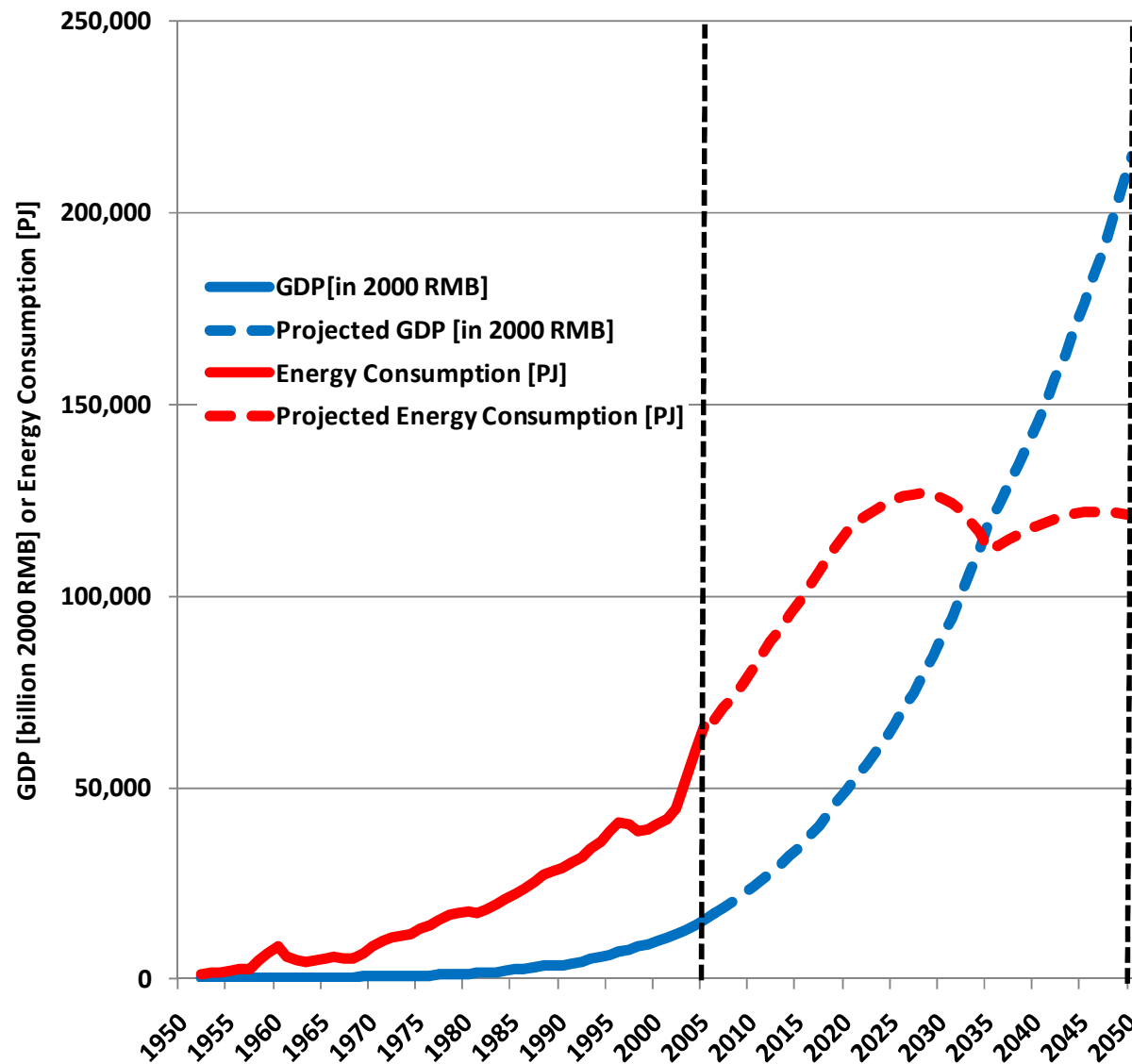
 Chinese Academy of Sciences

Yong Chen
Editor

Energy Science & Technology
in China: A Roadmap to 2050

GDP and Primary Energy Consumption (CAS Scenario)

GDP和一次能源消费(中科院情景分析)



Predicted Changes from 2010 to 2050

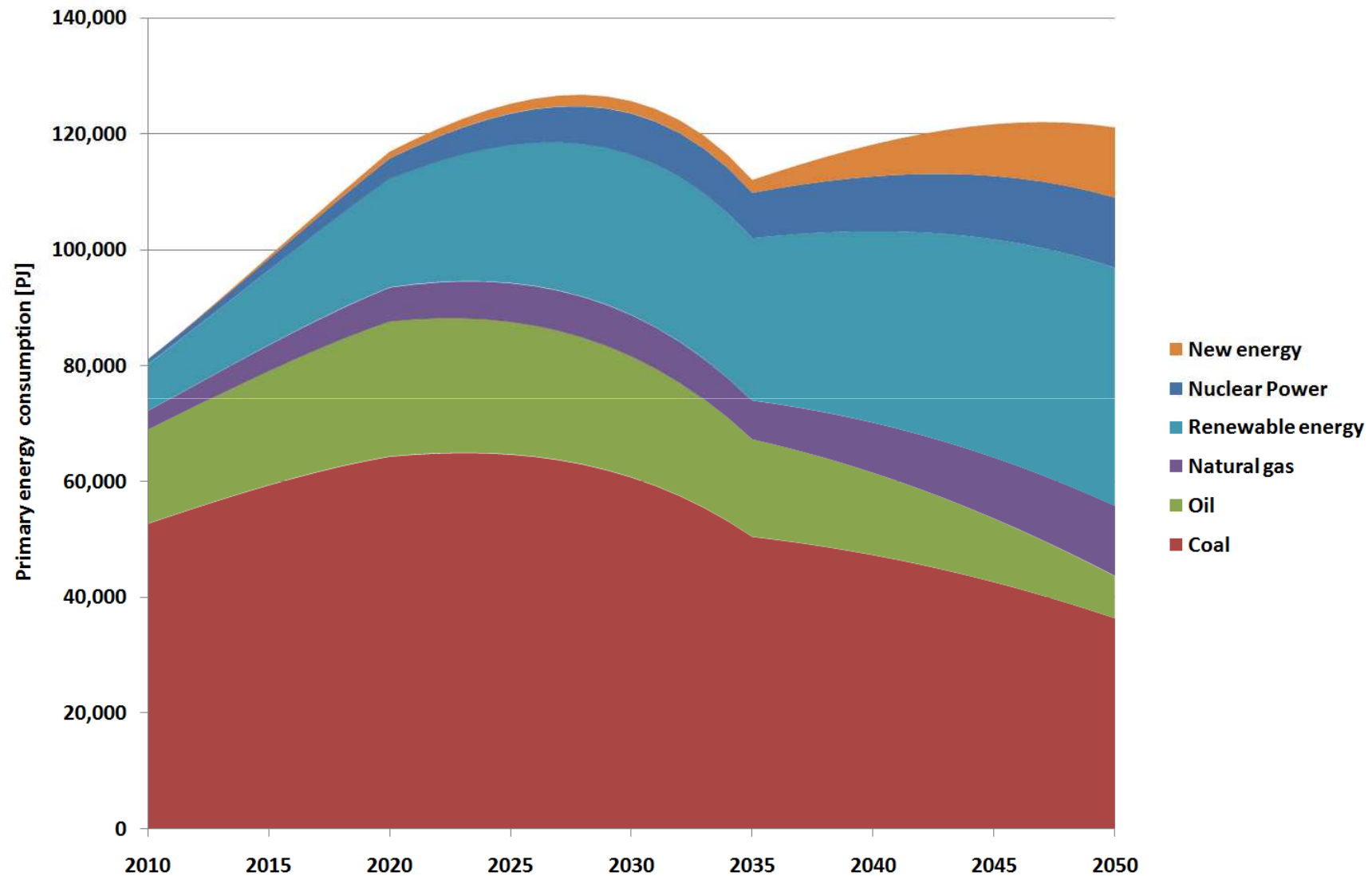
2010到2050的变化预测

GDP	+ 800%
Energy consumption	+ 50%
CO ₂ emissions	- 12%
GDP	+ 800%
能源消费	+ 50%
二氧化碳排放	- 12%

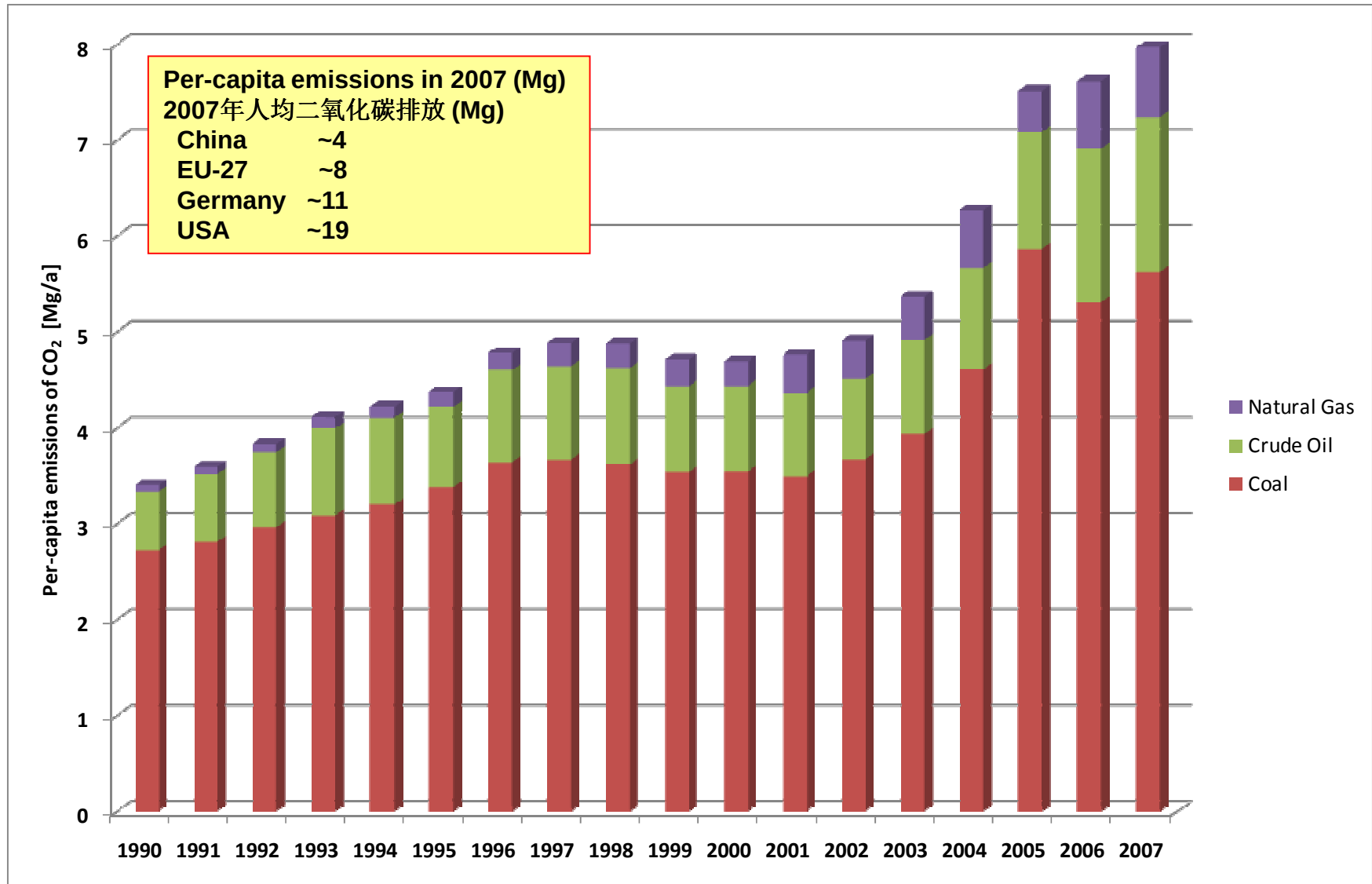
... very ambitious goals!
雄心勃勃的目标!

China: Primary Energy Consumption (CAS Scenario)

中国一次能源消费(中科院情景分析)



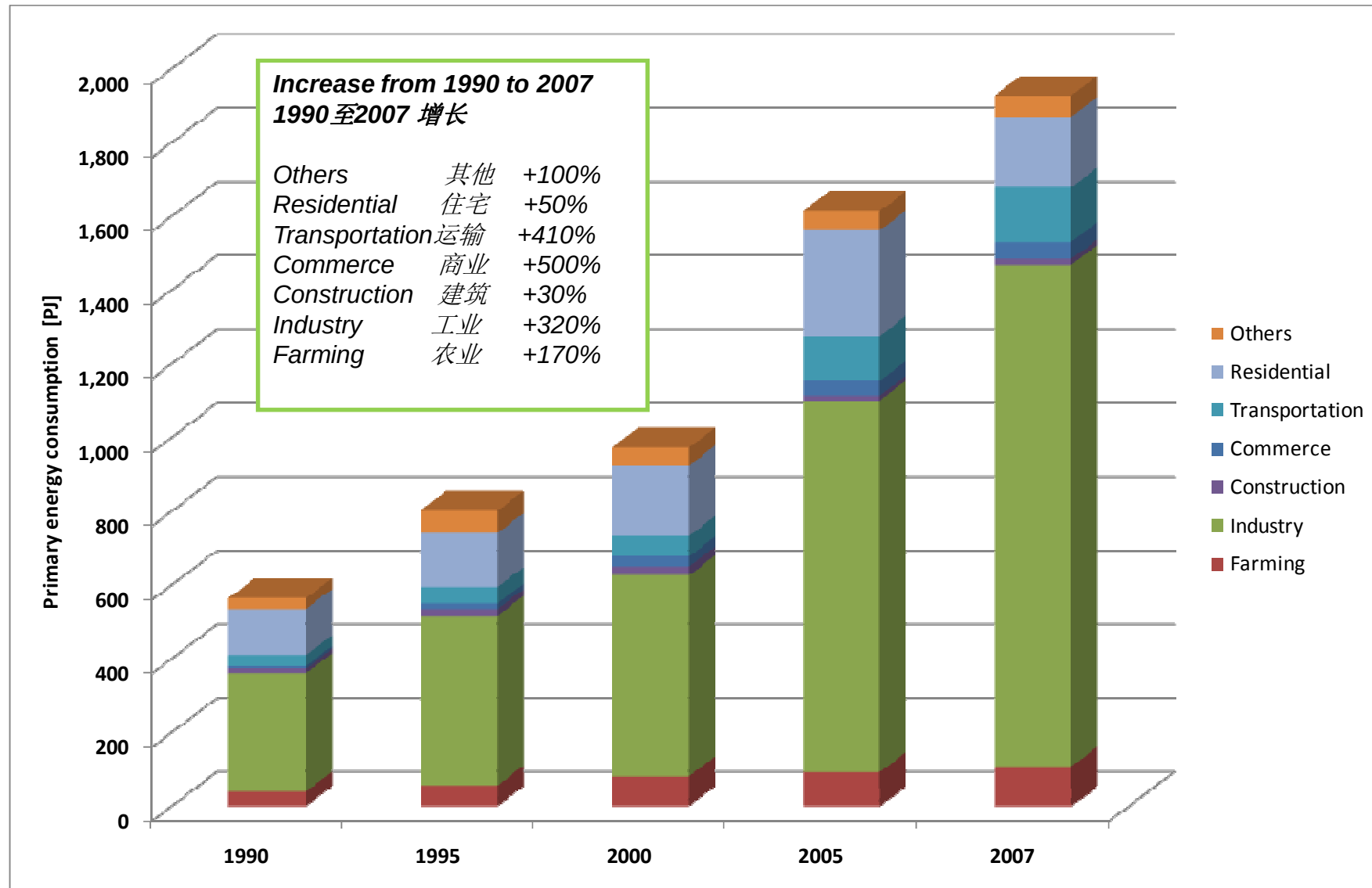
Xinjiang CO₂ Emissions per Capita 新疆人均CO₂排放



Source: Xinjiang Statistical Yearbook 2009 资料来源: 新疆统计年鉴2009

Xinjiang: Primary Energy Consumption by Sector

新疆各行业一次能源消费

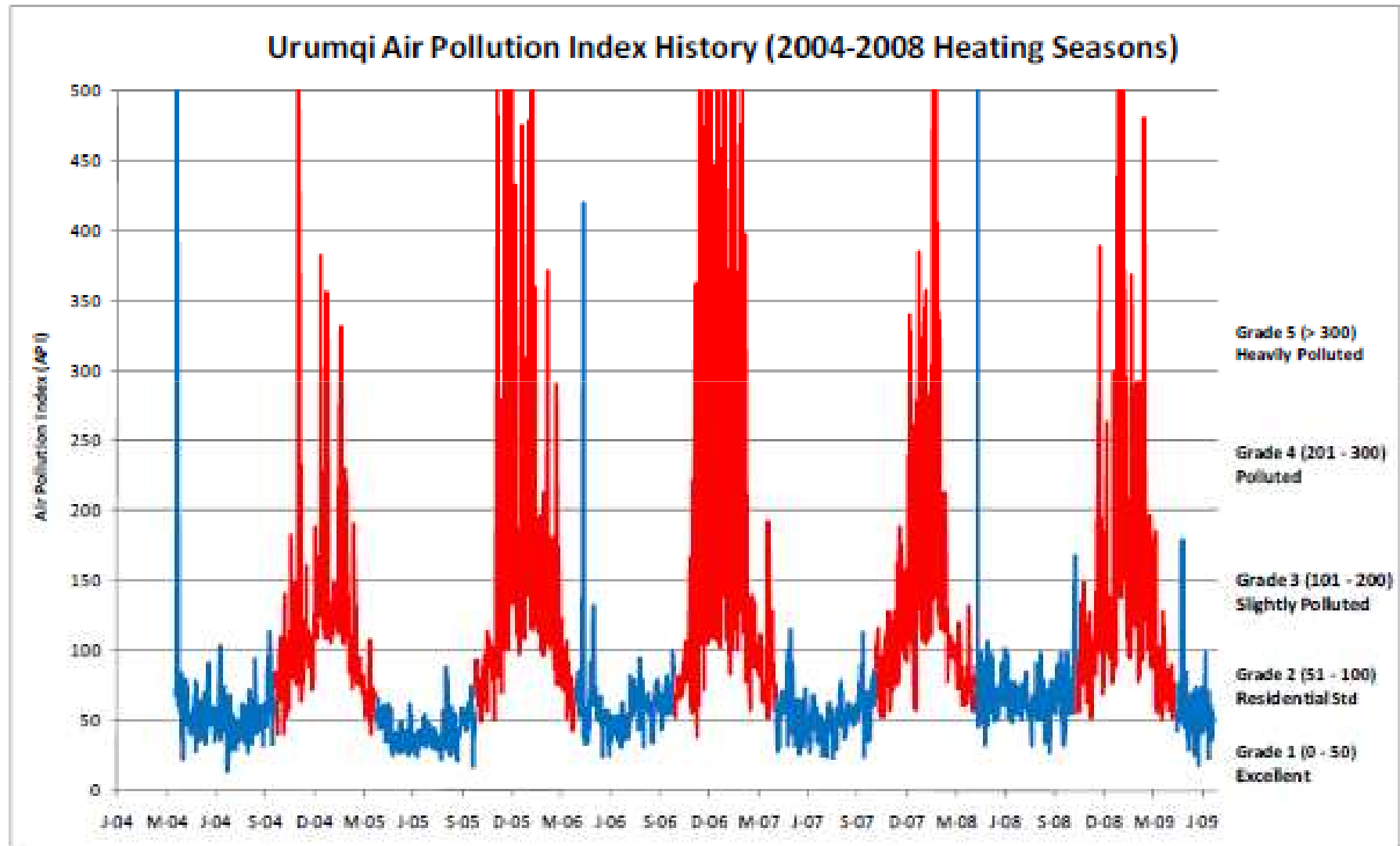


Source: Xinjiang Statistical Yearbook 2009 资料来源: 新疆统计年鉴2009

Urumqi: Air Pollution is Highest in the Heating Season

乌鲁木齐采暖期空气重度污染

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Source: Owens Corning / MVV-Decon (2009) 资料来源: Owens Corning / MVV-Decon (2009)

Urumqi in the headlines (DIE WELT 29.10.2008)

乌鲁木齐上头条新闻(世界报2008年10月29日)

UMWELT

(48)

China ist jetzt offiziell weltgrößter Klimasünder

29. Oktober 2008, 17:31 Uhr

Erstmals seit 14 Jahren gibt China Daten über den Anstieg der Emissionen preis: Die rasant aufstrebende Wirtschaftsmacht hat demnach beim Ausstoß von Treibhausgasen mindestens das Niveau der USA erreicht. Doch dabei bleibt es nicht: Bis 2030 wird das Land seinen Treibhausgasausstoß sogar verdoppeln.

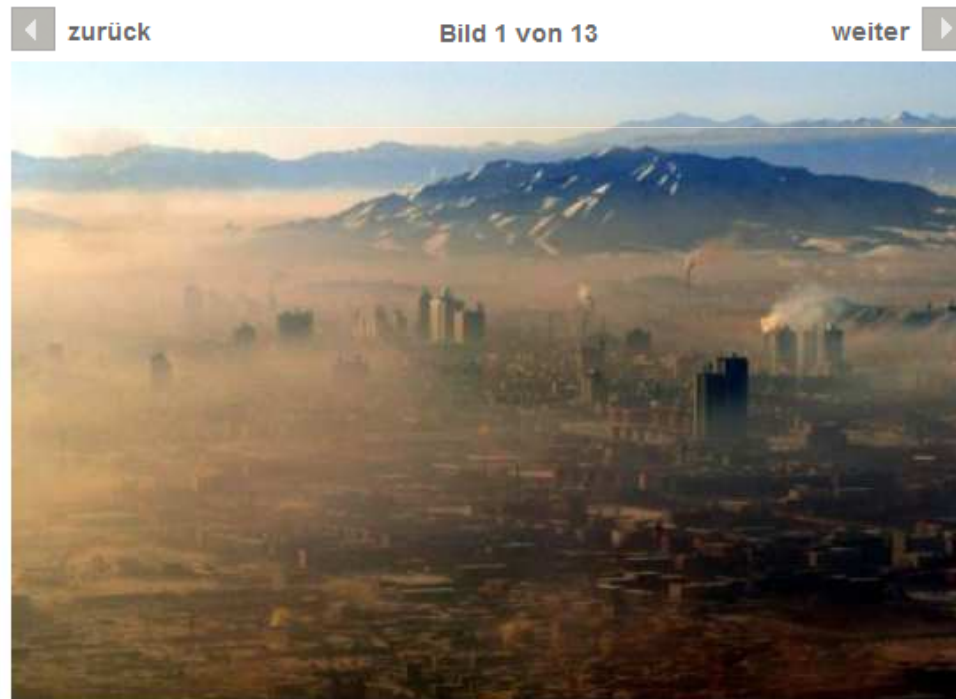


Foto: dpa

Krebsraten explodieren: Luftverschmutzung in der chinesischen Stadt Urumchi in der Region Xinjiang Uygur.

Urumqi in 2007

乌鲁木齐2007年

- 2.33 million residents
- 9 million tonnes of coal
- of that half for heating

- 2百33万人口
- 9百万吨燃煤
- 其中一半用于冬季供暖

Urumqi: Air Pollution Challenge

乌鲁木齐面临空气污染的挑战

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Urumqi: Air Pollution Challenge

乌鲁木齐面临空气污染的挑战

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Urumqi: Air Pollution Challenge

乌鲁木齐面临空气污染的挑战

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Urumqi: Air Pollution Challenge

乌鲁木齐面临空气污染的挑战

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Urumqi: Human Health Issues

乌鲁木齐的市民健康问题

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Sino-German Workshop on Energy Conservation, Urumqi, January 2007

2007年1月在乌鲁木齐举办的首届中德建筑节能高层研讨会

Energy Conservation in Residences and Public Buildings

- 12 Presentations from German & Chinese Experts
- Participation of many Urumqi stakeholders
- Simultaneous translation allowed for open exchange and candid discussions
- Media coverage, similar format planned for future project meetings
- Papers available at www.ifeu.de



民用建筑和公共建筑的节能

- 12位中德专家做了报告
- 与会者包括乌鲁木齐各方合作伙伴
- 同声传译使得与会者可以自由交流和公开讨论
- 技术支持和媒体报道，为远期项目会议提供了参考依据
- 在研究所网站上可以下载相关报告 www.ifeu.de

Sino-German Workshop on Planning for Low Energy Buildings, March 2009

2009年3月在德国海德堡成功举办了中德低能耗建筑规划的专业研讨会

- One week of workshop and excursions 为时一个星期的研讨会和参观
- Excursions to passive house projects in the region of Frankfurt
参观法兰克福被动式建筑项目
- Establishing a mutual understanding of standards and goals
交流理解双方的节能标准和目标
- Identification of future areas of collaboration 确认未来合作的领域

Case study: Passive house school in Frankfurt-Riedberg

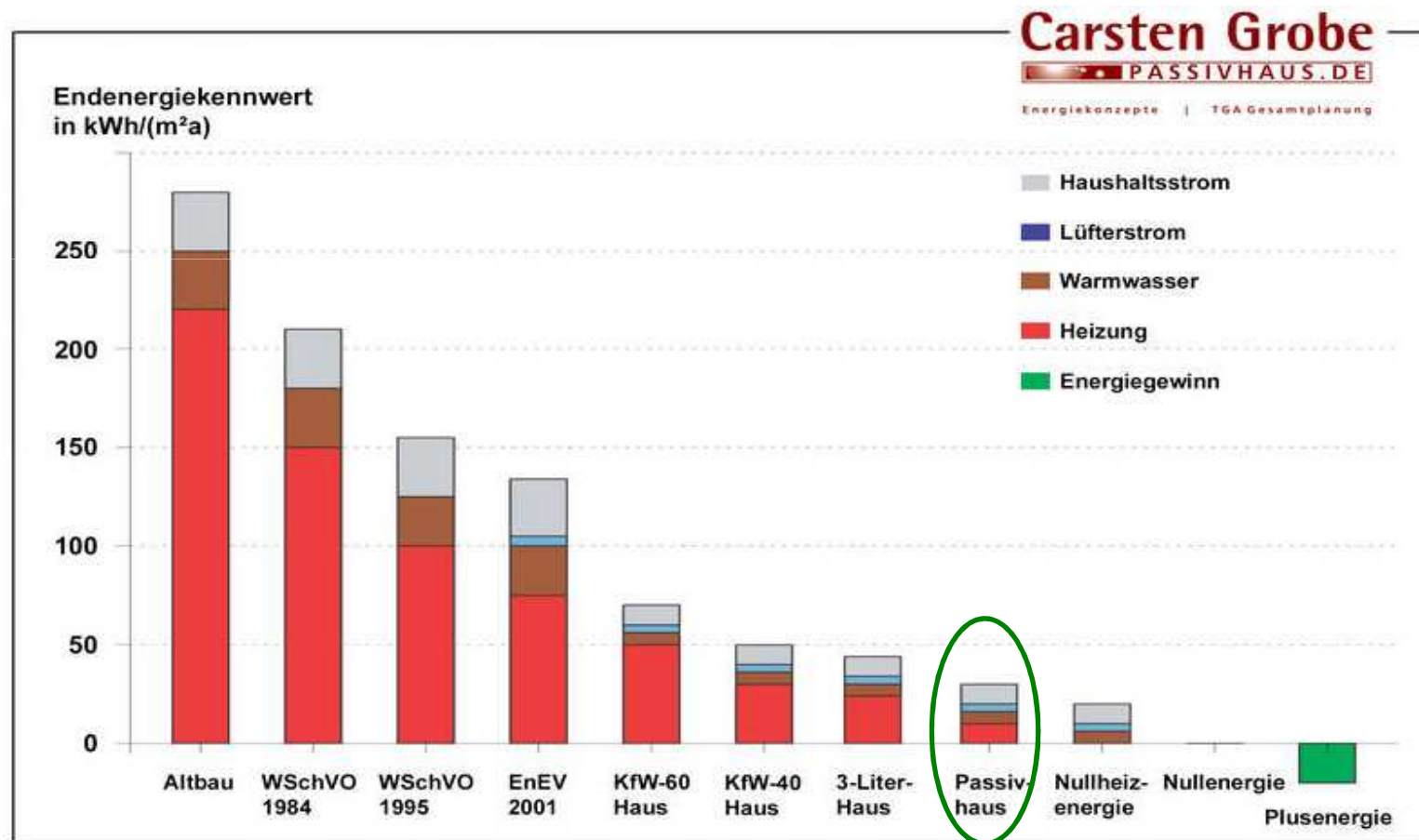
参观法兰克福Riedberg被动式标准的学校建筑



Passive House 被动式建筑

Ein Passivhaus ist ein Gebäude, in dem eine behagliche Temperatur sowohl im Winter als auch im Sommer ohne separates Heiz- bzw. Klimatisierungssystem zu erreichen ist.

被动式建筑是在无供暖和空调设备的情况下，室内冬夏季均可达到舒适温度的建筑。



Low energy and green buildings

低能耗建筑和绿色建筑

Alter	建筑实例	建筑类型	标准/标识	能源需求计算	类别 建筑设计 建筑外壳	能源 / 建筑技术
新建	单个或多个家庭房屋	住宅建筑	德国节能条例 2007 	一次能源需求 $Q_{p,max} = 51 + 75 \cdot (A/V_e)$ $+ DQ_{TW} \text{ kWh/m}^2\text{a}$ * 德国节能条例	热导损失 $H_T \cdot \max = 0,3 + 0,15 / (A/V_e) \text{ W/(m}^2\text{K)}$	
	家庭房屋 双户	住宅建筑	复兴银行节能建筑 	一次能源需求 $Q_{p,max} = 60 \text{ kWh/m}^2\text{a}$ * 德国节能条例	热导系数 [W/m ² K] 墙面积 U= 0,2 屋顶 U= 0,13 窗户 U= 1,3	
	连排房 瑞德堡		被动式房屋标准 	热能需求 $Q_{h,max} = 15 \text{ kWh/m}^2\text{a}$ * 被动式房屋设计包	不透气膜 $n_{50,max} = 0,6 \text{ h}^{-1}$ 热导系数 [W/m ² K] 墙面积 U ≤ 0,1 屋顶 U= 0,1 窗户 U ≤ 0,7	使用热量回收的机械通风
	瑞德堡学校 学校建筑	非住宅建筑		一次能源需求 ^h (^h 包括电能需求 !) $Q_{p,max}^h = 120 \text{ kWh/m}^2\text{a}$ * 被动式房屋设计包		剩余热能需求来至于原始能源或者新能源
	克劳斯塔 办公建筑		零排放 	最佳终端能源和一初能源需求	同被动式房屋	使用热量回收的机械通风
改建	蓝色家园 多户住宅楼	住宅建筑		热能需求 $Q_h = 21 \text{ kW/m}^2\text{a}$ 一次能源需求 ^h (^h 包括电能需求 !) $Q_p^h = \text{ca. } 100 \text{ kWh/m}^2\text{a}$	不透气膜 被动式房屋部件	剩余热能需求来至于新能源
	复兴银行主楼 (kfw) 办公建筑	非住宅建筑	绿色建筑 	热能需求* $Q_h = 15 \text{ kW/m}^2\text{a}$ 初次能源需求* $Q_p = 94,4 \text{ kWh/m}^2\text{a}$ * 德国节能条例	1. 建筑外壳 2. 夏季舒适度 3 供热 4. 热电联产	5. 太阳能热水器 6. 空调 7. 照明 8. 办公室设备 9. 标杆

Passive house - Construction and Certification

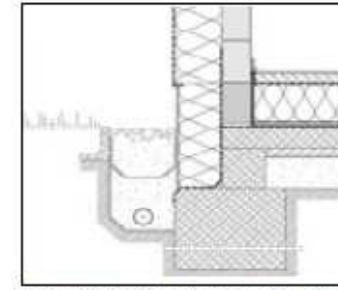
被动式建筑 – 建筑设计和认证

• Ausführungsplanung 施工规划

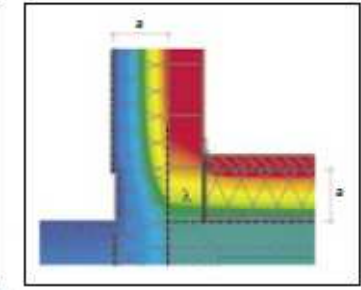
- Passivhauskomponenten
 - ▶ 被动式房屋组件
- Wärmebrückenfreiheit
 - ▶ 避免热桥



Kunststofffenster mit Passivhaus-Zertifizierung

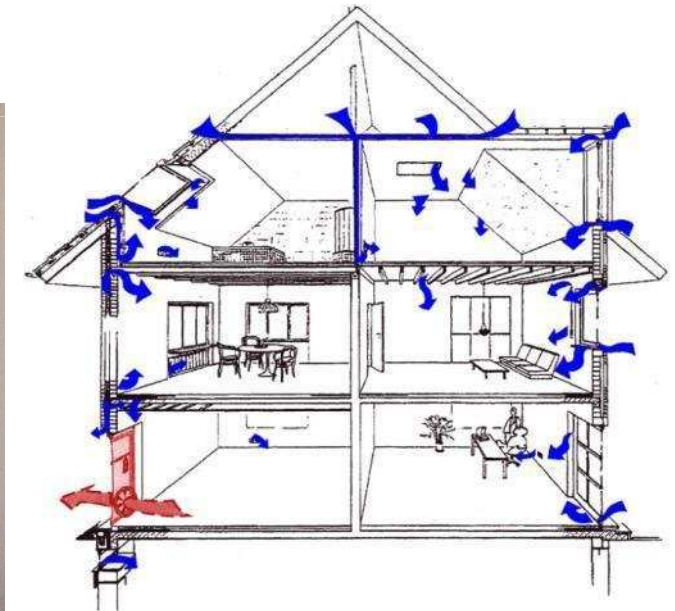


Anschluss Bodenplatte – Außenwand, nicht unterkellert



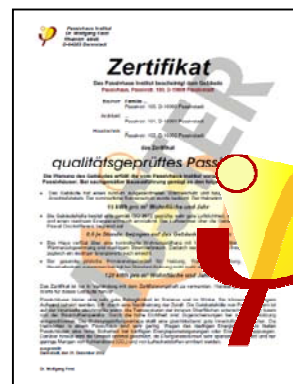
• baubegleitende Qualitätssicherung 实时质量检测

- Überprüfung kritischer Details
 - ▶ 检查关键细节
- Blower Door Test
 - ▶ 气密性检测实验



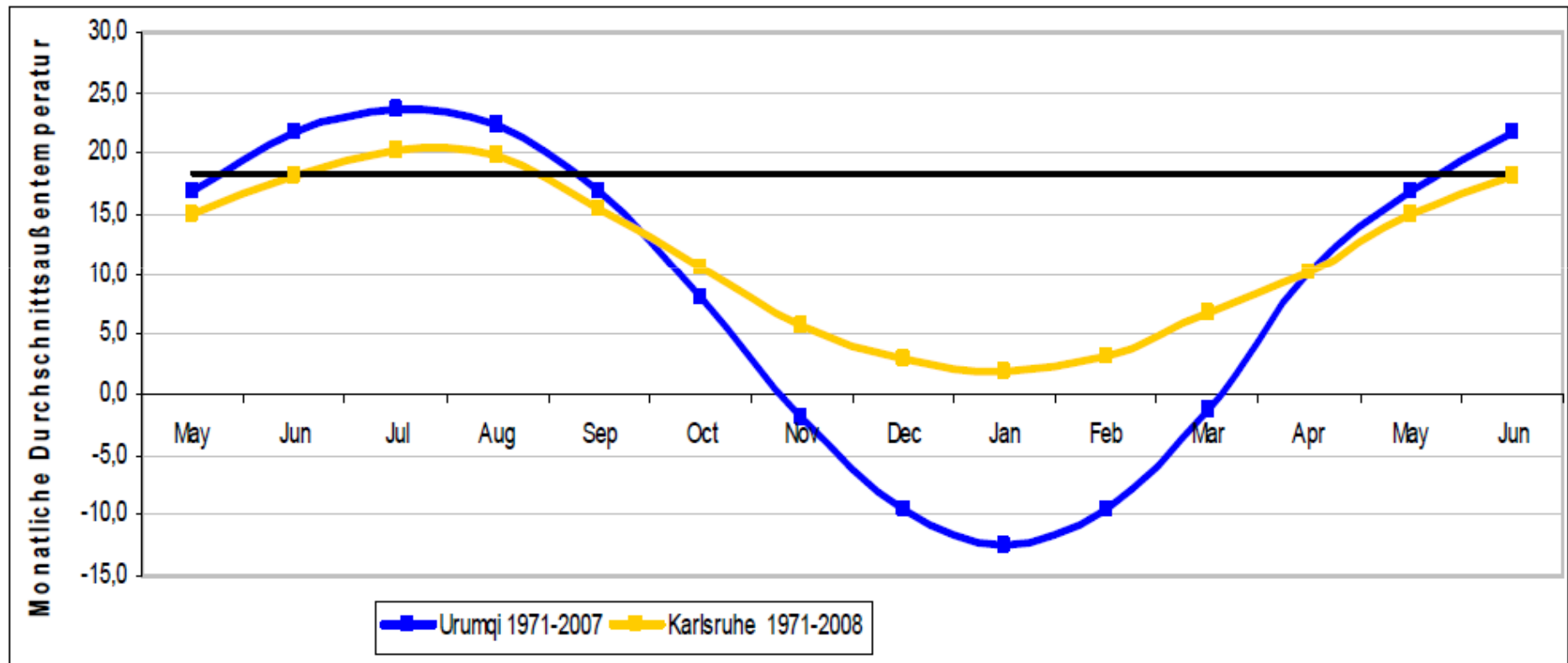
• mögliche Zertifizierung durch das Passivhausinstitut Darmstadt

- 由达姆施塔特市被动式建筑研究所认证



Heating energy demand in Urumqi: about 100% higher than in Karlsruhe

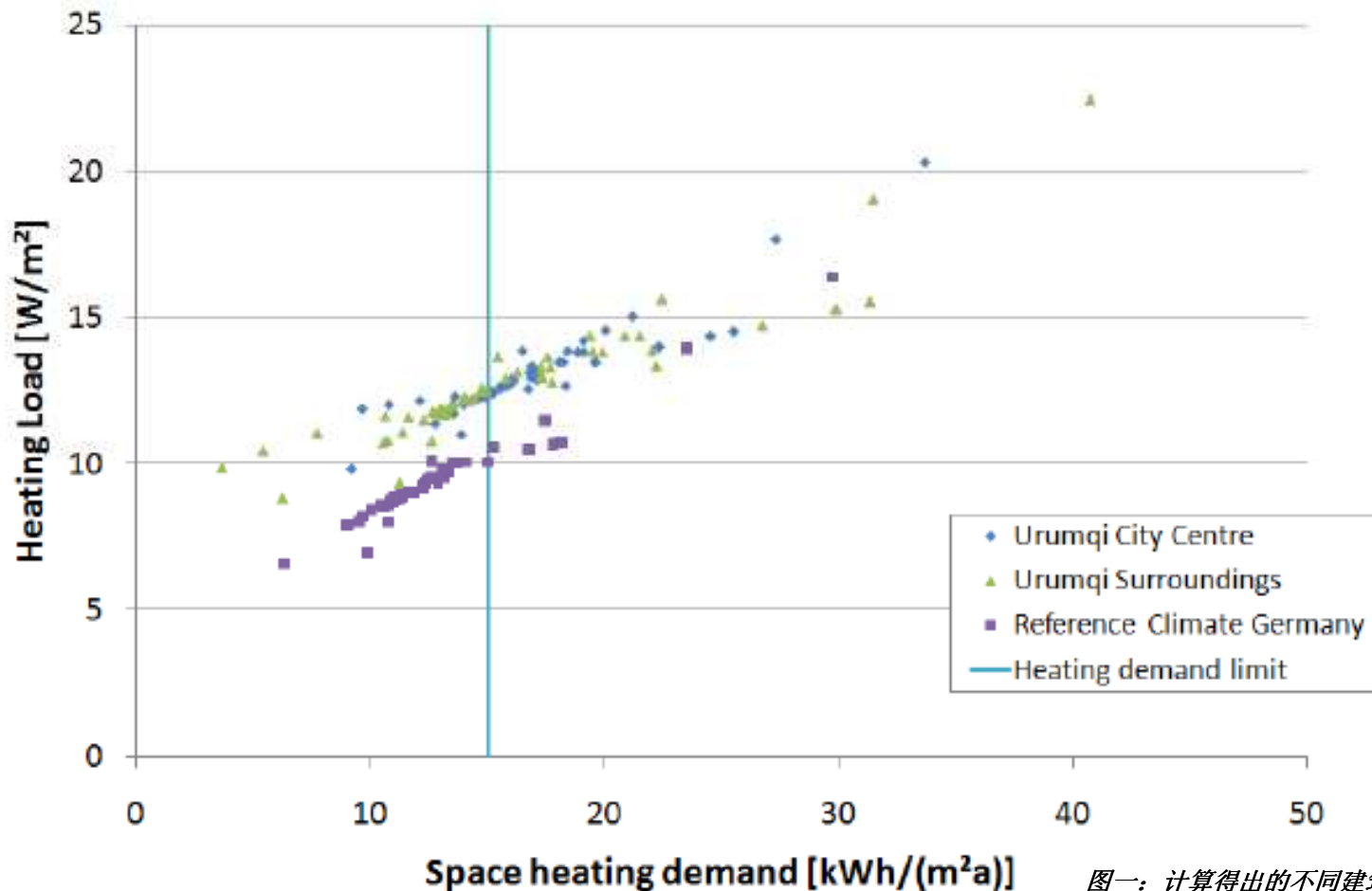
乌鲁木齐供热能耗高于卡尔斯鲁厄近100%



Passive House Institute in Darmstadt concludes...

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达姆施塔特被动式建筑研究所得结论：



图一：计算得出的不同建筑特性的需热量和热负荷

...that it is possible to achieve the Passive House Standard (15 kWh/m²a) in Urumqi as well!

在乌鲁木齐可以实现被动式建筑标准(15 kWh/m²a)

The housing retrofit challenge in Urumqi

乌鲁木齐既改挑战

- **Cost of district heating: 22 RMB/m² per year (= for a 80 m² apt: ~ 200 €/a)**
集中供暖的费用：22元/年.平米 (80平米的住宅每年约200欧元)
- **About 50% of the cost is variable (mainly cost for coal)**
大约50%的费用是为可变成本(主要为燃煤的成本)
- **If efficiency retrofit results in 50% energy savings, about 4.7 RMB/m² is saved per year.**
如果既有建筑全部实现50%的节能改造，每年每平米大约节省4.7元
- **Average cost of a 50% energy efficiency retrofit: ~ 220 RMB/m²**
实现50%建筑节能改造的平均成本约为220元/平方米
- **Amortization time: 47 years**
成本回收期为47年

- > **Energy is very cheap (one tonne of coal: 15 €; world market price: 70 €).**
能源价格太低(一顿煤15欧元，国际市场价格70欧元)
- > **Under current conditions, retrofit must be subsidized.**
根据现状，既改必须得到资助

Lighthouse Projects Low Energy Building: Sino-German Collaboration 中德合作低能耗建筑示范项目

- Preparation of recommendations to improve energy efficiency and indoor climate in Dacheng International high-rise, April 2009
大成国际写字楼提高能效和室内环境质量的建议，2009年4月
- Planning of renovation of the Nanshan conference center of the Construction Committee to near-passive house standard, November 2009 – October 2010
乌市建委培训中心近被动式建筑标准改造项目，2009年11月-2010年10月
- Planning of the Xingfu Rd. hotel/office building to near-passive house standard, start November 2009
规划幸福路新建近被动式建筑标准多功能建筑，2009年11月开始
- Capacity building of Chinese experts in Germany, 2009/2010
中国专家在德国的能力建设，2009/2010
- Contribution to public campaigns in Urumqi to increase energy efficiency of buildings and address climate protection, 2010
帮助乌市进行建筑节能和气候保护的宣传活动，2010



新華日報網
www.xjdaily.com.cn



Xingfu Road – planning process 幸福路 – 计划过程

**Project initiated jointly by IFEU Heidelberg and
DACHENG Urumqi**

该项目由海德堡能源与环境研究所和大成实业联合发起

DACHENG Industries, Inc.



**Joint planning in cooperation between
CULTUREBRIDGE ARCHITECTS and Xinjiang
Architectural Design and Research Institute**

参与合作设计方为文化桥设计公司 and 新疆建筑设计研究院



新疆建筑设计研究院
XINJIANG ARCHITECTURAL DESIGN INSTITUTE



文化桥
CULTUREBRIDGE ARCHITECTS
hennecke+honigsmann



Objectives of the construction projects 建设项目的目标

- **Natural and passive climatization** 自然和被动的创造室内环境
- **Activation of construction mass** 建筑大规模推广应用
- **Winter and summer energy savings without high-tech** 无需高新技术实现冬季和夏季节能
- **Use of interior heat sources and heat recovery** 利用内部热源和热回收
- **Optimized exterior surface ratio** 优化外表面比例
- **Four-season urban space** 四季城市空间
- **City traffic reduction by mixed-use concept** 通过混合使用方案解决城市交通问题
- **Function zoning and optimized solar orientation** 功能区和优化太阳朝向
- **Harmonious combination with urban space** 城市空间和谐组合
- **Involvement of Passive House Institute Darmstadt/Germany** 德国达姆施塔特被动式建筑研究所参与项目
- **Buildings will get German and Chinese Energy pass** 建筑将获得中德双方的能源证书

Lighthouse Project: Establishing Energy Flow Analysis in Industries Sino-German Collaboration, 中德合作工业能量流分析示范项目

- Workshop on Environmental Management of Companies, Heidelberg February 2010
工业企业环境管理专业研讨会，2010年2月于海德堡
- Training of scientists and engineers from Xinjiang Academy of Environmental Protection Sciences (XAEPS) and ZhongTai in Umberto®, Urumqi, March 2010
新疆环科院和中泰化学专家和工程师的Umberto®培训，2010年3月于乌鲁木齐
- Joint on-site preparation of a partial energy and mass flow model of ZhongTai Chemical Co., April 2010
现场参与中泰化学的能量和物质流模型的建立工作，2010年4月
- Ongoing collaboration with Xinjiang Academy of Environmental Protection Sciences
继续与新疆环科院的合作
- Feedback to Xinjiang Environmental Protection Bureau (XEPB)
给新疆环保厅的反馈



**Xinjiang Environmental
protection Bureau**
新疆环保厅

**Xinjiang Academy of
Environmental
Protection Sciences**
新疆环科院



Ecoprofiles for a Sustainable Industrial Production

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生态特性说明书：可持续工业生产

- **Ecoprofiles** 生态特性说明书
- **Sustainability reporting** 可持续性报告
- **Life Cycle Assessment (LCA)** 生命周期评估

... are well established and suitable tools to measure and improve the environmental performance of companies and of the products they produce. ...都是设计完善的测量和改善企业及其产品环境绩效的分析工具



Life Cycle Assessment of POLYLACTIDE (PLA)

A comparison of food packaging made from
NatureWorks® PLA and alternative materials

Final Report

IFEU Heidelberg
July 2006

Commissioned by
NatureWorks LLC



PlasticsEurope
Association of Plastic Manufacturers

Eco-profiles of the European Plastics Industry

POLYVINYLCHLORIDE (PVC) (SUSPENSION POLYMERISATION)

A report by

Axel Ostermayer
Jürgen Giegrich

for

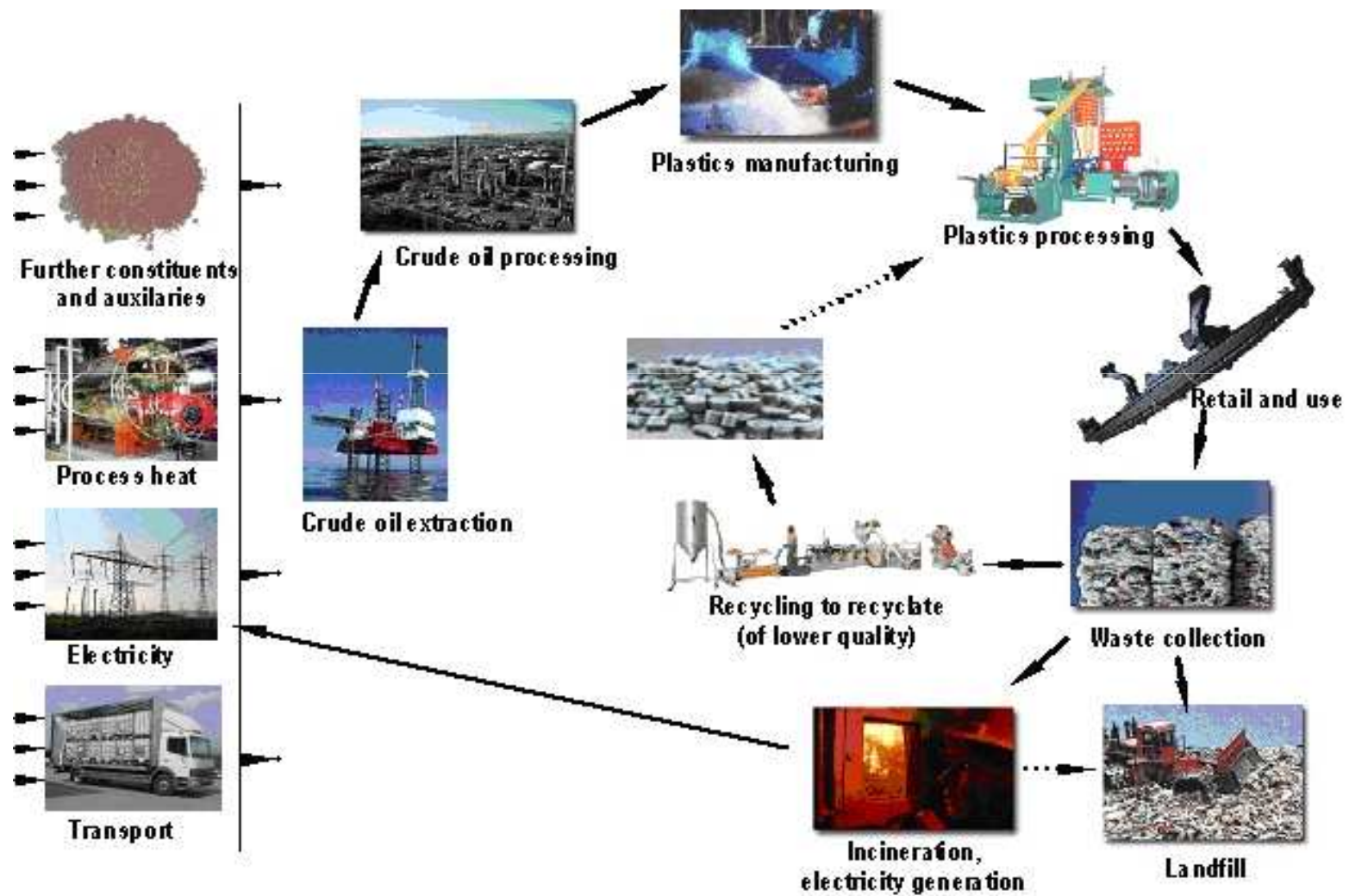
The European Council of Vinyl Manufacturers
(ECVM) & PlasticsEurope

Data last calculated
July 2006



Life Cycle Assessment

生命周期评估



All Major German Companies Report on Sustainability

所有大型德国企业都出具可持续性报告

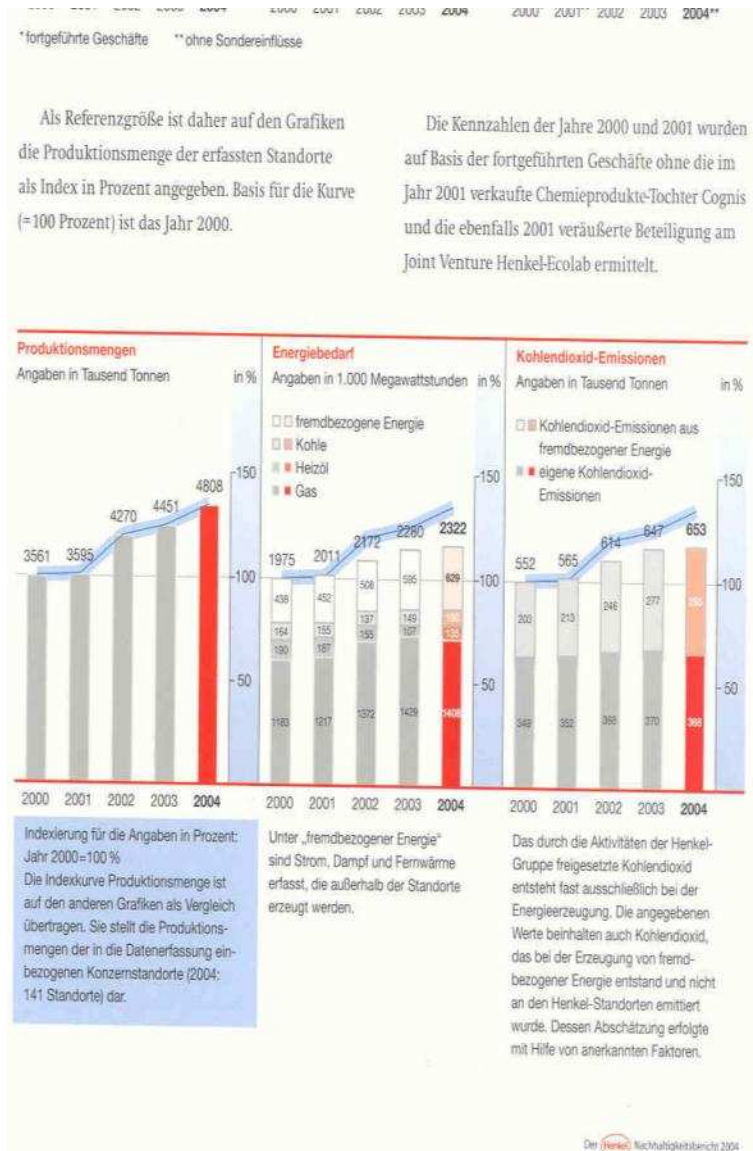


German DAX 30 companies were ranked by the way they reported on sustainability and environmental performance.
德国股票指数DAX30的企业根据其可持续性和环境绩效排名

Adidas AG	Fresenius Medical Care AG & Co. KGaA
Allianz AG	Henkel KGaA
Altana AG	Hypo Real Estate Holding AG
BASF AG	Infineon Technologies AG
Bayer AG	Linde AG
BMW AG	MAN AG
Commerzbank AG	Merck KGaA
Continental AG	Metro AG
DaimlerChrysler AG	Münchener Rück AG
Deutsche Bank AG	RWE AG
Deutsche Börse AG	SAP AG
Deutsche Lufthansa AG	Schering AG
Deutsche Post AG	Siemens AG
Deutsche Postbank AG	ThyssenKrupp AG
Deutsche Telekom AG	TUI AG
E.ON AG	Volkswagen AG

What Other Companies Report: Example Henkel

其他企业报告：汉高



Henkel Germany Sustainability Report Henkel Germany 德国汉高 可持续性报告

.. provides data on
提供给了如下数据

- Products 产品
- Energy Consumption 能源消耗
- CO₂ emissions 二氧化碳排放
- NO_x emissions NO_x 排放
- SO₂ emissions SO₂ 排放
- Particulate emissions 微粒排放
- VOC emissions 挥发性有机物排放
- Water consumption 水消耗

Eco-profiles for PVC in Europe

欧洲PVC制造行业的生态特性说明书



PlasticsEurope
Association of Plastics Manufacturers

*Eco-profiles of the
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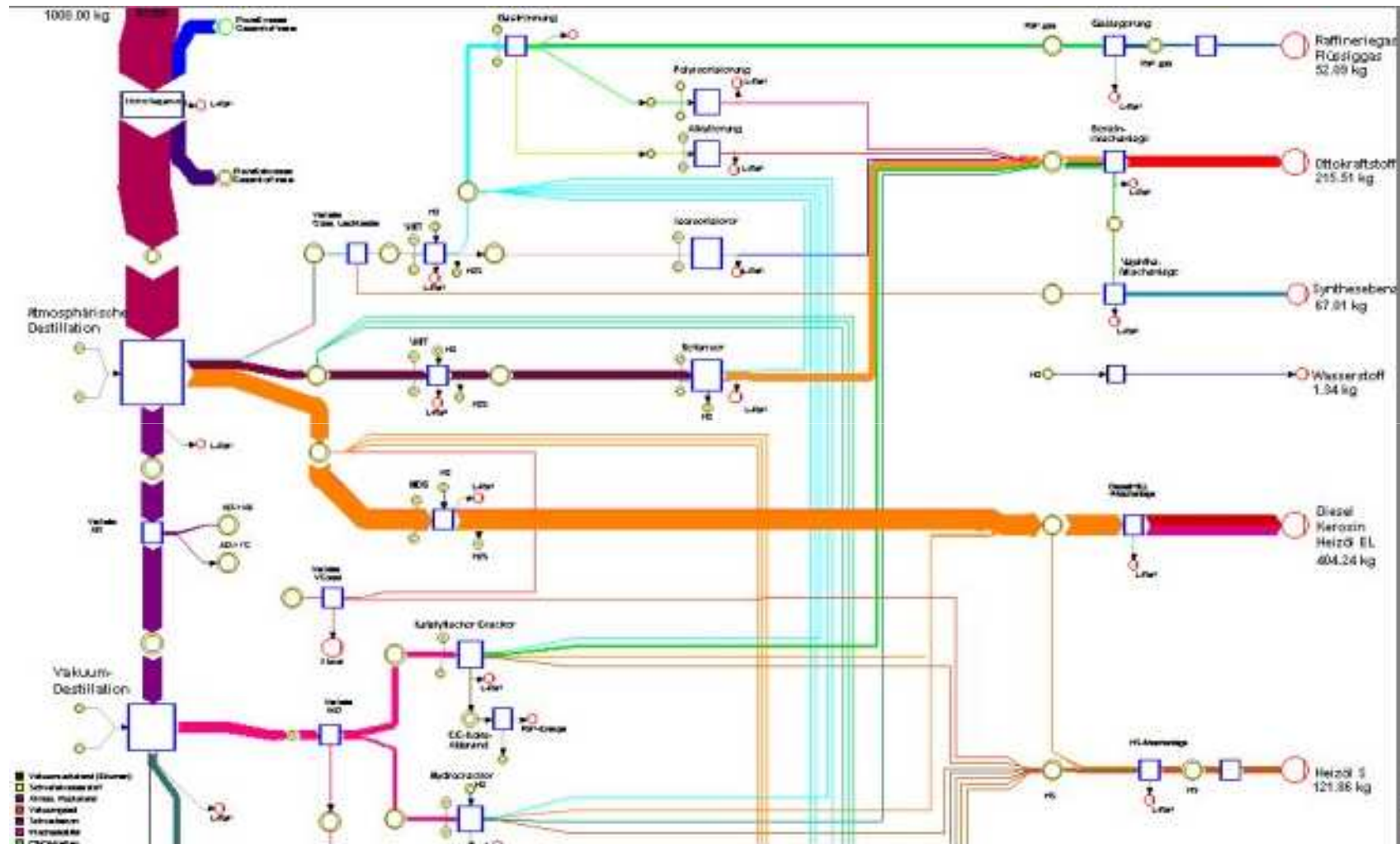
*Data last calculated
July 2006*

- **Data from individual companies was averaged**
数据为多个企业平均值
- **Individual companies can measure their performance**
单个企业可测量其自身环境绩效
- **Baseline for improvements**
改善的基准线

生产1公斤悬浮法PVC的平均投入

*Average process requirements for the production
of 1 kg of suspension PVC.*

Input	Quantity	
Vinyl chloride monomer	1.001	kg
Other chemicals	0.007	kg
Nitrogen	0.001	m³ (STP)
Compressed air	0.074	m³ (STP)
Process water	2.976	kg
Cooling water	24.428	kg
Electricity	0.749	MJ
Thermal fuels	0.510	MJ
Steam	2.056	MJ

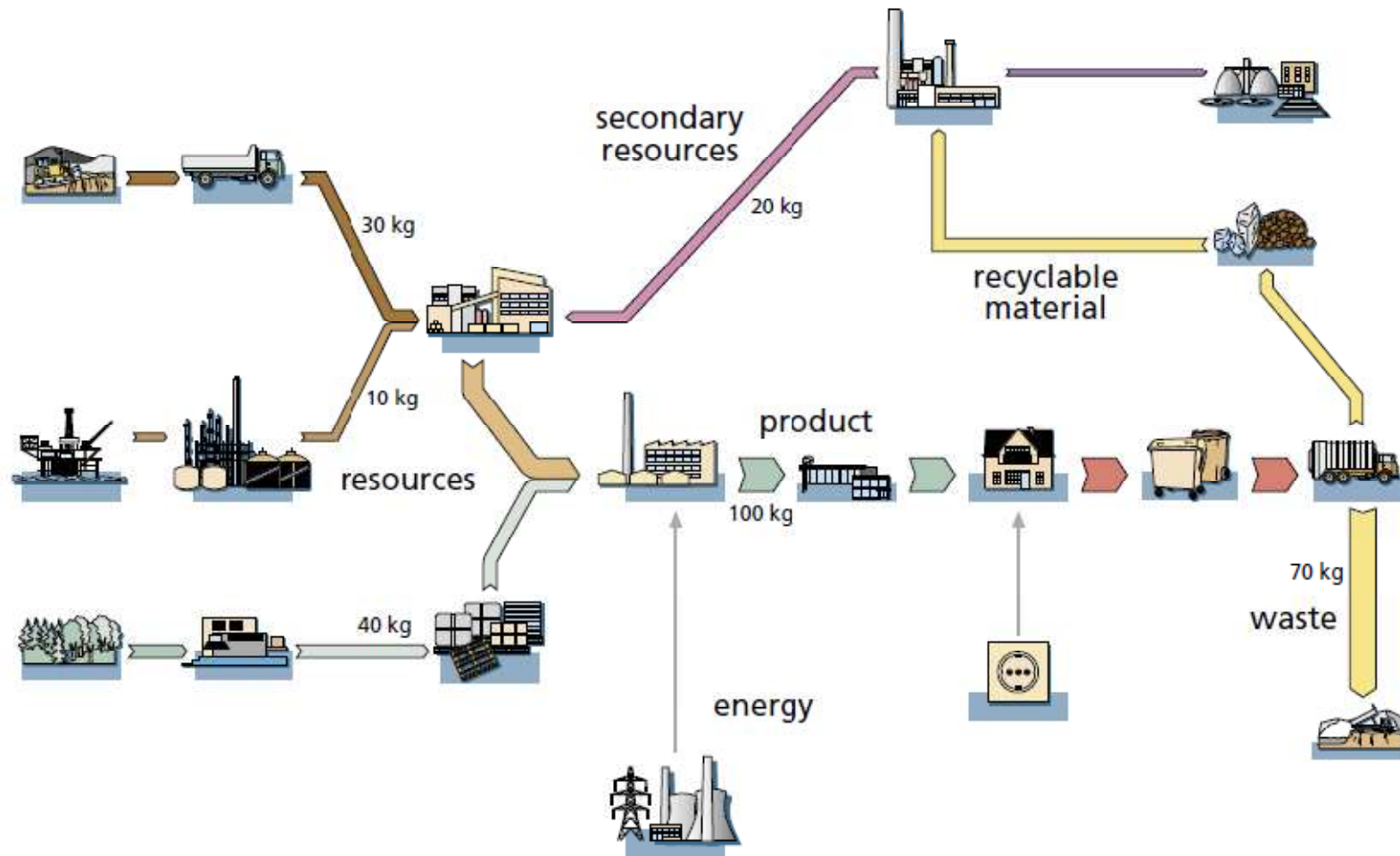


Simplified Module of a Refinery 精炼厂的一个简化分析模块

UMBERTO: Visualizing with Sankey diagrams

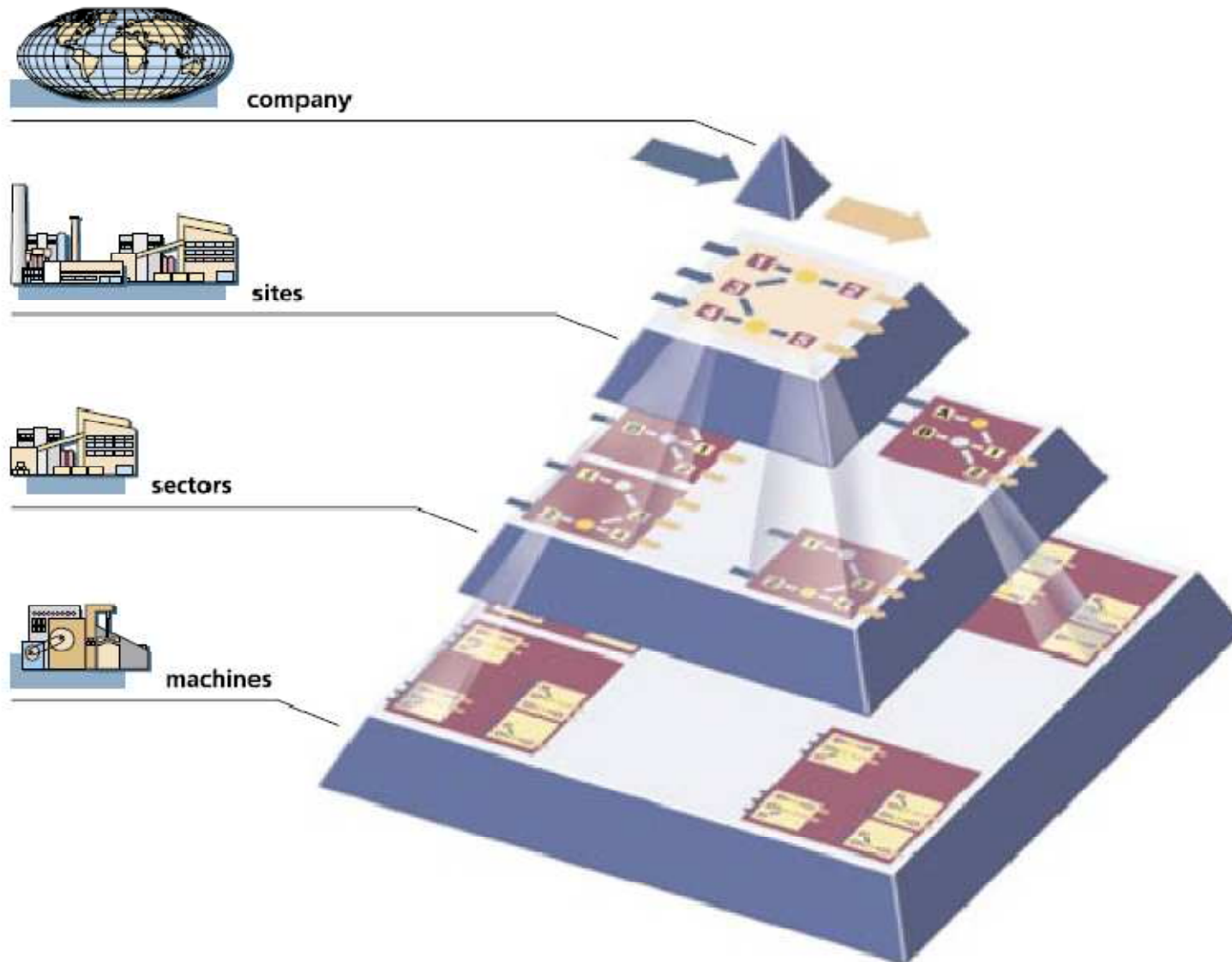
UMBERTO: 桑基视图

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UMBERTO: Possible Model structure

UMBERTO: 模型结构



ZhongTai Chemical Co. Urumqi – A Global Player

中泰化学公司：一个国际性的企业



ZhongTai Chemical Company 中泰化学股份有限公司

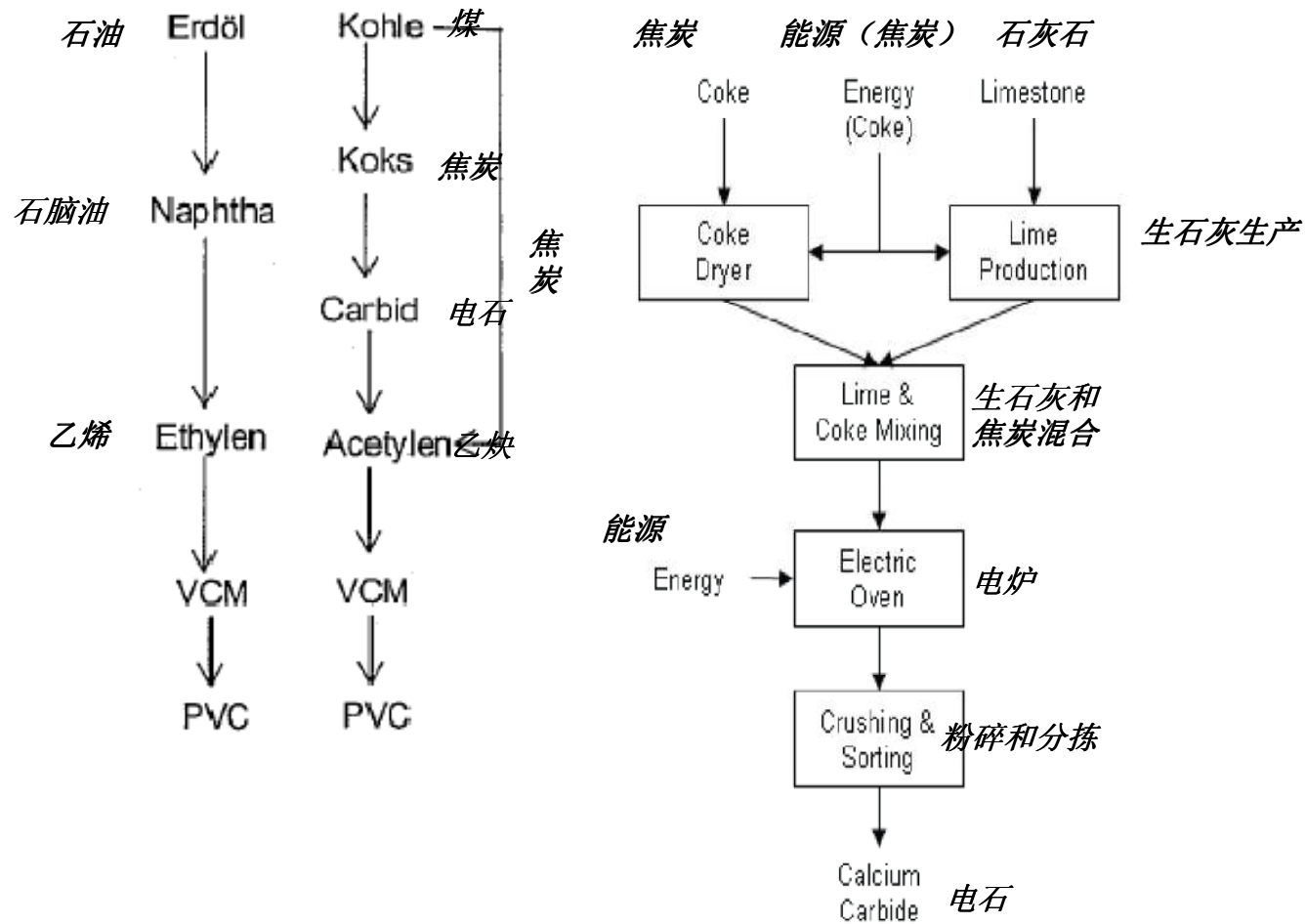
PVC resin	PVC	聚氯乙烯树脂
Nm calcium carbonate PVC resin	NMPVC	纳米碳酸钙 PVC 树脂
Hydrochloric acid	HCl	盐酸
Chlorine liquid (industrial)	Cl ₂	工业用液氯
Chlorobenzene	C ₆ H ₅ Cl	氯苯
Chlorinated paraffin		氯化石蜡
Sodium hypochlorite solution	NaOCl	次氯酸钠溶液
Caustic soda	NaOH	烧碱

PVC Production in 2007: 379,000 Mg 2007 年 PVC 产量: 379000 吨



Case Study: PVC Production from Oil and Coal

案例分析：以石油和煤为原料的PVC生产



Why an Ecoprofile of Zhongtai Chemical Company?

中泰化学公司为什么需要生态特性说明书

- **Transparent assessment of flow of energy and other resources, pollutant emissions and waste**

获得能源流以及其他资源，污染物排放和废物流的清晰的评估

- **Comparison with energy and environmental indicators of other producers (e.g. from Europe)**

获得不同生产者（例如，欧洲企业）能源和环境指标

- **Identify areas for improvements and cost cutting**

识别企业环境绩效尚待改善的领域

- **Setting benchmarks for future development**

设定未来发展的目标

- **Setting the stage for sustainability reporting**

确定可持续发展报告的阶段

- **Helps in communication with customers and government agencies**

协调客户与政府部门的沟通

- **Provides sound methodology if CDM carbon trading is considered for ZhongTai**

如果中泰考虑CDM碳交易方式，提供完整的方法论

Working Together on a Model of ZhongTai Chemical Co. 39

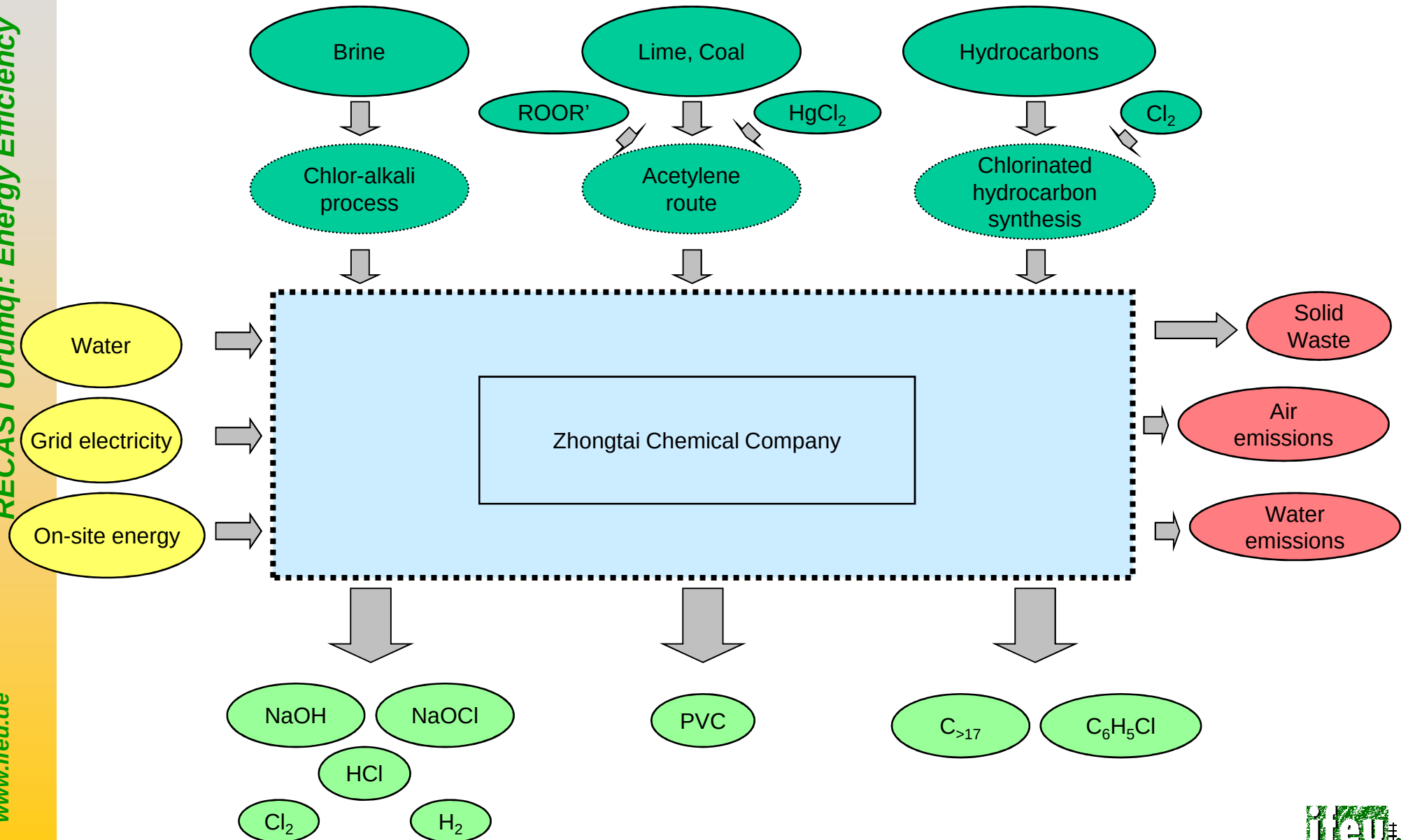
和中泰化学公司合作建立模型



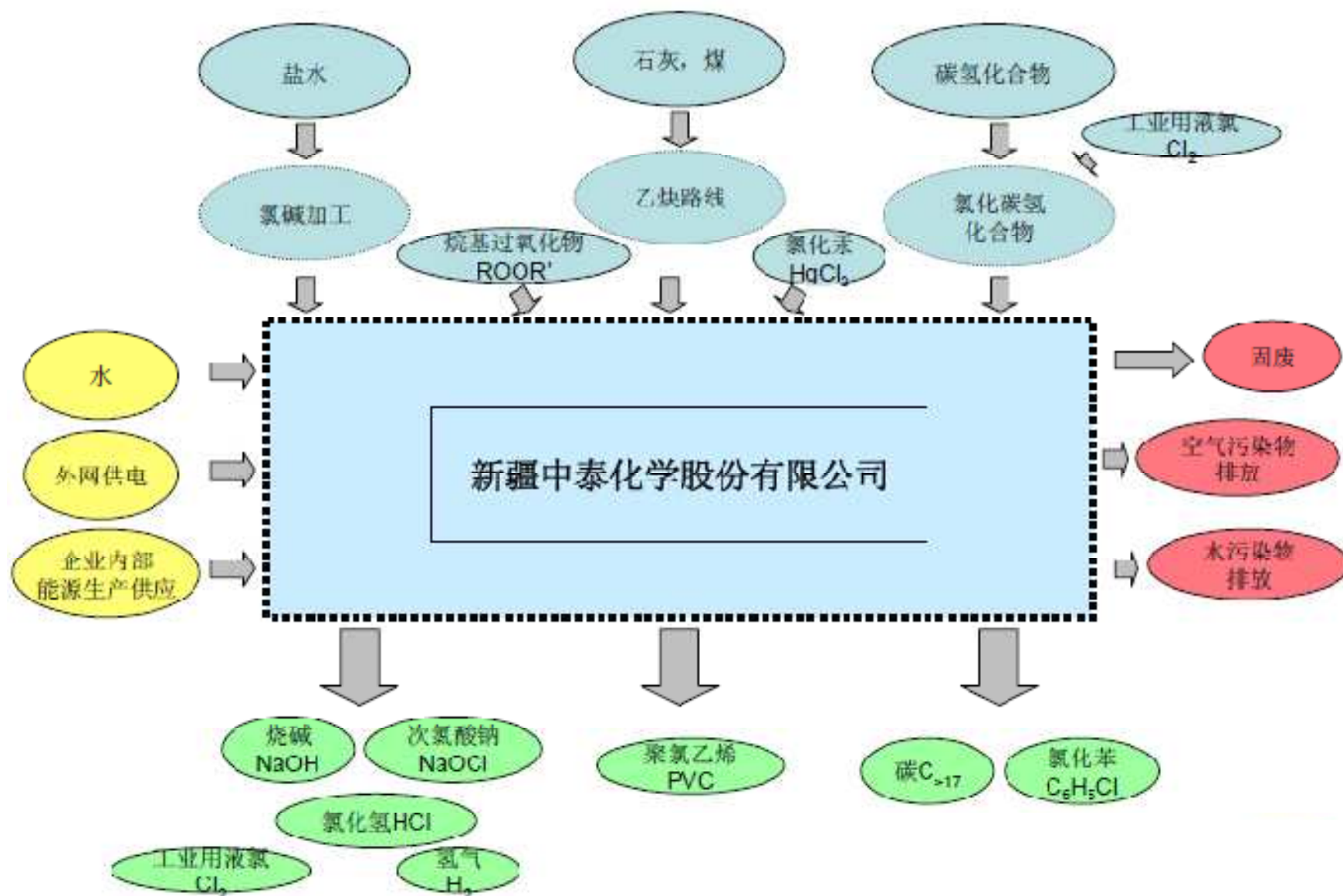
ZhongTai Chemical Company production

RECAST Urumqi: Energy Efficiency

www.ifeu.de

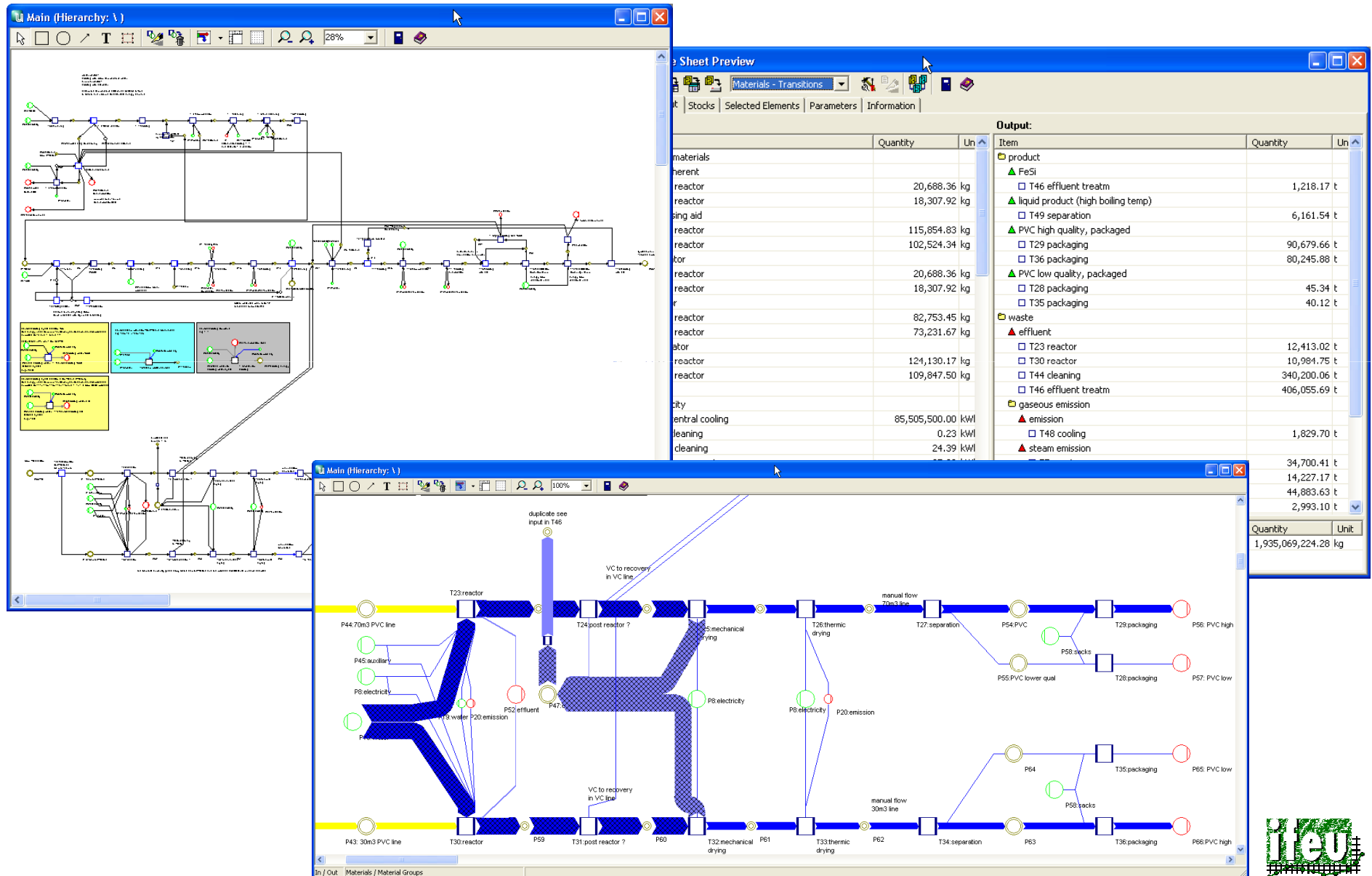


图三：新疆中泰化学股份有限公司生产示意图



A Draft Model of ZhongTai as of 10 April 2010

2010年4月10日，中泰化学模型草案



Possible next steps 合作步骤

- **Completion of Modelling 建模完成**
- **Performing Calculations for Efficiency Improvements Options**
完成提高能效选项的计算
- **Establishing energy/mass flow analysis as a tool to implement cleaner production and energy efficiency targets**
建立能量/物质流分析模型工具，实现清洁生产和能源高效目标
- **Expansion to other industries and/or scientific issues**
扩展到其他工业企业及科研领域
- **Establishing voluntary reporting of industries**
建立企业自愿性报告体系

Outlook until 2013 到2013年的前景

- **Joint analysis of lighthouse projects (lessons learnt)**
联合分析示范项目
- **Identifying areas of closer collaboration in construction**
确认建筑节能进一步合作的工作领域
 - **e.g. economic production of passive house components**
例如被动式建筑组建的经济生产
 - **establishing a passive house building standard for Urumqi**
为乌鲁木齐建立被动式建筑的标准
 - **collabortaion for a school built to passive house standards**
中德合作建设一幢被动式建筑标准的学校
- **Expansion of energy/mass flow analysis as a tool to other industries and/or scientific issues**
将能量/物质流分析作为工具推广到其他工业企业及科研领域
- **Identifying a lighthouse project in the transportation sector**
在交通领域确认一个示范项目
- **Collaboration in developing a low-carbon energy plan for Xinjiang (e.g. feasibility of buidling solar-thermal power plants)**
为新疆合作开发一个低碳能源规划(例如太阳热电厂)

Working Together for a Sustainable World.....

让我们为世界可持续发展而齐心协力

