OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

23000

UNIDO contract No.: 03/031
UNIDO project No.: EG/CPR/99/G31
P.O.No.: 16000394

Final Report

to
The United Nations Industrial Development Organization (UNIDO)

for the Contract Entitled
Provision of Services for the Execution of a Brick-making Sub-sector Survey Related to the Energy Conservation and GHG Emissions Reduction in Chinese TVES (Phase II)

for the Project
Energy Conservation and GHG Emission Reduction in Chinese TVES-Phase II

Prepared by
Xi'an Research and Design Institute of Wall & Roof Materials
on 15 April 2004

Contents

Draft Final Report of Project

I. Overview

In accordance with UNIDO contract document (contract No: NO.03/031, P.O.NO.16000394) and P.2003/017-EG/CPR/99/G31-China township enterprise energy conservation and greenhouse gases emission reduction—phase II—brick-making industry Survey executive plan (submit a report on July 8, 2003), phase I of survey project for China brick-making industry, i.e. the prophase work (including to work out the executive plan and sign contract, etc.) and the work in phases II to IV should be finished before August 30, 2003. All the members in the project group were asked to get down to the surveyed manufacturers for collecting the data, but, they couldn't carry out the project survey plan in time due to "SARS" epidemic situation prevailed in many areas of China at the same period. For ensuring the project quality, the project had to be prolonged for execution. The starting time is the mid 10-day or last 10-day of July. Via great effort, by December 15, 2003, all the project tasks in 2nd phase, 3rd phase and 4th phase were completely finished. Meanwhile, the project interim report was submitted. Up to March 10, 2004, the project team had finished the (draft) final report after modifying and supplementing the interim report submitted according to the examination and assessment opinion and the project final report was completed on 10 April this year.

In the implementation course of the project, 5 staff members have taken part in the whole course and they respectively went to other places for investigation for tens of times. The project team sent off 400 questionnaire forms altogether, 305 of them were recovered and the recovering rate is 75%. Hold 4-time special symposium, attend 4-time domestic large sized meetings and collect 3 compilations of wall material innovation policy laws & regulations made by the Chinese Government. Finish 7 interim reports and the final report including "Schedule of China Wall Material Innovation Policy Laws and Regulations" (Annex 1), "Influence and Future Development prospect of Brick-making industry of China Wall Material Policy Laws and Regulations" (Annex 2), "General Situation of China Brick-making Industry" (Annex 3), "Supply & Demand Market Condition of China Brick and Other Wall Materials" (Annex 4), "Schedule of China and International Brick-Tile & New Wall Material Equipment Manufacturers, Design Institutes, Associations, Societies and Network Stations" (Annex 5), "Situation Report of Energy Conservation and Environmental Protection Demonstration Enterprises in Brick-making Industry" (Annex 6) and "Brick-Tile Enterprise Survey and Statistical Table of Wall material industry Background" (Annex 7). The target requirements stipulated in the project contract and the project executive plan have been basically implemented.

II. Project Work and Outstanding Achievements

(I) Survey of Industry and Enterprise Background

The project work includes two parts of letter survey and field survey, starting from July and ending on 30 December.

The letter survey concerns 400 brick-making enterprises in 30 provinces and cities of China. After sending out the survey letters (questionnaire forms), we successively arranged 30 person-time to the brickyards in 20 provinces and cities throughout the country to let them fill in the questionnaire forms and send back, etc. at the time when the personnel in the State Wall Material Quality Inspection Center supervised, randomly tested the product quality of new walling roofing material and carried out the trade inspection in the 4th season. 305 questionnaire forms of enterprise fundamental state were taken back. Known from the reflective data in the questionnaire form, they can represent the actual level of the brick-making industry in the respects of product variety, specification, quality, raw material and fuel consumption, etc. For field survey, the personnel in the project team respectively went to Chengdu city, Changchun city, Qinhuangdao city and Tianjin municipality. They held 4-time symposia and each time, 10~20 persons from the government wall

innovation office, administrative office, building company and brickyard took part in the symposia. They mainly talked about the conditions of brick produce market, effective utilization of energy source and implementation of wall material innovation policy laws and regulations, etc. Five persons successively attended the brick-making industry technical equipment exhibition in Changsha city, the Yibin meeting of Sichuan Provincial Information Network, the site exchange to make brick with fly ash in Shijiazhuang city and the nationwide product quality analysis concluding conference in Guizhou province. In the meeting period, they asked for advices and proposals from the personnel of related enterprises. The necessary relevant data and information materials concerning the project were got via the mode of letter survey, special symposia and relevant meeting, etc. Furthermore, 1992~2003 relevant wall material policy laws and regulations issued by the Chinese Government, the Distribution and formation of China wall material industry association, society, information network, professional periodicals office, and scientific research academies & institutes, the fundamental state of China brick-tile mechanical equipment manufacturers and the relevant situation of some overseas corporations have been seized after adopting the means of indexing and looking up such as telephone call, investigation on the spot, interviewing the state departments concerned, inquiry from the network and using the journal of "International Brick-tile Industry", etc.

(II) Analyzing and Tidying up the Surveyed Related Data

After completing the survey work, the project team made a systematic statistic, tidying up, analysis and supplementation to the questionnaire forms, data, interview outcome and the matters known from the informal discussion in accordance with the seized information from September 1 to November 30. For the taken back 305 questionnaire forms concerning the enterprise fundamental state, 80% enterprises paid more attention to offer the required information according to the requirements in the forms and all the surveyed enterprises arranged the designated persons to fill in the forms. In the forms recovered, 80% data are more actual and reliable. Only 20% form isn't carefully filled in, short of more items. Therefore, the project team made a supplementation over the telephone. Known from the data comparison and comprehensive analysis, the surveyed enterprises account for 1% of the enterprise total in the industry, this is sampling survey. The reflective situation in such enterprises can basically represent the overall situation of the trade and they are listed in the project report indeed.As to the exploratory wall material innovation policy laws and regulations made by the state and local governments, merely the time of origin, document No, document issuing agency and plank of the policy laws and regulations issued by the state are included in the report. As the provincial and prefecture policy laws and regulations are made based on the state correspondent policy laws and regulations, their contents are similar, only the main files worked out by Sichuan Province, Chengdu City and Tianjin Municipality are collected in the report. Hereby, the general view of the wall material innovation policy rules and regulations made by the Chinese Government and local governments, the wall material innovative content, target, mission, trend and trend of development can be known (See Annex 1 of the report.). In the symposia to carry out the policy laws and regulations, most of the personnel taking part in it are the managers and factory directors from the basic level enterprises. They clearly know the function and existing problems while executing the policy laws and regulations. For reason given above, the situation to carry out the policy laws and regulations in basic level can be generally reflected.The report (Annex 6) introduces 8 brick-making enterprises that effectively use the energy resource and perform environmental protection demonstration. They come from comparison & analysis and based on survey. Besides, the personnel in the project team have made the survey on the spot. Their common features are that most of the products are perforated bricks and hollow bricks. Most of their raw materials are shale, coal slack and fly ash. The baking of brick basically doesn't adopt or uses a few of industrial coal. For the scale of production, the annual output of each enterprise is over 30 million pieces of brick. The quality, technology, equipment, environmental protection, management and investment & production ratio are all in the mid & high level of the trade. The adopted energy conservation and environmental protection technology & measure are all effective, practical and with popularization value.In the trade associations, societies, network stations, professional

periodicals offices, scientific research design institutes and mechanical equipment fabricators to be surveyed, in accordance with the qualification, quality rating, technology capability, scientific research & design or equipment working ability, business development status, famous level and exchange activity with foreign countries, etc., the concerning data and the information materials are analyzed and tidied up. Thus, the data and situations listed in the report (Annex 5) actually reflect the domestic and overseas relevant situation. The report (Annexes 3~4) more completely reflect the development general situation of brick-making industry in China and the market supply & demand of brick-making industry in Chengdu city and Tianjin municipality.

(III) Outstanding Achievements Obtained

Via the work of project in various phases, in accordance with the seized survey data and situation and tidy up, analyze, supplement and perfect them, the project team has finished 6 interim reports and the final report & one summary material, namely the "Schedule of China Wall Material Innovation Policy Laws and Regulations" (Annex 1), "Influence and Future Development prospect of Brick-making industry of China Wall Material Policy Laws and Regulations" (Annex 2), "General Situation of China Brick-making Industry" (Annex 3), "Supply & Demand Market Condition of China Brick and Other Wall Materials" (Annex 4), "Schedule of China and International Brick-Tile & New Wall Material Equipment Manufacturers, Design Institutes, Associations, Societies and Network Stations" (Annex 5), "Situation Report of Energy Conservation and Environmental Protection Demonstration Enterprises in Brick-making Industry" (Annex 6) and "Brick-Tile Enterprise Survey and Statistical Table of Wall material industry Background" (Annex 7).

The (draft) final report of the project is written both in Chinese and English. The draft final report was worked out on 10 March 2004 and respectively submitted to UNIDO and GEF Project Office of the Ministry of Agriculture of P.R. China. Via supplementing, the project draft final report has been submitted to the related authorities on 15 April this year.

III. Conclusion

When the draft final report was worked out, an appraisal and examination meeting about it was held on 18 Feb. 2004 and the meeting was presided over by the state-level expert-professor Xiao Hui. All the members attending the meeting considered that the data in the draft final report were true, reliable, the offered information in detail, complete, clear & typical reflected facts, scientific & strict analysis problem, the expressed viewpoint distinct & objective. The draft final report systematically reflects the development situation of the brick-making industry in China and basically meets the requirements of UNIDO project contract. The draft final report of the project has been revised and supplemented based on the experts' opinions made in the meeting. The project draft final report has been also supplemented, perfected and then, submitted to the higher authorities according to the opinions given by GEF Project Office of the Ministry of Agriculture of P. R. China and UNIDO.

Annex 1

Schedule of China Wall Material Innovation Policy, Laws and Regulations

Over the 10 years of wall material innovation and construction energy conservation in China, the government and relevant department have issued a dozen or more policy documents. In order to implement these policy documents, most of provinces, cities and areas have issued concrete implementation opinions. This section mainly lists the time, number, issuing agency and outline of the relevant policy documents issued by the State Council and different departments, specially lists the specific content of policy document of Sichuan Province, Chengdu and Tianjin City, where fundamental spirit of policy laws and regulations of wall material innovation in China and its various areas can be basically found out.

"China Brick-making Industry Investigation" Project Team

Dec.10, 2003

Catalog on China Wall Material Innovation Policy, Laws and Regulations

Title	Document No.	Issuing agency	Outline
Notice of Opinion on Expediting Wall Material Innovation and Popularization of Energy Conservation Building approved and forwarded by the State Council to the construction material bureau and relevant departments	Guofa No. [1992] 66	The State Council	Set forth development target of wall material from year 1990~1995; call for further policy regulation and control, create a fitness external environment for wall material innovation and energy conservation building popularization; insist on system engineering to carry forward wall material innovation and energy conservation building development; improve understanding, change concept and strengthen organization leadership.
Notice about further strengthen land management to protect cultivated land in real earnest by the Central Committee of the Communist Party of China and the State Council	Zhongfa No. [1977] 11		Try not to occupy or occupy less cultivated land to save land when developing township enterprises. Township enterprise should follow the requirement in approved village and small town construction plan when using land and have reasonably layout, properly concentrated and go through land use approval procedures according to law. Give energetic support to popularizing new wall material, control the production of fireclay brick and strictly prohibit the occupancy of cultivated land to build brick-tile kiln. The brick-tile kiln already occupied cultivated land should be adjusted in the limited time and reuse the land.
Notice about some Opinions on Carrying Forward Housing Industry Modernization and Improving Housing Quality forwarded by General Office of the State Council to construction department and other related departments.	Guobanfa No. [1999] 72	General Office of the State Council General Office	Set forth the target till year 2005 and 2010; call Strengthen study of fundamental technology and critical technology to establish housing technology guarantee system; positively develop and popularize new material, new technology to complete housing construction and product system, including positively developing different kinds of new building blocks, light weight plate material and high efficiency heat preservation material; recommend and choose composite wall; solid fireclay brick is prohibited to be used in coastal cities and other land resources sparse cities, and the production and use of other clayware has to be controlled according to possible conditions in order to set up a complete system and quality control system
Notice about eliminating backward product in residential construction	Jianzhufang No. [1999] 295	Construction Department Quality, Technology Supervision and Construction Material Bureau of State Economic and Trade Committee	New residential buildings in each municipality directly under the Central Government, in large and medium sized and coastal cities and in large and medium sized cities in the provinces with the cultivated land of less than 0.8mu per capita should gradually set the time limit to prohibit the use of solid fireclay brick according to its actual condition. Time

Title	Document No.	Issuing agency	Outline
			deadline is scheduled on June 30, 2003. Each area should take real measures to have alternative material and product linking up work, positively extend the use of new type of building structural system and new style wall material therewith matches the system.
Notice about printing and distributing Certain Opinions on "*Development of New Construction Material*"	National Economy and Trade Industry No [2000] 962	National Economy and Trade Committee, National Development and Planning Committee	It calls for to adjust the structure of construction material industry and develop new type of wall material, puts forward the principle of developing new type of construction material that should be followed and measures of carrying forward the development, requests that developing new type of construction material should adhere to saving energy resources, land and water, to making full use of different kinds of rejected materials and protecting ecological environment. It encourages the utilization of clay resources from waste mountains and hills, river silt, dredge up silt to produce clay wall material.
Notice about issuing and implementing "*Catalog of Restricted Land Supply Items, Catalog of Prohibited Land Supply Items*"	State Land and Resources No. [1999] 357	Land Resources Department of China Economy and Trade Committee	Restricted land supply item: Hollow clay brick production-line item that produces less than 3000 bricks (reduced standard brick) annually. Prohibited land supply item: solid fireclay brick production construction item.
Notice about publishing *The Names of Large and Medium sized Cities Gradually Be Limited Time to Prohibit use of Solid Fireclay Brick*	Wall office doc. No. [2000] 06	Construction Material Bureau of China Construction Department Land Resources Department of Ministry of Agricultural, Wall Material Innovation and Building Energy Conservation Office	Municipality directly under the Central Government: Beijing, Shanghai, Tianjin, Chongqing; City: 11 cities in Hebei province, 17 cities in Liaoning province, 25 cities in Jiangsu Province, 10 cities in Zhejiang province, 7cities in Fujian Province, 28 cities in Shandong Province, 34 cities in Guangdong Province, 6 cities in Gangxi Province, 2 cities in Hainan Province, 12 cities in Hunan Province and 4 cities in Guizhou Province. The time line to prohibit the use of solid fireclay brick will be as of June. 30, 2003 at the latest.
Notice about placing the 10 provincial capital cities on the name list of prohibition the use of solid fireclay brick.	Economy and Trade and Resources No. [2001] 55	National Economy and Trade Committee	The 10 provincial capital cities: Hefei, Chengdu, Xi'an, Taiyuan, Zhengzhou, Wuhan, Nanchang, Yinchuan, Urumqi and Kunming. Their limitation of using solid fireclay brick is up to June 30, 2003. Other provincial capital cities are limited at the end of 2005.
Notice about further strengthening the management of wall material special item fund	Finance and Construction Dep, letter No. [2000] 4	National Finance Department	Because of the obvious phenomena of embezzlement and occupancy of "fund", it is requested that each area has to establish "fund" management system and control the use of the specific fund for special purposes.
Notice about issuing Administrative Measures on	Caizong No. [2002] 55	National Finance Department,	Stipulates the "fund" collection object, i.e., construction unit that has not used new

Title	Document No.	Issuing agency	Outline
"*New Wall Material special Item Fund Collection and Use*"		Economy and Trade Committee	type of wall material for construction building. The fund collection standard is calculated according to finished construction area. Each square Meter is up to 8 Yuan. Stipulates the range of use of "fund" i.e., to give discount for introduced newly built, extended and upgraded new wall material production line project. New wall material demonstration project, new type of wall material development and new product popularization, etc. shall also get discount.
Notice about comprehensively use some of resources and issues on value added tax policy of other product	Caishui No. [2001] 198	Tax affairs General Office, Ministry of Finance	From January 1st, 2001, for non-clay sintered perforated brick with hole rate greater than 25, hollow brick, sintered shale brick, value added tax will be paid for half per actual value added tax that should be paid from December 1st, 2001. For fireclay solid brick and tile produced by general value added tax payer, value added tax should be collected according to applicable tax rate. It is no allowed to use simplified way to collect value added tax.
Notice about printing and distributing "*Wall Material Innovation in the Tenth Five-Yea Plan*"	National Economy and Trade Resource [2002] 1021	National Economy and Trade Committee	Puts forward the general target, key aspects and main countermeasures and measures of development of wall material innovation from 2001~2005.

Document Made by

The Construction Department of Sichuan Province

&

Wall Material Innovation and Building Energy Resources Conservation Office of Sichuan Province

SCOTD No. [2000] 0613

Provisions on Prohibiting the Use of Some Backward Wall Material in Construction Project

Construction committees in all cities and autonomous district, Huaxi group company ltd, related province Level offices (Bureau) and all concerned units:

In order to implement state substantial development strategy, protect cultivated land and environment practically and effectively, save energy resources, based on the requirement in GOOSCD No. [1999] 72 document issued by the General Office of the State Council and SCCD No.[2000]0330 document jointly issued by the two committees, one bureau and one meeting of Sichuan Province, combining actual condition in our province, it is discussed and decided that some kind of backward wall materials are prohibited to use and new type of wall materials should be popularized. Hereafter are the relevant provisions:

1. Solid fireclay brick is prohibited to be used for outside above horizontal construction and fencing wall of newly built, reconstructed, extended construction project and solid shale brick is prohibited to be used for frame structure project in the city planning area of Chengdu Mianyang and Deyang city from May 1st, 2001.

2. City planning area in other at district level cities, solid fireclay brick is prohibited to be used for outside above horizontal construction and fencing wall of newly built, reconstructed and extended construction project and solid shale brick is prohibited to be used in frame structure project from January 1st, 2002.

3. Planning area in counties, solid fireclay brick is prohibited to be used for outside above horizontal and fencing wall of newly built, reconstructed and extended construction project and solid shale brick is prohibited to be used in frame structure project from January1st, 2003.

4. In order to carry forward wall material innovation, it is encouraged to develop new type of wall material, such as perforated brick, hollow brick, concrete hollow building blocks, air entraining concrete building blocks, industrial ash concrete hollow partition wall slat, plasterboard, fiber reinforced cement board, air entraining slat, vegetable fibre board and etc.

5. Each architectural design, construction, project supervision, design review departments and quality supervision unit must strictly control the application quality of product. Design institute is not allowed to use prohibited product. Constructor should conduct construction strictly according to design requirements. Constructor and related parties are not allowed to change the design at their will. For the construction project that used eliminated product, the preliminary design and construction drawing can not be approved, supervision unit is not allowed to sign, construction unit can not organize acceptance, construction administrative department in charge and quality supervision department are not allowed to be filed.

6. Construction Committee in each city and autonomous district should together with wall material reformation office and etc. seriously carry out the implement and supervision work, and report the problems that met and suggestions to provincial construction department during the implementation.

October 23, 2000

Management Provisional Measures for Prohibition Making and Using Solid Clay Brick in Chengdu City

(No. 97 Document made by the People's Government of Chengdu City)

Article 1 In order to protect land resources, improve ecological environment, promote the development of new type of wall material, combining with the actual situation of Chengdu City, these Measures are formulated in accordance with the Law of Land Management of People's Republic of China and the Ore Resources Law of People's Republic of China and the Regulations on the Management of Construction Project Quality by State Council, and the relevant laws and regulations.

Article 2 The entities and individuals of production, sale and use of solid fireclay brick within administrative district of this city must observe these Measures.

Article 3 The administrative department responsible for the city construction is in charge of supervision and management of prohibiting the use of solid fireclay brick in this city, directly controls the prohibiting the use of solid fireclay brick in the five urban areas(include high and new technology zone), such as Jingjiang, Qingyang, Jinniu, Wuhou and Chenghua, entrusts the city wall material innovation and construction energy conservation office (hereinafter referred to as wall material energy conservation office) with the concrete work.

Administrative department responsible for the construction of other zones (cities), counties is in charge of supervision and management of prohibiting the use of solid fireclay brick in their own administrative districts. They can entrust the zone (city) and county wall material energy conservation office with concrete work.

Article 4 Government encourages and supports enterprises and scientific research entities to carry out comprehensive use of resources, increase scientific research investment, perfect complete technology, improve the quality of products, develop more new types of wall material products to replace the solid fireclay brick.

Article 5 Any newly built, rebuilt and extended construction project of production of solid fireclay brick are not allowed within administrative district of this city.

Existing production enterprises of solid fireclay brick borrowing from cultivated land must shut down as required; if they borrow from non-cropland, they must stop production of solid fireclay brick before December 31, 2005.

Article 6 The newly built, rebuilt, extended construction projects, and houses built by farmers within high speed way around city in urban area or within the planning area of planed town of other zones (cities) and counties are encouraged to use new type of wall material.

Article 7 Marketing activity of solid fireclay brick should not be carried out within solid fireclay brick prohibited areas.

Article 8 Construction entity should not ask design institute and the engineering company to use solid fireclay brick in the design and construction. Design institute should not use solid fireclay brick in the design, and should specify clearly in the construction drawing. Engineering company should not use solid fireclay brick against design drawing. Supervision unit should not sign for engineering supervisor of the project that used solid fireclay brick against the design drawing.

Article 9 Construction administrative department will not examine and approve the design construction drawing of design institute which has designed to use solid fireclay brick in construction drawing from the date when these Measures come into force. For the construction project that has finished the examination and approval of the construction drawing, but has not obtained construction license, if the material selected in the design is not in conformity with the provisions specified in these Measures, it should be changed.

Article 10 For historic building protection and repair project and other special construction project which really need to use solid fireclay brick, design institute has to give illustration in the construction drawing.

Article 11 Wall material energy conservation office of the city and zone (city) and county

should check and assess the condition of the construction project for the use of wall material. The construction entity that has not used wall material as required, he should pay special item fund of new style wall material according to law.

Article 12 For the construction building, in violation of these Measures, in solid fireclay brick prohibited area, that construction entity requires design institute and engineering company to design and use solid fireclay brick, construction administrative department in charge will order to correct and give penalty of 10 Yuan per square meter according to the construction area that has used solid fireclay brick.

Article 13 If anyone has violated these Measures and committed any of the following acts, he/she shall be ordered by the construction administrative department in charge to correct and a fine of ten thousand Yuan shall be imposed, where the circumstances are serious, his/her qualification grade shall be lowered and the qualification license shall be revoked.

1. Design institute designs to use solid fireclay brick for the solid fireclay brick prohibited construction building.

2. Construction entity purposely uses fireclay brick against the examined and approved design drawing.

3. Supervision unit signs for the supervisor of a construction engineering that used solid fireclay brick without in conformity with the design drawing.

The administrative penalty of lowering qualification grade and revoking qualification certification specified in these Measures shall be executed by Construction Administrative Department in charge of issuing the qualification certification.

Article 14 Anyone, who violates the provisions of these measures, occupies land purposely to newly build, rebuild and extend solid fireclay brick of production construction project and occupy land to borrow, shall be dealt with by land resources administrative management department in accordance with the Land Management Law of P.R.C and Ore Resources Law of P.R.C.

Article 15 Anyone, who violates the provisions of these measures, produces and sells solid fireclay brick, shall be dealt with by quality technical supervision or industry and commerce administrative department in accordance with the Product Quality Law .of P.R.C.

Article 16 Administrative law execution officials of neglecting duty, abusing power, conducing on malpractices for selfish shall be given administrative punishment in accordance with relevant provisions. If it constitutes crime, they shall be investigated for criminal responsibility in accordance with law.

Article 17 Party concerned, who is disaffected to certain administrative behavior, could apply for administrative reconsideration or ask for administrative lawsuit in accordance with law.

Article 18 The people's government of Chengdu City legal system office is in charge of the explanation of these measures.

Article 19 These measures shall enter into force on June 1,2003.

Provisions on Gradually Prohibiting Using Solid Clay Brick for Newly Built Residential Building in Tianjin City

Article 1 In order to protect land resources and ecological environment, accelerate the development of new wall material, based on "*Notice on Certain Opinions about Carrying Forward Residential Building Modernization and Improving Residential Building Quality*" re-forward by the General Office of State Council to Construction Department and etc,(domestic Docu. [1999] 72) and "*Notice on Replacing Backward Product in Residential Building Construction*" by the Fourth Department of Construction Department, (Construction Housing [1999] 295), these provisions are formulated combining actual condition of the City.

Article 2 As used in these provisions, the term "solid fireclay brick" refers to clay sintered solid fireclay brick, which does not include the hollow fireclay brick and solid fireclay brick with industrial waste of over 30%.

Article 3 The provisions are applicable to the production, sale, use of fireclay brick as well as associated management activities in the City urban area (includes the built-up part of Tanggu, Hangu and Dagang), the part within external ring of the four round-the-city region, as well as economic and technology development zone, Tiianjing harbor bonded area, new technology industrial garden. Farmer's self-built housing is the exception.

Article 4 Tianjin City Urban and Township Construction Management Committee (hereafter referred to as City Construction Committee) is the authorized administration department for gradually prohibiting the use of solid fireclay brick in the city. City Construction Committee shall, together with relevant departments, based on socioeconomic development condition of the city and the existing scale of solid fireclay brick producers, in accordance with yearly degression principle, work out overall productive regulation and control plan of solid fireclay brick and release "*Approval Certificate of Construction Structural Material and Special Type Material*" *(Solid Fireclay Brick).* At the same time, City Construction Committee should seize time together with relevant departments to establish some favorable policies for the production, use and popularization of new type of construction material.

Article 5 Newly built residential building project stipulated in Article 3 of these provisions with construction area within 20 thousand square meter (contains 20 thousand square meter) is prohibited to use solid fireclay brick. Construction area above 20 thousand square meter, but less than 40 thousand square meter (contains 40 thousand square meter), construction area of solid fireclay brick can not be exceed 30% of the overall construction area. Construction area above 40 thousand square meter, solid fireclay brick proportion shall not be over than 50%, whatever housing project without construction license, if design is finished, original design institute has to rework its design plan.

Article 6 Housing plan and management department should approve project plan according to provisions in Article 5 starting from August 1, 2001. The City Construction Committee will not examine and approve brick combined structure residential building construction drawing design documentation, if the above requirements are not met.

Article 7 Gradually prohibit production of solid fireclay brick and prohibit to build new solid fireclay brick production line up to August 1st, 2001.

Article 8 Housing planning and management department will not approve housing project plan that uses fireclay brick. City Construction Committee will not examine and approve brick combining structure residential building anymore from January 1, 2003. Newly built residential building will completely prohibit the use of solid fireclay brick from January 30, 2003. New residential building is completely prohibited to use fireclay brick in the City urban area.

Article 9 Non-bearing wall body as well as fencing wall of newly built residential building will prohibit the use of solid fireclay brick from January 1, 2001. Load bearing wall plus minus zero line of residential building project will be in accordance with the stipulations in Article 5 and 8.

Article 10 Solid fireclay brick can be use for projects which belong to the need of city

planning ,view building, building repairing project as well as special construction project after the verification of City Construction Committee and approval of the Municipal Government.

Article 11 Construction project which uses solid fireclay brick should pay wall material reform special item fund, which will be collected by Tianjin Wall Material Reform and Energy Conservation Office according to standard.

Article 12 If anyone, in violation of these regulations, has used solid fireclay brick for residential building project without authorization, his/her project, design, construction and supervision units will get penalized by City Construction Committee according to relevant provisions specified in Tianjin Construction Project Quality Control Regulations and Tianjin Construction Market Management Regulations.

Article 13 These provisions shall enter into force on August 1, 2001. City Construction Committee shall be responsible for the organization and implementation.

Tianjin Municipal Regulations
on
Wall Material Innovations and Building Energy Conservation

Article 1 The regulation is established based on relevant laws, codes and provisions, with the actual local conditions taken into consideration for developing new types of wall materials, promoting building energy conservation and protecting land resources and environment.

Article 2 The regulation shall be complied with in all production and use of wall materials, planning, designing, implementing, constructing and supervising of building energy conservation and construction quality supervision within this municipality.

The regulation is not applicable to residential buildings constructed by village farmers themselves.

Article 3 New types of wall materials referred to herein are materials other than solid and hollow fireclay bricks for building walls.

Building energy conservation referred to herein means making buildings satisfy building energy conservation design standards through utilizing energy conservation techniques and products.

Article 4 The municipal administrative authority for construction works is the administrative authority for wall material innovations and building energy conservation in this city. The Municipal Wall Material Innovations and Building Energy Conservation Office is in charge of routine management of the city's wall material innovations and building energy conservation. The administrative authorities for construction works at district and county levels are in charge of wall material innovations and building energy conservation within their respective areas.

Article 5 The groups and individuals that accomplish outstanding contributions and/or distinguished achievements in wall material innovations and building energy conservation activities shall be commended and /or rewarded by the administrative authorities for construction works.

Article 6 Introducing, expanding and reconstructing solid fireclay brick production lines are forbidden.

Starting from July 1, 2003, the use of solid fireclay bricks is entirely banned within areas inside the city's Outer Circle Road, in constructed areas in Tanggu district, Hangu district and Dagangyuan district, and on new residential buildings in Tianjin Economy and Technology Development Zone, Tianjin Tax-bond Zone and Tianjin New Technology Industries Zone.

Staring from January 1, 2003, the administrative authorities for construction works and other relevant administrative authorities shall not approve residential construction projects and construction engineering documents involving using solid fireclay bricks in the areas outlined above.

Article 7 New types of construction structures, including cast-on-site reinforced concrete frames (light), weight-bearing concrete hollow blocks, steel frames, composite weight-bearing walls, etc. are promoted by the municipality.

Article 8 The following new types of wall materials are promoted by the municipality:

1. Weight-bearing concrete hollow blocks and light-aggregate concrete hollow blocks;
2. Air-mixed concrete blocks and slabs;
3. Multi-function low weight composite partitions;
4. Prefabricated sections with high addition of recycled materials;
5. Other wall materials encouraged by the State and the municipality.

Article 9 Product standards for the new types of wall materials should be in conformity with national and trade standards, or local standards issued by the municipal administrative authorities for construction works in collaboration with the municipal administration for quality and technical supervision. When no such local standards are available, manufacturers of the new types of wall materials shall draw up their proprietary standards that are submitted to and put on records by the municipal administrative authorities for construction works and the municipal administration for quality and technical supervision.

New types of wall materials that fail to meet quality standards or for which no standards are

available shall not be permitted to be produced or sold.

Article 10 Wall materials made from solid wastes should be in compliance with relevant environment protection regulations to prevent personal harms or environmental contamination.

Article 11 Wall materials manufactured utilizing slag or cinder and the alike, and meeting state stipulations are exempt from value added tax levies.

Manufacturers of the new types of wall materials are entitled to the privilege of lowered or exempted taxation as per relevant state stipulations.

Article 12 Based on developments of the new types of wall materials and combining with the latest building structure systems, the municipal administrative authorities for construction works shall organize in a timely way the preparations and revisions of standards for construction project engineering, implementation and completion acceptance inspection.

Article 13 Owners of construction projects that fail to use entirely the new types of wall materials for new building, expansion or reconstruction shall pay a contribution to the New Types of Wall Materials Special Fund at the Municipal Wall Material Innovations and Building Energy Conservation Office according to relevant state and municipal regulations.

The municipal administrative authorities for construction works shall not grant building permits for construction projects to owner groups or individuals that fail to make contributions to the New Types of Wall Materials Special Fund.

Article 14 Drawings on the New Types of Wall Materials Special Fund should be ear-marked mainly for the following:

1. Establishing, expanding or technological upgrading projects for producing the new types of wall materials;
2. Research projects for developing and applying the new types of wall materials;
3. Research projects for developing new types of building structure systems;
4. Covering the costs of administrating wall material innovations and building energy conservation activities;
5. Rewarding the groups and/or individuals that accomplish outstanding contributions in wall material innovations and building energy conservation activities.

Article 15 Drawings as specified in items 1), 2), or 3) in Article 14 herein on the New Types of Wall Materials Special Fund should be processed through the following procedure:

1. The group or individual drawer shall submit a written application to the Municipal Wall Material Innovations and Building Energy Conservation Office, attaching project feasibility study approving documents issued by relevant authorities;
2. The Municipal Wall Material Innovations and Building Energy Conservation Office shall organize a project review by experts;
3. A verification shall be given by the municipal government or the municipal financing authorities authorized by the municipal government after approval by the municipal administrative authorities for construction works;
4. The municipal financing authorities shall appropriate amounts from the New Types of Wall Materials Special Fund according to the above verification.

Article 16 Imposition, using and management of the New Types of Wall Materials Special Fund should be subject to supervision and inspection by financial, pricing and auditing authorities.

Article 17 The following building energy conservation techniques and products are promoted by the municipality:

1. New types of energy-conservation walls, roof heat preservation and thermal insulation techniques and roofing materials;
2. Heat preservation, thermal insulation and sealing techniques for energy-conservation windows and doors;
3. Centralized heating and hybrid heat-electricity-refrigeration producing and supplying technologies;
4. Technologies and devices for heating system temperature regulating and house-hold heat quantity metering;

5. Technologies and equipment for utilizing renewable energy sources such as solar energy, terrestrial thermal energy, etc.;

6. Energy-conservation techniques and products for building lighting;

7. Energy-conservation techniques and products for air-conditioning and refrigeration;

8. Other mature and cost-effective energy-conservation technologies and energy-conservation management methodologies.

Article 18 Building energy conservation design standards shall be complied with in new, expanding and reconstructing building projects.

Owners as per building energy conservation design standards should entrust building projects engineering and implementation. Engineering documents should not be altered at will. Building energy conservation inspection shall be carried out at completion of construction.

Engineering firms should work according to building energy conservation design standards and guarantee building energy conservation design quality.

Building contractors should perform pursuant to design documents conforming to building energy conservation design standards and not alter energy-conservation designs at will, to guarantee building construction quality.

Construction supervision groups should implement supervision on building energy-conservation projects according to design documents and bear supervision responsibilities. No permission should be given to installation or using of building energy conservation, building accessories and equipment that do not meet requirements by building energy conservation design standards in building projects.

Article 19 In violation of paragraph 1, Article 6 herein, introducing, expanding and reconstructing solid fireclay brick production lines shall be charged to halt by administrative authorities for construction works and subject to penalties up to RMB 30,000.

Article 20 In violation of paragraph 2, Article 9 herein, producing or selling new types of wall materials that fail to meet quality standards or for which no standards are available shall be punished by quality and technical supervision administration, and industrial and commercial administration as per laws in their domains.

Article 21 In violation of Article 13 herein, construction project owners that start construction without paying contributions to the New Types of Wall Materials Special Fund shall be charged to make up the payments within specified periods by the Municipal Wall Material Innovations and Building Energy Conservation Office. The ones that fail to make up the payments within the specified periods shall be subject to late payment penalties calculated at 1% of the amount due on a daily basis. In addition there's the option of applying to the People's Court for forced implementation.

Article 22 Project owners, engineering firms, building contractors or construction supervisors violating Article 18 herein shall be punished in accordance with provisions in "*Ordinance for Managing Building Construction Quality*" issued by the State Council (State Council Ordinance No. 279), by the administrative authorities for construction works or other relevant administrative authorities.

Article 23 The administrative staff for wall material innovations and building energy conservation works, found delinquent at duties, abusing power, or involved in fraudulent practices and favoritism, shall be punished by the administrations or their upper level authorities. Criminal responsibilities are sought when crimes are considered committed.

Article 24 This regulation becomes effective on March 1, 2003. This regulation shall prevail where it contradicts other relevant municipal regulations issued previously.

Annex 2

Influence and Future Development Prospect of Brick-Making Industry of China Wall Material Policy, Laws and Regulations

I. Background of Making Wall Material Policy, Laws and Regulations

China wall material industry was first started and formed under the guidance of planned economic ideology. Owning to this and during a long period of time, enterprises were mainly in forms of regional state owned and were lack of development, creation, encouragement and ideas of promotion and system. Products were produced and provided according to the planed economy, which were not in variety and were short of energy. By the end of 70's of last century, China has carried out the open door policy and everything has needed to be recovered. In early 80's, large number of collective and private enterprises were established like a rising wind and scudding clouds, especially under the guidance of traditional recognizant where "there is a mud there is a brick", within only 10 years, China's brick enterprises were quickly increased from a few thousand to one hundred twenty thousand and production capacity from over 100 billion bricks to 600 billion bricks. It had increased to 810 billion bricks by the year of 1998. But most of the enterprises were in small production scale with low quality and high-energy waste. Resources had been wasted too much. This kind of "jet-propelled" development was playing an active part in the fields of exciting the passion to build enterprises in villages and towns and among farmers, promoting the capital accumulation in early stage both for collective and individual enterprises and relaxing the contradiction of demands and supply for the wall material of the market. But at same time, it had brought an obvious kickback in resources waste and bad environment and couldn't help to give an anxiety and to take it into consideration.

According to the figures announced by the officials at that time, about 300,000 ha of land were occupied and 120,000 mu of land had been borrowed every year, also 50 million tons of standard coal was consumed each year. The heap of coal powder and gangue in whole China had reached 70 billion tons, which covered an open area of more than one million mu in wind, sun and rain. It had given a heavy pollution in the quality of soil, water and environment and had become social effects of pollution.

In order to protect the cultivated land, save energy and improve the environment, also give guidance, push the wall material products to be developed in the direction of energy conservation, soil not being wasted, good quality with comprehensive performances, in 1988, a leading organization for wall material innovation and energy conservation was jointly established among those departments concerned in building material, construction, agriculture and land administration, they made experiments in Haerbin, Chengdu and Jiangsu Province early or late and experience has been achieved. It also has been well realized that it has no time to delay the matter in developing the new wall materials of energy conservation, soil protection, utility of waste, heat preservation and heat resisted, so as to speed up wall material innovation and push energy conservation in construction forward. We have to increase the power and focus on the policy laws and regulations, taking the job as the system engineering, heightening our realization, changing our concept and strengthen the leadership of our organization. With the same understanding obtained, it has laid a solid foundation for the purpose of making relative policy laws and regulations for China wall materials and moreover putting it into practice. Also China wall materials' innovation, alteration, improvement and development, as well as popularization and application have been listed into a

very important schedule of the government.

II. Formation and Summary of China Wall Material Policy, Laws and Regulations

The work for China wall material innovation and energy conservation in construction was officially started in the year of 90's of last century. In Sept, 1992, The State Council of China transmitted the announcement of Construction Material Bureau, Ministry of Construction, Ministry of Agriculture and Land Administration Bureau, which was issued by State Council in form of No. 66 document "the Opinions on Speeding Up Wall Material Innovation and Popularizing the Construction of Energy Conservation". After that, the specific policy and rules and regulations have been worked out and issued by the Departments of Tax and Finance etc, as well as by the provincial government and city council early or late. Over 10 items were issued by Nation and over 100 items issued by local government among them all. The specific requirements and methods have been pointed out in the fields of industrial direction, leading products, revenue, credit, financing, application standard and specification of construction, recourse utility and environmental protection. A complete system truss of policy laws and regulations has initially formed, which has given a clear direction to the tragedy adjustment and alteration for China brick making industry.

According to the policy requirements and national developing schedule, the general target for the wall material innovation and energy conservation in construction would be increased from 5% gross proportion in the year of 1990 to 15% up to the end of year 1995 which was at the end of the Eighth Five-Year Plan, which means that 50 billion bricks (standard bricks)* made of new wall materials have been increased. 4 million tons coal has been saved from the energy consumption during production and 667 ha of land have been free from occupation. 75 million tons of industrial waste powder has been utilized. Starting from the year of 1995, all newly built residential houses have been built according to the design that 50% heating consumption should be reduced under the basis of normal design level from the year 1980 to 1981. By the end of the Tenth Five-Year Plan, which will be the end of year 2005, the gross figure for the wall material will achieve 780 billion pieces (810 billion has obtained so far). Among them, 300 billion bricks are using the new wall material, which plays 38% of the total amount. The total capacity for the fireclay brick will be controlled within 480 billion pieces, saving cultivated land 1.1 million mu, saving 80 million tons of coal and utilizing 300 million tons of waste powder. The completed construction area has to be of 50% of the total finished buildings in township area, which will be of 60% in those big and medium size cities and of 80% inside of urban area.

To realize the target mentioned above, both national and local government policy laws and regulations on wall material clearly specifies that it is necessary to make the complete policy laws and regulations as per the requirements of industrial policy, performing the encouragement policy for those newly developed wall materials and energy conservation constructions, also conducting the limitation policy for those who are utilizing fireclay bricks and producing fireclay bricks. These policies are including the priority of being free from value added tax, income tax, tax of using land for those new wall materials used. They can price the products by themselves. Also a special developing fund will be established for the new wall materials, increasing the loan focused on technical innovation, etc. Those construction application entities require to make or amend all kinds technical rules of law in field of design and operation process, standard ration and conventional drawings. It has clearly made the task, responsibility for the design and operation entities in using the new wall materials and made the option in priority of using the new wall materials and energy conservation technology. A clear limitation has been given to the buildings detailed in structure, position, using time and places where fireclay bricks are used. The regulations have played and given a very important instructive significance and promoting purpose to China wall material innovation and the work of energy conservation in the past 10 years.

In order to well carry out the policy laws and regulations for wall material innovation and energy conservation in constructions, also under the leadership of the governments in different regions,

wall material innovation organization has been set up in most of the provinces, cities and towns and varies objectives have been guided, scheduled, organized, corresponded, checked and put into effect in consolidation for the purpose of providing full organization protection in the field of spreading the wall material innovation and construction energy conservation.

III. Implement Effect and Review for China Wall Material Policy, Laws and Regulations

China has a big area of land with a large population. There are many differences in conditions of resources, climate, developing level in economy, living habit, traditional conception and population diathesis. Because of this, there are a lot of differences in implement forces, results and functions for those policy laws and regulations conducted. Generally speaking, the policy laws and regulations have been well conducted in most regions, but in the regions of minority or remote and dropping behind areas, problems are still existed owning to the differences between conception and economical level. It is concluded mainly in what follows in the field of implement results for the policy laws and regulations:

1. Idea of protecting cultivated land has been boost up and excessive land resources cultivation and utility has been initially stopped. Brick making material has become rationalized day by day.

Raw material is the products' base. It has a big influence on reasonable option and effective utility of the material by using the instructive policy of raw material resources, and it also plays a very important part for the determination of the products in variety. It is investigated that in the regions of northeast, north and middle part of China, these areas are rich in coal, power and mine resources. A large number of gangue and coal cinder have been exhausted and accumulated. Most the newly built or reconstructed enterprises have been taking the gangue, coal cinder, varies industrial waste and sand or stone as their raw materials, manufacturing the bricks from gangue and coal cinder, as well as concrete blocks and other unnecessary fired products. In southwest region, Great number of clay material for fired bricks have been more and more replaced by the material of shale. Shale bricks have constituted over 80% in the area of Chengdu. In the east and southeast regions, hill soil, silt from rivers, varies industrial waste, etc has been used for hollow bricks, blocks and unnecessary fired products. In northwest region, it is rich for clay resources, most are using clay hollow bricks, but in Xinjiang, concrete blocks are accounting for large proportion. According to the stat of the Year 2003, total proportion for the new wall material being used in whole China has increased 33%, which means about 263 billion pieces. The solid fireclay brick has been reduced to 530 billion pieces. It has been known from the structural change of the raw material that the brick making industry, in the areas around big and medium size cities, which are destroying the farmland in a large

Scale has been effectively stopped by the reason of the policy guidance, inspiration and promotion. The phenomena of using the shale, hill soil, silt from rivers and all kinds of industrial waste have been initially constituted. It is no suspect to have a deep significance for effectively using the resources and protecting the environment.

2. Energy becomes effectively used and consumption becomes reduced, however it is still in very serious situation of energy waste in general.

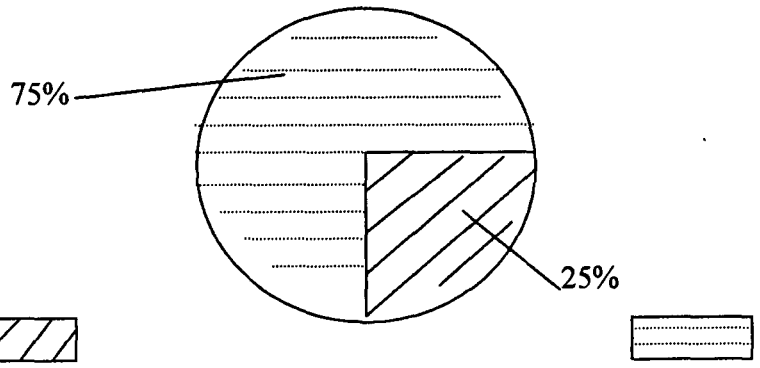
Energy consumption for brick making mainly have two aspects, including burning material and power consumption, especially the burning material consumption and waste. Since the wall material innovation work started, 10~25% heat consumption can be reduced because of changing the product from solid bricks to hollow bricks, including heat cost for industrial waste, such as gangue and coal cinder used. It can reduce part of the using coal, or completely. Those developed unnecessary fired bricks would have replaced some of the fireclay bricks. As a result, brick making industry, achieving a better result in energy conservation has saved 60 million tons of coal.

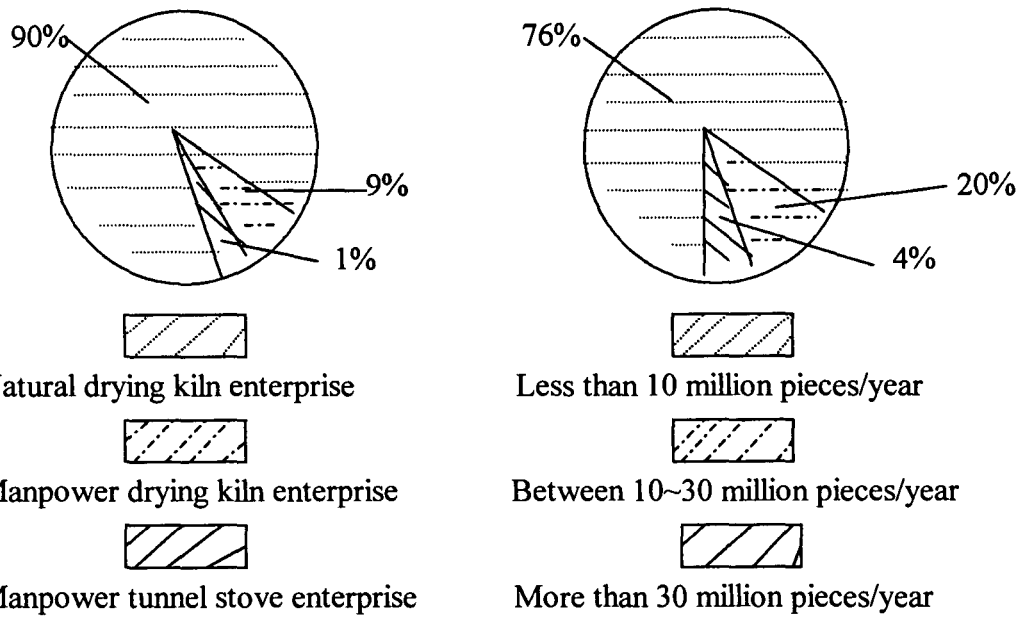
In the view of national spot check, energy consumptions are different in levels among enterprises. For example, those enterprises that are taking the gangue and coal cinder as main raw materials have stopped using coal, or small amount being used. Those enterprises that are taking gangue and coal cinder and slag as burning materials also can reduce their coal consumption 20%~30%, and over 70% enterprises are belonging to this range. But some enterprises that are completely using coal as burning material will consume 1.2~1.5 ton of coal for 10,000 bricks. Some are even higher than this figure. These enterprises are distributed in villages and are in 40% of the total enterprises approximately.

In view of wall material innovation policies and requirements, the inspiration methods of industrial energy conservation are mainly reflecting in solid clay brick manufacturing and in the field of using industrial waste. But there are lacks of methods in improving the heat facilities of itself, increasing the heat utility efficiency, remained heat recovery and reducing the energy lost and saving. For example that ration standard for industrial energy consumption, which issued in the year of 90s' last century, has not well been conducted so that it has completely influenced the energy conservation result of industry. From the view of power consumption, because it costs 0.55~0.70 Yuan RMB for each degree of electricity and has a big proportion in the expenses, enterprises have paid great attention on it, but still have the issues of "a big horse pulling a small cart" and very low efficiency with the facilities. So there is nothing to say about reducing the energy consumption and increasing the capacity for compensation in large scale. Production cost has been increased and utility efficiency of energy has been influenced.

3. The process equipment level in enterprises increased, but proportion is not enough in the whole business industry. The whole process equipment is still far behind.

Large investment in China brick making industry began in 80s' of last century. With the completion of reforming in deep and constitution of the economic marketing system, most of the old state-owned enterprises have carried out the operation of closing, stopping, integrating and transferring. Most of the newly invested enterprises have been built under the basis of private and collective economy in the village, or influenced by the consciousness of small-scale peasant economy. Because of this, it has a very popular phenomena named "three low and high", which means low equipment level in technology, low production efficiency, low quality and high energy consumption, high labor intensity, high proportion for small scale production. In recent years, owning to the interposition of coal, power, metallurgy and real estate industry, the newly built brick making enterprises have had a high mechanization in large scale with good quality. It has to be very good examples for the industrial reform and development. According to the investigation for 80 brick making enterprises in Chengdu, the total capacity are 2.1 billion bricks with 8900 employees, production efficiency is 0.236 million bricks for every employees in average and the average production capability of each enterprise is 26 million bricks per year. 36 enterprises have reached the capacity more than 30 million pieces every year among them. 44 enterprises have started to use vacuum equipments and 36 enterprises are still using the ordinary brick making machines. Only 13 enterprises that are having the tunnel stove. Among them, 75 enterprises are private owned or individual contracted, and the rest of the 5 enterprises are collective owned. Chengdu is one of the quick developed city brick making industry of China, which can reflect the developing level of the whole city regions of our Nation. Concerning about the whole situation in China, the brick making industry are still behind in system of raw material treatment, forming, cutting, finger lifting, oven drying and controlling. It shows clearly that there is no projecting point with the guidance of policy and rule of law and inspiration policy in the field of technical progress in business industry. One can't make bricks without straw. This reflects that the technology and equipments are also becoming the important facts to restrict the wall material innovation of China. Sketch 1~3 shows the basic technology and equipment condition of our brick making industry so far at the moment.





In the field of brick-tile machinery, brick making equipments have a certain improvement in variety, performances and quality because of the forces of wall material innovation, many new equipment have been developed and utilized in recent years, such as: type 70/60-3.8 double step vacuum mud extruder, auto cutting and figure lifting system, vertical monster type cutting line, vibration type mixer, material curing storeroom and big section tunnel kiln which have given an solid foundation for the alteration and improvement in brick making industry.

Among those main 30~40 domestic equipment manufacturers, only one enterprise's sales income is over 100 million and 5~6 enterprises' sales income are between 20 to 40 million. All others are below 20 million for sales income. Five enterprises passed the international quality certificate ISO 9001. 30% equipment manufacturers possess the coming inspection labs, brick testing entities and computer R&D system, which have a strong R&D capability. In the field of system and system reform, 70% enterprises have finished their stock alteration, or are at the stage of reform. Other enterprises are private enterprises. The equipments in those enterprises can basically meet the equipment requirements of China.

4. Environment pollution has been slightly alleviated, but volume for carbon dioxide exhaust has been still too much. It has given a heavy pollution for the environmental atmosphere.

Many small enterprises are existed among China's brick making industry, which are distributing widely. Coal is mainly used for brick—making. (According to the survey in 305 enterprises, the enterprises with raw coal account for 93% and this ratio may be higher in comparison with the integrative industry.) A large number of carbon dioxide exhausted during the coal burning and some

kind of coals give sulfur and other harmful gases while burning, which causes the damage or destroy for the environmental atmosphere. Owning to the long-term pricing for bricks are low, there is only a little profit for the business of brick enterprises. Most of the manufacturers have been unable to use gas and oil, or other methods for treatment, they can only let the harmful gases to be exhausted freely. In recent 10 years, because the hollow bricks and block forming products have been increased and solid fireclay bricks are reducing at same time, the quantity for coal is dropping down. Also the exhaustion for carbon dioxide gas from the brick making industry has been reduced. But in point of the reality with 500 billion solid fireclay bricks per year in China, it is still a very heavy pollution to the atmosphere environment. From the new wall Material Policy, Laws and Regulations at present in China, it is difficult to inspire and motivate the enterprises to save energy and reform exhausting. In the eyes of effectively use the energy, profit and concept understanding of brick making industry itself, there are many difficulties existed in the work of exhaustion reducing. So, it has still a long way to go and to be the great task of long term in the field of energy effective utility and carbon dioxide gas exhaustion for China brick making industry.

5. Environment of the market has been improved, but enterprise's financing channels are not well connected and the capability of the enterprise itself on reforming and developing is not powerful enough.

Brick belongs to local material, the constitution of the marketing environment and rules or regulations are mainly depending on the local policy, construction form, scale, consumption concept, group understanding and action to the market, etc. In this case, there has a big difference among different markets. In recent 10 years, with the guidance and inspiration of the policy, some changes have taken place in the demand market of brick products. For example, more and more customers have accepted hollow bricks and the market has been enlarged. More customers accept the products with good quality and high prices. It has given dynamical power to the quality improvement for the products of brick making enterprises. The selling price in northeast regions is 0.12~0.22 RMB Yuan (standard piece), 0.08~0.18 RMB Yuan in northwest and north part of China, 0.12~0.18 RMB Yuan in southwest and 0.11~0.32 RMB Yuan in south and east area of China. Shanghai and Beijing are the highest among the prices, which reflects that the speed on the basic construction is going fast in these regions and has a higher economical developing level. It also shows that much effort have been given in the field of wall material innovation and energy conservation.

The way of brick products on sales are normally distributed by the manufacturer themselves and it is very seldom to see distributors and agent. There are two groups of customers in private and organization sodality. The former is to build the individual houses, which are in cash deal. This group of people are mainly distributing in the countryside. The latter is mainly the real estate exploiters and contractors, which are distributing in the towns and cities. Because this group of people is going to use a large number of bricks, they normally order the bricks through agent or directly from the brick manufacturer and mostly on credit. It has caused large amount of money to be in arrears and even dead by the way of credit payment, which has brought great difficulty for the normal business of brick manufacturers. In order to avoid commodity payment being in arrears, brick manufacturers have to participate in the competitions with a low price, which causes a vicious circle and operates the business with little profit and even in the condition of loss. Under the support of Chengdu government, over 100 brick manufacturers have established a sales company with integration and have tried to use the same prices, sale in consolidation and receiving the payment within the price range approved by the pricing department. The purpose is to solve the problems of bad competition and payment in arrears, but the result is not in ideality and has to be researched, discussed, tested in a further step, and to summarize experience. From this you can see that the payment to be in arrears is in grain at present market, which is not only involving the diathesis, concept of law of individuals, but also involving the ethic moral and reputation rules of the whole society, even covering the system problem of society. It has become a very critical problem for troubling the operation and the development of brick manufacturers, as well as brick industry and should be attended to and regarded to.

Brick making is a traditional industry. The products have been priced in value of lower position

because of the social prejudice of low technique, position and bad visualization. Enterprises have been limited a lot in financing. In the past, the industry was mostly invested by local government or provided a loan by the bank. With the development of economical system reform, individuals replace the principle of investment and villages, financing are mainly relying on the nongovernmental. Via the survey in 305 enterprises, it shows that only 4.3% enterprise can gain the bank loan. Though large amount of wall material innovation funds have received as per the wall material innovation policy specified and have been used in the reforming work and development of the enterprises, but could have given the function what it should be as being lack of the detail specifications and methods of how to spend the funds. As for the channels of debt market and stock market, etc, they are in the situation of rarity.

Financing is the basic demand for an enterprise's business operation, reform and development. An industry of over 100 thousand enterprises with nearly 10 million employees, if the financing problems are not necessarily solved, only relying on the enterprises themselves and developing in freedom, our wall material innovation and energy conservation work can be only in the conditions of big thunder with little rain, meet difficulties in every single step and influence the corresponding development of economy.

IV. Problems and Future Development Prospect in Brick-Making Industry During Implement of Policy, Laws and Regulations

The policy laws and regulations for wall material innovation have given a great influence on production of brick making industry. It is no doubt to have given an opportunity and challenge to the brick making industry in reform and development. But there are some problems existed while implement and two big main obstacles existed in summary.

1. Obstacle of consciousness or named mentality, which causes a lot of difficulties while giving a complete implement to the policy of laws regulations.

Qin bricks and Han tiles have used to be a kind of symbolization with long history and honorable by our traditional culture. At present time, with the development and progress of the society, they are attended spurned by the whole society because of its dropping behind technology, conservation and endangering the environment. It requires people to change the conception and behavior guideline. Nevertheless, as far as the brick manufacturer is concerned, especially thousands of small enterprises, they are very much fond of the traditional production mode with small investment, quick efficiency and easy operation, it has become a habitual forces. The fireclay bricks are good products at a fair price to the customers with a long time test out. The bricks are still taken as the "believed" products though there are differences in quality and have never been lack of market. In regard to the construction industry, bricks are easier in transportation, moving around, operating on frame and use. It is not easy to break the bricks and the bricklayers are skillful with the operation on site, and fireclay bricks are available for the application and deeply loved by the bricklayers. As for the executers of law, thought there has a clear specification on policy and rule of law, executers of law might generate the emotion of being afraid of difficulty and collision sometimes. For example, during a conference, one officer pointed out the suspicion that the full gangue made bricks are complying with the standard, but would it loss the tensile after several years used on the wall and give a disaster? One officer once said that would the brick be strong enough with some holes on it? From this you can see that many people don't understand the national policy and the development of the brick making industry itself is much sealed. Marketing participants in consciousness and behavior are lag behind. The forces of principle part on promoting the wall material innovation have not been constituted or achieved the same understanding and composition. A famous person once said that it would be a most terrible forces coming from the habitual influence of millions of people. It should not be looked down on the industry of brick making. Up to now, people like to build their houses with fireclay bricks and tiles in some areas of China. In other places, people think the hollow brick is not earthquake resisted and not strong enough. They would rather choose the clay brick

than hollow brick. These potential conciseness existed have given difficulties to the implement of wall material innovation policy laws and regulations and great resistance to the wall material innovation work.

2. Obstacle of action or human obstacle influences the progress of wall material innovation work and the results of implement.

The wall material innovation is the work of system project, which needs the full support and cooperation from the department like industry, land utility and government, energy, environment protection, finance and tax, especially under the period and condition of China social shunt and uncompleted economical system of market. Owning to the driving of profit and various complicated personal connections, implement of policy in some areas has been influenced by some factors given by people, that caused the problem of implement not completed, or even error and deviation phenomena happened. It has brought the resistance for the implement of policy and rule of law. For example, 170 cities have been required with the time limitation to use the clay-brick, it is one of the important task specified in the wall material innovation and rule of law. But in some areas for the necessity of local profit protection, many excuses have been found, explaining that if the clay-brick factory is closed, the local financial income will be reduced and the loan provided by the bank will not be recovery, etc, which have made a lot of difficulties to close, stop and reform those solid clay-brick factories. Clay brick with 30% industrial waste mixed is the product supported by the policy, but how much quantity of the approved waste to be mixed up is seriously influenced by the factors of people, which causes the a lot of products to be taken care of by the policy with less quantity of industrial waste, or even nothing waste inside of the material. Wall material innovation fund is the special capital for industry developing the new wall material and it is also the principle channel of financing for the wall material innovation. Because there are lack of the detailed specification in field of application condition of utility, requirements to the object that who is going to use it, delivery standard and approving method, implement process, supervision and checking, etc, there has been a serious phenomena of appropriation and occupation. Thought the ministry of finance of China issued a specific collection and utility measure for the fund, the implement results are still not in transparency, which have caused the issues of not investing the full amount of billions fund collected from the whole nation every year into the causes of wall material innovation as per specification. For example that one wall material innovation department had invested the fund into a collective enterprise as the allowance of reform for the gangue hollow brick was deeply complained by various departments concerned. But in some cities, the fund that has been invested into the office building were accepted because of the causes named state-owned. Wall material reform office is a special organization under the leadership of the government. Large number of work has been done since it has established, but most of its responsibility existed so far at the moment seems to be reflected in the field of receiving the fund for the wall material innovation. A big reform engineering project which is only concentrating on issuing documents and ordinary call, but not on strengthening the forces of organization, implement, checking the specific objective and method of implement, as well as not on investigating and researching the popular issues existed inside of the industry and enterprises will have a big discount on the achievements of our wall material innovation and construction energy conservation. It is also very difficult to obtain the specific target and task for the wall material innovation. This problem has to be treated and considered in a sincere ways by the law execution department of the government, administration department concerned and people of same trade and occupation, which is also going to be the basic requirement and guarantee at present and future for the deep development work of wall material innovation.

3. Future development prospect of brick making industry

Brick making is an industry consuming the nature resources and its development is limited by the policy on resources and energy of the nation. It certainly has a close relationship with national economical development level, especially the rise and fall of construction industry. From 80's to 90's of last century, China brick making enterprises and whole product capacity were in the period

of quick dilatation, it was becoming a social hotspot by solving the problem of living, especially in the vast countryside. Farmers were set off upsurge of construction for houses and it is well nigh in a large-scale construction, which gave huge consumption demand for the development of brick products.

When 21 century came, the demands for the houses like "dress warmly and ear one's fill" have not been the critical problem. With the big increase of income among some people, the demands for the houses have changed from the period of "dress warmly and ear one's fill" to the period of "comfort and luxury". It means that inhabitation needs not only big space, but also the high quality of living environment, which points out a new requirement for the structure of the houses and the materials used.

It is forecasted by the department concerned that the buildings of whole society of China to be completed in a few coming years will achieve 1.8~2 billion square meters and the demands of the cities and countryside will be kept between 1.3~1.5 billion square meters. The average living areas will be gradually increased from 8 square meters to 20 square meters in future time. This means that there will be a large development space for construction industry of China, especially for the family houses.

According to the development features, demands of the market and development tendency of China brick making industry in 80's of last century, it is estimated that within next 5~7years, China brick making industry will have a clear improvement in product variety, quality, processing equipments, technical level, scale of enterprise, management quality, energy consumption and environmental protection. The whole industrial level will go up a new step, mainly representing in the following aspects:

(1) The yearly firebrick capacity of China wall material industry will be about 600 billion pieces, demands and supply will be balanced. It is estimated that the demand tendency for such a quantity will not be changed and it is going to be relatively stable.

(2) The structure of product variety will be optimized in further step, which means the fired multi-hole brick, hollow brick, gangue-brick, coal powder brick and decoration wall brick. 10%~15% will be increased within next 5~7 years according to the estimation. Fireclay bricks are going to be reduced with the implement policy of "forbidding using solid clay-bricks" and speeding up the construction step in the villages and towns. The quality of brick products will be improved and the prices will be stable or increased a little bit. Good quality with high price will become the demand tendency of the market.

(3) Small scale enterprises (less 10 million bricks per year) will be gradually eliminated and economical scale enterprises (over 30 million bricks per year) will be gradually increased. The scale of enterprises will become rationalization day by day. This is the necessary achievement by the guidance of the government, also the necessary option of the marketing development.

(4) The adobe dried by manpower and energy conservation stove or tunnel stove are the practical investment given by the brick manufacturer. It is the best combination among consumption, efficiency and production capacity. Though the manpower drying technology is not very popular used in brick making industry, it is estimated that the utility and demand for this kind of technology has to be more and more increased with the improvement of the marketing, serious competition among enterprises, policy control in land for brick making and internal demand of the enterprises' management. Within the next 5~7 years, it is hoped that such kind of technology will reach more than 40%.

(5) China is not only a large energy consumption country, but also with certain amount of shortages in energy demand. With the shortage tendency becomes worse and worse, it is a critical problem to make full use of the energy in brick making industry. It is estimated that the coal consumption and exhaustion for carbon dioxide will be clearly reduced with enterprises closed by the reason of high-energy consumption, small scale and solid clay brick to be reduced.

---

* The yield in China's brick-making industry is usually described with the converted standard brick quantity and the standard brick size per piece should be 240×115×53 (mm).

Annex 3

General Situation of China Brick-making Industry

I. Development History on Brick-making Industry in China

Being a traditional handicraft industry and an important component of construction material industry of China, the brick-tile industry of China belongs to the category of raw material industry, also one of the basic industries. And the sintered goods is one of the most ancient construction materials, which has enjoyed her glory history more than six thousand years (the sintered block unearthed at Sanxingdui Site in Sichuan) and back to five thousand years, there had been pottery-making workshop at the Banpo Village in Xi'an City, China. The brick-tile industry has developed on the basis of daily pottery trade while the genuine brick-tile had been discovered at the end of Chinese slave society and the early days of Chinese feudal society.

Brick, also called "BI" or "LINGDI", originated from the Warring States Period (from the year 475 BC to 221BC). Many varieties of brick such as bar brick, square brick and handrail brick have been discovered at the construction sites of the Warring States Period, which were mainly used for flooring and walling. The bar brick and square brick were shaped by the model with decorative pattern made on the surface while the handrail brick was decorated with crouching beast pattern, ancient, simple and vivid. Still there had been another kind of bar hollow brick used for constructing tomb and its chamber and the hollow brick was always decorated with geometry and the picture of dragon and phoenix. During the Warring States Period, the kingdoms such as Qi, Chu, Wei, Yan, Zhao, and Qin and Zhongshan, etc., had successively constructed the Great Wall with a lot of soil, sun-dried clay brick, stone and sintered brick, etc. for resisting others attacking.

Tile, also called "Weng", was originated much earlier. As far back as in the Xizhou period (from 11century BC to 771BC), the tile had already started making. The plate tile, tube tile, semicircle tile end and ridge tile have already been unearthed at the construction sites of West Zhou Period. The black tiles are bigger and made with primitive technology, not more. And guessing from the tiles, they may be used at the roof and cullis of the thatched cottage. The invention of the tile has resolved the difficulty on water-proof for the roof, which was a great progress on architecture for making people of the West Zhou Period get rid of rough living condition or the so-called "roofed with straw and walled in soil". By the period of Chunqiu Period (from 770BC to 476BC), the black tiles were gradually promoted for construction, tile having enhanced for shaping. The tile nail or tile nose of the plate tile and tube tile was basically disappeared. The tile nail was separately used if having to use it. The end of the tube tile, semicircle tile and circle tile shield had a wedge that could connect the tiles on the roof smoothly and levelly. The black tile from the Chunqiu Period is smaller and thinner than that from the West Zhou and the tile surface has some protruding texturization. By the Warring States Period, the plat tile, tube tile and roof tile had begun going in batch production, which were used for the roof of high officials and leud, with tiles colored. Although not getting rid of primitive state, the brick and tile had been better than that from the Chunqiu Period in decorative picture, solidness and the function keeping away water. The texturization had richened up to more than 20 varieties such as line vein, cloud vein, vein of a mythical ferocious animal, vein expressing double beast around a tree, dragon vein and bird vein, etc. which has demonstrated that the technology on brick-making and texturization at that times had reached the level considerably high.

The first important phase of ancient brick-tile industry in China

The Qin and Han period (from 221BC to 220) is the first important phase of ancient brick-tile industry of China.

After unifying China, the emperor Qinshihuang of Qin Dynasty had sintered a lot of bricks and tiles for constructing capital, palace, roads, tombs, etc. The black bricks used for flooring has been unearthed at the sites of Epang Palace in Xianyang, the ancient capital of Qin Dynasty, of Lishan

tomb. Except those without texturization, the rest bricks and tiles were decorated with sun, snowflake, and pane pattern, etc. Cast with geometry, dragon and phoenix, etc, the hollow bricks were used for step, footboard, or for walling. And still, there were some bricks such as five edge brick, trisquare brick, wedge brick and Zimu brick, etc., used for fastigium, house corner and arch location of tomb chamber. The varieties of the tile had not diversified much while they had richened with texturization, the animals on which such as running deer, standing bird, dashing leopard, etc. posturing beautifully and lifelike, the plant texturization on which such as foliage, sunflower and lotus, etc. vividly and attracting and cloud drawing on which had centralized characteristics of the kingdoms at that time, natural and smooth. The tile end and hollow brick with picture had already been beyond the scope of construction material, being listed as artworks. On the year 214 BC, to defend the aggression by the Xiongnu aristocrats from the North, the emperor Qinshihuang had mobilized hundreds of thousands labor force to construct the Great Wall at the north of Qin, Zhao, and Yan, etc. with a great lot of materials such as earth and stone, gravel, willow, reed and bricks, etc., having integrated the defending walls at that time, now called the "Great Wall". The ancient site of the Great Wall beginning from the west at Lintiao, close to the Yinshan Mountain at the north, reaching Liaodong in the east, had been up to more than six thousand li, called commonly as "Wangli Great Wall", leaving relics at the site by now. The Great Wall is one of the greatest projects in the world, demonstrating the marvelous wisdom and willpower of the ancient Chinese and the striking achievements on architecture material of Qin Dynasty.

By the Han Dynasty the arch structure and brick construction had further developed and small bar bricks had become the expensive wall materials, with similar weight and size to that of the present times. The proportion of length, width and thickness is about 4:2:1, which shows that the brick in the masonry works had already possessed modulus property. The bar bricks, except for constructing tombs, had also been used for storehouse, cave chamber and well and ditch. Generally, square brick and hollow brick had been decorated with various veins or geometry, the square bricks being used for flooring, hollow bricks for tombs and abutment support. The wedge bricks and tenon bricks were made in the West Hang Dynasty and the wedge bricks, matched with bar bricks, were used for constructing tomb chamber, the arch's integrity sometimes to be strengthened with the Zimu tenon bricks. The brick sculpture originated from the Han Dynasty, always decorating doorplate, door tower, screen wall, wall end, handrail, tomb chamber and Xumi pedestal. The figure brick and hollow brick with picture has possessed historic significance and art value, vividly showing the production activities of the day such as sowing, harvest, rice processing and brewing, etc., the buildings such as palace, pavilions, dwelling houses, street, and court door, etc. and the social custom such as marketing, banquet, hunting, and traveling by cart, etc. and some fables of remote antiquity. The varieties of the black tiles had extended to some extent with improved quality. The circular tile end has sculptured official words or epitaph, good fortune remarks with veins simple and clean, rich with diversity. The four tiles with deities such as Qing dragon, white tiger, red bird and Xuanwu may be listed as the best of the day. Eyebrow had shaped into band or tooth while small tiles did not have tile head.

By the period of Qin and Han Dynasty, the brick-tile industry of China had prospered than ever before, gradually formed into an independent handicraft industry. And from that time, the reputation so-called "Qin brick and Han tile" had begun popularizing in the society up to now. Although for this it is sorry that, by now, the systematic literature about brick and tile sintering technology has not yet been unearthed, we can still have a glimpse to the mystery on the sintering technology of the Qin and Han Dynasty from the fragmentary records in the scattered in the ancient literature. From the Qin Dynasty to the beginning of the West Han Dynasty, the tube tiles were made with three working procedures, firstly making the tile core, then the edge, finally to finish tile tube. And by the medium phase of the West Han Dynasty, the working procedure had simplified to some extent with tile core and edge finished one time. The bar brick, square brick and hollow brick had shaped with model for sintering.

By the period of Sanguo, Liangjin and Nanbei Dynasty (from the year 220 to 589), the output and quality of brick and tile had further improved. The brick structure was mostly used for the tomb

chambers, which were used for the secular buildings by the Beiwei Dynasty. The size of brick and tile is generally small and the large hollow brick is rarely seen. The brick and tile unearthed in the sites of the construction of Beiwei Dynasty are characterized respectively. The rectangle brick is solid, sintering in high temperature and the location of tile head is decorated with flower pattern or sawtooth vein. The tube tile is generally going without vein decoration and inner part is decorated with cloth vein. The lotus and beast decoration are mainly used for the tile end. The Songyue Temple tower built at the Dengfeng County of Henan province during the fourth year of Zhengguang period of Beiwei Dynasty is the brick tower with the longest history in China and the tower, except the tower pedestal constructed in stone sculpture, is wholly built with grey and yellow bricks. It is deserved to point out that the azure stone wares such as eyebrow, ditch head and bird tail had already been used for the important part of the palace roof. At the site of the ancient city of Beiwei Dynasty in Datong city, Shanxi province was discovered some azure stoneware pieces, the core of which contained fine sand with glaze colored shallow green. It is the earliest azure stone tile discovered by now.

The second important phase of ancient brick-tile industry in China

The period (from the year 581 to 907) of the Sui and Tang Dynasty is the second important phase of ancient brick-tile industry of China.

During this period the application of bricks had been gradually enlarging. It is discovered at the sites of Daming Palace and Bohai Shangjing Palace built in Tang Dynasty that, except the wooden pillar, arch and stake, the abutment base was generally built with two materials, stone and brick. The cities were successively built with brick, soil and lime. With tomb bricks increased gradually, the tombs of Tang Dynasty such as Qin mausoleum, Shun mausoleum, etc. all used bricks for constructing coffin chambers. The brick towers coping wood tower were gradually increased. The Xuanzang tower (or called Dayan pagoda by nowadays people) at Xingjiao Temple in Xi'an and Xiangji Temple are good examples that bricks in constructing replaced wood. The palace began to decorate floor with flower pattern. The surface of the court door was decorated with walling bricks. By this stage, the technology of brick-tile had made some record. During the period of the first emperor of Sui Dynasty, the azure stone was colored with green, which was later promoted for palace roof with color, painting red, coated with lacquer. The black tile, grey tile and azure stone tile had become the important materials of roof. The grey tile was generally used for the common buildings while black tile and azure stone tile for palace and temples. By the Tang Dynasty, the prescription and technology of azure stone glaze had again improved greatly, with "three colors of Tang" with yellow, black and green famous home and abroad come into exist. The azure stone tiles unearthed at the site of Daming Palace are more colored green, blue less. The pillar base of the Bohai Shangjing Palace was laid out with green azure stone components. The quality of the azure stone tile is solid, with beautiful color and primitive and simple shape, full of national characteristics. Although not much in quantity and only using it for the palace's roof ridge and cornice, it had already attracted the world with striking brilliance.

During the period of Wudai, Song and Yuan Dynasties (from the year 907 to 1368) and with the continuing development of brick-stone construction and arch structure, the sintering and use level of bricks and tiles had risen higher. The bricks and tiles output of the Song dynasty had increased to some extent and many cities, except using bricks for city walling, had also used bricks for paving roads and deck. At many places all over the country were built quite a lot of brick towers such as tower at Baoen Temple, Liuhe Tower at Hangzhou, the tower at Kaiyuan temple in Ding county, Hebei province, etc. By this period, the manufacturing technology of azure stone tiles had gone into mature stage, with the specifications of the azure stone tiles standardizing gradually, the application of the azure stone tiles apparently enlarged. At the fourth year of Qinli period of Beisong Dynasty (the year 1044), the technology improvement of azure stone tiles and other azure stone wares and the standardized components and incrustation achievements were demonstrated by the reconstruction of the multi-eave azure stone tower with eight corners at Guo temple in Kaifeng.

It is worthwhile to point out that, by this stage the more systematic conclusion about sintering

technology of brick and tile had begun. At the second year (the year 1103) of Congning period of the Beisong Dynasty, the Shaojian official Li Jie of construction department in charge of projects, according to the emperor's decree, had compiled a book titled "*Regulations on Construction*". On the kiln regulations of the fifteenth volume, the author had firstly in history summed up and ruled more scientifically on the size, raw materials, forming, drying, kiln loading, sintering, the specifications and bricklaying of the kiln. For the technology strictness of the day, a glimpse may be got from the abstract of the book: "before making adobe, the soil must be mixed and made ahead of the schedule by one day", "fine soil to be used for making tile body, no sand to be mixed, and to be shaped and compacted ahead of the schedule by one day, taking it out of the model for sunning", the adobe " to wait for a little drying and to veined deeply, four pieces to be made from every bucket of raw material (tiles to be two pieces from every bucket of raw material, a line to be drawn at the center of the lined tiles, to draw with cross way), for the lined tiles, the water component to be designed outside", for the azure stone tile, "to be colored with Huangdan, Luohe stone and copper powder, which would be evenly mixed in water (in winter to mix with hot water), to sculpture beast on the tile back, the sculptured beast to be designed outside, (for the heavy tube tile, the big end to be shaped from the back and for the lined tile, to be shaped from the tile lip), for the azure stone tiles, yellow to be taken as the main, which was stated with detail in the book, "the empty kiln to be loaded by one day in advance, to begin sintering next day, and another day, to water the sintering bricks which would be thoroughly cooled in three days, then unloaded by the seventh day. For the black brick kiln (loading and unloading the kiln to be operated strictly following the regulations), common grass to burn firstly (to get a glimpse into the kiln, no firewood, sheep excrement and oil residue to be burned), next to burn wormwood, pine and cypress branches, sheep excrement, boon, and thick oil, to cover it for preventing smoke from going out", "the azure stone kiln to be loaded one day in advance, the sintering to be changed next day and the kiln to be opened on the third day, the kiln to be unloaded after it is cooled in five days." For the size and construction of the kiln, introduction about it was also given. "for constructing kiln, the bar bricks with length one foot and two inches, width six inches, thickness two inches to be used for constructing, and for the lower part of the kiln tank, tunnel, bed, sub-door and gate, they will be constructed with beautiful eyebrow form with the upper part supported and the smoke to go out through the shielded tunnel." The book "*Regulations on Construction*" was the specifications for the Beisong Dynasty government to administrate the projects such as palace, altar, temple, official building, and mansion, etc., which had mainly summed up the effective experience of the masters relayed from generation to generation. The volume on kiln regulations has demonstrated the technology level on sintering bricks and tiles of the day in the middle region of China, which has significant reference for studying the material development of the Song Dynasty, even of the whole ancient times.

The third important phase of ancient brick-tile industry in China

The period (from the year 1368 to 1911) of the Ming and Qing Dynasty is the third important phase of ancient brick-tile industry of China.

At this stage, the bricks and tiles were commonly used for civil buildings. The application of cavity wall had saved bricks greatly, which accelerated the promotion of the brick wall. The skill on "brick ornaments" and "brick sculpture" had already matured. Most city wall of counties and cities in Nanjing and Beijing and other regions had constructed with bricks. In the Ming dynasty, for defending aggression from Tartary and Wala nationality, the Great Wall had been built and maintained more than eighteen times from Hongwu to Wanli period. The existing great wall more than two thousand li in Beijing, Hebei, Shanxi, etc. was built at that time, most of which are preserved well by now. It is rarely seen in the world for the majesty verve, the arduous extent of the works, quantity of the used bricks. The Beijing of Ming Dynasty was built and enlarged on the basis of the capital of the Yuan Dynasty, from the west to the east of which was 7,950m, north to south 3,100m, from the west to the east inside the capital 6,650m, north to south 5,350m, basilica city to be located at the center close to the south, from east to west being 2,500m, north to south 2,750m, the dominating buildings of which are palace garden, temples and cloisters, official office and

mansion, etc. The brick quantity to be used for the basilica city was considerably striking. The Imperial Palace in Beijing, is a palace group, which finished the construction with fourteen years beginning from the fifth year (A.D.1407) of the Yongle period of the Ming dynasty, the bricks used for which were from Suzhou, Jiangsu province, pottery soil from the Taiping county of Anhui province, azure stone tiles and other azure stone wares to be produced by the "official kiln"—the West Kiln, etc. with monopoly. The demand for the quality was very strict. The large square brick was produced with purified mud, which was solid with metal echoing from beating. For most occasions, the bricks were used for constructing fireproof buildings such as imperial archive room, sutra storage tower, etc. Both quantity and quality are unprecedented for the produced azure stone tiles and bricks, only to be restricted with color and decoration theme. The yellow azure stone walling bricks and tiles to be used by the imperial class with monopoly were absolutely prohibited from being used by the civil citizen, "those to violate the law shall be sentenced to death." The blank to be made with clay for the early azure stone wares, the kaolin was used for making blank from the Ming dynasty. The azure stonewares from such blanks were solid and close-grained with high strength, not easily to be wet from moisture. The walling bricks of azure stone were used for towers, gates, and screen walls. It was recorded that the damaged Baoen pagoda at Baoen temple in Nanjing was a brick tower with nine floors, the surface of which was decorated in azure stone walling bricks with different colors such as white, shallow yellow, deep yellow, deep red, brown, green, blue and black, etc., glittering with effulgence.

The book "*Making Products with Mined Materials*" written by Song Yingxing published on the tenth year of Congzhen period of the Ming dynasty is one of the important scientific literatures of the Ming dynasty. The book was divided into three parts, eighteen volumes, which recorded and narrated with detail the production experience and skill about the ancient agriculture and handicraft industry, with a lot of iconography appended. The seventh volume on pottery craft had again drawn the experience on sintering bricks and tiles, recording and narrating the technology on the raw material, forming, drying and sintering, etc. To take soil for making tile has to dig more than two foot, "to select the clay without sand for making tile blank", "for taking soil for making bricks, the soil color has to be made clear through digging and those will do such as blue, white, red, or yellow (much red clay deposited in Fujian province while the blue clay to be much deposited in Zhejiang province, called "kind clay"), those of which will be the best with property "clay not scattering and powder without sand". And after this, taking water for moistening clay, several cattle will be driven to trample the clay into paste which was to be put into the wood basket." The method for making raw material has still been used in the mountain village where minority nationality people densely lived and the remote region. The tile to be used for the civil houses was divided into four pieces. For this, the circular bucket will be firstly used for model, the four bisectrix to be made outside the bucket. To trample the clay into ripe clay, it will be formed into oblong clay bar and a piece of tile blank will be cut off from the oblong clay bar with a bowstring set on the clay bar end with scale fixed. The clay piece cut off from the clay bar would be kept close to the outside wall of the bucket tightly and when it was a little drying, the clay piece would be off from the bucket model. The clay circular tube from the bucket would be divided into four tile blanks. Bricks would be shaped with model. When the tile blank was made and dried, they would be laid inside the kiln. Then making fire for sintering, it would be going for a night or two nights and when to flame out would be decided by the tile blank quantity inside the kiln. When flaming out finished, watering would be going on the top of the kiln (to have kiln drunk), which would make the tiles inside the kiln emit blue and black luster. The finished brick blank would be laid inside the kiln. "to burn for a whole night for the kiln loaded about three thousand Jin. And two nights burning would be going for the kiln loaded with six thousand Jin. The flame should be burned into white if the coal would be used." At the side of the top of the kiln taking as firing the firewood were cut out three holes, which were used for discharging smoke. And when the burning came to its end, the orifices would be sealed with mud, with watering followed for "essence changing". If the firepower had one part not met, the bricks would lose luster and if three parts not met, the bricks would be turned into "bricks sintered with weak fire". The bricks out of the kiln would show the original color of the soil blank, which

would be returned into clay after a period of eroding by rain and wind. If the firepower had one part exceeded, the surface of the bricks would be broken and having three parts exceeded, the bricks would be broken and arched. And the burning temperature symbol had to be observed and identified with experience only. The "essence changing" (meaning to change blank color with watering) was the method on sintering black bricks and black tiles, which was invented by the Chinese working people two thousand years ago. This was recorded and narrated with detail by the book, "for essence changing, the top of the kiln to be made into plane, a little humping around with watering on it. For the kiln loaded with three thousand Jin, four thousand Jin of water would be used. The water would be penetrated into the soil film, combining with the fire. With fire and water well working each other, the quality of the bricks would be undergone a thousand years!" This technology has still now been using in the countryside. When the blank was sintered, it would still be in the reverting ambience from the incomplete burning, which would make the (Fe_2O_3) revert into FeO. As for size of the tiles there were not specifications. "big one to be eight or nine inches for length and width while small one to be smaller by 3/10" . The trough on the top of the roof would not be able to stand continually raining with leakage prevented without the big tile named "gouwa" to be used. "Hanging an eave for dropping water and below the fastigium a sky tile to be equipped, a component named 'qiangtong' to cover the fastigium, with bird and beast figure crouched on the fastigium, which, all made by manpower, would be loaded inside the kiln for sintering with the same method." For the azure stone tiles to be used for the imperial palace, "some to be formed into plate, some into tube, which was shaped with bamboo tube or wood model, to be made one by one with soil to be got from Taipingfu." When the tile blanks finished, they would be put into the azure stone kiln. For sintering tile about one hundred Jin, five thousand Jin of firewood would be used. After sintering, the glaze of blue or green made from palm leaves would be used to coat the tiles, or to be coated with the yellow glaze made from ochre, rosin and cattail, etc. And after this, the coated tile blanks would be put into another kiln and with burning degree reduced, the precious color of azure stone would be created." For the bricks, although there were not specifications for size, varieties had increased to some extent. "all the materials used for the city wall of the states, the civil houses had divided into two kinds. One is sleeping brick and the other side one." "Except the bricks for walling, those to be used for flooring would be called 'fangman bricks' and those used to support the tiles on the shuaijiao would be called 'manban bricks', those used to arch small bridge or to construct tombs would be called 'knife bricks' or 'ju brick'." The knife bricks with narrowness were lined closely to arch, which was very solid and would not be damaged even if treading by horses pulling a cart. The bricks to be used for the imperial palace would be produced by the brick plant set up by the construction department of the Ming dynasty at Linqing county, Shandong province. Firstly there were auxiliary bricks, arch bricks, plane bricks, wangban bricks, axe blade bricks and square bricks, etc. half of which were later be cancelled. And after that, the fine bricks used for the imperial palace were transferred from the Suzhou, Jiangsu province where the bricks were sintered.

The Qing Dynasty is the end of feudalism society and at this period, the development of brick-tile was as slow as that of politics, economics and culture. Before the year 1840, the production of brick-tile was basically going with the tradition from the Ming dynasty copied. Adopting handicraft industry way, the technology and kiln type had not advanced much, to mine soil and carry it with manpower, earth kilns to be universally used such as square kiln, circular kiln, hanging kiln and hoof kiln, etc. Black brick and black tile had already used universally. The north house taking as its representative the Beijing square yard constructed its outside wall with bar bricks, flooring outside and inside with square bricks, covering roof with black tiles. Onto the surface of gate, screen wall, step end and the ridge of the house were decorated the sculptures which showed good artistic result. The hollow walls were constructed thinly around the civil houses in the south. To prevent the soil from falling and to protect yanwa, the arch bricks were laid inside the kiln in the middle of China. Although the form was singular, they may be used as decoration. The tube tiles were divided into two kinds: one was pottery quality and the other azure stone, which were used for the constructions such as palace, official office and temple, etc. The azure stone tiles, according to size, were

classified into "ten kinds", one of which had not number, ten of which had number, having not things. For practical use, the "eryang" was the best while the "jiuyang" the poorest.

Beginning from the first OPIUM WAR, China had entered into semi-colony and semi-feudal society (from 1840 to 1949) and brick-tile industry was going with extreme imbalance. In the metropolis the machine-made brick-tile plant was beginning to prosper with quicker development while viewing as a whole the brick-tile industry had been swaying in the storm with low productivity and unstable output, technology and equipment being dropped behind and stagnancy.

In the 20th century, beginning from 1906, with machine-made blank and cycle kiln and shale bricks introduced, the brick-tile industry—the production way with handicraft form had turned into modern industry domain. Before and after the year 1930, in China were 19 brick plants that were going with capacity in producing hollow bricks, glaze bricks, and machine-made tiles, etc. Although the brick-tile plants had increased later, the equipment and technology had not yet improved. By the 1950s, the hoof kilns and pot kilns were still used to produce brick-tiles. It was not until by the 1950s or 1960s that the tunnel kilns with high consumption and low efficiency and the outdated cycle kilns had been introduced into China, which later had become the main force of Chinese brick-tile industry. In the 1970s or 1980s of the 20th century, the demand for brick-tile had quickly increased because of reform and opening. Under the situation that the construction material industry was growing like bamboo shoots after a spring rain, the brick-tile industry was going as a new force suddenly rises, with quantity of brick-tile enterprise quickly increased. In the early days of 1950s there were only a few thousands brick-tile enterprises and by the middle period of 1990s the brick-tile enterprises had reached 120 thousand or so at most. The annual output had increased up to 810 billion pieces (converted into standardized bricks) in the year 1998 from the 14.9 billion pieces in the year 1952. And the annual output had increased up to 75.176 billion pieces (converted into standardized bricks) in the year 1997 from the 11.011 billion pieces in the year 1953.

Table 1 Output Statistics on Bricks from Different Phases in China after 1950s

Unit: 100 million pieces (converted into the standardized)

Year	1952	1965	1974	1977	1982	1984	1986	1990	1992	1994	1996	2000	2003
Output	149	326	341	939	1963	2499	3749	4688	5208	6264	7200	7300	Predict 7000~8000

Table 2 Output Statistics on Tiles from Different Phases in China after 1950s

Unit: 100 million pieces

Year	1953	1963	1969	1973	1975	1980	1986	1997	2000
Output	110.11	150.37	95.04	281.87	119	275.07	422.75	750.76	700

But the enlargement of the brick-tile enterprise had done with low level and low grade of repeating construction. Although the brick-tile industry has met demand from Chinese construction with product quantity, the great consumption in resources and energy, especially in land has seriously restricted Chinese economy from sustainable development. The dropping behind actuality of Chinese brick-tile industry has manifested by the following aspects: enterprise being restricted in small scale, small annual output not up to 10 million, the average output for the better enterprises in 305 of them is only more than 20 million pieces of brick via the industry survey this time, products in low grade, enterprises falling down in equipment with most enterprises' machine capacity less than 500kw. The average total installation capacity of the production enterprises with renovation capability in 305 firms surveyed is 434.6kw and that for most of the enterprises is 200kw below. . And because of the above situation, the enterprise and its product have no way to enter the international market of brick-tile, not to mention taking part in the product competition.

According to the incomplete statistics, by the end of the year 2003, the annual output by 90 thousand brick-tile enterprises has been close to 800 billion pieces of standardized bricks (including solid clay bricks about 530 billion pieces), output value close to 150billion yuan. In order to protect farmland the Chinese government has established a series of policies on wall reform and being

pushed forward by the policies, the output of solid products has already shown falling down trend in total quantity. But being restricted by the various factors, the solid core bricks have still amounted to 70% of the total quantity. The various new materials made from industrial waste (such as gangue, fly ash and all kinds of residue) and wall material of environmental protection have quickly developed. In 305 production enterprises to be surveyed, those with gangue, fly ash and all kinds of residue as inner fuel take about 79% of the total. By the year 2003, the bricks sintered from refuses has already reached 7billion pieces (converted into standardized brick) and the output of sintered products has been increasing by 10~30%. For 305 enterprises to be surveyed this time, 177 enterprises make such products, accounting for 58% of the total enterprises surveyed. It is anticipated that in 2003 the output of various sintered products may reach 100billion pieces (converted into standardized brick), which has increased close to 50%, comparing with 20billion pieces by the year 2000. And still, the products went to the market with multi-varieties and multi-specification, meeting the different demand from the construction market. Via survey, the varieties of daily use of sintered bricks at present are seen in Table 3:

Table 3 Varieties and Specifications of Sintered Bricks in China at Present

Variety	Specifications (mm)	Pore rate (%)	Pore shape
Solid brick	240×115×53	/	/
Bearing porous brick	240×115×90	25~35	Rectangle pore or circular pore
	240×115×115	25~35	
	240×180×115	25~35	
	240×190×90	25~35	
	180×180×90	25~35	
	216×190×90	25~35	
	240×240×90	25~35	
Hollow brick	240×240×115	40~47	Rectangle pore
	240×200×115	40~47	
	240×190×190	40~51	
	190×190×90	40~51	
	190×180×115	40~51	
	200×115×90	40~51	
	290×290×150	40~51	
	300×200×115	40~45	
	300×240×150	50	
	240×180×180	52	
	240×175×115	45~53	
Hollow building blocks	190×190×190	45~58	Rectangle pore
	240×240×240		
	300×240×240		
	370×240×190		
	290×290×115		
	290×290×240		

The provinces with brick-making developing more quickly are: Hebei, Jiangsu, Shandong, and Henan, etc. The product prices of bricks from different places by now are seen in Table 4.

Table 4 Price Reference Table of Sintered (Steaming with Pressure) Bricks from Different Places by Now

Unit: yuan/piece

Region	Porous brick KP_1	Common bricks	Ash and sand bricks steamed with pressure
Beijing	0.26~0.30	0.15~0.20	—
Tianjin	0.26~0.28	0.11~0.12	—
Hebei	0.23~0.25	0.11~0.12	0.14~0.15
Shanxi	0.15~0.16	0.08~0.10	—

Region	Porous brick KP_1	Common bricks	Ash and sand bricks steamed with pressure
Inner Mongolia	0.18~0.20	0.10~0.11	—
Heilongjiang	0.30~0.35	0.09~0.12	—
Jilin	0.15~0.19	0.09~0.12	—
Liaoning	0.25~0.28	0.14~0.15	—
Jiangsu	0.20~0.42	0.20~0.28	—
Zhejiang	0.32~0.52	0.26~0.32	—
Anhui	0.15~0.18	0.13~0.17	—
Fujian	0.25~0.27	0.14~0.16	—
Jiangxi	0.35~0.38	0.12~0.14	—
Shandong	0.16~0.18	0.11~0.12	—
Henan	0.17~0.27	0.10~0.12	—
Hubei	0.20~0.30	0.15~0.19	—
Hunan	0.28~0.30	0.14~0.15	—
Guangdong	0.30~0.36	0.20~0.22	0.15~0.17
Guangxi	0.19~0.21	0.13~0.14	0.14~0.15
Sichuan	0.15~0.18	0.10~0.18	—
Chongqing	0.28~0.30	0.12~0.18	—
Guizhou	0.32~0.33	0.13~0.17	—
Shaanxi	0.16~0.22	0.08~0.11	—
Gansu	0.22~0.24	0.07~0.13	—
Qinghai	0.15~0.27	0.07~0.13	—
Ningxia	0.18~0.20	0.12~0.13	—
Xinjiang	0.18~0.20	0.10~0.12	—

II. Technology Status of Chinese Brick-making Industry

The technology of Chinese brick-making industry has made quite great progress for the recent years and to prepare raw materials with machine, to shape with machine, naturally drying and sintering with cycle kiln have basically realized for the brick-making enterprises, 85% of which have adopted internal combustion. To dry with manpower, to sinter with tunnel kiln and load with machine have also used in the large and medium scale brick-making plants. But viewing as a whole, the township enterprises whose output accounting for most of the brick-making industry has been dropping behind. For the recent years, although the equipment has been updated by a lot of work, the brick-making industry has not apparently changed on the whole.

In the past the raw material for brick-making is mainly the soil from the farm land and for recent years, soil from mountain, barren slope, sullage and shale, gangue, fly ash and other industrial residue, etc. Because the rigidity, plasticity and natural water content have more fluctuation than that of the pure farmland, the mining and preparation way will be different from the product requirements and soil quality. Viewing from the present situation, the brick-making enterprises have basically realized supplying soil through mechanical system and most brick and tile plants have adopted the preparation way of rolling doubly with face to face and doubly mixing.

To form with machine has been adopted by brick-making enterprises of China. The most commonly used method for brick-making is forming technology with extrusion, some individual enterprises to adopt pressing forming. For recent years, extrusion forming with semi rigid has been adopted more and more for brick-making. At present, the water content from the plasticity extrusion forming in China is about 16~25%, the water content from semi rigid extrusion forming is 11~16%. The most commonly used extruding machines: type 45/40, type 45/45, type 50/45, type 60/55, type 75/65, etc. For 305 enterprises in this survey, 5 of them adopt types 70/60 and 60/65 de-airing brick-making machine, being less than 2%. 246 enterprises use types 50/45 and 45/40 de-airing brick-making machine, being about 80% and the rest take type 350 small size common brick-making machine, being 15% below.

The brick making in China is, at present, mainly adopting natural drying while to dry with manpower is adopted by some minority enterprises. In 305 enterprises surveyed this time, 68 of them adopt manpower drying technology, accounting for about 22% and most of the others are via natural drying, taking 78% or so. At present, drying room is mainly adopted for drying with manpower. And nacelle-drying technology is only adopted by the individual enterprises.

The main size and structural form of the tunnel drying room adopted by now is approximately as the follows:

Length	32.00~65.00m
Width	0.910~1.20m
Height	0.85~1.30m

Blasting way: to centralize blasting at bottom, to scatter blasting at bottom, combination between to scatter blasting at bottom and to scatter blasting at side, to scatter blasting at side, to centralize blasting at upper and to scatter blasting at upper, etc.

Air discharging way: to centralize discharging at bottom, to centralize discharging at upper, to scatter discharging at side, to scatter discharging at upper.

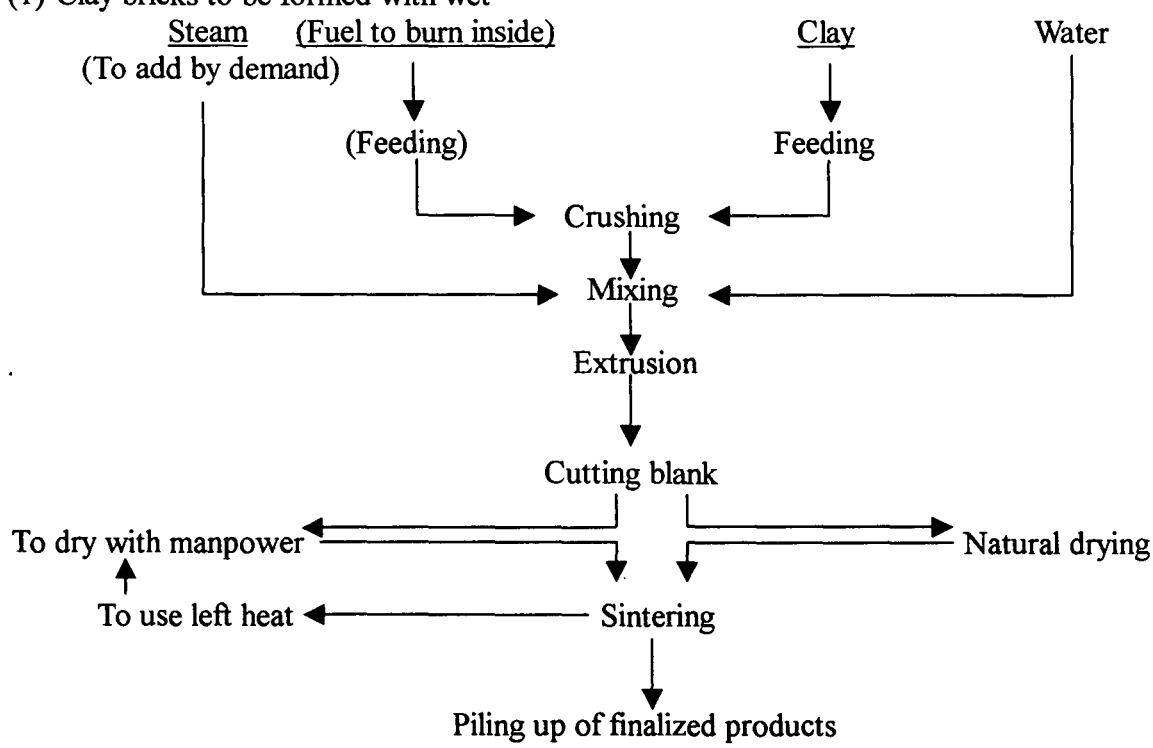
Cycle kiln sintering is adopted commonly the most in China at present. And tunnel kiln technology is adopted by just a few enterprises. In the 305 enterprises surveyed this time, 260 of them adopt cycle kiln to sinter brick, being about 86% and 42 of them utilize the tunnel kiln, being 14% or so.

Analyzing the information from the whole country by now, the cycle kilns with types from 18~54 doors has small cycle kilns taken majority while the kilns with doors 20~32 taken as the most. Generally, the tunnel kilns have length of 100~150m or so, with section 2.5m or so in width and arch top structure, which account for the majority. Flattop made of heat-resistant concrete is adopted for the tunnel kiln with large section and the kilns are of 4.9m, 6m and 9m in length. The flat top is convenient for mechanical operation. Except the few tunnel kilns adopting machine to load the kiln, at present to feed coal, load and unload kiln with manpower is basically adopted by the cycle kiln and tunnel kiln commonly used in China at present. And only are there some enterprises that adopt automatic coal feeding and the device to spray fly ash, automatic controlling of kiln temperature and the recording system.

Brick-making technology has approximately the several kinds as the following:

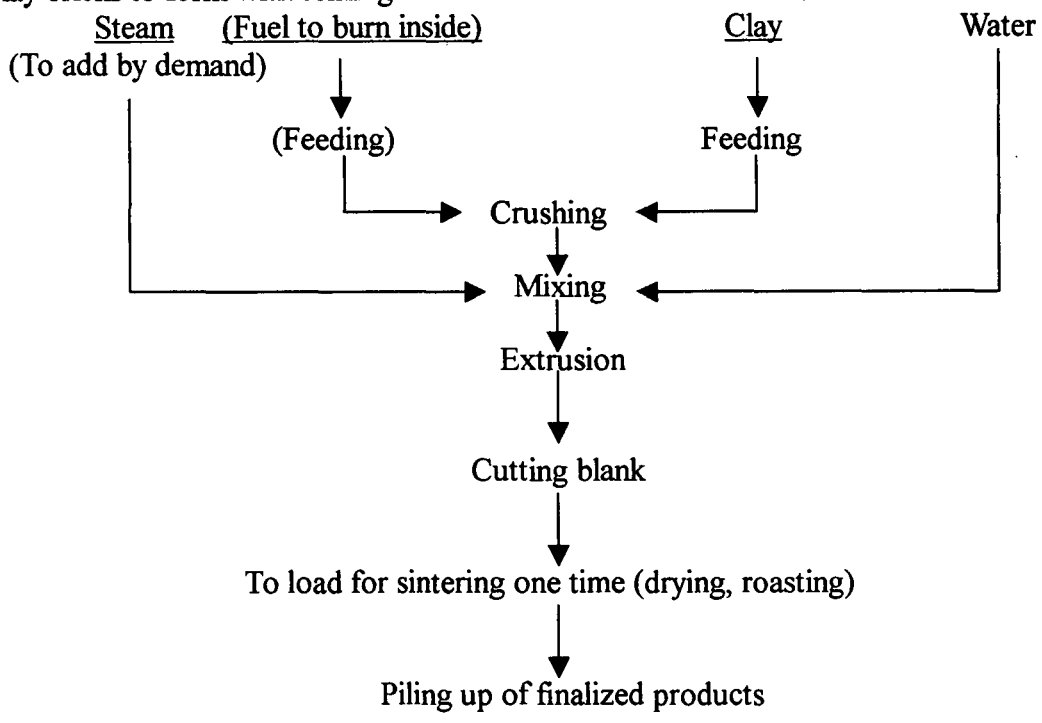
1. Clay bricks

(1) Clay bricks to be formed with wet



Notes: 1. If the fuel is block, crashing will be done before feeding.
2. Rolls for crashing.

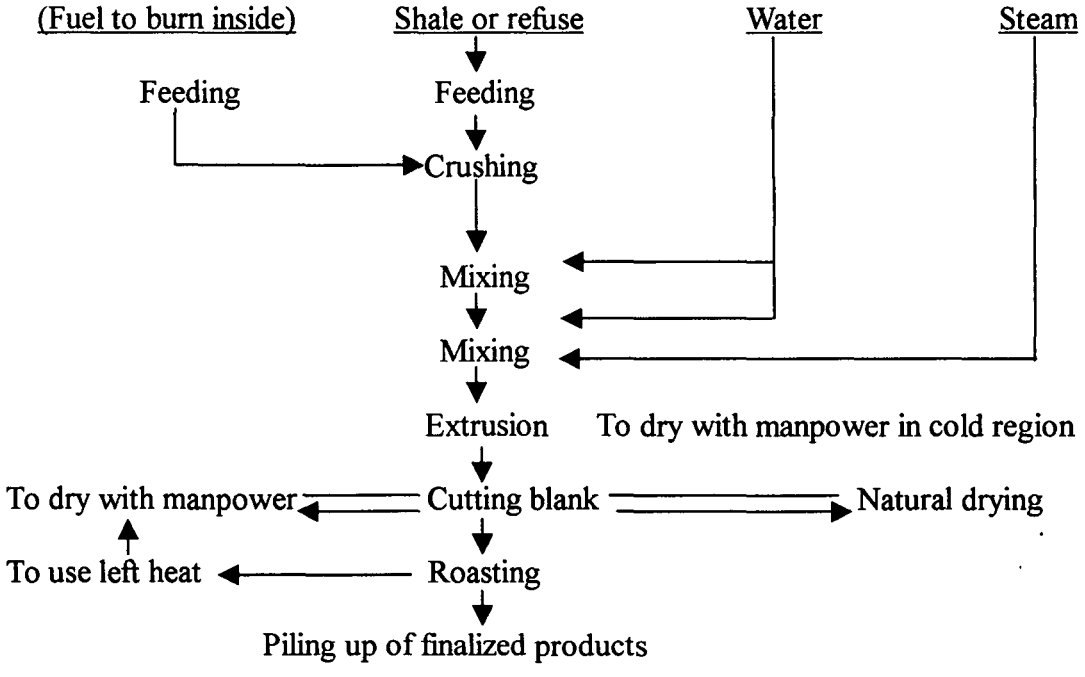
(2) Clay bricks to form with semirigid



2. Shale bricks, refuses bricks

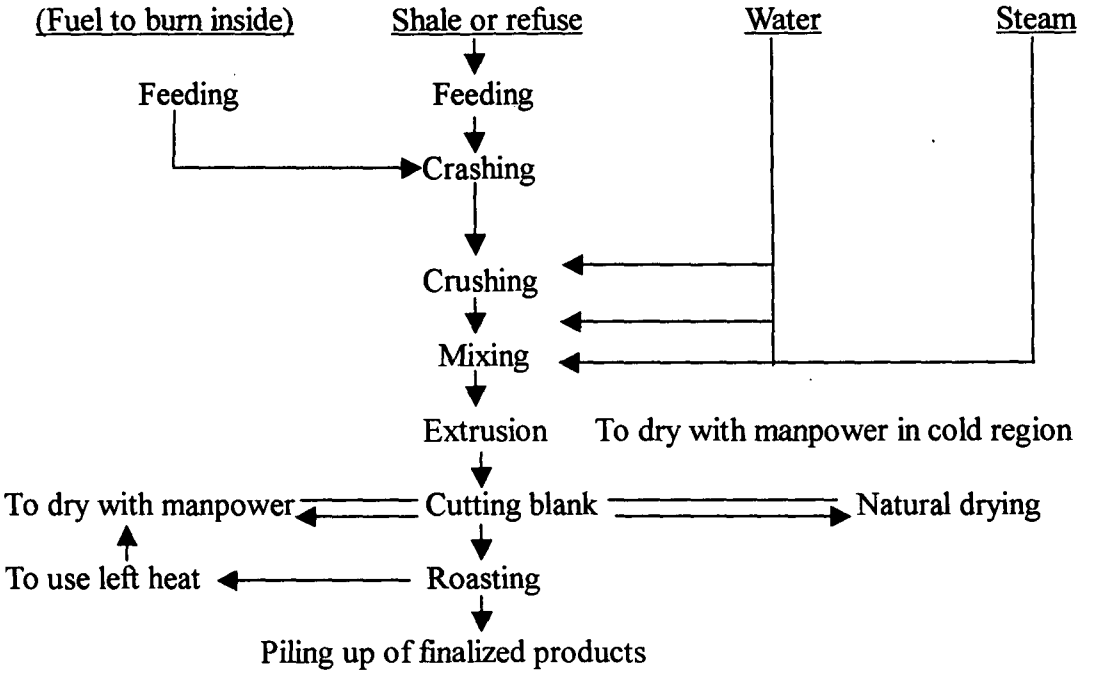
1) To form in wet

(1) Shale raw material, refuses



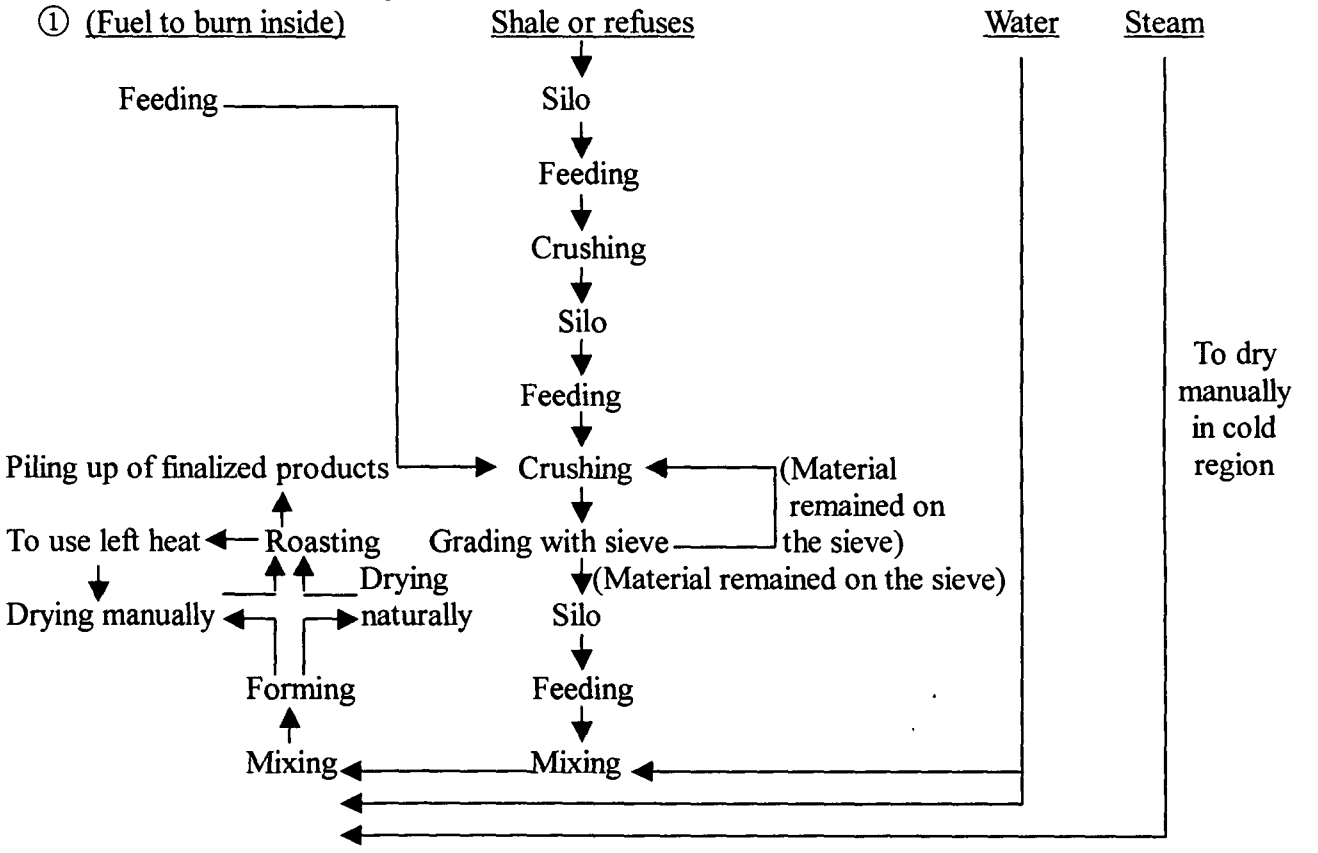
Notes: The technological process on brick making with soft shale raw material is basically the same with that of clay bricks.

(2) Soft quality intermingled with small quantity of rigidness or semirigid raw material

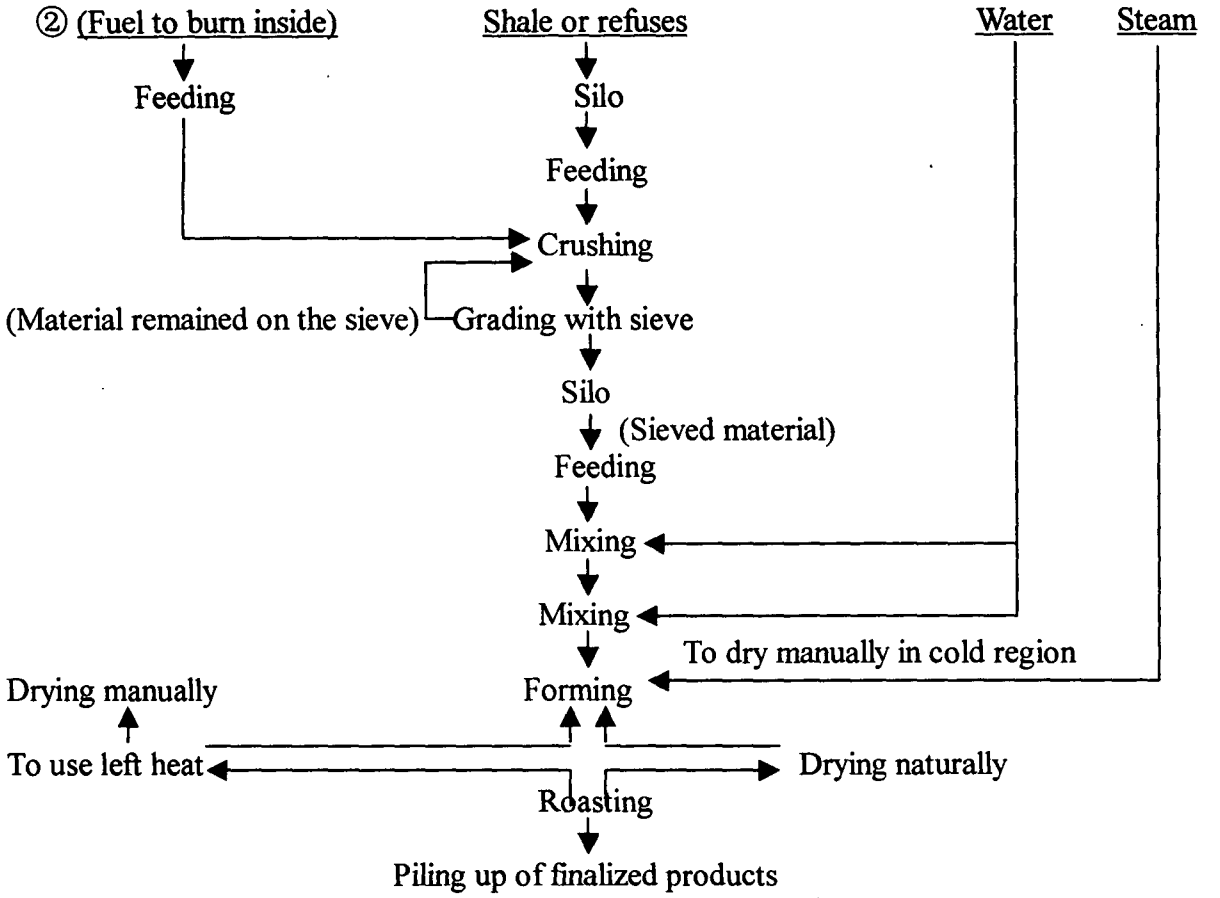


Notes: The slot form rolls are generally used for the first crashing and if the water content is not more than 12%, the crusher with double tooth rolls may be used. The second crashing is better to adopt wet rolling.

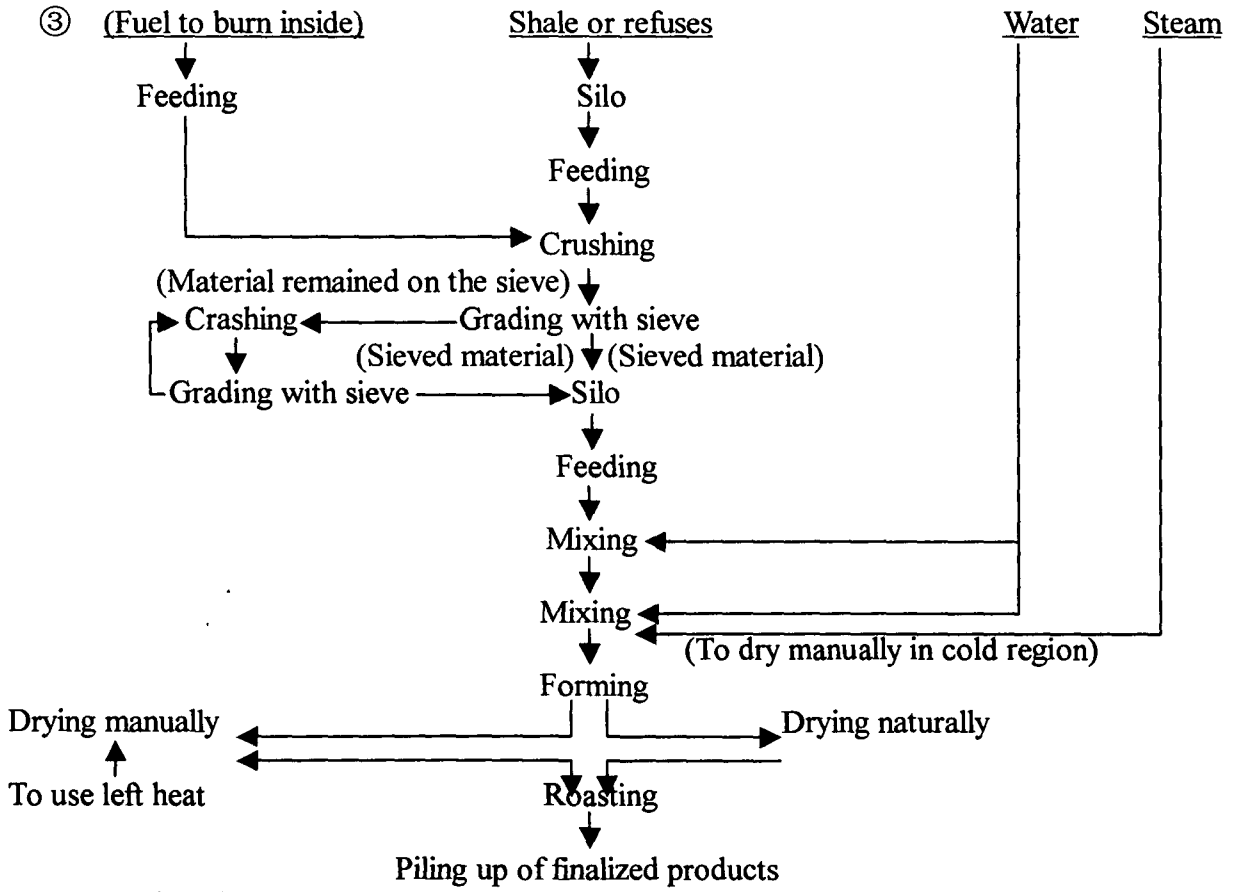
2) To form with medium-rigid or rigid material



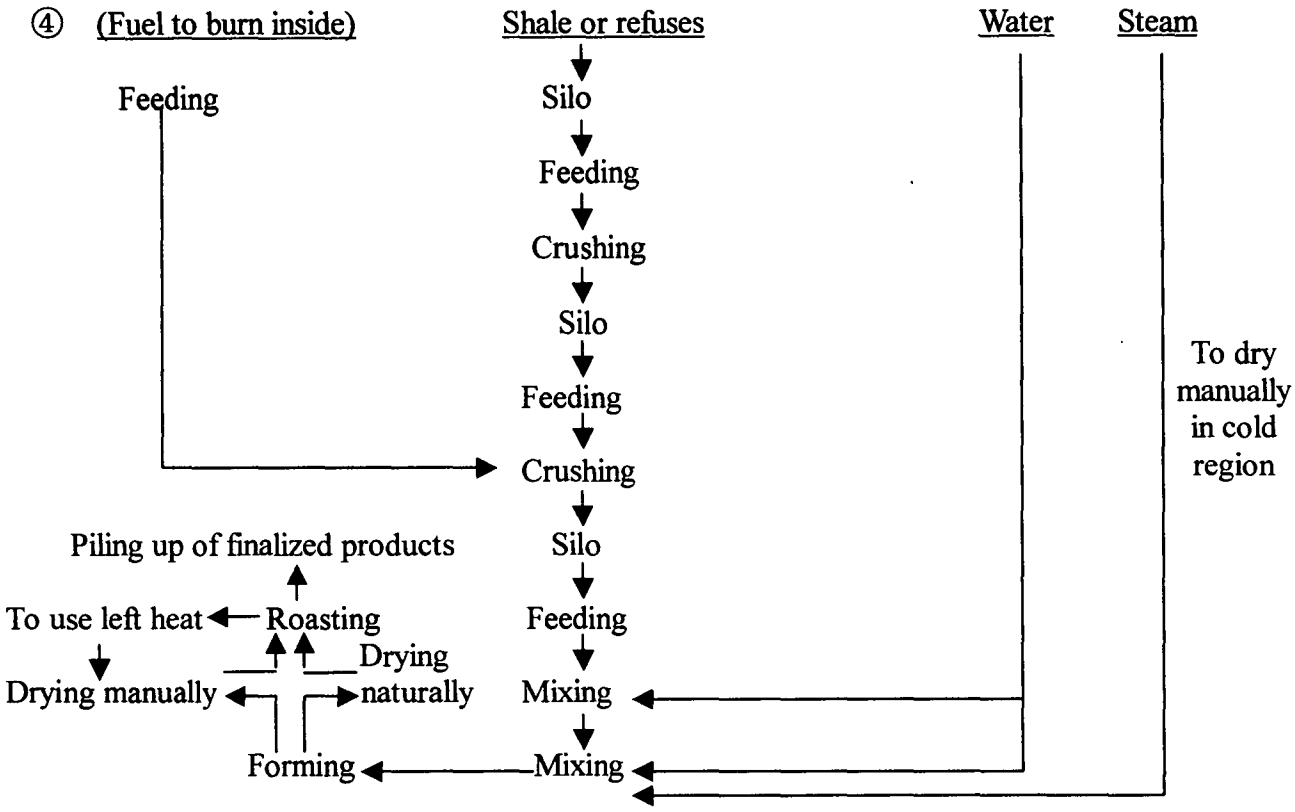
Notes: The technological process is more adopted by now and for common crashing, jaw crusher or double-geared roller crusher may be used, crashing to be done with cage disintegrator.



Notes: Adopting this process, hammer breaker ϕ1300×1600 may be used.



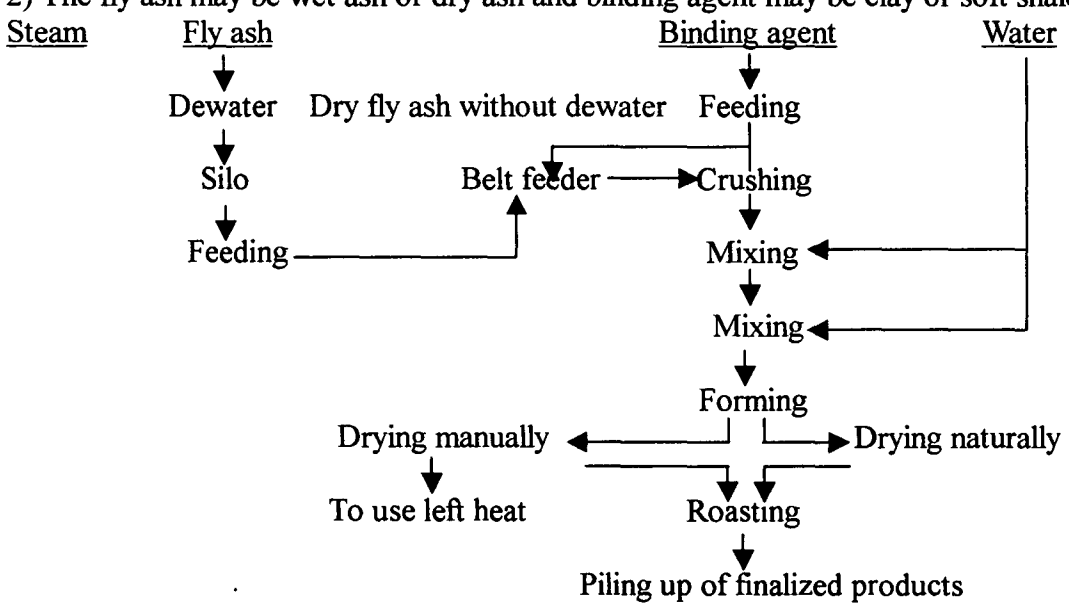
Notes: Adopting this process, impact breaker may be used and crashing to be done with cage disintegrator.



Notes: Adopting this process, air classification hammer breaker may be used.

Notes: When using refuses as raw material, the fuel to be mixed should be appropriately added according to caloric value of refuses.

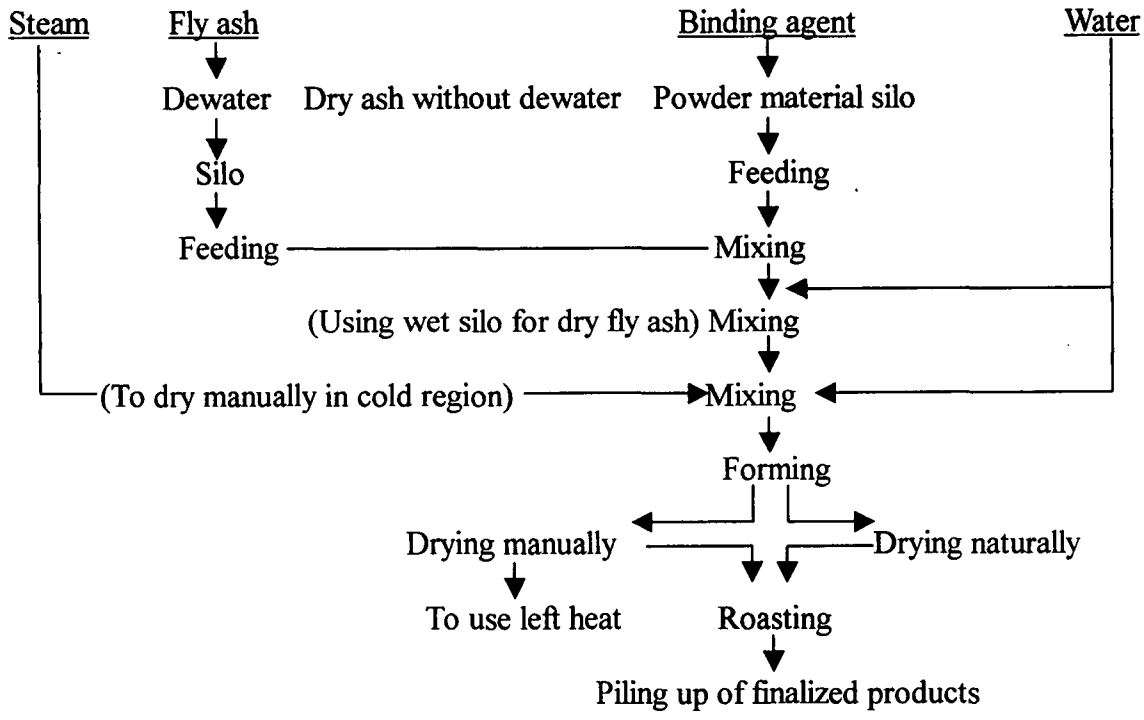
2) The fly ash may be wet ash or dry ash and binding agent may be clay or soft shale.



Notes: 1. For dry fly ash, the second mixing may be changed into wet silo.

2. If binding agent such as soft shale is intermingled with a little solid block, wet rolling may be used for the second mixing.

3. When the vacuum brick press with double level is used for forming, the third mixing may be cancelled.



Notes: 1. Processing of the raw material binding agent is seen in the relating section of the basic technological process on shale and gangue bricks.
2. Before the first mixing, it may be cancelled if the two materials have reached the requirements on dry material mixing in conveying process (such as adopting screw conveyer and hoisting shaft).
3. When the vacuum brick press with double level is used for forming, the third mixing may be cancelled.

III. Specifications and Quality on China's Brick-making Industry

For China's brick-making industry, there are 17 specifications, which basically include the products of wall materials and building blocks at present, seeing it with detail in table 5. Most enterprises are going without raw material storage facilities and the raw materials will be put into use upon mining because of not having aging facilities. Naturally drying is adopted by most brick-making enterprises. The product roasting is basically done by the cycle kiln (wet difference being at least tens of degree or hundreds of degree) controlled with manual experience prevailing before 1960s. Because of difference of technological and production management, the quality has much difference between them. The bricks are very coarse and the wall constructed with it has to have the ugly wall surface covered. The inner water absorption is generally between 20~30% and strength between 10MPa~20MPa. The raw material is poorly treated and as long as harmful impurities happened to be contained in the raw material, lime crack must be happening. Frost floating above medium level is much occurred in the trade. And freezing resistance can only be able to undergo 15 times of cycling tests. The durability and use property are also having much difference. The situation also includes the non-sintering products. The variety of wall is basically the singleness product with right angle hexahedron.

Table 5 Applicable Criterion of Wall Material

No.	Criterion No.	Criterion title	Classification
1	GB5101-2003	Sintered common bricks (including shale bricks)	Brick verity
2	GB13544-2000	Sintered porous bricks	
3	JC/T422-1991 (1996)	Non-sintered common clay bricks	
4	JC525-1993	Slag bricks	
5	GB11945-1999	Steaming pressed lime-sand bricks	
6	JC239-1991 (1996)	Fly ash bricks	
7	JC/T637-1996	Steaming pressed hollow lime-sand bricks	
8	GB13545-2003	Sintered hollow bricks	

No.	Criterion No.	Criterion title	Classification
9	GB13545-2003	Sintered hollow building blocks	Building blocks
10	GB8239-1997	Small hollow building blocks of common concrete	
11	JC/T641-1996	Concrete building blocks of decoration	
12	GB11968-1997	Steaming with air pressed of concrete building blocks	
13	GB/T15229-2002	Hollow building blocks of light aggregate concrete	
14	JC/T698-1998	Plaster building blocks	
15	JC238-1991 (1996)	Fly ash building blocks	
16	JC862-2000	Small hollow building blocks of fly ash	
17	JC716-1986 (1996)	Medium hollow building blocks	

IV. Equipment Manufacture of China's Brick-making Industry

During the period before 1950s, Chinese brick-making industry was developing slowly, not to mention mechanical equipment. For raw material treatment, making mud with manpower and cattle would be enough. Adobe was shaped with wood model by manpower. The dropping behind equipment was not only going with low productivity but also with big labor intensity and poor product quality. After liberation, the brick-making industry had quickened its development with mechanical extent raised. In the 1950s, many brick-making plants had adopted machine for forming, to cut bar with manpower, to use mechanical equipment for processing of raw material, beginning to use rolls and mixer, etc. At the beginning of 1960s, the mechanical production line had primarily formed. But to load blank with manpower and roasting in cycle kiln had still accounted for the most. For the whole production line, heavy labor has still taken quite a lot proportion.

In 1970s, brick-making equipment had been quickly developing. Some plants had used setting machine to replace heavy handwork. And especially, since adopting tunnel-roasting technology, labor intensity has greatly reduced with working condition enhanced. New advanced equipment such as stone eliminating machine, mixing and purifying machine, kneader, etc. has successively come into existing. With these equipments of processing, the treating result of the raw material has been enhanced. The two-stage de-airing extruder replaced the non-de-airing extruder. 1980s was the leaping years for Chinese brick-making equipment. The Morando advanced production line was introduced to Dongguan, Guangdong, China. The Linong brick-making plant had sent personnel to see about abroad and with advanced technology referenced, a demonstration production line of hollow brick was newly built. The advanced technology, equipment introduced into China has accelerated the renewing of Chinese brick-making equipment. Fine crashing rolls, filtering rolls, two-stage de-airing extruder with type 500, two-stage de-airing extruder with type 600, etc. had successively developed successfully. By now, the contingent on research, design, and manufacture of brick-making equipment has primarily formed. The manufacturers have set up all over China, able to provide the whole industry with all the equipment on brick-making, basically meeting the requirements on technology and production.

In 1970s, to promote the experience on production and use of the equipment, the personnel of Chinese brick-making industry had researched and probed into the parameters on the brick-making equipment and many good articles not only having theoretical level but also practice experience were written by the enterprises such as Linong brick-making plant, Changsha construction material plant, and Lanzhou Shajingyi brick-making plant, etc. At the same time, the personnel of the No had translated quite a lot of information. Design room under Xibei Construction Design Institute of China, and Xi'an Tile Institute, etc. also having the new type processing equipment of raw material processing, and forming equipment deeply studied.

At the end of 1980s and the beginning of 1990s, especially under the direction of wall reformation policy, an entire production line for gangue-standardized hollow bricks with capacity of 60 million pieces had been introduced from the Xifang Company of France to China by Shuangyashan city, Heilongjiang province. And with it begun, the advanced equipment on brick-making had developed in China, which pushed forward the equipment development going on with a florescence. The large-scale brick press with type JZK70/70-25 (capacity being

25,000~30,600 pieces per hour) and JZK75Y-35 and its supporting devices had been manufactured, with the various types of brick press and its supporting devices with type JZK60/60, 50/45 developed according to the requirements of Chinese brick-making industry. The equipment such as LNP serial edge runner wet mill, devices for cutting, loading and conveying and automatic upper and lower unit system had been successfully developed and tested by production practice, which filled the blank for China with higher level. Going along with it, the Changle, Shandong had introduced the whole set technology and the key equipment from the KWS Company of Germany and in line with the product standard of Germany the de-airing brick press and it supporting devices was developed, which has already put into the market. Of 30~40 equipment manufacturers, one enterprise has reached annual sale more than 100million yuan and about 5~6 enterprises have reached annual sale between 20~40 million yuan. The rest manufacturers has got annual sale below 20million yuan. And five enterprises have passed international quality attestation ISO 9001. 30% of the equipment manufacturers, owned raw material lab., proof test brick-making plant, development institute of product design and study with computer, are stronger in developing ability. On system and machinery reformation about 70% of the enterprises have realized stock reformation or going on with it. Others are private enterprises.

What the work stated above has provided the Chinese brick-making industry with more advanced equipment, advancing the brick-making industry of China, with production scale of brick-making industry quickly enlarged, product quality improved, product variety and specifications raised quickly. By now, China has got higher level on hollow brick production, raw material processing equipment, two stage de-airing extruder, and the equipment for loading, cutting, and conveying, not only answering the domestic market but also supplying the international market.

V. Energy Conservation and GHG Emissions Reduction of Chinese Brick-making Industry

Actually, reducing greenhouse gases such as carbon dioxide, etc. and energy-conservation of Chinese brick-making industry had begun at the end of 1960s. And for this, China, using new information on energy-conservation of construction from abroad, had firstly done the innovation of wall material, which broke through the solid brick tradition on production and application going on for several thousand years in China, helping the production and application of porous brick and hollow brick products going for large scope come into exist, with some energy and clay resources saved, having reduced the carbon dioxide exhaust to some extent with sorry. The use of porous brick and hollow brick is only limited in the regions such as Nanning, Shanghai, etc., with the porous rate only reached 15%. The results on reducing emissions are very limited. In the medium-stage of 1980s, China had done her secondary innovation on wall materials, which had done a lot of proof test and validation on the Chinese construction frame structure for which hollow products were filled. This had not only got the production and application data and experience on producing in batch the hollow products with porous rate over 40% but also helped the regions such as Xi'an and Shanghai gradually to begin their production and application on the hollow products by 40% over. But it was sorry that the innovation had not yet promoted in large scope, being only a scientific research and a try in some regions.

At the beginning of 1990s, China had launched the third innovation on wall material, for which Chinese government used the systematic engineering from policy to application. With more than ten years' hard work, the wall material series of China had turned, from the state then and there that the hollow products only accounted 1% less of the total volume, into the system that was complemented by the new wall materials such as brick, plate, block, and chemical construction materials, etc, with total volume up to 33%. The clay solid products had reduced to 530 billion pieces of standardized bricks from the original 810billion pieces of inverted standard bricks. And porous rate had increased to 25~60% from the original 15~40%, with average porous rate up to 30% over. At present, for the clay and coal consumption from the annually saved 84 billion standardized bricks, they will annually save standard coal up to 11million tons with 7.843 million

tons of carbon dioxide and 28.6 thousand tons of sulfur dioxide prevented from discharging in line with the statistics that 1.3 ton of standard coal will be consumed from producing ten thousand pieces of standardized bricks with the Chinese master production kiln—cycle kiln whose average heat consumption is 1,000 calorie or so for a brick. According to the statistics by some relating departments, by now, 60 million tons of standard coal has already been saved by the brick-making industry of China, with 43 million tons of carbon dioxide and 150.6 thousand tons of sulfur dioxide prevented from discharging. And if with construction energy-conservation added, it is anticipated that 10 million tons over of carbon dioxide and 30 thousand tons over of sulfur dioxide will be prevented from discharging annually. Totally by now, it has estimated that 50 million tons over of carbon dioxide and 170 thousand tons over of sulfur dioxide were prevented from discharging.

Yet it is sorry that by now, the brick-making industry in China has still been going without macroscopic readjustment and control. The industry has not yet been going with restructuring and producing that takes into consideration the environmental protection, energy-saving, and having greenhouse gases prevented from discharging. At present, energy consumption from sintered bricks by tunnel kiln is estimated as 581~2,590 calorie/piece (inverted to common bricks) and by cycle kiln estimated as 1,000 calorie/piece (inverted to common bricks). Most of the enterprises haven't carried out the energy conservation and fume purification. In 305 better enterprises to be surveyed this time, the ratio of enterprises adopting roasting and heating utilization in drying room is only 32%. The ratio of enterprises with electric power increasing capacity compensation equipment is about 28%. The kiln with thermal insulation measures only accounts for 15%. Those with energy conservation fan to exhaust fume and ventilate only take 28%. The hollow products and waste integrative utilization such as slag mixing with inner fuel, etc. should be respectively 79% and 58% in order to reduce the cost only. But, for the industry energy conservation, great potential and demand still exist. In the surveyed enterprises, the power of the de-airing shaping brick machine is generally greater, having much potential to conserve energy and reduce consumption. Via using the capacity increasing and compensation device, 15%-20% electricity can be saved. The natural drying is changed into manpower drying room. Except recovering a part of heat, the land use area can be also greatly reduced. It can do a lot of good for improving the ecologic environment, too. Via adopting heat preservation measures and temperature monitoring and control system, the cycle kiln can increase the heat utilization effect. About 20% of the enterprises surveyed can use the kiln remained heat for manpower drying. Less than 15% enterprises have adopted the dust removal device and only one enterprise utilizes the fume purification equipment. This shows that the labor protection and environmental protection consciousness in the brick-making industry has been strengthened. As to 90 thousand production enterprises in the whole industry, the energy conservation and GHG emission reduction is quite huge. The energy-conserving products of bricks and tiles have come into exist by the requirements on saving farmland and construction energy conservation. Being small in quantity, the variety of such products is difficult to help restructuring the entire structure of brick-making industry of China. Also, it is a gap for brick-making industry of China to be equipped with facilities having carbon dioxide prevented from discharging and air pollution. And only the production line with annual capacity of 80 million pieces refuses hollow bricks. And the Xi'an Research and Design Institute of Wall & Roof Material designed the production line for Beijing Shiquan Co. Ltd. of Wall Materials. With the production line put into production, the situation lacking of the facilities reducing air pollution and preventing harmful gases from discharging will be greatly overcome. By now, many metropolis, especially large and medium scale cities, their governments and people have already focused on environmental protection and many factories with chimney have already moved out of the cities or been reformed. The brick-making industry is also facing the same problems such as environmental protection, saving farm land, reducing pollution, energy utilization and recycle, resources utilization and recycle, which has already been the strategic stress in the industry's sustainable development. The key advantage for the Chinese brick-making industry will be located at the energy-saving, farm land protection, utilization of industrial slag and construction slag, energy utilization and recycle and reducing and preventing the harmful gases such as carbon dioxide, etc. from discharging, etc.

Although China has made a lot of hard work with some achievements got on energy-saving and preventing greenhouse gases such as from discharging and industries are equipped with the facilities reducing and preventing harmful gases from discharging, the annually consuming of standard coal 0.7 billion tons from producing 530 billion pieces of clay solid bricks is still going on. In the surveyed 305 enterprises, the average 10,000 pieces of brick can consume 1-ton coal or so. In general, the industry can annually consume about 50 million tons standard coal. The emission of carbon dioxide is 35.65 million ton and that of sulfur dioxide 130,000 tons. At present, the total amount of various energy conservation and emission reduction work each year merely reaches 1/5 of annual discharge. Almost all the enterprises have no the emission reduction facilities. As to the brick-making industry in China, the GHG emission reduction work for carbon dioxide, etc. is still too heavy and the emission is also difficult.

VI. Aspects of Research, Design, Association, Detection, Magazine and Information, etc. in Chinese Brick-making Industry

The aspects on Chinese brick-making industry such as research, design, association, detection, magazine and information, etc. had begun from 1960s and by 1970s~1980s the contingent on scientific research and design of brick-making industry had primarily formed.

Xi'an Brick and Tile Institute and Xibei Designing Institute of Chinese Architecture have already been listed as Scientific Research Center and Design Center of Chinese Bricks and Tiles Industry respectively. To sum up and promote production experience, train employee and meeting the requirements from the various places on newly setting up, construction reformation and construction enlargement, quite a lot of books on bricks and tiles have publicly published. The important contributions were made by the books such as "*Bricks and Tiles Technology*" compiled by the Industrial Administration Bureau of Nonmetal Mine and Local Material, "*Theory and Practice on Speedy Sintering Bricks with Cycle Kiln*" compiled by Wang Qibiao, etc., "*Technology on Clay Bricks and Tiles*" by the bricks and tiles institute of Shaanxi, China, "*Plant Technology Design on Sintering Bricks and Tiles*" by the Xibei Building Design Institute, etc.

During the 1990s, Xi'an Wall Material Research and Design Academy of Chinese Construction Materials (the former Xi'an Bricks and Tiles Institute) had gradually become the national core institute of scientific research and design for the Chinese brick-making industry. Xi'an Wall Material Research and Design Academy of Chinese Construction Materials is a professional design institute under the Group Corporation of Chinese Construction Material. Forty years since setting up, the institute has been bending herself on researching and development of new type wall materials such as sintering products from clay, porous bricks, hollow bricks, engineering design, works contracting and works supervision. The institute has successively contracted the research and design question of national key brainstorm project of construction materials trade, hosting scientific research and technical development in comprehensive utilization of shale, clay, refuses and fly ash, having successfully set up more than 200 brick and tile production lines of large and medium scale with annual capacity 10 million ~ 230 million pieces for the manufacturers of Mongolia, Russia, Cambodia, Malaysia and Nepal, etc. and more than twenty regions and provinces and cities of China. The institute has got the achievements recognized by the trade publicly in comprehensive utilization of industrial slag fully using refuses and fly ash for sintering hollow bricks, having won national result awards of scientific research and design from province and ministry.

Xi'an Wall Materials Research and Design Institute of Chinese Construction Materials is by now the only professional scientific research and design institute directly under the former National Construction Material Bureau, professionally going in for research and design of sintering material for wall and roof, with national A grade qualification on engineering design, chief engineering contracting and engineering supervision and consulting possessed.

The national professional organizations such as: Development Center Of Chinese Wall and Roof Materials by UN, Detection Center Of National Construction Material Industry Of Quality Supervision On Wall And Roof Materials and The Attached National Recognized Lab., Testing

Center Of Brick And Tile Heat Energy Of National Construction Material Industry, National Sci & Tech Information Network of Wall Material, "*Bricks and Tiles*" Magazine, and the Web Site of Chinese Wall Materials have all set up within Xi'an Wall Materials Research and Design Institute of Chinese Construction Materials.

There have also been scientific research academy and institute of Chinese brick-making industry, which are: Xibei Design Research Academy of Chinese building, Suzhou Institute of Concrete Products, Xianyang Ceramic Research and Design Institute of Chinese Construction Materials, Construction Material Science Academy of China, Guizhou Research and Design Academy of Construction Material Science, and Chongqing Construction Design Research Academy, etc.

In the provinces and cities there have been detection and testing departments of Chinese brick-making industry. The institution at national level—the national detection and testing center of quality supervision on wall and roof materials of construction materials, the former quality detection center of brick and tile products under National Construction Material Bureau, had set up in 1985 in the yard of Xi'an wall material research and design institute of Chinese construction materials, later in 2001 having changed into Inspection And Testing Center Of Quality Supervision On Wall And Roof Materials Of National Construction Material Industry which have passed the attestation by the Committee of National Attestation Laboratory (CANL) and national measurement attestation and national organization attestation. With 20 years' hard work, the Center has become the only detection center at national level of quality supervision on the materials such as bricks for square and road, all the wall materials including various roof tiles and wallboard, hollow building blocks, hollow bricks, and supporting bricks and, also the comprehensive detection institution including analysis and detection center on radioactivity and physical and chemical performance of the raw materials at different grades of construction trade and pyrology detection center of kiln equipment.

The publication "*Bricks and Tiles*", whose newsroom is also located within the yard of Xi'an Wall Materials Research and Design Institute of Chinese Construction Materials, is a standard technical publication of Chinese wall and roof material trade, distributing to the public home and abroad. It is a core periodical of construction material series, which, with progress and practicality of content, the instant, universality and reliability of the information, has been providing the enterprises with scientific basis, excluding the difficulty and anxiety for the enterprises. To spur the innovation of wall materials and energy-saving of construction, to comprehensive utilize industrial slag, protect ecological environment and exploit the technical range of Chinese wall and roof materials, the publication has been doing positive contribution in policy guide, scientific research, topic probing, project establishment, technical service, report on the latest technique home and abroad, the internet web site, etc. With 32 years' loyal service, the publication "*Bricks and Tiles*" are deeply upheld and loved by the readers home and abroad, whose main content are: policy direction, topic study, technical experience, hollow bricks, building blocks, wallboard, colored tiles and road bricks, specifications and supervision with detection, construction application, reader's mill box, information window, etc, to be followed by more than ten of other technical publications such as "*Wall Material and Energy-Conservation of Construction*", "*Construction Building Blocks and Building to be Constructed with Building Blocks*", etc.

On information, since set up in 1976, the information network of national wall materials, under the direction of the upper authority in charge and supported by the technical advantage of the Xi'an Wall Materials Research and Design Institute of Chinese Construction Materials, has actively organized many enterprises to exchange technical information in different ways. With 27 years since setting up, the network has successively organized various technical exchanging more than one hundred, with network publications more than 240 published, having published various subject technical information more than ten kinds, having provided the enterprises with various technical service and helped the enterprises resolve technical difficulty more than one hundred times, being depended on and welcomed by the enterprises. In Guizhou and Sichuan there are more than ten of information networks.

The association of Chinese brick and tile industry has already become the only professional

association at national level in China. Approved by the Civil Administration Ministry, the association had set up in Jun. 5, 1996, being the only juridical association at national level of national brick and tile industry. It has now got 3,783 of associators (including 408 associators directly under it and 36 of group members), distributing in cities and countryside all over China to have formed a much bigger organic whole consisting of the brick and tile enterprises above county level, of township, of the departments such as construction materials, public security and judicature, coal, construction and power, etc. and some units of scientific research, design, universities and colleges, etc. having broad representative. The association council consist of 156 directors with managing directors of 45, vice association head of 13, the current association head named Yang Zhiyuan and secretary-general Xu Yanming. The professional scope of the association is: trade management, information exchange, professional training, and international cooperation, consulting service. The other relating associations are: silicate association of China, building industry association of China, building block association of China and other more than tens of various regional associations.

The wall material information network of China is a professional information web site of wall material industry, setting up with joint investment by the "*Brick and Tile*" magazine house, the Sci & Tech information network of national wall material, being the first professional web site of wall and roof material trade. The "*Information Network of Chinese Wall Material*", supported by the extensive and all-sided information approaches provided by the "*Brick and Tile*", taking as the basis the expert group of technical service of national wall material information network, has provided the broad wall material enterprises with trade information, enterprise propaganda and technical service. With trade express news, the network has offered the information such as trade activity, product technology, subject report, wall material abroad, etc. and with exhibition hall, the network has offered nearly twenty thousand brick and tile enterprises name list and the equipment on brick and tile, light board, building block, colored cement, road bricks and, the product data base of auxiliary device. With standard regulations, the network has offered the existing trade policy of wall material, statute, national standard of wall material, trade standard issued by the country and the authority in charge of construction material trade. With scientific research and technology, the network has offered the technical service such as product development, production technology, and expert consulting, etc. and with experience forum the network has provided the professional personnel of wall material industry with the platform to do dynamic exchange and, finally, with data center, the network has offered downloading service of professional data and technical CD, etc.

Still there are some other web sites with considerable scale such as Chief Information Network of Chinese Construction Material, National Construction Material Network, Construction Material Network of China, Chief Network of Chinese Construction Material, Construction Material of PRC, and Sifang Construction Material, etc.

VII. Future Development of Chinese Brick-making Industry

It has anticipated that in the future period the Chinese brick-making industry will advance with stress in the following aspects:

1. With enterprises restructured into group, have the "Combined Fleet" organized for Chinese brick-making industry.·

Scatted all over the country, the Chinese brick-making industry has been at low level with small scale, disheveled, not disciplined, low efficiency, which is a fact without argument. The trade's present state is quite similar to that of the west Europe countries in the past. After the world second war, from 1950 to 1960 the countries of the west Europe had found brick and tile plants and construction sites everywhere. And in the medium period of 1960s and at the beginning of 1970s, they had their wall material industry restructured and reformed. For example, Germany had more than 2,000 small brick-making plants combined into the existing 250, some of which have become transnational corporation owning more than ten or tens of brick-making plants, making brick and tile trade to be the industry with huge sum assets. And this may the so-called the transition from

"cannot but" to "freedom", which has told us that our production and application of brick and tile products should not be going with the traditional management mode, small, extensive management with low efficiency. The "combined fleet" must be structured for us, which in the future will provide the Chinese brick-making industry with modernized management system. And the modern enterprise system will not be going without scientific and professional management for production process, which means that what we need for directing production is Sci & Tech resort, not experience instead. Only in this way will the grade of brick and tile be effectively raised and with new products successfully developed, the Chinese brick-making industry will have bigger energy.

2. Have the comprehensive utilization of industrial slag and builders rubbish from towns and cities further enlarged

To protect national land resources and the limited farmland is the basic national policy for a long term. The situation that the brick-making industry is going with farmland destroyed, energy highly consumed, poor quality of products and, low grade should not be going on. But what we cannot ward is that the modern building development, especially the dwelling houses shall not be going without sintered multi-function products. And for this, the best settling approach is to further enlarge the comprehensive utilization of industrial slag and builders rubbish from towns and cities, especially to have strengthened the comprehensive utilization of refuses, fly ash, builders rubbish from towns and cities, silt from sewage treatment and other industrial waste.

3. To focus on raising the requirements on sustainable development in utilization and recycle of various kinds of resources from environmental protection and energy conservation

With the requirements on global environment protection and sustainable development raised, environmental protection, farm land protection, utilization and recycle of energy resources and saving various energy resources have become the important factors absolutely necessary for wall material development of every countries in the world. And so, the questions such as smoke purifying of brick-making industry, utilization of left heat, noise pollution, etc. will be first stress to pay attention to by the industry. And especially, the greenhouse gases including carbon dioxide to be prevented from discharging or reduced shall be the focus problem to be paid attention to by Chinese brick-making industry. The 'today' of the advanced nations shall be our 'tomorrow'.

4. Hi-Tech to equip production

With requirements of construction energy conservation, ecological and environmental protection, health dwelling houses, etc, the products of brick and tile are developing toward multi-function. And the continuing advancement of modern industry, new technique and new materials, especially the speedy development of automatic controlling by computer has greatly impacted the traditional trade of brick-making, which has spurred the trade to continually change the existing production way, resulting in great progress. With Hi-Tech to equip the equipment and production process such as machinery design and manufacture, high degree automatic controlling of hollow brick production line, the equipment of drying, roasting, raw material processing, smoke purifying, reduction of carbon dioxide discharge, etc. will be the striking characteristics of the industry in the future.

5. To stress developing the six kinds of energy conservation products in favor of national sustainable development

"Construction energy conservation" or "to raise the energy utilization rate in construction" has already become the choice in common by the global construction circle, a world tide not to blocked off and the most comprehensive and effective approach having greenhouse gases to be reduced or prevented from discharging. In development of modernization and industrialization, happy and gay are being created for people along with the negative effect increasing. Some so-called "economic development" has actually been destroying the global on which we are living. Nowadays, what many actions we are doing are leaving a legacy of trouble to our descendent consciously or non-consciously. With huge quantity used, the energy used by construction has done a big damage to environment. Many men of sight in the world have understood that construction energy conservation has a lot to do with retrieving the global and human being. With economic development, continual improvement of people's living standard, heating scope of buildings to increase with the passing day, air conditioning buildings to quickly increase, the increase of

construction energy consumption shall be much bigger than that of energy production, especially the demand for high quality energy resources such as electrical power, natural gas, terrestrial heat, are terribly increased. From this it has shown that letting the buildings with high energy consumption develop without limit will be hindering the national economy developing. And so, to develop national economy with sustainable, healthy and speedy way, construction energy conservation must be well done. To have requirements on construction energy conservation met with construction materials especially the brick products, the products by the trade must be developed in this direction.

① The sintered hollow building block with high performance of heat insulation is to be used for the framework structure or for the maintenance architecture of the outside wall. In 2010, the heat conduction system of the building blocks will reach 0.20W/mk and for single brick outside wall (thickness being 300~365mm), the requirements for the outside wall material may be reached when the energy conservation is reached by 65%. And in 2020, it will reach 0.11W/m·k and with single wall thickness being 300~365mm, energy conservation by 75% for outside wall material may be reached. And the products of this kind will be the stress of the trade development.

② For the main wall structure, the porous brick for the dry wall having decoration function will be used for the outside wall while the common porous brick for common main wall will be used for inside wall. And within the wall will be set heat insulation or air layer, which are called compound outside wall. And the outside wall like this, the thickness of the inside heat insulation may be increased or reduced in line with the different requirements from different regions. With this done, the requirement to reach energy conservation by 75% for the outside wall may be met further. And also, this kind of products should either be the mainstay products in the future development of the industry.

③ The construction materials such as floor brick with big size and high porous rate, pre-cast hollow brick wallboard, large-scale ribbon board brick, partition brick should be development direction of the industry because they are especially seasoned with the requirements for dwelling houses construction and modernized construction with energy conservation guaranteed and met.

So, the production and application of the above products shall inevitably become the stress and direction of the industry in the future.

To sum up, the Chinese brick-making industry shall be developed into the new system and new mode reinforcing each other, perfecting each other to meet the requirements on construction for sustainable development. At the same time, GHG emissions reduction of Chinese brick-making industry will enjoy a new era along with the development of Chinese economy. Yet, the work to do is arduous for the GHG emissions reduction in Chinese brick-making industry is only 1/5 of the total discharge amount in a year. The industry energy conservation has still great potential and demand. For the enterprises we have surveyed, the de-airing shaping brick-making machine has more power, existing much potential for energy conservation and reduction fuel consumption. Via using the capacity increasing & compensation device, 15%~20% electric power ca be saved. The natural dry is changed into manpower drying room. In addition to recover a part of heat, the land use area can be also greatly reduced. It can be good for improving the ecologic environment. Via adopting the heat conservation measures and temperature monitoring control system, the cycle kiln can increase the heat utilization effect. About 20% of the enterprises surveyed use the remained heat for manual drying and less than 15% of the enterprises adopt the dust removal equipment. Only one enterprise uses the fume purification device. This clearly shows that the labor protection and environmental protection consciousness has been strengthened in brick-making industry. For 90,000 production enterprises in brick-making industry, the energy conservation and GHG emission reduction emission will be quite heavy. Only all the concerning respects make constant great effort and the natural effect can be achieved accordingly.

Annex 4

Supply & Demand Market Condition of China Brick and Other Wall Materials

I. Basic Situation of Present Real Estate Industry Development in China

Since 1998, with deeply pushing of the housing system reforming in cities and towns in China, the housing concept has great changed. The housing consumption has effective started and the new system for the commodity housing has been basically established. The market system of real estate has been gradually set up. The real estate industry has become mainly a support industry in domestic economy and play an important role to improve the housing condition, pull the economic growth enlarge employment chances and quicken the urban construction.

With deeply pushing of the housing system reforming in cities and towns, the market system of real estate has been gradually set up. At present, the currency distribution has been implemented in many cities instead of the object distribution in China. Public housing has been pushed step by step, more than 80% of public housing have been sale to staff and workers. The proportion of owned-houses has reached 72.8%. A new housing supply system has been initial set up. The economic housing construction has made a great progress and the housing system with low-price renting in cities and towns also has started into a new and essential stage. The housing market class II has been opened gradually, existing housing exchange is brisk day by day. The intermediaries of real estate and housing management have rapidly developed with increasing items. The service system of real estate has been essentially built up. At the moment, accumulation fund loans for individual have quickly increased; loan structure from bank has considerable adjusted so that the function of housing finance has constantly strengthened.

Secondly, the housing consumption is lasting to enlarge and the housing level is also improving constantly. In the past five years, the individual purchase houses amount to 54.5% of total sales was increased to 95.3% in the whole country. In 2002, the total payments of individual to buy new, old and constructing houses were RMB 800 billion yuan, in which, the trade volume of purchase new commodity houses was RMB 450 billion yuan. The housing payment has become a main demand in the real estate market and an essential motive force for development of the real estate industry. It strongly promotes housing construction in cities and towns. In the past five years, the accumulative spaces completed in cities and towns were 3.4 billion m^2, the annual average spaces completed had reached 0.68 billion m^2, it had over twice times of annual average spaces completed since reforming and opening. In 2002, the average constructing spaces in cities and towns was 22.8 m^2, increasing 5.2 m^2 than that in 1997. Meanwhile, the housing quality had been constantly raised and the necessary facilities and housing environment had also been improved.

Thirdly, because the development investment on the real estate is rapidly increasing, both supply and demand of housing are brisk. In past five years, annual average investment growth of China's real estate industry had reached 19.5%. The proportion of the investment on the real estate covering that on the fixed assets was raised from 12.7% to 17.9%. Since five years, the developing investment growth of the real estate had directly or indirectly promoted GDP's growth within two percentages or so per year. The developing structure is improving step by step. In 2002, the proportion of housing investment taking that of the developing investment on the real estate had arrived to 83.3%. From 1997 to 2002, both supply and demand of commodity houses were brisk. The spaces completed and sale had a yearly average increase of 15.5% and 22.6% separately. In the past five years, house price in China had been raised up during stable prices. The average sale price had a increase of 3.6%, this was lower than the growth of allowable payment income of residents in cities

and towns at the same period.

To make a conclusion of the above, the basic situation of China's real estate development is better at present.

II. Forecast Development of Real Estate Industry in China

Based on the data, the residents in twenty large and medium cities mainly lived in buildings. 87.7% of families lived in buildings without elevators, but 3.7% of families lived in buildings with elevators. In additional, 8.2% of families lived in one-story houses, a small part of families still lived in together to share one washroom or one chicken. With constantly promoting of housing reforming, at the moment, the proportion of own houses has come up to 59.3%. 18.2% of families rented houses from a management office to live in, 11.5% of families rented houses from their units to live in. Living spaces were mostly between 40 m^2 and 80 m^2. According to the survey, the people who will purchase a house within five years reach 21.9%of total survey, in which, to buy economic and commodity houses as key way, the space will be between 70 m^2 and 150 m^2.

The data show that, in total survey, 59.3% of families have held housing properties with 20~80 m^2 living spaces. Such families mostly have two, three or four people, in which, the most proportion is such families with 50~80 m^2 living spaces, families with 20~50 m^2 living spaces take the second. A small part of families or individual hires a house from their unit or own-house to live in. So, isn't there only small part of tenants to purchase houses? The survey results show that it isn't like this. They demonstrate that, in such families holding the housing properties, 23.3% of families will buy a house within five years, 20.1% of families will purchase a house next year. The commodity and economic house have still taken mainly position.

The survey show that, the families without the housing properties will purchase a house with below 80 m^2 spaces in order to settle the living problem, they belong to the first purchase. On the other hand, the families with the housing properties will buy a house with more large spaces in order to improve the living quality, they are the second purchase.

The proportion of families with the housing properties planning to buy a house within five years is much higher than those without the housing properties planning to buy a house within 1 or 2 years and especially, they will focus on those houses with large spaces.

Besides, in a mass of families, the pre-purchase proportion of the families with the housing properties has reached 55.6%, much higher than other. The spaces which they will purchase are between 81~100 m^2, covering 30.5%. In purchase houses with 100~150 m^2 spaces, the proportion of families with the housing properties has achieved 62.3%. From this, the purchasing house market has great potentialities in these families.

The survey data above on explain that, the mass of purchase houses and market are much more potentialities in China. Therefore, the developing prospect of housing in the first fifty years of twenty-one century in China will be so wide, we can forecast from some aspects as following:

1. Forecast urban development

At present, the urban level in China is 30%, population of cities and towns is 0.37 billion. It is forecast that the urban level will reach to 45% in 2020, the population of cities and towns will increase to 0.63 billion based on 1.4 billion population of China. It is estimated that the urban level will reach to 60% in 2050, the population of China will be 1.6 billion, the population of cities and towns will increase to 0.96 billion. The population of cities and towns will increase to 0.26 billion in the first twenty years of twenty-one century. Based on 10 m^2 living spaces per person that is 20 m^2 construction areas to count, 5.2 billion m^2 houses will need to be constructed for the increasing population, average 0.26 billion m^2 houses will need to be built per year. The population of cities and towns will add 0.33 billion in the last thirty years. Based on 20 m^2 construction areas to count, 6.6 billion m^2 houses will need to be constructed for the increasing population, average 0.22 billion m^2

houses will need to be built per year. Some relevant experts pointed out that, in the processing of urban in China, because most peasants will live in the original small towns developed, they will not occupy the houses in cities and towns. The number of houses that were counted before because of to be an urban will take out of half houses. According to half houses reduced, 0.13 billion m^2 houses and 0.11 billion m^2 houses will be constructed separately in first twenty years and last thirty years.

2. Forecast based on increasing housing level in lower speed

It is forecast that the living space in cities and towns will reach 12 m^2 per person in 2020, that is, construction space is 24 m^2. It is forecast that the living space will reach 16 m^2 per person in 2050, that is, construction space is 32 m^2. In accordance with 0.63 billion population in cities and towns in 2020 and increased spaces of 4 m^2 per person to count, 2.52 billion m^2 houses, that is a yearly average 0.126 billion m^2 houses, will need to be constructed in first twenty years so as to improve housing level. In accordance with 0.96 billion population in cities and towns in last thirty years to count, 7.68 billion m^2 houses, that is a yearly average 0.256 billion m^2 houses, will need to be constructed based on the numbers of 2020. The forecast above on is based on less 1% yearly increasing rate of constructing space, maybe it is slow. If the increasing rate is slightly raised up, the yearly increasing rate will be more than 1%, that is, the constructing space will be 26 m^2 in 2020 and 36.4 m^2 in 2050. So, 0.189 billion m^2 houses will need to be built up in first twenty years, 0.333 billion m^2 houses will need to be constructed in last thirty years.

3. Forecast from house depreciation and demolishment

At the moment, there is more 6 billion m^2 storage houses in cities and towns of China. According to depreciating of fifty years to calculate and properly take out some factors, such as some houses were expiry but they weren't demolished, it is estimate that 0.1 billion m^2 houses will be demolished or reconstructed a year. To adding the three items above on including the uncheck or economic check numbers, 0.486 billion m^2 ~0.549 billion m^2 houses will need to be constructed every year in first twenty years of twenty-one century, or 0.356 billion m^2 ~0.419 billion m^2 houses after checking. 0.576 billion m^2 ~0.653 billion m^2 houses will need to be constructed every year in last thirty years of twenty-one century, or 0.466 billion m^2 ~0.543 billion m^2 houses after checking. The forecast before is only for the living spaces constructed. The development of housing construction and the important function for domestic economy need to be forecast from two aspects below:

4. Forecast from sustaining investment growth of housing construction

Based on the statistic from Japan, during twenty years from 1970 to 1990, the constructing spaces hadn't increased. But, the appreciation, which is created by the houses and relevant industries, increased 16 times through reforming the traditional produce method. It is estimated that the continuously increasing investment speed will be slower than that in Japan under China wouldn't add house construction. Thus, it is forecast that China will increase 16 times investment on the housing construction in fifty years. According to this calculation, the housing investment will have a yearly growth rate of 0.6% for national economy and will be a giant contribution for China.

5. Forecast from effective demand and pushing domestic demand

Based on the forecast before, 0.4~0.5 billion m^2 houses in cities and towns in China will be constructed every year. The yearly net increasing houses will be 0.3 billion m^2 excluding yearly depreciating and demolishing houses, that is the yearly net increasing houses will be 15 billion m^2 in 2050. At that time, the living space of cities and towns in China will reach 21 billion m^2 adding existing 6 billion m^2 houses. If 8% storage houses had been sale in the market in the same year, there would be 1.7 billion m^2 houses on the market. If 1 m^2 house would have been bought and sale in the same year, RMB 200 yuan would be paid by the person, at the same time, RMB 3,400 billion yuan for housing consumption would be increased in the society. Of course, this consumption will be increased year by year. It is estimated that the housing consumption that residences in cities and towns in China will buy and sale houses in 2020 will be RMB 800 billion yuan. And then, it will be increased step by step in thirty years, at last, reach to RMB 3,400 billion yuan, grow RMB 100

billion yuan a year.

To sum up, in first fifty years of twenty-one century, the base of huge population of China and rapid economic development will make an alarming potential in the real estate industry. The investment on the housing construction and housing consumption in China's real estate industry will keep sustaining development and become a growth point and a consumption point in national economy. The relevant constructional material industry, especially the wall material, which covers over 85% of constructional solid material, will have a astonishing space to develop.

III. Supply & Demand and Development of Wall Materials

According to our investigation and analysis mentioned above, there will be a continuous increase in investment in China real estate industry, especially in residence construction and consumption. The real estate industry in China will still be the focal point both in growth of national economy and consumption. Therefore, the building material trade, especially wall material will undoubtedly be the importance in development. The development of wall material is closely related to the development of building construction. It is also affected by many elements, such as regions, resources, politics, culture, economy, trade and industrialization level etc. In China, following the progressive enforcement of national innovation policy on wall material and the gradual implementation of national sustainable development strategy, wall materials certainly will develop to be light, high strength and multi-functional compound material which can meet the requirements of construction efficiency, saving energy, cutting down on soil use, making use of scrap materials and protecting environment. Consequently, the new wall materials have a lot of advantages that can meet the requirements of modern buildings and residences. The traditional solid clay wall material will be gradually eliminated.

According to the uncompleted statistics, by the end of 2003, there have been more than 90 thousand wall materials manufacturers in China. The total output of standard bricks by these manufacturers reached 800 billion (among which 530 billion bricks are fireclay brick). Up till now, the varieties and amount of environmental protection new wall materials run as follows: coal stone fired bricks reach 7 billion (converted into standard bricks); fly-ash bricks (including sintering and steaming products) are 6 billion (converted into standard bricks); autoclaved sand-lime bricks have 6 billion (converted into standard bricks) and fired hollow bricks reach 10 billion (converted into standard bricks). Other wall materials, such as light board, block and aerated concrete etc., have about 15 billion (converted into standard bricks). The development of wall materials also showed distinguishing features from different regions.

As the northeast area is the old industrial base in China, there are a lot of industrial waste residue, such as gangue and fly ash.

In recent years and a long time afterwards, the development of gangue and fly ash products is the most important work in Northeast China. In 305 enterprises to be surveyed this time, those enterprises in Northeast China basically mix with the industrial waste residues such as fly ash, gangue and slag, etc. while making brick. Even some enterprises make the sinter products with gangue only and such enterprises take 93% of the total in Northeast China. At present, there are about 10 thousand manufacturers in this area that are producing mainly sintering products and partly ceramists block and aerated concrete, etc. It is estimated that coal stone and fly ash will still be the major part in production of sintering wall materials in the future. At present, output of wall materials can basically meet the requirements of construction in this area. Refer to the list below for prices of brick-tile.

Although northwest and southwest regions are underdeveloped in China, the areas are vast in territory and rich in resources, especially rich in clay and shale. For the industrialization level in the areas are low, it is estimated that sintering clay or shale products will still be the main stream of wall materials. In 305 enterprises to be surveyed this time, half of the shale brick-making enterprises are in Southwest China, accounting for 53% of the shale brick-making enterprises surveyed. But, in

Northwest China, all the brick-tile making enterprises adopt the clay from the plateau abundant resources (mainly using the clay in slope land or earth gully and a little farmland destroyed).

At present, there are no more than 20 thousand manufacturers in the areas, producing mainly sintering clay and shale products and partly light partition wallboards. Production and sales are basically balanced. Refer to price list for prices of brick-tile. It is estimated that sintering shale bricks and fireclay bricks (porous or hollowed) must be the major product in these areas because of difference of aerial development, disparity of industrialization level comparing with developed areas and rich resources of clay and shale.

Central China and South China are appropriate in resources and moderate in economical development. At present, there are 20 thousand manufacturers in the areas, with variety of products. It is estimated that there is a tendency toward a diversity of future development in the areas. In 305 enterprises surveyed, the products of wall panel, block and sintered tile, etc. mainly come from Central China and South China. The product price in the coastal developed region is distinctly higher than the nationwide average price. The inland region includes the provinces of Hunan, Hubei and Henan. The product price in these regions is quite lower than that in the coastal region. At present, in some of the areas, such as Henan, Hunan and Hubei, supply exceeds demand; while in other developed areas, such as Guangdong and coastal areas, supply falls short of demand. Due to insufficient resources in the areas, wall materials will probably develop in direction of chemical building materials and light boards.

The areas in East China are the most economically developed regions in China. There are now more than 20 thousand manufacturers in the areas. They have a variety of products not only sintering, but also block and aerated concrete etc. However, the supply cannot meet the demand yet. In 305 enterprises to be surveyed this time, a part of non-sintering product manufacturers are also from East China. The resources for sintering product manufacturers are almost used up. It is estimated that wall materials manufacturers will go on developing in some places with raw material. For the regions lacking of resources such as clay and shale, etc. the chemical building materials and waste-using products will be the major part of development in the areas afterwards.

North China's areas refer to Hebei, Beijing, Shandong and Inner Mongolia. There are more than 20 thousand manufacturers producing sintering products in the areas. Most of the manufacturers use soil to make sintering products. At present, the supply and demand are balanced. In 305 enterprises surveyed, gangue, fly ash, slag and the industrial waste residue are commonly adopted by the enterprises in North China. As the earth is from the plain land and with the implementation of China's industrial policy, the sintering product manufacturer will be gradually reduced to the resource region for local development and the waste utilization product will be developed accordingly.

To make a conclusion of the above, there are about 800 billion bricks (converted into standard brick) in present China wall material production. Most of them are sintering products and some of them are block, light board and aerated concrete. New wall materials and waste-using products are developing very fast in developed areas. Sintering clay products and shale products will still be the major part in west areas. At present, supply can basically meet the requirements. In some coastal areas, supply falls a little short of demand; while in some inland areas, supply exceeds demand. Refer to the list blow for prices of sintering (autoclaved) brick- tile in 2003.

Price List of Sintering (Autoclaved) Brick-Tile in 2003

Unit: Yuan/Piece.

Region	Porous Brick KP_1	Common Brick	Autoclaved sand-lime brick	Sintering tile	Concrete tile
Beijing	0.26~0.30	0.15~0.20	—	—	2.5~2.8
Tianjin	0.26~0.28	0.11~0.12	—	0.26~0.28	2.5~2.8
Hebei	0.23~0.25	0.11~0.12	0.14~0.15	0.28~0.52	1.7~2.5
Shanxi	0.15~0.16	0.08~0.10	—	—	1.7~2.5
Inner Mongolia	0.18~0.20	0.10~0.11	—	—	—

Region	Porous Brick KP_1	Common Brick	Autoclaved sand-lime brick	Sintering tile	Concrete tile
Heilongjiang	0.30~0.35	0.09~0.12	—	—	2.0~2.5
Jilin	0.15~0.19	0.09~0.12	—	0.5	—
Liaoning	0.25~0.28	0.14~0.15	—	—	2.4~2.5
Jiangsu	0.20~0.42	0.20~0.28	—	0.75	1.2~2.6
Zhejiang	0.32~0.52	0.26~0.32	—	0.80	1.0~1.7
Anhui	0.15~0.18	0.13~0.17	—	—	1.8~2.0
Fujian	0.25~0.27	0.14~0.16	—	—	1.8~2.0
Jiangxi	0.35~0.38	0.12~0.14	—	0.5~0.6	1.5~2.7
Shandong	0.16~0.18	0.11~0.12	—	0.33	1.52
Henan	0.17~0.27	0.10~0.12	—	—	—
Hubei	0.20~0.30	0.15~0.19	—	0.8	1.2~2.0
Hunan	0.28~0.30	0.14~0.15	—	—	1.8~2.5
Guangdong	0.30~0.36	0.20~0.22	0.15~0.17	—	1.8~2.0
Guangxi	0.19~0.21	0.13~0.14	0.14~0.15	—	—
Sichuan	0.15~0.18	0.10~0.18	—	—	1.2~3.2
Chongqing	0.28~0.30	0.12~0.18	—	—	2.0~2.6
Guizhou	0.32~0.33	0.13~0.17	—	—	1.2~1.8
Shaanxi	0.16~0.22	0.08~0.11	—	0.27	2.2~3.5
Gansu	0.22~0.24	0.07~0.13	—	0.28	2.8~3.0
Qinghai	0.15~0.27	0.07~0.13	—	0.52	—
Ningxia	0.18~0.20	0.12~0.13	—	—	1.8~2.2
Xinjiang	0.18~0.20	0.10~0.12	—	—	3.5~4.0

IV. Supply & Demand Market of Real Estate, Brick and Other Wall Materials in Chengdu City

In economical respect, it is showing an obvious tendency to increase in fixed assets investment, real estate exploitation investment, GDP, real estate increase value in Chengdu from 1996 to 2001. It is estimated that investment in real estate exploitation in Chengdu will keep a fast increasing speed in the "10th Five-Year Plan" period. Amount of increase of real estate exploitation investment is obviously more than that of fixed assets in the corresponding period. It is estimated that investment in real estate will increase to 39 billion in 2005. Real estate exploitation investment amounted to 29.3% in 2001 of fixed assets investment will arrive to 33.1% in 2005. Therefore, use of bricks and other wall materials will be continuously increasing in Chengdu.

In residential respect, in recent years, there has been a bigger increase in population of Chengdu city and towns. There were total 10.199 million people in Chengdu in 2001, among which 3.5478 million live in Chengdu city and towns. Per capita residential area of inhabitants in Chengdu city and towns in 2001 was 24.4 square meters. Per annum increase was 5.5% from 1996 to 2001. Therefore, we can calculate as follows: population in city and towns is 3.6464 million in 2002 and will increase to 3.959 million in 2005; residential areas in city and towns is 93.87 million square meters in 2002 and will probably increase to 119.67 million square meters in 2005. Target of Chengdu old city transformation is: demolishing 5.29 million square meters old shabby houses in 3 years. Target of this year is demolishing 1 million square meters. This part can be considered as natural damage area. New increased residential needs in city and towns will be 8.3 million square meters in 2002. According to the convention, there is an expansion rate in natural damage areas. That is every demolishment of 1 square meter will bring 2 square meters need. For that reason, from 2002 to 2005, new residential requirement in city and towns will be accumulated to 38.39 million square meters.

As a result of the above, in the coming several years, residential requirement in Chengdu will keep on increasing. Per annum residential need will reach nearly 10 million square meters. By the year

2005, per capita residential area in Chengdu city and towns will reach 30.2 square meters, basically coming to well-to-do residential standard.

The above doesn't include residential requirement of nonnative populations, buildings for commercial or business use and office buildings. If calculated as the aim of "Tenth Five-year Plan", there will be 4.066 million population in city and towns in 2005. Hence, the new residential requirements will be accumulated to about 41 million square meters.

According to our investigation, as Chengdu locates in southwest China, there are a lot of shale resources. Products are mainly shale bricks. There are more than 600 sintering brick manufacturers in Chengdu with gross annual production 8.8billion bricks (about 5 billion porous bricks and hollow bricks), which can meet requirement of 5.72 million square meter residential wall use. There will be an annual increase of 10 large brick manufacturers, about 800 million bricks and 50 thousand square meter use; about 10 concrete block manufacturers with gross annual production of 300 thousand square meter, can meet requirement of 100 thousand square meters residential wall material use; 13 light board manufacturers, with gross annual production 2.2 million square meters, can meet requirement of 730 thousand square meters residential wall materials use. Total of the above three can meet 7 million square meters residential wall material use. Shortage is about 3 million square meters, which should be met by means of other chemical construction material, ceramists exposed wall and cladding glass or increase the production of wall material.

V. Real Estate Construction and Supply & Demand of Brick and Other Wall Materials in Tianjin City

System engineering method is popularly used in Tianjin to improve innovation of wall material and energy saving in construction. During the 11 years since 1992, it has got a great efficiency in economy, society and environment. At present, clay brick manufacturers have been cut down by 22%. Production of new wall material has accumulated to 16.8 billion standard bricks. The new wall material amounted 5% in 1990 of the whole wall materials increased to 55%. Area of completed construction using new structure material accumulated to 21.2 million square meters, amounted to 35% of the total completed area. Resource- saving residential area reached 31.32 million, 21 million square meters of which saving 50% resources. During the ten years, total 1.45 million ton standard coal and 9,391 mu (1mu=666.6m^2) soil have been saved and 13.6 million ton waste has been used. Solid clay bricks have been reduced from 5 billion in 1990 to 2 billion.

Overall plan of wall material innovation in Tianjin is: new construction area reaching 37.12 million square meters during 2001 to 2005. About 25.8 billion bricks (converted into standard bricks) will be needed for wall materials. As Tianjin locates on north China plain, soil resources are in short supply, products are mainly sintering clay type, partly waste-using and block. Now, there are 220 sintering brick manufacturers in Tianjin with gross production of 3.418 billion. Among the manufacturers, 30 of them produce hollow bricks and porous bricks with estimated productivity of 1 billion (converted into standard bricks); 49 of them produce concrete block, with gross annual production of 470.9 thousand square meters (converted into 320 million standard bricks); 39 of them produce light board, with gross annual production 15 million square meters (converted into standard bricks 1.35billion). Annual total of the above three is about 5.088 billion. Total of the five years is 25.44 billion, which can basically meet the requirements. Because of using soil and severe cultivated land damage, it is estimated that sintering products will be cut down greatly and plate material and block products will go on increasing.

Annex 5

Schedule of China and International Brick-Tile New Wall Material Equipment Manufacturers, Design Institutes, Associations, Societies and Network Stations

The scientific research development has made a great promotion to the rapid development of brick-tile and new wall material in our country. The scientific research and design institutes with stronger integration strength in the aspects of research, development and popularization, etc. of brick-tile and wall material inside the trade have been selected in this part. Their fundamental state and primary service contents are recommended.

The continuous increment of the performance of brick-tile and new wall material production equipments has made a solid foundation for improving the quality of products and promoting to make more new products of brick-tile and new wall material. In this part, 40 machinery manufacturers in the trade are selected and their fundamental states are summarized.

In today information age, the association, society and wall material information network station are the linkage in the sectors of product popularization, enterprise management & cooperation, enterprise image propaganda, new technology and scientific research achievement information exchange. So, we have selected some essential information of associations, societies and network station with certain scale and affective force inside the trade.

The development level of the international brick-tile and new wall material is higher. The product is series, advanced & ripe production technology, perfect laws and regulations, smooth information circulation & collaboration. We have selected the scientific research & design institution, association and main machinery manufacturing corporations with more international influence power in 6 countries of America and Italy, etc. and briefly introduce their key business contents.

In this part, the contents include 4 kinds of schedule:

Table 4: Schedule of China Wall Material Industry, Society and Network Organization

Table 5: Schedule of China Wall Material Industry Scientific Research and Design Institution

Table 6: Schedule of China Wall Material Industry Machinery Manufacturing Corporation

Table 7: Schedule of Wall Material Industry Scientific Research & Design Institution, Association and Main Machinery Manufacturing Corporation in 6 Countries of America, etc.

Project Team of "*Brick-making Industry Survey*"
December 10, 2003

Table 4 Schedule of China Wall Material Association, Society and Network Station Organization

Institution/organization name	Registration place	Mail address	Contact phone	Post code	Brief situation of institution business
China Silicate Society	Beijing	No 11, Sanlihe Road, Beijing City	Tel: 010-68342007 Fax: 010-68313364 68342016 E-mail: cersoc@public3.bta.net.cn	100831	China Silicate Society was set up in 1945. It was voluntarily established by China silicate (inorganic non-metal material) scientific and technological personnel with lawful registration. It is a legal person social institution with technicality and public welfare as well as a constituent part of China Science & Technology Association. The uppermost policy-making body is the nationwide member general assembly and the nationwide member general assembly is once held every 4 years and its council formation is via election. During the period when the nationwide member general assembly is closed, its council carries out the resolution made in the nationwide member general assembly and leads the society work. The academicians include the individual member, high-level member, organization member and foreign nationality member. At present there are 33,000 individual members, 40 organization members. 18 speciality branches and 3 operating commissions are under it. It has 124 local societies now. The society affairs handling institution has 5 departments (offices). Scope of business and main activities: Carry out domestic & overseas academic exchange, scientific and technological communication and folks international scientific-technical cooperation, etc.; Edit & publish the science and technology books and periodicals; Develop the recurrent education, science and technology popularization, decision consultation, technology consultation and technical service work; Find, recommend and train talent; Perform the reward and encouragement work; Hold both abroad and home science and technology show & exhibition activity. Sponsor periodical: "*Silicate Academic Journal*", "*Silicate Bulletin*", "*Modern Technology Ceramics*" and "*Building Ceramics Information*", etc. It has taken part in the International Glass Association, the International Ceramics Federation, the International Refractory Material Academic Conference Organization and the International Growth of Crystals Organization. It has been a member of the executive commissions in the 4 international organizations above. Present incumbent chairperson of the council: Zhang Renwei.
China Building Materials Industries Association	Beijing	No 11, Sanlihe Road, Haidian District, Beijing Municipality	Tel: 010-68394706 68311144-3646 Fax: 010-68332658	100831	China Building Material Industry Association was established in Beijing in 1996. It is a nationwide social organization with legal personality. Its mission is to carry out the contact, coordination, consultation and service in the same trade; perform the technical economy exchange & collaboration with the same international trade. Meanwhile, in accordance with the state policy, take in the government commission for unified planning, coordination and surveillance, offer the decision gist & suggestion to the governments at all levels, reflect the enterprise desire & requirement to the government and safeguard the lawful rights and interests of enterprise. Zhang Renwei is chairman of the China Building Material Industry Association. Its vice-chairmen are Lei Tianye, Zhu Chuansheng and Sun Xiangyuan. Its secretary-general is Chen Guoqing. Its inner institution: Office (secretariat), trade working department, international cooperation department (market exhibition & trade department and foreign affairs office), information department, standard quality department, financial assets department and personnel department (Party affairs office & training).

Institution/organization name	Registration place	Mail address	Contact phone	Post code	Brief situation of institution business
China Brick-Tile Industry Association	Beijing	Baiwanzhuang, Beijing	Tel: 010-68303484 Fax: 010-88386484	100831	The Ministry of Civil Administration of PRC ratifies the association. It was set up on 5 July 1996 and it is the only country-level juridical association unit in the brick-tile trade throughout the country. There are 3,783 members at present (408 directly under members and 36 provincial, municipal & regional community members), distributing in vast city and countryside throughout the country, forming a nationwide fair-sized federation body that the brick-tile enterprises in partial villages and towns and over county level throughout the country in the respects of building material, public security judicature, coal, construction and electric power, etc. and the respect scientific research & design institutes, academies, colleges & universities, etc. are participated in. Therefore, the association has vast representativeness. The association council is composed of 156 councilors, 45 standing councilors and 13 vice-chairmen. The present incumbent chairman is Xu Yanming. Scope of business: Trade management, information exchange, business training, international cooperation and consulting service.
China Building Block Association	Beijing	No 11, Sanlihe Road, Beijing City	Tel: 010-88364764	100831	The association is a national building block trade association confirmed by the Ministry of Civil Administration of PRC. In 18 years since coming into existence, the association actively carry out the activities of exchange of experience concerning the building block and building blocks architecture, information transmission, business training, technological development, consultation and business coordination, etc. Organize the technology trade, exchange and collaboration of the international same trade. The publication bulletin is "*Building Block and Block*" (bimonthly) and association conference message. Its more than 500 members are distributed in 29 provinces, autonomous regions and municipalities directly under the central authority.

Added Table 4

Schedule of China Wall Material Association, Society and Network Station Organization

Institution/organization name	Mail address	Contact phone	Post code
Tianjin Municipality Building Material Industry Association	1403 Seat A, Wanlong Center Building, No 85, Liuwei Road, Hedong District, Tianjin Municipality	022-24015026	300012
Beijing City Wall Material Association	3rd of South Building, No 2, Huishujie Street, Beijing City	010-63021580	100053
Liaoning Wall Material Industry Association	11-2 of Trade and Economy Building, No 32, East Chongshan Road, Shenyang City	024-86611832	110032
Nanjing Brick-Tile Trade Association	No 670,Zhujiang Road, Nanjing City	025-3374867	210018
Shanxi Provincial Wall Material Innovation Construction Energy Conservation Trade Association	No 226, Fudongjie Street, Taiyuan City	0351-4075853	030002
Shaanxi Provincial Wall & Roof Material Industry Association	No 6, South Chang'an Road, Xi'an City	029-85221477	710061
Guangdong Provincial Wall Material Industry Association	No 10, No 1 Street of Dongchuan Road, Guangzhou City	020-82794188	511350
Sichuan Provincial Chengdu Municipal Wall Material Enterprise Association	No 1, Wenhua Road, Chengdu City	028-7783413	611437
Xiamen City Construction Work New Materials Association	2nd Floor of Zhiwu Building, No 52, South Hubin Road, Xiamen City	0592-2214752	361003
Chungqing Municipal Wall Material Industry Association	No 2 of 2nd Branch of North Jianxin Road, Jiangbei District, Chungqing Municipality	023-67502599	400020
Guangxi Brick-Tile Industry Association	5th Floor of Building Material Building, No 167, Weiwu Road, Nanning City	0771-2801499	530022
Shandong Provincial Building Material Industry Association	No 360,Jinsi Road, Jinan City	0531-7065173	250001
Jiangxi Provincial Brick-Tile Industry Association	No 309, West Hefang Road, Nanchang City	0791-5210434	330001
Ningbo City Wall Material Association	Room 101, Building 12, Wangaiyicun, Wangai Road, Jiangdong District, Ningbo City	0574-87837774	314040

Added Table 4

Schedule of China Wall Material Industry Association, Society and Network Station Organization

Institution/organization name	Registration area	Mail address	Contact phone	Post code	Simple situation of institution business
China Wall Material Information Network http://brick-tile.com	Beijing	No 6, South Chang'an Road, Xi'an City	Tel, Fax: 029-85221476 E-mail: btagency@pub.xaonline.com	710061	The speciality information internet station in the wall material industry jointly invested by the "*Brick-Tile*" periodical office and the nationwide wall material scientific & technical information network is the first speciality network station of walling & roofing material trade in China. Based on the overall extensive information channel of "*Brick-Tile*" and the nationwide wall material scientific & technical information network technical service expert panel, "*China Wall Material Information Network*" can offer the inner information, enterprise propaganda and technical service for vast wall material enterprises. The trade fast message can supply the information of wall material industry dynamic, product technology, special topic news and overseas wall material, etc. The exhibition hall can offer the brick-tile business directory & brick-tile equipment, light board equipment, building blocks equipment, colored cement tile equipment, road brick equipment, auxiliary equipment product database concerning nearly 20,000 enterprises in the domestic wall material industry. The standard laws & regulations offer the current wall material industry policy, laws & regulations, wall material national standards and industry standard issued by the executive departments in the state and building material trade. The scientific research technology can offer the technical service of product development, production technology and specialist consult, etc. The exchange of experience forum can offer the dynamic exchange site for wall material industry personnel. The information center can offer the download service of speciality material and technology compact disk, etc.
China Building Material Information Main Network http://www.cbminfo.com	Beijing	No 11, Sanlihe Road, Beijing City	Tel: 010-88376372 Fax: 010-88376372	100831	Sponsored by China Building Material Industry Association and the Architectural Journal Material Industry Information Center, take full advantage of progressive hardware & software equipment and modernized internet & communication technology, adopt 10M optical fiber cable and international internet Unicom Internet/Intranet advanced network rack and hold multi-set UNIX host computer, work station and NT server that is the strongest integration capability international internet station in the domestic building material trade at present. It is also the most authorized communication distributing center of China building material trade.
China Building Material Network http://www.Chinabmnet.com	Beijing	1#, Guanzhuangdongli, Chaoyang District, Beijing City	Tel: 010-65728538 65728539 E-mail: bmtest@163.bj.com	100024	The network precursor is China building materials industry information network. It was set up in 1998. In recent years, it has been reconstructed as a commerce business network. For the 1st phase project, RMB 30 million has been invested for the establishment work of the hardware & software of building material e-business network platform. More funds will be invested to set up the physical distribution delivery center in large and medium size cities at home. The network station faces domestic and overseas market with two-language page.

Institution/organization name	Registration area	Mail address	Contact phone	Post code	Simple situation of institution business
China Building Material Network http://www.bmlink.com	Hangzhou	Seat B & A, 15th Floor of No 1 Building, Hangban Mansion, Hangzhou City	Tel: 0571-88318060 88318676 Fax: 0571-88350439	310014	It has more than 13,000 registered members in the building material trade. It can set up the speciality network station for enterprise and help the building material enterprises carry out trade and get profit via network. It can perform the multipoint link, uniformity enterprise preference arrangement, search engine preference arrangement, newly market conditions posthaste per day, well-known search engine registration, China construction material network recommendation in particular, breadth advertisement of product classification at different levels, poluralization network station extension service in combination of brand name propaganda and production extension. In doing so, the enterprise product information can be released to over 100 trading posts & spots all over the world.
China Building Material Main Network	Wuhan	Xinhan Office Building, No 221,Hankou Zhongshan Road, Wuhan City	Tel: 027-85414370 85415707	430022	The Chinese Building Material Main Network (China Building Material Main Network) is a professionalization trade gate network station in China building material ornament trade. It faces the construction material ornament enterprises in China, offers the information services such as the member enterprise joining in, enterprise & product information consultation and release & inquiry of the latest supply and demand information, etc. It can supply the all-weather large size e-business information platform to carry out product trade and information exchange for domestic, overseas construction material ornament enterprises and the interrelated enterprises.
Chinese Building Material Network http://www.China-ebm.com	Shanghai.	Room 706, Jielong Business Mansion, No 618, Pingliang Road, Shanghai City	Tel: 021-65358138 Fax: 021-35110688 E-mail: marketing@china-ebm.com	200082	The Chinese Construction Material Network is a gate network station in the construction material trade via joint-stock society natural persons and its counselors are the associations of construction material, construction, ornament and design, etc. It is B to B network station integrating the communication, resources, brand name, reputation and transaction. It has the management team with the trade background of many-year operation traditional construction material, construction, ornament and design, etc. Its top ranking officers master the network technology and have rich management experiences for large size gate network station. The operation idea is the main customer from party A, design, construction and purchase, accept the domestic overseas famous construction material manufacturers and agents as transaction members, implement information exchange and purchase transaction mutual interaction, make identity authentication on both transaction parties, strictly manage the behavior of reputation record, etc. Monitor the overall process of transaction every time and offer related legal services for both sides.
Sifang Building Material Network http://www.sfjc.com	Beijing	No 1409, 2nd Building, Anningli Residential Area, Qinghe, Haidian District, Beijing City	Tel: 010-62950195 Fax: 010-62950195-805 E-mail: eagent@sfjc.com	100085	Dynamic building material enterprise information alternation platform. The demand party of construction material can inquire the necessary construction material, set up its supply file, inquire the market price of construction material, release information, carry out budget & rough calculation. The supply party can release and keep product information and other information, inquire the demand status, recommend product to demand party and carry out the exchange on line.

Table 5 Schedule of China Wall Material Industry Scientific Research & Design Organization

Institution name	**Xi'an Wall Material Research & Design Institute of China Building Material**
Responsible person	Xiao Hui
Quality grade	Country-level engineering design grade A and works general contracting grade A
Number of employee	200 persons
Post code	710061
Mail address	No 6, South Chang'an Road, Xi'an City
Business brief introduction	The institute is a speciality scientific research and design institute under China Building Material Group Company. The institute has been engaged in R & D, engineering design, engineering contracting and works supervision work of new wall materials such as burnt clay product, perforated brick and hollow brick, etc. for nearly 40 years since its setting. It has respectively taken on the research design subject matter of the state essential project to tackle key problems in the construction material trade, taken charge of the scientific research and technological development in the respects of shale, clay, coal slack and fly ash comprehensive utilization. Owing to the excellent design of the institute, more than 200 large and small size brick-tile production lines with annual production capacity of 10,000~23,000 pieces each have been successfully set up in domestic over 20 provinces, cities & regions and some foreign countries such as Nepal, Malaysia, Cambodia, Russia and Mongolia, etc. In the field of industrial residue comprehensive utilization of coal slack, fly ash sintering hollow brick, etc., the institute has gained the trade accepted achievement and got many scientific research and design achievement awards at the state, province and ministry-level. Xi'an Wall Material Research & Design Institute of China Building Material is a unique speciality scientific research and design institute directly under the original state building material bureau. It is engaged in wall and roof material sintered product research & design in China at present. The nationalwide specialty organizations such as the UN China Wall & roof Material Development Center, the state structural material industry wall & roof material quality monitoring & inspection center, the state authorization laboratory, the state building material industry brick-tile heat energy test center and the national wall material scientific and technical information network, etc. are all located in the institute. The sponsor journal of "*Brick-Tile*" is the only nationwide building material science & technology core journal in the trade for public issuance at home and abroad. The constructed and maintained China Wall Material Information Network Station (www.brick-tile.com.cn) column can offer a large number of information with the features of wide trade, immediate renewal content and higher visit point-and-click rate.

Added Table 5

Institution name	**Xianyang Ceramics Research & Design Institute**
Responsible person	Liu Aiping
Quality grade	Grade A design quality qualification
Number of employee	200 persons
Post code	712000
Mail address	No 35, West Weiyang Road, Xianyang City, Shaanxi Province
Business brief introduction	The institute is a research unit directly under the original state building material administration. It is mainly engaged in research, design, production, technological development and consulting service of new technology, new technique, new equipment and new product in sanitation porcelain industrial production. The state construction sanitation product quality inspection center, the scientific and technical information center, the industry energy conservation test center and the ceramics development center aided by UN are all set up in the institute. It has accumulatively finished 15 state significant scientific research projects, evaluated over 100 scientific research projects, more than 30 of them in domestic advanced level and more than 50 are rewarded. It also took the state science and technology key project and state priority industry experimental project in the "9th Five-Year Plan". The institute has grade A Design quality qualified certificate, taking on the general contract of ceramics enterprise complete set of technological equipment, design, production & installation works, sanitary porcelain mediate & high pressure thick liquid injection plastic mould development, sanitary porcelain new style design, raw material and slurry homogenization technology at home and abroad.

Institution name	**Henan Provincial Building Material Research and Design Institute**
Responsible person	Yang Xiaozhi
Number of employee	275 persons
Post code	450002
Mail address	No 34 Red Flag Road, Zhengzhou City, Henan Province
Business brief introduction	The institute was set up in 1973. It is under Henan Provincial Metallurgy Building Material Industry Department. Its fixed assets are RMB 10 million and equipment instrument RMB 5 million. Two cement and new material research (design) institutes are under its jurisdiction. Its main scientific research field and orientation: Scientific research, technological development, technology transfer, technical consulting service, engineering design, inspection test and production operations of science, industry & trade integration in the fields of cement, ceramics, waterproof sealing material, walling material, ornament fitment material, heat preservation heat insulating material, chemistry building material, industrial process autocontrol and construction material equipment, etc.

Added Table 5

Institution name	**China Construction Northwest Design and Research Institute**
Responsible person	Fan Hongkang
Quality grade	Grade A survey & design unit
Number of employee	844 persons
Post code	710003
Mail address	No 173, Xiqi (West No 7) Road, Xi'an City
Business brief introduction	The institute was set up in 1952. It is the earliest established and the biggest state grade A survey and design unit in Northwest China, belonging to the Head Office of China Construction Engineering. In 1993, it was appraised as one of 100 strong enterprises of survey & design synthesis strength in China. The institute has 7 engineering design offices, 1 building material branch and its branch institutes are also set up in Shanghai, Xiamen, Shenzhen and Hainan Province. In addition to design and production, it also carries on business in the sectors of building technician consultation, works supervision, architectural ornament and trade of import & export, etc. The institute always pays more attention to adopt the modernization design tool and improve technical equipment without cease. The institute has completed over 3,400 various large & medium-scale industry and civil architecture design, more than 100 typical designs and 616 scientific research missions all together in past 45 years since its establishment. Since 80s, it has gained 12 national patents and 30 nation scientific technical progress awards.

Institution name	**Suzhou Concrete Cement Product Research Institute**
Responsible person	Zhu Rongyao
Number of employee	400 persons
Post code	215004
Mail address	No 162, Sanxiang Road, Suzhou City, Jiangsu Province
Business brief introduction	The institute is an integrity scientific research design unit directly under the original state building material industry administration, principally engaged in research of concrete cement product, building construction material, ornament fitment material and chemical engineering building material, the development of new technique, new product and new equipment and design of associated equipment to set up plant. It is a undertaking unit of "Nation cement product (including concrete admixture) measurement surveillance test & inspection center" and a work handling unit of the Secretariat of China Cement Product Standardized Technique Commission. Nowadays, it controls three institutes and nine departments such as the information training center, the state cement concrete quality of item surveillance test & inspection center, the cement product power-saving technology service center of the state building material industry administration, Suzhou Construction Building Material Design Institute and the science and technology industrial corporation, etc., fitting with testing laboratory and workshop concerning concrete, concrete admixture, fibre cement, physics & chemistry, manufactured product technology and structure, etc. In addition to take on the state scientific research mission, it also undertake the projects of scientific research entrusted by enterprise, new technique and new product development, design to set up plant, industry & agriculture or civil architecture design, test, science and technology consultation and technological achievement transference, etc. as well as supply the technical support for factory & mineral enterprises within the trade throughout the country.

Added Table 5

Institution name	**China Building Material Scientific Research Institute**
Responsible person	Yao Yan
Quality qualification grade	Large size science and technology enterprise directly under CC Government
Number of employee	1500 persons
Post code	100024
Mail address	1#, Guanzhuangdongli, Chaoyang District, Beijing City
Business brief introduction	Main research, development and operating scope of the institute: New cement and new building construction material, special engineering material, special glass, industrial technology glass, special glass fibre & its manufactured product, sanitation of buildings ceramics, high-performance ceramics, flame-proof material for structural materials industry, finishing material, special inorganic nonmetal new material, etc., production technology for different kinds of product, mating and engineering technology service of production facilities, working out of product technology standard, structural materials industry automation and instrument, testing technology and meter, environmental engineering consulting and monitoring, engineering design of building material enterprise, technical economical analysis, engineering contracting & engineering supervision, structural materials industry technical information and service, trade of import & export and export on consignment business, etc. The institute has the progressive scientific research and detection equipment & technical strength, 6 scientific research design offices and 3 departments with opening key laboratories: The state glass deep processing engineering & technological research center, the state building material test center, the state cement quality inspection hub, the state quartz glass goods quality inspection hub and 11 quality inspection hubs & metering stations for the building material trade. 17 branches of the state & local building material trade professional societies and associations are located in the institute for handling work. The institute is a channel to the proper authorities unit of nationwide standardized technique for cement and quartz glass speciality.

Table 6 Schedule of China Wall Material Industry Machinery Manufacturing Corporation

No	Enterprise name	Contact	Mail address	Post code	Contact mode	Main processing products
1	Qinhuangdao Municipal Hailan Building Material Metallurgical Machinery Manufacturing Co Ltd	Tian Yan	No 100, linanjie Street, Haigong District, Qinhuangdao City, Hebei Province	066000	0335-3031316 hailan@163.com	Nautilus brand de-airing extruder, hard plastic extruder and different kinds of material handling cutting, piling & transporting complete sets of equipment
2	Jiangsu Suqiantongyu Construction Machinery Co Ltd	Tian Xianchun	North of Zhikoujie Street, Suqian City, Jiangsu Province	223812	0527-4385198	QM3-2, QT4-25, QTJ3-25, QT2-35, QT2-35A series building blocks forming machine and different kinds of building blocks die set
3	Xiaoshan Weida Color Tile Machinery Co Ltd	Shen Shiwei	Hangzhou Xiaoshan Economic Development Zone	311215	0571-82831029	SM concrete series colored face tile equipment
4	Yancheng Building Material Machinery Co Ltd	Gao Zhong	Wulidun of North Shanggong, Northern Suburbs, Yancheng City, Jiangsu Province	224731	0515-6411008	JZK series compact type, composite type de-airing extruder set, JZ series antivacuum extruder set, 0.25m^3 full hydraulic pressure full circle swinging dredger and vertical & horizontal series crusher, etc.
5	Fujian Haiyan Building Material Mechanical Equipment Co Ltd	Chen Shaohua	3rd Floor of Haiyuan Building, No 2, Xihong Road, Fuzhou City	350002	0591-3787273 haiyuan@public.fz.fj.cn	HF series kiloton full automaticity hydraulic pressure walling brick press and complete production line
6	Jinan City Brick-Tile Machine Works		No 779, Jiyan Road, Jinan City	250117	0531-7994189	"Jinniu" brand series brick-tile equipment
7	Wuxi City Taifeng Machine Works	Wang Yuping	No 84, Lixi Road, Wuxi City, Jiangsu Province	214072	0510-5163721	JZK45/45-20D and 45/40-20D de-airing brick press, high speed fine crushing crush roll, SJ250×36 high speed twin shafts stirring machine and SCrD dividing crush roll
8	Shenyang Gaokan Brick-Tile Machinery Manufacturing Co Ltd	Meng Xianwei	No 1-3, Xinglongjie Street, Gaokan Town, Donglin District, Shenyang City	110163	024-24781303	Brick-tile mechanical equipment
9	Jianxin Corporation of China Zhenhua (Group) Science & Technology Co Ltd	Wei Zuye	No 201 Post Box of Guiyang Municipal State-level Hi-tech Industry Development Zone	550018	0851-6305749 jxfgs@public.gz.cn	Hollow brick automatic production line
10	Hangzhou Jingzhen Electromechanical Science & Technology Co Ltd		Hudong, Shushan Street, Xiaoshan, Hangzhou City	311203	0571-82762678	JTM-8A, 12A, 18A, 20A/B, 30A, etc. multi-complete set of colored tile machinery, JZQ-8 & JZQ-12 hydraulic pressure concrete

No	Enterprise name	Contact	Mail address	Post code	Contact mode	Main processing products
						perforated brick machinery
11	Henan Provincial Gongyi City Zhenda Machine Works	Tai Qinzhao	No 56, Haoluo Road, Gongyi City	451200	0371-4364490 hnzhengda@371.net	Energy conservation plane dental electric loader digger
12	Zhonhao Kiln Co Ltd of Huayao Group	Wang Hailin	No 55, Yanjiang Road, Huanggong City, Hubei Province		0713-8691608	Production and installation of different kinds of speciality kiln for ceramic brick-tile, etc.
13	Shaanxi Huangcheng Building Material Machinery Co Ltd	Yang Enquan	No 2, Shoushanjie Street, Chengguan Town, Mixian County, Shaanxi Province	722300	0917-5556478	JZK55/50-38 and JZK50/45-30 compact type de-airing extruder
14	Hangzhou Xiaoshan Xiehe Brick-Tile Machinery Co Ltd	Xie Hegen	No 195, Shanxi Road, Xiaoshan, Hangzhou City, Zhejiang Province	311203	0571-82677447	JZK45/40B-20-Y, JZK45/45-15 two-stage de-airing extruder, GS70×50 high-speed small aggregate crusher, etc.
15	Tienjin Hongda Building Material Machine Works	Wang Jian	No 5, Jingwang Road, Jinhhai County, Tianjin Municipality	301600	022-28940421 hongda@bricktilemachine.com.cn	JZKD Hongdawang brand single stage de-airing extruder, etc.
16	Wuxi City Canal Machinery Manufacturing Co Ltd	Xu Fukang	No 7 Bridge, Chengnan Road, Outside South Gate of Wuxi City	214028	0510-5360982	GZ50/50-35, GZ45/45-20 de-airing press, 45B3, 45B2 two-stage de-airing brick press, Z40A common extruder and various auxiliary equipments
17	Shaanxi Xijing Brick Press Manufacturing Co Ltd	Li Shengcheng	Baqiao Town, Xi'an City	710024	029-83612044	JZK40-15, JZK45/45-20, JZK40/40-15, JZK50/45-20, etc. de-airing extruders
18	Shanxi Baoshn Building Material machinery (Group) Co Ltd	Feng Yitao	No 8, Pingyangjie Street, Mixian County, Shaanxi Province	722300	0917-85556369	"Baoshen" brand brick-tile machinery series products
19	Henan Yutai Machinery Manufacturing Co Ltd	Li Binjiang	No 157, Xiaokang Road, Gongyi City	451200	0371-4311498 libinjiang@371.net	"Shuantu" brand free sintering brick press, hollow block machine, high mixing fly ash internal combustion common brick complete sets of equipment and "Taiyu" brand new style light wallboard extrusion press
20	Sichuan Mianzhu Taiji Machinery Co Ltd	Liao Hongqing	No 591, Danan Road, Mianzhu City, Sichuan Province	618200	0838-6101356 lhq@mz-tj.com	"Taiji brand" block machine and full auto production line
21	Beijing Jingjian Building Material Machinery Co Ltd	Li Huaijun	Liersi Industrial Park, Zhangjiawen, Tongzhou, Beijing	101113	010-61501993	Building material equipment and brick-tile mechanical equipment
22	Guangdong Gaozhou City Brick Machine Works	Liang Yuming	No 156, North Street, Gaozhou City, Guangdong	525200	0668-6663777	"Gaozhuan" brand de-airing brick machine

No	Enterprise name	Contact	Mail address	Post code	Contact mode	Main processing products
			Province			
23	Hefei Jianhua Hollow Brick Machine Works	Xue Moyou	No 322, Haozhou Road, Hefei City	230041	0551-5526678	Compact type two-stage de-airing extruder, high speed fine crushing wear resistant crush roll and high performance stirring extruding machine
24	Jiangsu Nantong Hengda Machinery Manufacturing Co Ltd	Chui Hengquan	South Head of Longzhen Large Bridge, Haian County, Jiangsu Province	214000	0513-8802113 hengda@chinese666.com	JZK45/40-20, 50/45-30 compact type two-stage de-airing machine series, etc.
25	Shandong Taishan Jianneng Machinery Co Ltd	Zhang Jishao	Dongdu Town, Taian Xintai City, Shandong Province	271222	0538-7831258	JZK series new two-stage de-airing hard plastic extruder set
26	Anhui Provincial Liuan City Xinglin Building Material Machinery Co Ltd	Wang Zhijin	100m of Down-hill Slope, Beizhan Bridge, North Huashn Road, Liuan City	237000	0564-336788	De-airing brick moulding machine series, no-wear slitter and magic road type perpendicularity slitter
27	Xinyang Xongshi Building Material Equipment Manufacturing Co Ltd	Wang Hengxian	No 128, Beijing Road, Xinyang City, Henan Province	464000	0376-6335405	JZK50/50-20, 50/45-20, 45/40-20, 40/40-15, 35/35-15 Series high performance energy conservation compact type two-stage de-airing extruder complete sets of equipment
28	Huayao Group Zhongyang Kiln Co Ltd	Xu Houlin	No 55, Yanjiang Road, Huanggong City, Hubei Province		0713-8691576	Production and installation of various speciality kilns
29	Jiangsu Haian Zhencheng Brick-Tile Equipment Manufacturing Corporation	Yu Jiaping	No 46, North danfeng Road, Haian County Seat, Nantong City, Jiangsu Province	430050	0513-8821860 hayuzm@pub.nt.jsinfo.net	JZK50/45-30, JZK45/40-20 compact type & composite de-airing extruder
30	Wuhan Hongyi Building Material Equipment Corporation	Li Fanggui	No 402, Hanyang Road, Wuhan City	430050	027-84843468 whjcjcx@public.wh.cn	Huanghelou brand JZK45/45-20energy conservation de-airing extruder, JZK40/40-15, 45/45-20, 50/45-25, 50/50-30, 60/55-30 series de-airing extruder, etc.
31	Shuanyashan Dongfang Industry Corporation	Sui Guangtian	No 159, Changhong Road, Shuangyashan City, Heilongjiang Province	155100	0469-4224163	Clinker brick-tile machinery series complete sets of equipment
32	Shandong Changluo Mining Machine General Factory Co Ltd	Zhao Duxue	No 8, Jianshe Road, Luoshan County Seat, Shandong Province	262400	0536-6234486	VP40, 45, 56 series de-airing extruder, MB800-MB1000 Series hammer crusher, etc. full set of hollow brick equipment
33	Dalian Tonghua Building Material Equipment Manufacturing Co Ltd	Liu Wenhua	Daxin Village, Xinzhaizi Town, Gangjingzi District, Dalian City	116031	0411-6301152	All-steel structure two-stage de-airing extruder, twin shafts stirring machine, etc., YHQ18-425 adjustable swallowtail slide way cutter
34	Kaifeng Oupa Automation	Feng Hongbin	No 15, Weidu Road,	475000	0378-3983127	Series perpendicularity automation slitter, super

No	Enterprise name	Contact	Mail address	Post code	Contact mode	Main processing products
	Research Institute		Kaifeng City, Henan Province			large cutter and nobody self-loader
35	Hangzhou Zhenshi Colored Face Tile Equipment Co Ltd		No 73, Xiaohang Road, Xiaoshan, Hangzhou City	311202	05712-82805686 zhenshi88@sina.com	HZM4.5 fine quality tile pressure forming machine, HZ-8 colored face tile rolling depression equipment, HZM-20 colored face tile rolling depression equipment and HZM-30 colored face tile rolling depression equipment
36	Nanjing Shuanyang Building Material Machinery Manufacturing Co Ltd	Mang Mufeng	No 5, Heyan Road, Nanjing City	210037	025-5507378	Series products of 60/60-4.0 and 60/50-30 de-airing extruders, etc.
37	Shandong Weifang Huate Magnetoelectricity Equipment Co Ltd	Liu Hai	No 48, Qinchi Road, Linqu County Seat, Shandong Province	262600	0536-3214543 lqhg@wf-public.sd.cninfo.net	Hanging electric magnetic iron remover, permanent magnetism de-ironing separator, magnetism roller, metal detector and shaker feeder, etc.
38	Hangzhou Zhongyi Coloured Face Tile Equipment Co Ltd	Wang Weisong	No 9, North Tonghui Road, Xiaoshan Economy & Technology Development Zone, Hangzhou City	311215	0571-82606788	ZYM series Tianyuan tile rolling depression colored face tile machine, Dushi tile mould colored face tile machine and ZYQ light aggregate concrete multi-orifice brick making machine
39	Sichuan Provincial Luoshan City Machine Works	Ren Fuqiang	No 67, Haitong Road, Luoshan City, Sichuan Province	614800	0833-2121377	No 1 brand series brick machine
40	Guizhou Wanda Building Material Machine Works	Jiao Xingguo	No 20, Lijiang Road, Xiaohe District, Guiyang City	550006	0851-3832065	Wanda brand planer tool double-roll crusher, planer tool trio-roll crusher and all-steel configuration energy conservation de-airing brick squeezing machine

Table 7 Schedule of Wall Material Industry Scientific Research Design Organization, Association and Main Machinery Manufacturing Corporation in 6 Countries of America, etc.

Country name	**Britain**	Unit name	**English Pottery Research Society**
Main business or processing products	The society came into existence in 1948. At that time, it was consisted of English Pottery Research Association and Britain Refractory Body Association to be the biggest ceramics research center in the world. It took on the works almost in all the enterprises of English pottery field, the works of many corporations in other countries. Anymore, it also undertook the trusted projects from non-member unit. The society can offer the science and technology service in ceramics and its relevant industrial departments, mainly facing the fine pottery (household porcelain, tile, sanitary porcelain and electrotechnical porcelain), stoneware (brick-tile & ceramics), refractory ceramics, engineering ceramics, supply business (crude material business & machinery manufacture business), etc. It also faced the ceramics production plants. Half pf the institutionary working personnel were the talented scientists and the other half with outstanding technology and talent in good co-ordination with the formers. They did their best not apart from practice. Half of the institutionary expense came from the members themselves and the rest from the thrusters (including government). The department and field of interest of the association concerned the fine pottery, stoneware, refractory body & engineering ceramics, test & analysis and outside contact & marketing, etc. The contents were related with construction, engineering research, carry out some British standard test and a series of non-standard test to meet customer requirements, regularly inspect the product quality in brickyard and also implement some exploitive research. The fine pottery research content included the tea vessel, ornament ceramics, sanitary ware, wall & floor tile, electrotechnical porcelain, rough material and equipment delivering, etc.		

Country name	**America**	Unit name	**Brick-tile research institute**
Mail address	Clemson, South Carolina, U.S.A		
Min business or processed products	In 1937, for completion of the organization & management, work & wage structure and product price, the association of American paviour, wall brick, tile and face tile producers drawn up 3 primary missions. In conformity with the voice in the whole industry sector reflected by Washington government departments and in order to maintain other authority and extend the stoneware produce market, its organization was renamed as a construction clay product research institute. In 1943, the clay tube association was set up. In 1949, the financial group fund was set up and in 1972; it became an American brick-tile research institute. Its activity was wide, being involved in training of manpower, building code and laboratorial development, etc. All the efforts were in the service to promote the brick usage and quality improvement for all brick buildings. It had 7 primary targets: To cooperate with the standardization organization, publication of technological documents and to establish contact with legislation department. Make contact with the government construction agency and department. Culture and attend in a advanced studies for undergraduates and relevant professional personnel. To complete the research projects and offers the service for their members. Its key specialists were architects, engineers and agents so a to work out the better brick masonry structure norm. Make situation recommendation for architects, corporations and the state institution, put on seminar and give lectures for various universities or hold on seminar. The brick engineering training course was also held per year. Carry out the building code in cooperation with some organizations such as American Civil Engineer Association, American Concrete Research Institute and the American Test & Material Society. One vital continuity work in the brick-tile research institute was the publication of industrial technology citation indexes and some of them were the irregular publication. The publications include the brick structure technological review, the brickwork construction, works & research abstract and brick-tile research, etc. Under study, put forward the research project, project plan basis and establishment of corresponding research organization via the cooperation of the research institute and many corporations. The company promoter managed and supervised these projects. Some research mission can be in cooperation with the American Ministry of Energy and the state science financial group. In addition, the research institute also supported the private laboratory and research in university.		

Country name	**Germany**	Unit name	**Essen Brick-Tile Research Institute**
Mail address	Institut für Ziegelforschung Essen e.V. (Brick and Tile Research Institute (IZF) Essen Regd.), D-45301 Essen		
Main business or processed products	The research institute is a standard institution in the global brick-tile technical study field. It has the sophisticated technique in the fields of brick-tile machinery, crude material, calcine, energy conservation and environmental protection, etc. It is a commonweal organization and carries out the research work based on the benefit of the intermediary majority of brickyards in technical development level. In accordance with the difference of institution, research facilities and employed personnel, the institute mainly performs the stoneware research and the key research includes the wall brick, face tile, quarry tile and roof tile, etc. Its primary mission is to solve some emergent problems with brickyards together in production and usage of the products made in brickyard and offers the technology consultation for brickyard. On the one hand, it is engaged in the basic theory research closely with the industry. On the other hand, it is for relevant production research so as to solve the practical question. The members of the research institute are mainly the Federation Germany Brick-Tile Industry Association laboratory, the equipment manufacturer, the specialties producer research community and the brickyards of reasonable quantity. The expenses come from various members, the industry trust business and the state bankroll. Furthermore, put on the trial research with the qualified testing station in the related sectors. The scope of work concerns the respects from the assessment of crude material technical skill to the check and development of finished products. The institution formation of the research institute is closely based on the mission. The ceramics division, chemistry division, technical skill division, construction research division, literature tidying up division, electric appliance & machine shop, administrative service division and testing station. The material testing station has the test aid to detect whether all the products made in brickyard meet the standard specifications. It can also inspect the material performance of concrete, storm height wallboard, floor slab, quarry tile and roof tile, etc. The building physics testing station has the test sets to measure the heat-conducting property of storm height brick wall. The hazardous material discharge testing station can test the discharge condition of polluted air matters in brickyard and make suggestion to restrict the discharge of hazardous material via adoption of effective technical measures. Its scientific association and the assistance department consultant engineer committee are the uppermost policy-making bodies. The primary mission of the research institute is in the respect of industry research and the investigation mission and target should be decided based on the manufacturing demand. In the respect of production technology, first of all, it is devoted to the research of crude material and its characteristic, the research of different technique of production, method of computation and working out of working method for machine and equipment. The major research contents are the energy conservation, enhance the output in drying chamber and reduce the injuring discharge to pollute air, etc. The major research emphasis in construction respect focuses on the research to extend usage of brickyard products. Establish the "Research Bulletin" to popularize the scientific research achievements. Set up the study class to initiate the testing technology and heat engineering production technology. Publish the research paper in other scholarly journals to popularize the research findings.		

Country name	**France**	Unit name	**France Brick-Tile Technical Center**
Main business or processed products	The general mission of the brick-tile technical center is to promote the technological advances, enhance the industrial production efficiency of sintered clay building material and product quality. The center is managed by one council and the council members are decided by the industry and research division, including the leaders in business world, the representatives in technology circles, the technology persons in authority or user's representatives and the state authority Accredit government commissioner & provost in council. The expenses comes from the contribution quota of various burnt clay product enterprises in France, carry out technical service in various works, the collected expense to train the technical personnel and the project fund supported by the state. The center has the modern research institute. Main jobs to take on in the center: The research work includes the new product research, improvement of product Performance, the problems occurred in the performance research & production of construction industry. The technical service includes the raw material research, mixture selection, take part in solving the technical matters in plant production or help to establish the testing laboratory and inspect the product performance, etc. The standardized work includes the related constructional material, co-coordinating member, technology, material property and application, etc., in addition to the standard of France Standardization Association, it also concerns the unitized technology provision, the related technical proposal & opinion and quality mark, etc. as well as the training of specialized persons and popularization & enhancement of profession skill intelligence. The testing center is primarily in charge of the works of raw material, technique of production, development of new product, taking on reification and chemical test and check. The plant cooperation department is to solve the problems occurring in industrial production. The engineering department takes charge of the works of technical skill, economy and research organization. The construction department takes charge of application and popularization of the traditional products and new product under construction. Carry out the product inspection and offer the advice and revision to technical standard. In technology, make contact with construction industry; study the inner properties of burnt clay product and the effectiveness of ceramics member, etc. The center research study team takes part in the discussion of relevant high mathematics and physical topics as well as document delivery, etc. The center has made excellent cooperation and contact with all the units concerned both here and abroad. The center is often in contact with the domestic construction science and technology center, the construction & public works technology association and the science and technology research center, etc. It also makes contact with overseas similar units. The center is a member of the Europe Brick-Tile Production Association.		

Country name	**Switzerland**	Unit name	**Europe Brick-Tile Manufacturer Association (TBE)**
Mail address	Obstgartenstrasse 28, P.O.Box.CH-8035zürich		
Main business or processed products	The brick-tile professional association came into existence in 1950, its work is to enhance and promote the technical knowledge and propaganda of products in brick-tile industry to let them reach the best and the most extensive application effect, develop & help the brick-tile industry and expand the production & application. Such sustainable development not only can solve the existing problems, furthermore find out the new problem. For each new work, the positive and negative opinions should be studied in order to solve problem. The association has been noticed more and more. Presently, TBE members are as follows: 25 member states such as Germany, Austria, Belgium, Denmark, Spain, Ireland, France, Britain, Italy, Holland, Norway, Sweden, Finland, Switzerland and Tunisia, etc. TBE Association is consisted of the departments of the executive board, operating committee and executive secretary division, etc. TBE Association holds one meeting attended by all the members per year. The meeting formation should be two sorts: One sort is academic report and discuss speciality problem. The other sort is to make survey & research. In recent years, TBE has established and completed the following important projects: 1. The production figure and statistical study of economics in the relevant construction industry; 2. Different kinds of experience recommendation of the relevant legal matters (law of labor, land law and insurance against loss rules, etc.); 3. Attend in advanced studies and technical training work for cadre and technician in brick-tile enterprise; 4. Information exchange of relevant market information; 5. Development of brick-tile productive new technology; 6. The technical standard of relevant stoneware products (for wall and floor slab) and disciplinary analysis in all the Europe countries; 7. Analysis & assessment of research findings in member research units and coordination of the relevant projects; 8. Discuss the relevant construction and building physics problems, etc. with university, college and research institute; 9. Energy conservation research of building construction and production facility; 10. Co-ordinate the work of the speciality group of European Communities and make comment to the suggestion and policy in brick-tile industry. Furthermore, offer the recent development situation of brick masonry structure published in "International Brick-Tile Conference" to the governments, the construction industry specialists and counselors. The allied nations in Europe and the associations in some countries generally arrange such activity. TBE is always in contact with the brick-tile industry and structural materials industry associations in many eastern Europe states and other countries beyond Europe. TBE often carries out the exchange of experience activities with paper or via the formation to invite the trade specialists for attending annual meeting.		

Country name	**Germany**	Unit name	**Central Association of the German Building Industry**
http	www.bauindustrie.de		

Country name	**Germany**	Unit name	**Federal German Association of the brick and tile Industry**
http	www.ziegel.de		

Country name	**Germany**	Unit name	**Brick Industry Association)**
http	www.brickinfo.org		

Country name	**Germany**	Unit name	**(American Ceramic Society)**
http	www.acers.org		

Country name	**France**	Unit name	**France West Industrial Company (OCI)**
Mail address	France West Industrial Company beijing Representative Office Contact: Li Yi, Tel: 010-68499483, Fax: 010-68425221, E-mail: hopekin@public3.bta.net.cn		
Main business or processed products	The head office of France West Industrial Company is set up in Paris. Two manufacturers are respectively located in France mid part of LA MERLATIEREZI industrial park and western MONTREMY Z.A. industrial park. In past nearly 30 years, OCI is always devoted to the plant design and equipment manufacturing in brick-tile, gypsum and fireproof material trades and continuously carries out the renewal of production technology and technological progress of equipment. By now, it has offered technological design or equipment for more than 200 brick-tile, gypsum, fireproof material works in the world. These works are distributed in Europe (France, Britain, Belgium, Holland, Poland & Russia), Africa (Algeria, Burkina Faso, Tunisia), Asia (China, Korea, Malaysia), America and Australia. In the brick-tile trade, the equipment supplied by OCI including: Tank type feeding machine (sheet iron type and belt type), hammer crusher, roll crusher, multi-bucket excavator, twin shafts stirring machine, de-airing extruder. air brick surface treatment equipment, cutter, setting machine and hot shrinkage packer, etc. The applicable crude materials for these equipments including: Coal slack, shale, fly ash, clay, industrial residue, watercourse and lacustrine argillaceous silt, etc. These equipments can produce the products of different design and standard top grade dry wall brick, load bearing hollow brick, non-load bearing hollow brick, paviour, macrospore insulating brick, common roofing tile and glazed tiles, etc. In kiln respect, OCI can offer the design proposal, control system and essential elements for sinter kiln, quadratic piling burn dry kiln. The invented fast calcimine kiln has been extensively applied in fast calcine of higher pore space rate products. The technology can have the roasting time of higher pore space rate product decrease to 4h below. The technology is a world initiate and gained the Europe patent.		
Country name	**Italy**	Unit name	**MORANDO**
Mail address	Stabilimento: Strada Rilate, 22, 1-14100 Asti Tel: +39/0141/417311 Fax: +39/0141/417504 E-mail: euroimpianti@tin.it		
Main business or processed products	The corporation is located in Asti Italy. It is consisted of brick-tile equipment manufacture subsidiary company, cement & concrete equipment manufacture subsidiary company and cement & other building material equipment manufacture subsidiary company. The first subsidiary company was set up in 1909 and the scope of business of the related brick-tile subsidiary company is as follows: Take charge of designing and manufacturing different kinds of material handling equipments such as disintegrator, stirring machine, double roll crusher and shaping equipments of extruder, etc. Manufacture different kinds of cutter, auto setting machine, brick unloader, orbit delivery system and the conveyer system in drying room, etc. Manufacture clay brick and roof tile squeezing out cutter, setting machine, brick loader and auto separating unfired brick machine, etc. In charge of constructing chamber type drying room and tunnel drying room. Manufacture the electric appliance and automatic control equipment for brickyard, cement plant, concrete plant and gypsum works. Manufacture different kinds of auto setter, brick loader, packing machine and assembly type tunnel kiln. Take charge of kiln firing systems such as gas, liquid & solid-fuel firing system and design & installation of firing system in brickyard. All the technology consultation, technical service, business, plant design general planning, technology, civil work, electric appliance, automation and site debugging, etc. There are more than 10-type extruders made in Morando Corporation. In addition, it still manufactures different kinds of stirring machine, crusher, drying room, double roll crusher and kiln, etc. Since 1960s up to now, the corporation has respectively established hundred of brickyards all over the world. Besides, it has also supplied single machine for many countries. On 2 September 2000, Morando Corporation formally joined Nosenzo combination institution. Guiseppe Nosenzo, including Tecnoimpianti, Tenosoft and Roar Corporations under the Ministry of Industry, Italy, leads Nosenzo combination institution. Nowadays, the full set of manufacturing & forming machine and production line with Morando trademark is as reliable & excellent as before. All the existing customers give good appraisal. These machines include the full set of roof tile press and extra MVC extruder and the twisting cable diameter is 770mm. Morando Corporation will supply different kinds of original parts and accessories throughout the world.		

Country name	America and Germany	Unit name	America Styr Corporation and Germany Handle Corporation
Mail address	**America Styr Corporation (STEEL) address: P.O. Box 1834 Statesville, NC 28687 USA** Fax: (001-704)8780789 E-mail: Jianh@jcsteele.com **Germany Handle Corporation (Handle) address: D-75402Mühlacker, P.O. Box 1251** Fax: 07041/891-232 Tel: 07041/891-1 E-mail: Info@Haendle.com http://www.Haendle.com		
Main business or processed products	**America STEELE Corporation (J.C.STEELE & SONS, IN)** was set up in 1889. It is a family corporation especially devoted to the machine design and machinery manufacturing of crusher and extruder, etc. Corporation head office and general factory are situated in Statesville city of North Carolina State. At the same time, 3 large-sized shale sintered product plants are also located in the state. The branch offices are set up in Australia and South Africa. In 2000, it successfully became a holding company of Germany HANDLE Corporation. The American STEEL Corporation initially invented and adopted the hard plastic extruding molding technology before 70 years and began to export the equipment in the respect. It is suitable for making brick and tile with industrial wastes such as shale, plasticity index low clay, fly ash and coal slack, etc. The hard plastic extruding molding equipment can be also easily for semi-hard plastic extruding molding and soft plastic extruding molding. The technology and equipment are widely used in the respects of hollow brick production, splitting brick, pervious, ornamental brick, different kinds of tile, light wallboard, sintered bauxite, model coal, ceramic ware, fireproof material and weep pipe, etc. Their technological equipment was not only adopted nearly by all the American brickyards, furthermore, it was used by more than 50 countries in the world such as Canada, Australia, Britain, South Africa, Asia and South America, etc. So far, some thousands of sets and complete sets of equipment made in America STEEL Corporation are in service everywhere in the world. In Korea, nearly 40 complete sets of equipment are in operation. In China, a dozen or more production lines adopt the equipments made in STEEL Corporation. **Germany Handle Corporation (Handle GmbH)** was set up in 1870, mainly engaged in crude material preparation and vacuum forming equipment drawing production in ceramics and brick-tile industry. It is a corporation with high reputation and advanced technology in the field in Europe. The brick, tile and fireproof material extrusion equipments made in the corporation are spread all over the world. Tens of them are used in the mainland of China. Handle Corporation is a corporation to carry out the fibrous reinforcement cement light production study with the vacuum extruding method of forming in the earliest time. Before 35 years, the most ideal choice of fibrous material is asbestos. Afterward, they performed the substitute fibrous material research and intermediate test in progression. In recent years, they successfully put up the production lines in Asia and Australia. Especially, the weight ratio 40% or more fly ash can be mixed so that the cost is in much depression. Besides, 3E light inside and outside wall assembly board (The word beginning of 3 English words of vacuum extruding forming, economy & cheap. green environmental protection is "E"). **The American STEEL Corporation and Germany Handle Corporation** are in copartner relation and they can supply nearly all the first-class equipments and service from crushing technology to mold technique for customers in the world.		

Country name	Italy	Unit name	BEDESCHI Corporation (BEDESCHI)
Mail address	Via Praimbole, 38-3510 LIMENA(Podova)-ITALY Tel: +390498848088 Fax: +390498848006 E-mail: bricks@bedeschi.it http://www.bedeschi.it		
Main business or processed products	Fly ash, coal slack & silt clinker brick complete sets of equipment, top grade western-style tile and splitting brick complete sets of equipment. The world-renowned enterprise came into existence in 1908. It has been engaged in brick-tile equipment manufacture for nearly 100-year history. The first set of double mud strip extruder got the world invention golden award in 1908. At present, it is one of a few speciality equipment-manufacturing groups who can carry out self-design and make once and twice setting burnt technology of required full set of technology, equipment and kiln. Being one of the leading companies in the world brick-tile trade, it is devoted to the multipurpose research and development for the industrial wastes such as fly ash, coal slack and silt, etc., It has achieved extensive experience and encouraging outstanding achievement. In the past years, BEDESCHI Corporation supplies the following equipments and production lines of the domestic users with remarkable service, superior equipment and favorable price: 1. Qinhuangdao Generating Electricity Co Ltd: full set of production line to produce 0.125 billion fly ash /shale, top grade clear water bricks and hollow bricks. 2. Qinhuangdao Generating Electricity Co Ltd: full set of production line and design in production of 0.125 billion fly ash /shale, heat preservation building blocks and hollow blocks. 3. Xibaipo Generating Electricity Co Ltd: The main production line is to annually produce 0.125 billion fly ash /shale, top grade clear water bricks, hollow bricks and hollow blocks. 4. Shanxi Luan Bureau of Mines Changcun Village Coal Mine: The main production line to produce annually 0.125 billion fly ash /shale, top grade clear water bricks, hollow bricks, hollow blocks and other tens of production lines.		

Country name	**Italy**	Unit name	**Bongioanni Corporation**
Mail address	China Agency of Italy Bongioanni Corporation address: 5B Room 08 of Huamailen Holiday Hotel, No 28, Linhuaxili, Fengtai District, Beijing Post code: 100073 Post box: Beijing 569(100031) Tel: 010-63985671, 63985674 & 63963436 Fax: 010-63963321 E-mail: prxm@bj163.com		
Main business or processed products	Italy Bongioanni Corporation is a specialized company to manufacture the brick-tile equipments of extruder and tile-making machine with raw material preparation and molding equipment. The corporation has its extensive market everywhere in the world. In the world, more than 3000Bongioanni brick-tile production lines are in operation and production. The extruders made in the corporation are 3 different series of extruding molding equipments such as soft model, semi-hard model and hard model. The extruding technology can be confirmed and selected in accordance with chemical composition analysis, molding, drying and burnt experiment of raw material. In order to produce the products of sinter hollow brick, top grade western-style tile, face tile, floor tile, splitting brick, stamping brick, stoneware pipe, fireproof material and prefabricate wall member, etc. Italy Bongioanni Corporation's progressive technology and equipment represent the frontier level of brick-tile machinery manufacturing industry in the world. Thus, the extrusion equipments made in various extrusion equipment works of Bongioanni Corporation in Europe have the remarkable features of low energy consumption, high efficiency and fine quality. The technology and material of brick-making equipment of Italy Bongioanni Corporation are widely used in Europe to make hollow brick and top grade dry wall brick with the raw material of clay, silt, shale, coal slack, fly ash, slag and tailings. The corporation can supply the newest reamer or even the extruder design and equipment for clients in accordance with the raw material used by the clients. Since it has joined the well-known Italy Industrial Group Gruppo Filea, the technology and commercial ability has been further enhanced. Therefore, the newest series of TECNO extruder have been shown in China and the production capacity per set is 15~120tph (tons per hour) with different types of soft extruding and hard extruding. Italy Bongioanni Corporation can manufacture and offer different types of preparation equipment and molding equipment suitable for various raw materials. The equipments are: Crusher, tank type feeding machine, high speed crush roll, ageing silo equipment, edge runner, mixing machine, screen type de-airing extruder, de-airing extruder and automation tile press, etc.		

Country name	**Germany**	Unit name	**Rieter Corporation (Rieter)**
Mail address	RIETER-WERKE GmbH D-78417 Konstanz, Postfach 101753 E-mail: rieter@rieter.de http://www.rieter.de		
Main business or processed products	The corporation has been over 100-year development history. It has invented and produced a series of brick-tile mechanical equipment. It can offer different kinds of excavators, tank type feeding machine, double roll crusher with 100T output of a set per hour, stone removal crush roll, screen type blending crusher, humid tower, edge runner and screwed extruder, etc.		

Country name	**Germany**	Unit name	**Germany Lingl Brick-Tile Machinery and Kiln Corporation (Lingl)**
Mail address	Hans Lingl Anlagenbau and Verfahrenstechnik GmbH & CO. KG D-89206 Neu-Ulm, Postfach 1629 Tel: +49/7319/751-0 Fax: +49/7319/751-210 E-mail: Lingl@lingl.com		
Main business or processed products	It's one of the biggest corporations to manufacture the architectural pottery machine and package plant in the world. The corporation was set up in 1938 and its employees in German factory are more than 1,200 persons. It also has 4 sub-factories and its branches are established in Britain and Italy, too. Nowadays, over 500 Lingl production lines are in service all over the world. Adopt the different kinds of extruding molding technology for soft model, s mi-hard model and hard model. The once or quadratic setting burnt technology can be used to make the products of sinter hollow block, top grade western-style tile, face tile, floor tile, splitting brick, stamping brick, stoneware pipe, fireproof material and prefabricating wall member, etc with different specification and different pore space rate. The Lingl Corporation's cutting, piling, transporting, ornamental surface handling, spraying glazing device, drier, kiln, stacking, packing equipment, stored program control system, computer art auxiliary system, interconnection equipment and factory network system have represented the frontier level of brick-tile machinery manufacturing industry in the world.		

Country name	**Germany**	Unit name	**KELER Corporation (KELER)**
Mail address	China connection for business mode: GRIEGER GMBH Kommunikationsdesign WallstraBe 27 04600 Altenburg/Thüringer Tel: +49 3447 8952-11 Fax: +49 3447 8952-25 Http://www.Keller-hcw.de		
Main business or processed products	The corporation is located in German North Rhine State and it is one of the first rate speciality manufacturers in the world to supply the architectural pottery mechanical equipment and production line. The primary service of the corporation is to offer the mechanical Equipment and production line for architectural pottery industry. Its scope of business also includes the survey control & adjusting instrument, automation control technique and working plastics equipment. The corporation can offer the mechanical equipment and production line for architectural pottery trade. The products include: inner wall brick (Europe universal hunk macroscopic void hollow brick), external tile (various face tiles, dry wall brick, exterior wall cladding), paving floor tile, splitting brick and stamping brick applying the wall face and ground-surface, clay and cement tile, etc. The production equipments offered by KELER Corporation include various cutting machines that are applied to soft extruding, semi hard extruding & hard extruding technique, ornamental surface processing unit, setting machine unit, transport transmission & regimentation device, once stack burnt & quadratic stack burnt technology progressive drying kiln, kiln technology & equipment and product stacking & packing system, etc. The stacker work is substituted by robot is a successful example. In recent years, KELER Corporation has ripe fabrication technology and experience in brick making with shale, fly ash, coal slack and different kinds of industrial residue to meet the market demand. In the respect to serve customers and develop market, KELER Corporation has also gained conspicuous achievement. In addition to develop the styles and designs of face tile without intermission, the hunk hollow brick coating jointly developed with clients has farther enhanced the heat preservation insulating property of product. The production of external wall ornament clevis fittings and large-sized tile represents the new trend of tile product in Europe.		

Annex 6

Report of Energy Conservation and Environmental Protection Demonstration Enterprises in Brick-making Industry

I. Overview

The China Brick-making industry is bulkiness. There are nearly 0.1 million enterprises altogether in China. The annual production gross amount exceeds over 600 billion pieces of brick. But, h average scale is very small and the annual production capacity is only 6~7 million pieces of brick each enterprise. The technological equipment is background. Up to now, most of the enterprises adopt the natural drying natural drying and ring kiln calcine, low labor productivity. The year per capita production brick in one enterprise is only more than 0.1 million pieces. Singleness of product variety, most of bricks are clay solid bricks accounting for a large number, large consumption of land resources. The difference of energy consumption among enterprises is much obvious. For the majority of enterprises, to produce 10,000 pieces of brick can consume over 1.2 T standard coal. Most of the enterprises are based on the fuel of coal and GHG emission amount is too much. Therefore, in early 90s last century, China officially started the wall material innovation work. The Governments at all levels successively issued a series of policy laws and regulations. The clay solid brick was strictly restricted, enhancing the strength of development, production, application and popularization of new walling materials such as hollow brick, waste residue brick, concrete masonry unit and plates, etc., clearly pointing out the trade reform, developing target and mission of walling material. This has played a vital impulse part for energy conservation, earth saving, environmental protection an implementation of mechanization production in China's brick-making industry.

Via tens of years effort and development, China's brick-making industry has made a certain improvement in consumption of raw material, product variety structure and structure of enterprise scales. A number of backbone enterprises have come into existence due to their multi-product variety, best product quality, more advanced technical skill and sensible resources utilization of energy. Meanwhile, some background enterprises to make clay solid brick are to be closed or turned for other product production because of their lag technology and serious wasting of resources. This has become an unblocked trend. To select the advantage one and get rid of the disadvantage one has become the obvious feature in the trade. This is also the brilliant prospect to develop and enhance the brick-making industry in China. So, selecting the excellent energy conservation and environmental protection demonstration enterprise has vital operation significance.

II. Basis and Condition of Demonstration Enterprise

For so many brick-making enterprises in China, via multi-year survey, physical verification and cruising data analysis & comparison, we have selected 8 enterprises as energy effective usage and environmental protection demonstration enterprises. They rank in the leading position of the trade in the sectors of investment idea, operation mechanism, management model, technical skill equipment level, product variety quality, energy resources effective utilization, plant area environment, business culture construction and input-output ratio. They have important guide and demonstration significance for reform and development of brick-making industry in China.

In selecting the demonstration enterprise, the basis and condition we closely observe can be reflected in the following several respects:

1. The crude material to be used conforms the state industrial policy, conforms earth saving and ecology environmental requirements. In addition, its amount is too much and wide spreading. The crude materials are generally shale, coal slack, fly ash and slag, etc.

2. Multi-product variety, the main production standard prescriptive perforated brick (240mm×115mm×90mm) has over 25% of pore space rate. They are mainly for building bearing. The hollow brick (multi-specification such as 240mm×180mm×115mm, etc.) has more than 40% of pore space rate, mainly for frame construction filling in, belonging to non-bearing material and the product quality conforms the national standard.

3. The residual heat of coal slack and fly ash is utilized as fuel or internal combustion material and coal is used as auxiliary fuel. The kiln afterheat is for artificial drying. Fundamentally carry out the purpose that baking of brick is without coal or a few coals are used.

4. The technology and equipment are in the intermediate level or high level of the trade, higher degree of mechanization and the scale of production is over 30 million pieces/year.

5. Effective plant system, good management specification, better economic benefit, fine plant environment and most of the plants are park type. Besides, the environmental protection consciousness s stronger and some handling measures have been taken.

6. They have ever rewarded many encouragements in the trade and the located area, influence power with higher reputation and their development potential is remarkable.

III. Comprehensive Analysis of Selected Enterprise Situation

In accordance with the condition above, we have comprehensively analyzed the 8 recommended enterprises. Although the physical circumstances of various enterprises are different, their used crude material, fuel, product and technological equipment condition are differing from, too, but their advantage is quite obvious. They have stronger demonstration effect for so many enterprises.

1. The local distribution and periphery market business environment advantage is distinctness. Their product takes possession of larger market share and the enterprises have higher influence power and good reputation.

In the elected 8 enterprises, 3 of them are situated in the provincial capital suburbs and the other 5 ones are located in the periphery of medium cities. Their product sales radius is generally within 50 km and the main customers are the building contractors in cities and towns. Owing to these enterprises belonging to new works set up in the last few years, with higher first time step, convenient traffic, more officers, building contractors and fellow traders make visit or study. The nearby trade meeting or congress representatives have made visits to 7 enterprises. All the representatives have actively appraised such outstanding enterprises. Thus, the influence power of the enterprises and reputation has been enhanced. In doing so, the enterprises have also got new market space. The 8 enterprises are confirmed as the fine quality standard enterprises by the state trade quality inspection center and their products are the first choice products for local users.

2. The technical skill equipment is in the domestic leading level, representing the development trend of China's brick-making industry.

About 90% of China brick-making enterprises still adopt the natural drying and ring kiln. A few enterprises use tunnel kiln for baking of brick. The difference is too much in comparison with almost 100% usage of tunnel kiln in the developed countries of Europe. So, when selecting the demonstration enterprises, the existence conditions and possibility of brick-making industry in China should be fully taken into account so that the practical demonstration effect can be brought into full play for most of the brick-making enterprises in China.

In the 8 recommended enterprises, 4 enterprises adopt artificial drying tunnel kiln firing and the other 4-use artificial drying ring kiln technology. They are all the model enterprises in China brick-making industry. The technical skill used by the former is more advanced, with higher degree of mechanization, but the investment is relatively larger. The technical skill used by the Latter is utility and the investment is relatively less, being suitable for intermediate and small investors or intermediate and small operators.

Being one of model enterprises to use tunnel kiln technology, Changchun Guangda Industry Group is a private enterprise. The invested and set up coal slack brickyard has been well assessed by the fellow traders in the trade. The crude material preparation line has used bi- shattering (jaw shattering and hammer shattering), bi- stir (bi-time stirring), one aging (ageing) and one roller (rolling) technology, clay uniformity handling, reasonable gradation and good processability. For molding, the domestic high extrusion pressure de-airing screwed extruder is adopted with body appearance specification and better compactness. As to big slip, cutting and setting, automatism cutting, turning, transportation, regimentation and stacking loading system, the technology is smoothly, higher work efficiency and the labor intensity decrease greatly. The drying and burning of brick use the wide section (4.6m, bi- strip) tunnel kiln once stacking burnt technology. Computer controls the kiln work. The whole production-line technique is reasonably arranged, coordination, sensitive operation, stabilization and high performance. The technological equipment used in Shijiazhuang Xinghui Construction Material Co Ltd is similar with that to be adopted in Guangda Industry Group. But, its main crude material is fly ash, slag as internal combustion material. This has important demonstration significance in shale reserves abundant region while without rock refuses resources.

Being one of 4 enterprises with utility technology and minor investment, Sichuan Yaan Jinshi New Material Co Ltd is a joint stock system enterprise. Owing to is brick-making shale crude material mixed with 30%~35% fly ash, the crude material preparation technology adopts the measures of ageing and rolling, etc., mixed uniformity of pug, better body molding, drying with afterheat, adoption of ring kiln, excellent input-output ratio. It is a desired selection for intermediate and small investors to construct works or carry out technology renovation in China's brick-making industry.

3. Lower raw material and fuel consumption, earth saving, energy conservation and fine waste utilization effect, conforming the industry development policy requirements of the state sustainable development strategy and protection ecological environment.

In 8 brick-making enterprises, 3 ones such as Changchun Guangda Industry Group adopts the crude material of coal slack and the fuel is the residual heat value of coal slack. 4 enterprises of Sichuan Yaan Jinshi New Material Corporation, etc. adopt shale as crude material, mixing with fly ash or slag in crude material. The residual heat value of fly ash or slag is used as fuel. Hebei Provincial Hengshui Transport Corporation Brickyard uses fly ash as crude material and the residual heat value of fly ash is for fuel. Therefore, except using coal of Chengdu Yongxing Shale Hollow Brick Co Ltd, the rest don't adopt earth in brick making and baking of brick without coal. According to the statistics of the 8 enterprises, the annual production capacity for different kinds of clinker brick (90% as hollow brick) is 0.52 billion pieces (converted into brick), the annual saved standard coal is 50,000T, industrial residue utilization nearly 1 million T and the saving of land about 500mu (1 mu=666.6m^2).

China is a great power in population and she is also a developing country. So, land & energy source effective use and environment improvement are the urgent requirement for sustainable development of Chinese economy in the future. It is also the certainty selection to develop China's brick-making industry. This is the renovation and developing orientation & trend in brick-making industry.

4. High performance & specification of operating mechanism, higher level of management, preferred outstanding achievement, with stronger adaptability, self-remolding ability and self-advancement ability.

In the 8 enterprises, 2 ones are private enterprises, 5 joint stock system enterprises and one local state-owned individual proprietorship. Their common merits are preferable integral diathesis of enterprise, with a number of management staff having strong responsibility & super hard style, with a lot of business skilled technology backbone, a better employee team who can be endurance in hard condition, fine labor skill. They have perfect working systems, labor discipline and methods of excitation mechanism & rewards and punishments. When entering the work area and living quarters of these enterprises, the orderliness, and better environment and fine mental state of employees can

b found. This shows that the business culture construction is quite important in enterprise management.

In the 8 enterprises, owing to excellent management, their production costs are low, satisfied product quality and higher labor productivity. Per capita substance Labour productivity in the Guangda Industry Group Brickyard is 0.70 million pieces of brick, the lowest Labour productivity can reach over 0.30 million piece/year. The operation of business profit is 20%~30% and with better economic benefit. Various economic indexes are in the leading level of the trade.

Known from description above, 8 enterprises of Changchun Guangda Industrial Corporation, etc. in the respects of raw material, fuel usage & waste utilization, product variety & product quality, technological equipment technology capability, running mechanism & management, the enterprise integration benefit and condition of business construction, etc. have visible advantage and leading status in comparison with the majority enterprises in China's brick-making industry.

(Attachment: 8 copies of enterprise fundamental background table)

[Note: The specific measure detailed description of energy conservation & environmental protection adopted by the enterprise can be read in the project training teaching material—— "Collection of Training Teaching Material (Collection of Clinker Brick Production Technology and Application)"].

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

Enterprise name	Chengdu Yongxing Shale Hollow Brick Corporation			Tel	028-82420301	Establishment time	In 1992
Mail address	Shuangjiang Village, Yongshang Town, Xinjin County			Post code	611437	Construction investment (yuan)	9 million
Business entity representative	Gong Muquan	Enterprise property	Joint stock system	Number of employee	310	Yearly output (standard brick)	65 million
Adoptive energy conservation environmental protection measure and implementation effect	1. Energy conservation type direct tail pulley kiln and residual heat drying system. The kiln can be easily controlled, good heat-insulating property, easy implementation mechanization taking off reform, reutilization of kiln residual heat. The drying system saves about 40mu of land and the investment should increase RMB 0.80 million and yearly save coal 1,300T. 2. Increase capacity compensator. The major equipment adopts the capacity increasing compensator and some investment should be added. One set of installed capacity 110kw brick making machine should mate one set of capacity increasing compensator cost about RMB 5,000. 12 work hours per day and calculation with 250 days, the year electricity saving is about 65000 kw/hour and about RMB 30,000 can be saved. 3. Dust collection equipment Owing to shale of raw material, there is plenty of dust while crush. After installing the dust collection equipment, the workshop environment improves greatly.						
Product variety & specification (mm)	240×115×90	180×115×190	240×115×240	240×90×240	200×115×240		
Crude material & industrial residue utilization (Variety & annual consumption)	Year consumption of shale is 0.15 million T.						
Fuel service behavior (Variety, unit generating heat & annual consumption)	Whole usage rough coal & thermal value 4,100~4,700 kilocalorie/kg Year coal 8,000 T and coal consumption 800kg/10,000 piece (converted into standard brick)						
Service of equipment (Major equipment name, matching power, drying mode & kiln model, etc.)	Jaw crushing, hammer crushing, ageing silo, extruding & stirring, 60/50 de-airing extrusion molding, 14 artificial drying chambers, one direct ring kiln and installed gross capacity 910kW.						
Technique of production process	Jaw crushing → hammer crushing → ageing silo → extruding & stirring → de-airing extrusion molding → artificial drying →direct ring kiln →burning of brick → finished product storage space						
Environmental construction in plant and enterprise rewarded situation	The plant greening area is 20%, environment neatness and it is the provincial trade advanced enterprise and trade high quality standard enterprise throughout the country.						
The administrative mechanism feature & operation state	Perfect management system, stringency and better state of operation.						

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

<table>
<tr><td>Enterprise name</td><td colspan="3">Changchun Guangda Industry Group Company</td><td>Tel</td><td>0431-8938725</td><td>Establishment time</td><td>In 1999</td></tr>
<tr><td>Mail address</td><td colspan="3">No 719, Changchun Avenue, Changchun City, Jilin Province</td><td>Post code</td><td>130041</td><td>Construction investment (yuan)</td><td>37.80 million</td></tr>
<tr><td>Business entity representative</td><td>Wang Lijuan</td><td>Enterprise property</td><td>Private</td><td>Number of employee</td><td>107</td><td>Yearly output (standard brick)</td><td>75 million</td></tr>
<tr><td>Adoptive energy conservation environmental protection measure and implementation effect</td><td colspan="7">1. The total raw material is coal slack, body drying & burning of brick, kiln residual heat is for workshop, office building, heating and bathing of staff members. The annual standard coal saving 7,500T, waste residue 15,000T and save borrow soil land about 70mu.
2. Adopt electricity saving & increasing capacity compensator. For type 70/60 vacuum brick making machine, increase investment about RMB 14,000, annual electricity saving 0.18 million kw/hour and electric cost saving about RMB 0.09 million.
3. The kiln heat engineering automatic monitoring control. The kiln body uses the energy conservation heat preservation technology. Per kilogram product heat consumption can reduce from 1,600kJ to 1,350kJ in general. The kiln thermal efficiency can enhance over 10%.
4. Use the dust collection equipment and the work environment of the raw material preparation workshop can improve greatly.</td></tr>
<tr><td>Product variety & specification (mm)</td><td colspan="7">240×115×90
240×115×115 190×190×90
240×190×90</td></tr>
<tr><td>Crude material and industrial residue service condition (variety & annual consumption)</td><td colspan="7">All the crude materials are coal slack and annual consumption 0.15 million T.</td></tr>
<tr><td>Fuel service behavior (Variety, unit generating heat & annual consumption)</td><td colspan="7">All the crude materials are based on the residual heat of coal slack and coal slack thermal value per kilogram is about 430~470 kilocalorie.</td></tr>
<tr><td>Service of equipment (Major equipment name, matching power, drying mode & kiln model, etc.)</td><td colspan="7">Stepwise feeding machine, blade type crusher, hammer shattering, aeging silo, stirring machine, edge runner, 70/60 de-airing gyratory crusher, automation cutting system, 2 sets of once stack burnt tunnel kiln (144.5×4.6×1.12m) and the installed gross capacity 1,100kW.</td></tr>
<tr><td>Technique of production process</td><td colspan="7">Tank type stepping feeding →jaw crushing → hammer crushing → ageing → stirring → edge running → stirring → de-airing extrusion → bar cutting & cutting → automatism setting carriage → in-kiln → finished product storage space</td></tr>
<tr><td>Environmental construction in plant and enterprise rewarded situation</td><td colspan="7">The plant is reasonable layout, neatness, better and greening just like a "garden".
It has ever honourly got the provincial new product award and scientific technical progress third class award.</td></tr>
<tr><td>The administrative mechanism feature & operation state</td><td colspan="7">Management stringency, specification, higher efficiency of labor (0.70 pieces/person year), desired business circumstance and preferable profit enterprise.</td></tr>
</table>

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

Enterprise name	Heilongjiang Shuangyashan City Hollow Brickyard			Tel	0469-4247420	Establishment time	In 1991
Mail address	No 159, Changhong Road, Jianshan District			Post code	155100	Construction investment (yuan)	34.50 million
Business entity representative	Sui Gungtian	Enterprise property	Joint stock system	Number of employee	138	Yearly output (standard brick)	75 million
Adoptive energy conservation environmental protection measure and implementation effect	1. The raw material is coal slack. The full heat source is the residual heat of using coal slack. The kiln residual heat is for body drying, burning of brick, heating of workshop & work and bathing of staff members. The annual saving standard coal is 7,500T, waste residue utilization 0.15 million T and save 70mu (1mu=666.6m^2) borrow soil right of way. 2. Adopt electricity saving & increasing capacity compensator. For type 70/60 vacuum brick making machine, increase investment about RMB 14,000, annual electricity saving 0.20 million watt/hour and electric cost saving about RMB 0.10 million. 3. Use the fume cleaning equipment, improve the workshop environment and fume emission comes to the local zone standard. 4. Kiln heat engineering autocontrol, the fibre thermal insulation heat preservation technology is for the kiln body and the kiln thermal efficiency has raised over 10%.						
Product variety & specification (mm)	370×240×190 (hollow block) 240×240×115 (hollow brick) 240×115×90 (perforated brick)						
Crude material & industrial residue utilization service condition (Variety & annual consumption)	All the crude materials are coal slack and annual consumption 0.15 million T. The rock refuse residual heat value is 600~700 kilocalorie/kilogram.						
Fuel service behavior (Variety, unit generating heat & annual consumption)	The full fuel is the residual heat value of coal refuses.						
Service of equipment (Major equipment name, matching power, drying mode & kiln model, etc.)	Jaw crushing, hammer crushing, domestic mating stirring system and all the extrusion, cutting, setting, transport system and kiln system are imported from he West Corporations in France. The installed gross capacity is 1,600kW.						
Technique of production process	Jaw crushing → hammer crushing → stirring → aging → edge running → de-airing forming → cutting, stacking & transporting automation delivery system → once setting burnt transect tunnel kiln.						
Environmental construction in plant and enterprise rewarded situation	Layout tidiness of plant area, layout reasonableness, better greening, the provincial advanced enterprise an ever gained many medals from all levels of government.						
The administrative mechanism feature & operation state	Joint stock system operation, specification management, the optimized integration benefit enterprise for project imported in the trade and good state of operation.						

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

Enterprise name	Shijiazhuang Xinghui Building Material Co Ltd			Tel	0311-6811790	Establishment time	In 2001
Mail address	No 477, Victory Street, Shijiazhuang City			Post code	050041	Construction investment (yuan)	21 million
Business entity representative	Ye Dali	Enterprise property	Joint stock system	Number of employee	160	Yearly output (standard brick)	70 million
Adoptive energy conservation environmental protection measure and implementation effect	1. Slag and fly ash, etc. are for internal combustion and heat source, the mixing amount is 35%, without industrial coal, annual saving standard coal more than 7,000T and shale raw material saving 35% or so. 2. Adopt the increasing capacity compensation equipment, the brick making machine can yearly save electricity about 0.17 million Kw/hour, save electric cost RMB 0.08~0.09 million and the increasing capacity equipment merely requires adding investment about RMB 15,000. 3. Use the fume cleaning and raw material crushing & dedusting system, improve the environment in plant area and come to the urban district waste gas emission standard requirement. 4. Kiln heat engineering automatic monitoring control system and the thermal insulation heat preservation technology and the kiln thermal efficiency has risen about more than 10%.						
Product variety & specification (mm)	240×115×90 240×240×90						
Crude material & industrial residue utilization service condition (Variety & annual consumption)	The crude materials are soft quality shale, industrial residue fly ash, waste residue with 32~35% mixing ratio.						
Fuel service behavior (Variety, unit generating heat & annual consumption)	The used fly ash residual heat value is 1,600~1,700 kilocalorie/kilogram and it can fully meet the demand of baking of brick and non-use of industrial coal.						
Service of equipment (Major equipment name, matching power, drying mode and kiln model, etc.)	Rod mill, stirring machine, de-airing gyratory crusher, 6 dual rail drying chambers, 4.6m dual channel tunnel kiln and installed gross capacity 1,430kW.						
Technique of production process	Tank type ingredient → rod milling → stirring → de-airing vacuum forming → bar cutting & cutting → drying → calcine → finished product						
Environmental construction in plant and enterprise rewarded situation	Best layout of plant area, 30% greening area, "park type" plant and top quality trade enterprise, etc.						
The administrative mechanism feature & operation state	Joint stock system enterprise management, operation specification and best business circumstance.						

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

Enterprise name	Sichuan Yaan Jinshi New Material Co Ltd			Tel	0835-2851137	Establishment time	In 2001
Mail address	Yaoqiao Town, Yucheng District, Yaan City			Post code	625000	Construction investment (yuan)	5 million
Business entity representative	Wang Zhiyao	Enterprise property	Joint stock system	Number of employee	220	Yearly output (standard brick)	65 million
Adoptive energy conservation environmental protection measure and implementation effect	1. Mix 35%fly ash shale raw material, body drying & burning of brick basically rely on the residual heat of fly ash.10,000 pieces of merely need standard coal 20kg around and yearly save standard coal about 6,000T. 2. Adopt the electric power increasing capacity compensator. In comparison with the tunnel kiln enterprise in the same scale, the installed gross capacity merely reaches 30%~50% with full striking electricity saving effect 3. More practicability of technology & equipment, more advanced and in comparison with the tunnel kiln enterprise in the same scale, the gross investment merely reaches 25%~30%, being applicable for the actual demand of majority enterprises in China.						
Product variety & specification (mm)	240×115×90 (perforated brick) 240×115×240 (8-hole) 200×115×90 (2-hole) 240×115×53 (6-hole)						
Crude material & industrial residue utilization service condition (Variety & annual consumption)	The shale, industrial residue are for fly ash, the fly ash residual heat value is 800~1,200 kilocalorie and the mixing amount is 35%.						
Fuel service behavior (Variety, unit generating heat & annual consumption)	Usage of a few coal, 20~30 kilogram/10,000 pieces of brick Coal thermal value of 3,700~4,000 kilocalorie/kilogram						
Service of equipment (Major equipment name, matching power, drying mode & kiln model, etc.)	Jaw crushing, hammer crushing, stirring machine, ageing silo, wet edge runner, 50/45 de-airing brick press, 12 drying chambers and one 32-gate ring kiln. The installed gross capacity is 680kW.						
Technique of production process	Jaw crushing → hammer crushing → stirring → aging → edge running → extrusion molding → cutting & setting → drying → calcine → finished product						
Environmental construction in plant and enterprise rewarded situation	Best plant environment and top quality enterprise to meet the trade standard						
The administrative mechanism feature & operation state and business circumstance	Post rating, quality, duty & benefit are all in coupling of logging, perfect system and better state of operation.						

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

<table>
<tr><td>Enterprise name</td><td colspan="3">Hebei Hengshui State-owned New Building Material Corporation</td><td>Tel</td><td>0318-205810</td><td>Establishment time</td><td>In 2001</td></tr>
<tr><td>Mail address</td><td colspan="3">Hebei Provincial Hengshui City</td><td>Post code</td><td>053000</td><td>Construction investment (yuan)</td><td>6 million</td></tr>
<tr><td>Business entity representative</td><td>Li Guoping</td><td>Enterprise property</td><td>Government owned</td><td>Number of employee</td><td>210</td><td>Yearly output (standard brick)</td><td>45 million</td></tr>
<tr><td colspan="2">Adoptive energy conservation environmental protection measure and implementation effect</td><td colspan="6">1. The whole raw material is fly ash, body drying & burning of brick are completely based on the residual heat value of fly ash and non-use of industrial coal. Yearly save the standard coal over 4,000T, yearly save the borrow soil land about 50mu and yearly utilize 90,000T industrial residue & fly ash.
2. Be the first domestic baking of brick enterprise fully using coal ash, save earth & use waste and the coal saving is in the leading level of the industry.</td></tr>
<tr><td colspan="2">Product variety & specification (mm)</td><td colspan="6">240×115×53 (full fly ash solid brick)</td></tr>
<tr><td colspan="2">Crude material & industrial residue utilization service condition (Variety & annual consumption)</td><td colspan="6">Over 90% of power plant fly ash and less than 10% of external admixture</td></tr>
<tr><td colspan="2">Fuel service behavior (Variety, unit generating heat & annual consumption)</td><td colspan="6">The fuel is fundamentally based on the residual heat of fly ash, non-usag of coal basically, the fly ash heat value is 350~380 kilocalorie/kilogram and the annual fly ash consumption of 90,000 T.</td></tr>
<tr><td colspan="2">Service of equipment (Major equipment name, matching power, drying mode and kiln model, etc.)</td><td colspan="6">Belting metering device, stirring machine, wet edge runner, extrusion stirring machine, e-airing extruder, bar cutting cutter, tunnel drying chamber, ring kiln and 420kW installed gross capacity.</td></tr>
<tr><td colspan="2">Technique of production process</td><td colspan="6">Proportioning & measuring → stirring → edge running → extrusion stirring pugging mullring → de-airing forming → cutting & setting → drying burning of brick → finished product storage space</td></tr>
<tr><td colspan="2">Environmental construction in plant and enterprise rewarded situation</td><td colspan="6">Planning tidiness of plant area construction, better greening, it is a model enterprise of fly ash clinker brick and it has got many encouragements.</td></tr>
<tr><td colspan="2">The administrative mechanism feature & operation state and business circumstance</td><td colspan="6">Management nicety and good state of operation</td></tr>
</table>

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

Enterprise name	Sichuan Dongri Industry Co Ltd			Tel	0833-7669111	Establishment time	In 2001
Mail address	Qinglong Town, Pengshan County			Post code	620866	Construction investment (yuan)	7 million
Business entity representative	Zhang Qigui	Enterprise property	Private	Number of employee	250	Yearly output (standard brick)	60 million
Adoptive energy conservation environmental protection measure and implementation effect	1. The raw material is shale, the mixed slag amount 30%, yearly save standard coal about 3,000T and waste residue consumption about 40,000T. 2. Adopt the electric power increasing capacity compensator, the brick making machine can yearly save electricity about 60,000 kw/hour and yearly save electric cost about RMB 30,000. 3. Use the dust collection equipment, better workshop environment and fine landscaping in the plant area.						
Product variety & specification (mm)	240×115×90 240×200×115 (6~8 holes)				240×240×115 (12 holes) 190×240×190 (6 holes)		
Crude material & industrial residue utilization service condition (Variety & annual consumption)	30% of shale, slag dosage and 600 kilocalorie /kilogram of slag heat value						
Fuel service behavior (Variety, unit generating heat & annual consumption)	Coal is as outer thrown fuel, coal thermal value 5,500 kilocalorie/kilogram and standard coal consumption 500~550 kg/10,000 pieces (converted into standard brick)						
Service of equipment (ajor equipment name, matching power, drying mode and kiln model, etc.)	Jaw crushing, hammer crushing, stirring machine, agein silo, wet edge runner, 50/45-3.0 de-airing brick press, 9 artificial drying chambers, one 34-gate ring kiln and afterheat artificial drying. The installed gross capacity is 550kW.						
Technique of production process	Jaw crushing → hammer crushing → stirring → de-airing extrusion → cutting & setting → drying → calcine → finished product storage space						
Environmental construction in plant and Enterprise rewarded situation	The plant is reasonable layout, 30% greening area and a "garden type" plant. It is a trade advanced enterprise and quality qualification enterprise.						
The administrative mechanism feature & operation state and business circumstance	Quota management and work efficiency are connected, rigour checking up system and the better state of operation						

Table of Brick-making Industry Energy Conservation and Environmental Protection Demonstration Enterprise Fundamental State

Enterprise name	Shandong Jining Kemai New Material Corporation			Tel		Establishment time	In 2002
Mail address	Jining City			Post code	273500	Construction investment (yuan)	22 million
Business entity representative	Song Yancheng	Enterprise property	Government owned	Number of employee	130	Yearly output (standard brick)	60 million
Adoptive energy conservation environmental protection measure and implementation effect	1. The raw material is coal slack. The total fuel is the residual heat of refuses utilization. The annual utilization amount of industrial residue coal slack is 12,000T, standard coal saving is about 6,000T and the annual borrow soil right-of-way saving 60mu. 2. Adopt the electric power increasing capacity compensator. Increase investment about RMB 15,000, annual electricity saving 0.18 million kw/hour and electric cost saving about RMB 0.09 million. 3. The kiln adopts the thermal insulation heat preservation measure and utilizes the fume cleaning equipment. The kiln thermal efficiency enhances about 10% and the fume emission reaches the relevant standard requirements.						
Product variety & specification (mm)	240×115×90 240×180×115 240×240×115						
Crude material & industrial residue utilization service condition (Variety & annual consumption)	Full coal slack crude material, thermal value 520 kilocalorie/kg and 12T annual consumption.						
Fuel service behavior (Variety, unit generating heat & annual consumption)	The full fuel is the residual heat value of coal refuse and non-use of coal.						
Service of equipment (Major equipment name, matching power, drying mode & kiln model, etc.)	Jaw crushing, high performance hammer crusher, twin shafts stirring machine, gin silo, two-stage de-airing brick-making machine, once setting burnt tunnel kiln, dust control unit used in dust emission point and 1200kW installed gross capacity.						
Technique of production process	Jaw crushing → hammer crushing → stirring → aging → stirring → de-airing extrusion → bar cutting & setting → once setting burnt → finished product storage space						
Environmental construction in plant and enterprise rewarded situation	Best plant area greening and in conformity with GB 3095-96 "*Ambient Air Quality Standard*" requirement						
The administrative mechanism feature & operation state and business circumstance	Management science, stringency and better state of operation						

Annex 7

Summary of Brick-Tile Enterprise Survey Table and Wall Material Industry Background Statistical Table

By December 2003, in combination with the opportunity when the quality surveillance inspection test center of the state building material industry walling & roofing material makes spot test for key enterprise and random sampling in the works, in order to implement the "*Provision of Services for the Execution of a Brick-making Sub-sector Survey Related to the Energy Conservation and GHG Emission Reduction in Chinese TVES (Phase II)*", we have respectively surveyed 305 enterprises in 26 provinces, cities & municipalities and autonomous regions such as Beijing, Tianjin, Sichuan, Guangdong, Jiangsu, Fujian, Jilin, Heilongjiang, Liaoning, Shaanxi, Hunan, Zhejiang, Hebei, Chongqing, Anhui, Shandong, Jiangxi, Guangxi, Henan, Mongolia, Gansu, Qinghai, Xinjiang and Ningxia, etc. The survey concerns 290 brick-tile enterprises, accounting for 95% of the total investigated enterprises, 8 concrete block & steam pressure building block enterprises, 5 plates enterprises, 1 ceramic brick enterprise and 1 concrete tile enterprise. The enterprise survey questionnaire form has basically listed the corresponding annual product quality random sampling work sheet in 2003. The related data have been checked by the site random sampling personnel and via phone in later period.

The fundamental state statistic of the wall material industry in 9 provinces, cities and autonomous regions such as Jiangxi Provincial Nanchang City, Sichuan Provincial Chengdu City & Panzhihua City, Tianjin Municipality, Jiangsu Provincial Nanjing City, Hebei Provincial Chengde City, Fujian Provincial Xiamen City, Hunan Provincial Changsha City and Xinjiang, etc.

Attachments: A. Catalogue of Enterprise Survey Questionnaire Form Collection
B. Catalogue of Statistical Table of Wall Material Industry Background
Table 1 Enterprise Survey Questionnaire Form (305 copies)
Table 2 Statistical Table of Wall Material Industry Background (9 copies)

Project Team of "*China Brick-making Industry Survey*"

December 10, 2003

Catalogue of Enterprise Survey Questionnaire Form Collection

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
1	Beijing City	8	2nd Works of Beijing (Fangshan) Yaxin Special Building Material Company	Li Kewang	010-51172516	1 mile to East of Dujian Railway Station, Fangshan District, Beijing	102402	Sinter perforated brick	3600	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
2			Aoyuan Building Material Co Ltd	Yu Liming	010-89317161	Yancun Town, Fangshan District, Beijing	102412	Sinter perforated brick	17000	
3			Beijing Guduguohua Glazed Product Co Ltd	Sun Hongli	010-61899060	West of Longquanwu Village, Mentougou District, Beijing City	102300	Ancient architecture coloured glaze series product	3 million pieces	
4			Beijing Xishan Glazed Works	Sun Jinsheng	010-69843206	Inside Linchangkou, North Shuizha Road, Mentougou District, Beijing City	102300	Ancient architecture coloured glaze series product	12 million pieces	
5			Beijing Fangshan District Hongtu Ancient Building Material Works	Cai Zhixing	010-61392664	Zhuangtou Village, Liulihe Town, Fangshan District, Beijing	102403	Ancient architecture coloured glaze series product	5 million pieces	
6			1st Plant of Beijing Concrete Product	Wang Youbin	010-82910819	East of Dewaixisanqi, Haidian district, Beijing City	100096	Sinter perforated brick	4000	
7			Beijing Jewel Glazed Product Co Ltd	Li Peihua	010-69842216	No 2, Liuliqu Street, Mentougou District, Beijing City	102300	Coloured glaze product	3 million pieces	
8			Beijing Shiquan Wall Material Co Ltd	Guo Chunsheng	010-69825980	No 17, Donglongmen, Mentougou District, Beijing City	102300	Sinter perforated brick	4500	
9	Tianjin Municipality	7	Tianjin Wuqing District Dongfa Building Material Co Ltd	Li Shulai	022-82127367	Puwa Township, Wuqing District, Tianjin City	301700	Sinter common brick	2000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
10			Tianjin Jinghai County Liangtou Town Brick-Tile Field	Zhang Zhongyu	022-68968377	2 miles to West of Jinghai County Seat, Tianjin City	301600	Sinter common brick	3000	
11			Tianjin Jinghai County Building Material Product Main Plant	Du Chunxi	022-28940988	No 5, jingwang Road, Jinghai County, Tianjin City	301600	Sinter common brick	4000	
12			2nd Brick-Tile Field of Tianjin Jinghai County Zhongwang Town	Luo Songhan	022-68531115	Zhongwang Town, Jinghai County, Tianjin City	301615	Sinter common brick	4000	
13			Tianjin Jinghai County Xiyaozhuang Township Brickfield	Ding Yuqing	022-68598508	North of Shunmington Village, Xiyaozhuang Township, Jinghai County, Tianjin City	301611	Sinter common brick	3000	
14			Tianjin Red-star Welfare New Type Building Material Product Works	Dong Li	022-82131900	West Side of Jing-Jin Road, Damangzhuang, Wuqing District, Tianjin City	301711	Haydite building blocks	50000m^3	
15			Tianjin Jiatai Glazed Tile Co Ltd	Chen Weizhi	022-29899208	Development Zone, Jixian County, Tianjin	301914	Western-style glazed tile	9 million pieces	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
16	Sichuan Provincial	22	Sichuan Provincial Pengshan County Pingchuan Hollow Brickyard	Zhang Pingchuan	0833-7633796	Group 6,Gaoji Village, Fengmin Town, Pengshan County, Meishan City, Sichuan Province	620860	Sinter hollow brick	3000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
17			Sichuan Provincial Qionglai City Honglin Brickyard	Liu Guoquan	028-88755069	Lianhua Village, Huilong Town, Qionglai City, Chengdu City, Sichuan Province	611536	Sinter hollow brick	5000	
18			Chengdu Municipal Xinjin County Huangdu Shale Brick Co Ltd	Liao Fengchao	028-2469377	Group 4,Taoyuan Village, Huangdu Township, Xinjin County, Chengdu City	611432	Sinter perforated brick	3000	
19			Chengdu Municipal Xinjin County Tongxing Building Material Works	Wen Xiyun	028-2469341	Yuanshan Village Huangdu Township, Xinjin County, Chengdu City	611432	Sinter perforated brick	3000	
20			Sichuan Provincial Luoshan City Mojiang Coal Mine waste Brickyard	Long Keqing	0833-3659341	Caoba Village, Taiping Town, Shawan District, Luoshan City	614902	Sinter perforated brick & hollow brick	4300	
21			Sichuan Provincial Pengzhou Jinfang New Type Wall Material Plant	Zhang Suyun	028-83836119	Jianshe Road, Jiulong Town, Pengzhou	611941	Sinter perforated brick & hollow brick	15000	
22			Sichuan Provincial Deyang CityHongqiang new Type Building Material Works	Ge Xiaofang	0838-2585377	No 8 Area of Deyang Prison, Sichuan Province	618000	Sinter common brick	4500	
23			Sichuan Provincial Zigong City, Red Flag Shale Machine Brick-making Field	Diao Chengshi	0813-8262833	Daquekou, Huidong Road, Zigong City, Sichuan Province	643000	Sinter perforated brick	3000	
24			Sichuan Provincial Xichang No 303 Works	Liu Conglong	0834-3302723	No 47, Laoximen Street, Xichang City	615000	Sinter hollow brick	4500	
25			Sichuan Provincial Meishan City Dongbo District Minjiang Shale Machine Brick-making Field	Kang Yurong	0833-8019395	Group 3, Qingliang Village, Zhangkai Town, Dongbo District, Meishan City	612160	Sinter hollow brick	3000	
26			Yaan City Jinshi New Type Building Material Co Ltd	Wang Zhiyao	0835-2851137	Yaoqiao Village, YaoqiaoTown, Yucheng District, Yaan City	625000	Sinter hollow brick	6000	
27			Sichuan Provincial Yibin City Wuqiao Building Material Industrial Co Ltd	Li Degao	0831-3564437	No 19, East Minjiang Road, Yibin City	644007	Sinter perforated brick & hollow brick	9500	
28			Sichuan Provincial Qionglai City Tenglong Shale Brickyard Brickyard	Du Xuehongg	028-88755219	Lianhua Village, Huilong Town, Qionglai City, Sichuan Province	611536	Sinter hollow brick	5000	
29			Sichuan Provincial Yongxing Shale Hollow Brick Co Ltd	Gong Muquan	028-82420301	Shuanjiang Village, Yongxing, Yongshang Town, Xinjin County, Chengdu City	611437	Sinter perforated brick & hollow brick	7500	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
30			Shale hollow Brickyard of Sichuan Provincial Dongri Industrial Co Ltd	Zhang Qigui	0833-7669000	Boyang, Qinglong Town, Pengshan County, Sichuan Province	620866	Sinter hollow brick	6000	
31			Sichuan Provincial Neijiang City Donxing District Xiaohekou Brickyard	Wu Yunlu	0832-2611261	Xinjiang Street Sub-district, Donxing District, Neijiang City, Sichuan Province	641000	Sinter common brick	12000	
32			Meishan City Dongbo District Wantong Machine Brick-making Field	Wan Congquan	0833-8440666	Group 1, Jiatong Village, Baima Town, Dongbo District, Meishan City	612160	Sinter common brick	2000	
33			Sichuan Provincial Chengdu Longquanlongwen Shale Brickyard	Yan Dashou	028-84893093	Group 5, Toumen Village, Hongan Town, Longquanyi District, Chengdu City	610109	Common brick, perforated brick & hollow brick	5000	
34			Sichuan Provincial Dujiangyan City Longsheng Waste Brick Co Ltd	Shuai Guoming	028-87263290	Donglin Village, Xiange Township, Dujingyan City, Sichuan Province	611834	Sinter common brick	2400	
35			Sichuan Provincial Chengdu Longquan Ranjian Company	Yu Duozhang	028-84860894	No 10, Randeng Road, Longquanyi District, Chengdu City, Sichuan Province	610100	Common brick, perforated brick & hollow brick	3500	
36			Sichuan Provincial Dujiangyan City Xiange No 2 Machine Brickyard	Ren Daie	028-87263355	Group 4, Donglin Village, Xiange Township, Dujingyan City, Sichuan Province	611834	Sinter common brick	3000	
37			Sichuan Provincial Chengdu City Longquanyi District Tianchang Shale Brick-Tile- Field	Zhu Shirong	13708075066	Group 10, Sizi Village, jinlong Town, Longquanyi District, Chengdu City, Sichuan Province	610108	Sinter common brick	6000	
38	Guangdong Provincial	11	Guangdong Provincial Penyu Hualong Shenqing New Type Light Brickyard	Yao Runcang	020-84754132	Shenqing Village, Hualong Town, Penyu District, Guangzhou City, Guangdong Province	511434	Sinter common brick	5000	
39			Guangzhou City Penyu Xingguang Light Brick Co Ltd	Chen Ruiqi	020-84771215	Zhongcunshier Village, Penyu District, Guangzhou City	511495	Sinter perforated brick	5000	
40			Guangdong Guangzhou Zengcheng City Ningxi Town Huzhongcun Hollow Brickyard	Chen Qingqiu	020-82961287	Huzhong Village, inxi Town, Zengcheng City, Guangzhou, Guangdong Province	511358	Sinter hollow brick	4500	
41			Guangdong Provincial Dongwen City Zhongtang Town No 3 Building Material Works	Zhang Yaolin	0769-8811405	Xiangshuizha, East of Zhongtang Town, Dongen City, Guangdong Province	523220	Sinter hollow brick	3000	
42			Guangdong Provincial Nanhai City Wuzhung South Building Material Ceramics Plant	Pen Chaodai	0757-6411180	Wuzhung Industrial Park, Nanhailuo Village, Nanhai City, Foshan, Guangdong Province	528226	Ceramics square brick	1 million m^2	
43			Guangdong Provincial Foshan City Shiwen Yongdaxi Tile Field	Feng Jianbin	0757-2204383	Dafu, Zhangcha Town, Foshan City, Guangdong Province	528000	Sinter tile	4.5 million pieces	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
44			Shiwen Art Ceramics Plant Co Ltd of Guangdong Fotao Group	He Yongle	0757-2714119	No 17, Dongfeng Road, Shiwen Town, Foshan City, Guangdong Province	528031	Sinter tile	14.20 million pieces	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
45			Shenzhen Zhujiang Junan ement Prouct Co ltd	Yang Shiqiang	0755-26602301	Qiaoxiang Road, Shahe North Ring Road, Nanshan District, Shenzhen City	518053	Concrete pavement brick	50000m^2	
46			Guangdong Provincial Naihai City Jianfeng Ceramics Art Plant	Luo Qiqiu	0757-5323333	Waisha, Cunweiceramic Industrial Park Nanzhuang Town, Nanhai City, Guangdong Province	528219	Sinter tile	700	
47			New Building Material Product Works of Shenzhen Anlonqiang Industrial Co Ltd	Lin Golong	0755-28164028	Guanlandashuikeng Industrial Zone, Boan District, Shenzhen City	518110	Industry clinker partition plate	0.12 million m^2	Enterprise survey questionaire The state control spot test & random sampling sheets in 2003
48			Jiatai Ceramics (Guangzhou) Co Ltd	Zhou Jinghua	020-82794188	North Area, Xintang Industrial Processing Zone, Zengcheng City, Guangzhou, Guangdong Province	511356	Sinter western-style glazed tile	11 million pieces	
49	Jiangsu Province	16	Nangjing Gaochun County Gubo Brick-tile Field	Huang Tianmu	025-87354042	Gubo Dingsong Village, Gaochun County	211316	Sinter perforated brick	1400	Enterprise survey questionaire
50			Brick-tile Field of Nangjing Municipal Qixia Building & Installing Enginering Company	Dong Dejin	025-85503591	Heban Village, Nangjing City	210028	Sinter perforated brick	1100	
51			Nangjing Shiliqiao Brick-tile Field	Tian Xinliang	025-88852061	Dingshan Shifo Village, Pukou, Nangjing City	210031	Sinter common brick & hollow brick	1622	
52			Nangjing Municipal Yuhuatai District Xishanqiao No 2 Brick-tile Field	Shi Guangtai	025-82805907	Tianbaoqiao Bridge, Outside of Zhonghua Gate, Yuhuatai District, Nangjing City	210041	Sinter common brick	1750	
53			Nangjing Municipal Jiangning District Moling Longfeng Hollow Brickyard	Chen Qinglin	025-82755688	Moling Town, Jiangning District, Nangjing City	211111	Sinter perforated brick	2500	
54			Nangjing Jiangpu County Chengdong Brick-tile Field	Liu Jiachang	025-88289033	Qiliqiao Bridge, Zhujiang Town, Jiangpu County, Nangjing City	211800	Sinter perforated brick	4000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
55			Nangjing Municipal Liuhe District Lingyan Brick-tile Field	Tang Hanjun	025-87500031	Qiancang Village, Xongzhou Town, Liuhe District, Nangjing City	211500	Sinter perforated brick	2100	
56			Nangjing Municipal Jiangning District Lukou No 2 Brick-tile Field	Du Dacheng	025-82770876	Lukou Town, Jiangning District, Nangjing City	211113	Sinter common brick & perforated brick	2500	
57			Nangjing Municipal Jiangning District Qilin No 2 Brick-tile Field	Cao Qingyou	025-84128905	Qilin Village, Jiangning District, Nangjing City	211135	Sinter perforated brick	1650	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
58			Nangjing Municipal Yuhuatai District Youfang Brick-making Field	Liu Zhenghua	025-82809511	YoufangqiaoBridge, Outsie of Zhonghua Gate, Nangjing City	210041	Sinter perforated brick	2045	
59			Nangjing Municipal Jiangning District Chunhua Brickyard	Tang Yaxiang	025-82290461	Chunhua Brickyard, Jiangning District, Nangjing City	211122	Sinter perforated brick	2800	
60			Nangjing Municipal Jiangning District Gulihuagang Brick-tile Field	Yang Yongren	025-86130808	Guli Town, Jiangning District, Nangjing City	211164	Sinter perforated brick	2600	
61			Nangjing Municipal Guxong Brick-tile Co Ltd	Long Huabin	025-86700090	Guxong Village, Banqiao Town, Nangjing City	210039	Sinter perforated brick	2500	
62			Nangjing Shengjian Brick & Tile-making Co Ltd	Zhu Zhenxia	025-86732141	Xinjian, Outside of of Zhonghua Gate, Nangjing City	210039	Sinter perforated brick	2200	
63			Nangjing Xinxiang New Building Material Co Ltd	Zhong Liming	025-86704707	Xinjian, Outside of of Zhonghua Gate, Nangjing City	210039	Sinter perforated brick	6000	
64			Jiangsu Provincial Hongze County Jinhe Building Material Works	Dong Xinnian	0517-7302988	South Head of Yanhe Road, Xishunhe Town, Hongze County	221300	Sinter common brick & perforated brick	3000	
65	Fujian Province	18	Fujian Provincial Lonhai City Fulong Machine Brick-making Field	Wang Shuiping	13006242199	Longtian, Jiaomai Town, Longhai City	363107	Sinter perforated brick	500	
66			Fujian Provincial Lonhai City Jiaomaishaban Machine Brick-making Field	Chen Longqin	0596-6780013	Jiaomaishaban, Longhai City	363107	Sinter perforated brick	2180	
67			Fujian Provincial Lonhai City Jiaomai Town Puwei Machine Brick-making Field	Yang Jinchang	0596-6786357	Jiangxianbian, Puwei Village, Jiaomai Town, Longhai City	363107	Sinter perforated brick	1000	
68			Fujian Provincial Lonhai City Jiaomaihualong Porous Brick-making Field	Lin Wutian	13709315080	Jiaomaishaban, Longhai City	363107	Sinter perforated brick	1000	
69			Fujian Provincial Lonhai City Jiaomai Wuze Village Machine Brick-making Field	Chen Shaohong	0596-6795552	Linmai, Wuze Village, Jiaomai Town, Longhai City (No 324 National Highway)	363107	Sinter perforated brick	900	
70			Machine Brick-making Field of Fujian Provincial Lonhai City Jiaomai Commodity Housing Development Company	Huang Chunhui	0596-6774167	Shangfang Village, Jiaomai Town, Longhai City	363107	Sinter perforated brick	900	
71			Machine Brick-making Field of Fujian Provincial Lonhai City Jiaomai Development Company	Lin Yazai	0596-6792834	Jiaomai Town, Longhai City	363107	Sinter perforated brick	1000	
72			Fujian Provincial Lonhai City Jiaomaishimai Machine Brick-making Field	Lin Qiaoyao	13906957123	Jiaomaishimai Town, Longhai City	363107	Sinter perforated brick	1000	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
73			Fujian Provincial Lonhai City Wuze Fruit Farmer Machine Brick-making Field	Chen Haize	13906048261	Wuze Village Fruit Farmer, Jiaomai Town, Longhai City, Fujian Province	363107	Sinter perforated brick	600	
74			Fujian Provincial Lonhai City Jiudong Machine Brick-making Field	Xu Biantou	0596-6760328	Inside Jiudong Group, Wuze Village, Longhai City, Fujian Province	363107	Sinter perforated brick	1000	
75			Fujian Provincial Lonhai City Buwenwupu Machine Brick-making Field	Chen Denghai	0596-6571988	Changzhou Access of Tai Expressway, Yingbin Road, Zhangzhou	363109	Sinter perforated brick	800	
76			Fujian Provincial Lonhai City Jiaomai Construction Machine Brick Co Ltd	Guo Qinghui	0596-6774135	Jiaomaineiding Farmer, Longhai City	311190	Sinter perforated brick	700	
77			Fujian Shaxian County Jianguo Machine Brick-making Field	Xu Agui	0598-5822318	Small North Gate, North Exit of Shaxian County Seat	365500	Sinter perforated brick	2000	
78			Xiamen City Tongan New Star Hollow Brick-making Field	Sun Xinming	0592-7201213	Houze Village, Xinming Town, Tongn District, Xiamen City	361100	Sinter perforated brick	900	
79			Tongan Brickyard of Dasheng Kiln Industrial Construction Development (Xiamen) Co Ltd	Li Rongqin	0592-725700	Puhou Village, Hngtang Town, Tongan District, Xiamen City	361100	Sinter perforated brick	6000	
80			Xiamen Yijia Building Material Co Ltd	Huang Wuzhuan	13077816767	Houqing Village, Xinyu Town, Tongan District, Xiamen City	361100	Sinter perforated brick	1500	
81			Xiamen City TonganRongxing Machine Brick-making Field	Lin Youmian	0592-7011335	Liushanshe, Hongtang Village, Xike Town, ongan District, Xiamen City	361100	Sinter perforated brick	1000	
82			Xiamen City haicanglongquanfa New Building Material Co Ltd	Lv Yunfeng	0592-5981352	Room 903, No 597, West Lianqian Road, Xiamen City	361009	GRC light weight ribbon board	0.10 million m^2	
83	Jilin Province	1	Jiutai Branch of Jilin Guangda Industrial Group Co Ltd	Guo Yongliang	0431-2384037	No 124, Jiuying Street, Jiutai City, Jilin Province	130500	Sinter common brick	6000	
84	Hailongjiang Province	5	Hailongjiang Provincial Harbin City Huabin Brickyard	Song Fengkui	0451-84101221	Dujia Village, Wanggang Town, Harbin City, Hailongjiang Province	150088	Sinter common brick	2000	
85			Hailongjiang Provincial Harbin City Power District, Lantian Brickyard	Yang Delong	0451-82913700	Opposite to Bayi Gasoline Station, Ha-A Road, Power District, Harbin City	150048	Sinter common brick	800	
86			Hailongjiang Provincial Harbin City Daoli District West Suburb Brickyard	Peng Bin	0451-84321221	No 206, Airfielf Road, Daoli District, Harbin City	150078	Sinter common brick	6000	
87			Hailongjiang Provincial Harbin City wanggang Brickyard	Cheng Qiang	0451-86706307	Wanggang Town, Nangang District, Harbin City	150088	Sinter common brick	4000	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
88			Hailongjiang Provincial Jimus City Tianfu Hollow Brick Co Ltd	Gao Shoushan	0454-8782042	West Section of Hongxia Road, Jiamus City	154002	Sinter common brick, perforated brick & hollow brick	6300	
89	Liaoning Province	24	Liaoning Provincial Shenyang City Xihuan Hollow Brickyard	Zhang Yudong	024-89361292	West Side of Bailiguan, Yuhong Township, Yuhong District, Shenyang City	110141	Sinter hollow brick	1800	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
90			Liaonin Dalian Lvshun Tongda Light Material Co Ltd	Huang Zhaokun	0411-6210760	Wangjia Village, Tiexi Town, Lvshun City	116045	Sinter common brick & hollow brick	2400	
91			Liaonin Dalian Huaqiao Brickyard	Han Jianchao	0411-6690048	Shishangou Village, Yinchengzi Town, Gangjingzi District, Dalian City	116036	Sinter common brick & hollow brick	2500	
92			Liaonin Dalian Gangjingzi District Jinxia Brickyard	Zhao Qingwen	0411-6740560	Bayi Farm, Xiajaihezi, Gangjingzi District, Dalian City	116035	Sinter common brick & hollow brick	2300	
93			Shenghua Brickyard of Liaonin Dalian Xiajiahezi Industrial Company	Cui Xuesheng	0411-6409343	Xiajiahezi Village, Caozhenbo, Gangjingzi District, Dalian City	116035	Sinter common brick	2600	
94			Liaonin Dalian Lvshun Hollow Brickyard	Wang Zhende	0411-6210184	Wangjia Village, Tieshan Town, Lvshun, Dalian City	116045	Sinter hollow brick	10000	
95			Liaonin Dalian Longda Brickyard	Feng Wenbin	0411-6400756	Anzishan Village, Caozhenbo, Gangjingzi District, Dalian City	116035	Sinter common brick & hollow brick	2000	
96			Liaonin Dalian Lvshun Shundao Brickyard	Wang Lushneg	0411-6247331	Qujia Village, Shundaowen Town, Lvshunkou District, Dalian City	116047	Sinter common brick & hollow brick	2000	
97			Liaonin Dalian Lvshun Guangming Building Material Works	Wang Yongli	0411-6358135	Dawang Village, Shuisiying Street, Lvshun, Dalian City	116604	Sinter common brick & hollow brick	2000	
98			Liaonin Dalian Lvshun Dawang Building Material Works	Liu Jilian	0411-6233115	Dawang Village, Shuisiying Street, Lvshun City	116604	Sinter common brick & hollow brick	2000	
99			Dalian Brickyard	Zhang Deping	0411-6635961	Shahekou District, Dalian City	116033	Sinter common brick	3000	
100			Dalian Lvshun Longhai Building Material Works	Wang Zhijun	0411-6244129	Aizikou Village, Shuangdaowen Town, Lvshunkou District, Dalian City	116047	Sinter common brick	3000	
101			Dalian Lvshun Tieshanjiucaifang Brickyard	Liu Zuoying	0411-6120233	Jiucaifang Village, Tieshan Town, Lvshun, Dalian City	116045	Sinter common brick & hollow brick	1800	
102			Dalian Lvshun Tieshan No 2 Colored Face Brickyard	Wang Lizhi	0411-6212208	Wangjia Village, Tieshan Town, Lvshun City	116045	Sinter common brick & hollow brick	2800	
103			Dalian Lvshun Chenghua Building Material Works	Zhang Guangyou	0411-6260016	Touchengzi, Lvshun, Dalian City	116043	Sinter common brick	3100	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
104			Dalian Lvshun Zhoujiawei Brickyard	Sun Renzhong	0411-6241996	Zhoujiaweizi Village, Shundaowen Town, Lvshunkou District, Dalian City	116047	Sinter common brick	3000	
105			Dalian Lvshun Longhua Building Material Works	Zhao Yuanhe	0411-6233242	Xigou Village, Shuishiying Town, Lvshun, Dalian City	116050	Sinter common brick & hollow brick	4000	
106			Dalian City Jinzhou District Nanshan Colored Face Brickyard	Liu Chenglian	0411-7693748	Nanshan Village, Guangming Street, Jinzhou District, Dalian City	116100	Sinter common brick & hollow brick	2500	
107			Dalian City Jinzhou District Longwang Colored Face Brickyard	Sun Qizhong	0411-7803941	Longwang Village, Guangming Street, Jinzhou District, Dalian City	116100	Sinter common brick & hollow brick	2600	
108			Dalian Lvshun Century Building Material Works	Song Yugui	0411-6351336	Shigou Residents Commission of Shuishiying Street, Lvshunkou District, Dalian City	116604	Sinter common brick & hollow brick	2600	
109			Dalian Lvshun Xigou Building Material Works	Cui Jianlu	0411-6233072	Xigou, ShuishiyingTown, Lvshun, Dalian City	116604	Sinter common brick & hollow brick	2200	
110			Dalian Lvshun Xinjia Building Material Works	Zhang Hengkuan	0411-6675047	Industrial Park of Xinjia Zone, Lvshunkou District	116035	Sinter common brick	2500	Enterprise survey questionaire
111			Tieling Xinxinhelisi Building Material Co Ltd	Wang Yinchen	0410-8865777	Xintaizi, Tieling City, Liaoning Province	112611	Concrete minitype hollow block	0.5324 miillion standard pieces	
112			Liaoning Santuo New Building Material Co Ltd	Chen Tiebo	0412-2229152	No 58-1, Naner Street, Tiedong District, Anshan City	114001	Woven wire rack PS sandwich plate	0.20 million m^2	
113	Shaanxi Province	22	Xi'an Baqiao District Baling Hollow Brickyard	Liu Huixue	029-83576675	Hollow Brickyard, Baling, Baqiao District, Xi'an City	710038	Sinter perforated brick	1200	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
114			Xi'an Baqiao District Shijiadao Hollow Brickyard	Shi Baoli	029-83465557	Hollow Brickyard, Shijiadao, Baqiao District, Xi'an City	710038	Sinter perforated brick	800	
115			Xi'an Weiyang District Dongfang Hollow Brickyard	Jiangbo	029-86724703	Zhao Village, Tanjia Township, Weiyang District, Xi'an City	710021	Sinter perforated brick	1500	
116			Xi'an Baqiao District Liu Village Hollow Brickyard	Ling Fuhe	029-83576073	Liu Village, Xiwang Street Sub-district, Baqiao District, Xi'an City	710038	Sinter perforated brick & hollow brick	2500	
117			Chang'an District Jiyang Township Zhou Village Brickyard	Lei Zhiqiang	029-85808768	Zhou Village, Jiyang Township, Chang'an District, Xi'an City	710116	Sinter perforated brick	1500	
118			Xi'an Baqiao District Shenlufang No 2 Brickyard	Chen Fang	13072931595	Shenlufang Village, Baqiao District, Xi'an City	710038	Sinter perforated brick	1000	
119			Xi'an Weiyang District Daming Palace Xinhua Machine Brickyard	Zheng Yongan	029-86713821	Xinhua Village, Daming Palace, Weiyang District, Xi'an City	710021	Sinter perforated brick	1500	
120			Xi'an Weiyang District New Building Material Works	Yu Xingyuan	029-86612069	Tanjia Township, Weiyang District, Xi'an City	710021	Sinter perforated brick	1800	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
121			Xi'an Xiangfa New Building Material Works	Ren Xuanming	13991935239	Zhongdian Village, Red Flag Street Sub-district, Baqiao District, Xi'an City	710038	Sinter perforated brick	900	
122			Xi'an Weiyang District Miaozhang Brickyard	Zhang Baocheng	029-86614147	Miaozhang Village, Tanjia Township, Weiyang District, Xi'an City	710021	Sinter perforated brick	1500	
123			Xi'an Baqiao District Red Flag Street Sub-district, Shenlufang No 5 Brickyard	Da Xiaoning	029-83463683	Shenlufang Village, Red Flag Street Sub-district, Baqiao District, Xi'an City	710038	Sinter perforated brick	1300	
124			Xi'an Baqiao District Red Flag Tonship Xiangyanggou Brickyard	Li Hebin	029-83545162	Xiangyanggou, Red Flag Tonship, Baqiao District, Xi'an City	710038	Sinter perforated brick	1200	
125			Xi'an Chang'an District Huaxing Building Material Works	Xue Jun	029-85900555	Nanfeng Village, Dumen Town, Chang'an District, Xi'an City	710016	Sinter perforated brick	1500	
126			Chang'an District Zhoudu Wall Material Industrial Co Ltd	Xue Shuangsuo	029-85902456	Haojing Beifeng Village, Dumen Street Sub-district, Chang'an District, Xi'an City	710116	Common brick, perforated brick & hollow brick	4700	
127			Chang'an Hongfang Building Material Works	Xue Yong	029-85900668	Beifeng Village, Dumen Town, Chang'an District, Xi'an City	710116	Sinter perforated brick	2000	
128			Chang'an Lingzhaoxishi Brickyard	Bo Shouchang	13319243895	Chang'an Lingzhaoxishi Brickyard	710116	Sinter perforated brick	800	
129			Xi'an Xinyue Industry & Trade Co Ltd	Zhang Guoxuan	029-85963869	Shiyang Village, Xiliu Town, Chang'an District	710115	Sinter perforated brick	1000	
130			Chang'an District Haojing Haoyi Brickyard	Xue Sherui	029-85901298	Beifeng Village, Dumen Town, Chang'an District, Xi'an City	710116	Sinter perforated brick	800	
131			Xi'an Chang'an District Xidu Building Material Company	Luo Junxue	029-85901555	Nanfeng Village, Dumen Town, Chang'an District, Xi'an City	710116	Sinter perforated brick	1500	Enterprise survey questionaire (2 copies) Annual product quality random sampling work sheets in 2003
132			Xi'an Chang'an Dasheng New Building Material Works	Xue Qinhu	029-85901268	Haojing, Chang'an District, Xi'an City	710116	Sinter perforated brick	3000	
133			Chang'an Xijing Hollow Brickyard	Tang Mingli	029-85806418	Haojing, Dumen Town, Chang'an District, Xi'an City	710116	Sinter perforated brick	1200	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
134			Xi'an Qianjin Building Material Works	Xie Zhiying	13087573122	West Yangyuan Village, Guodu Town, Chang'an District, Xi'an City	710016	Sinter perforated brick & hollow brick	1000	
135	Shaanxi Province	16	Xi'an Ruifeng Hollow Brickyard	Xing Xinguo	029-8346553	No 6, Baling Road, Baqiao District, Xi'an City	710038	Sinter common brick & perforated brick	2350	Enterprise survey questionaire Annual product

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
136			Chang'an Hejiaying Hollow Brickyard	Tang Zhongwu	029-85620845	Hejiyin Village, Chang'an District, Xi'an City	710100	Sinter perforated brick	1000	quality random sampling work sheets in 2003
137			Chang'an District Guosheng Building Material Works	Ren Yi	029-85972496	Renjiazhai Village, Guodu Town, Chang'an District, Xi'an City	710118	Sinter perforated brick & hollow brick	1200	
138			Chang'an District Dazhao Brickyard	Wu Wei guo	13991129566	Sanyi Village, Dazhao Township, Chang'an District, Xi'an City	710103	Sinter common brick	750	
139			Chang'an District Xiliu Town Xiaozhao Brickyard	Gao Zhiping	13991126080	Chang'an District Xiliu Town Xiaozhao Brickyard	710100	Sinter common brick	600	
140			Xi'an Red Flag New Building Material Works	Li Wanxue	029-83550692	Xiangyanggou Village, Red Flag Street Sub-district, Baqiao District, Xi'an City	710038	Sinter perforated brick & hollow brick	3600	
141			Chang'an District Weiqu Town Jiao Village Building Material Works	Lv Baoan	029-85643100	Chang'an District Weiqu Town Jiao Village Building Material Works	710100	Sinter perforated brick	800	
142			Chang'an District Dumen Zhongfengfangxing Brickyard	Xue Quanxi	029-85901555	Zhongfeng Village, Dumen Town, Chang'an District	710115	Sinter perforated brick	1200	
143			Gaoling County Jiyouchen Brickyard	Ji Youchen	029-86070530	Manan Village, Yuchu Township, Gaoling County	710200	Sinter common brick	800	
144			Gaoling County Weiqiao Building Material Works	Shi Ming	029-86070108	Weiqiao Village, Gaoling County	710200	Sinter common brick	1200	
145			Gaoling County Weihe Red Flag Co Ltd	Ji gang	13319280688	Weiqiao Village, Gaoling County	710200	Sinter perforated brick	1500	
146			Common Brick Branch of Gaoling County Building Material Works	Dong Anren	029-86071189	Yinwang Village, Yuchu Township, Gaoling County	710200	Sinter common brick	1000	
147			Gaoling County Mabei Machine Brickyard	Wei Deming	029-86071920	Xiaozhai Village, Yuchu Township, Gaoling County	710200	Sinter common brick	800	
148			Xi'an Baqiao District Red Flag Street Sub-district, Xiangyanggou No 2 Brickyard	Lu Binxue	029-83534163	Xi'an Baqiao District Red Flag Street Sub-district, Xiangyanggou No 2 Brickyard	710038	Sinter common brick	1200	Enterprise survey questionaire
149			Xi'an Baqiao DistrictXiangyang Building Material Co Ltd	Liu Qunan	029-83514960	Xi'an Baqiao DistrictXiangyang Building Material Co Ltd	710038	Sinter common brick	1300	
150			Xi'an Baqiao District Liu Village Brickyard	Wang Zhengxu	029-83576554	Xi'an Baqiao District Liu Village Brickyard	710038	Sinter common brick	2300	
151	Hunan Province	29	Hunan Provincial Yueyang City Linxiang Yaolin Town Ceramics Plant	Li Guanxong	13808403380	Hunan Provincial Yueyang City Linxiang Yaolin Town Ceramics Plant	414314	Sinter common brick	650	
152			Hunan Provincial Yueyang City Linxiang Changtang Town Brickyard	Luo Sibao	0730-3530368	Chafnf Village, Changtang Town, Linxiang, Yueyang City	414316	Sinter common brick	600	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
153			Hunan Provincial Chenzhou City Beihu District Dongwan Machine Brickyard	Zhang Caizhi	1397554791	Dongwen Group, Qilidong Village, Chenjiang Township, Chenzhou City	423000	Sinter common brick	1200	
154			Hinshi Qinzhan Farm Brick-tile Field	Meng Xiaolong	0736-4298334	Zhangjiaqiao Bridge, Jinshi Prison	415400	Sinter common brick	4300	
155			Chengnan Branch of Chenzhou Building Material Product Works	Lin Xinghua	0735-2184299	Development Zone, Chenzhou City	415000	Sinter common brick	2000	
156			Chenzhou City Yongfa Machine Brickyard	Zhang Chenghe	13307358507	Chenzhou City Yongfa Machine Brickyard	415400	Sinter common brick	2000	
157			Chenzhou City Beihu District ZhngjiaHongfa Machine Brickyard	Zhang Xiaoyuan	0735-2152957	Zhangjia Group, Qilihe Village, Chenjiang Township, Chenzhou City	423000	Sinter common brick	1438	
158			Changsha Municipal Kaifu District Laodaohe Town Material Product Works	Rao Tieliang	0736-8672358	Daming Village, Laodaohe Town, Kaifu District, Changsha City	410153	Sinter perforated brick	1700	
159			Chenzhou City Beihu District Shjiao Township No 1 Building Material Works	Gao Guojin	1330758507	Qianling Village, Zhonhutangzhuyu, Shjiao Township, Beihu District, Chenzhou City	423000	Sinter common brick	2000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
160			Hunan Provincial Chenzhou City Suxian District Bailudongzhenxing Machine Brickyard	Zhang Zhenzhi	0735-2874194	Zaojiaoshu Group, Suochangqiao Village, Bailudong Town	423000	Sinter common brick	1800	
161			Hunan Provincial Chenzhou City Suxian District Bailutang Town Yashi Brickyard	Yang Xinyuan	0735-2650078	Chenzhou City Suxian District Bailutang Town Yashi Brickyard	423000	Sinter common brick	1000	
162			Hunan Jinhe New Building Material Co Ltd	Huang Jianxin	0731-6906148	Muyun Industrial Park, Changsha City, Hunan Province	410114	Common oncrete minitype hollow block	426	
163			Changsha Municipal Xingguang New Wall Material Works	Yao Jinyi	13907489032	No 301 Suit, Gate 1, Building 3, Sanxing Shopping Center Tianxinqu, Changsha City	410005	GRC light weight wallboard	0.03 million m^2	
164			Zhuzhou City Xiaguangxiawen Building Material Co Ltd	Wu Zonghui	0733-8317281	Jitoutang, Tongxia Road, Shiping District, Zhuzhou City	412005	Sinter common brick & concrete colored face tile	90 million pieces, 0.10 million m^2	
165			Machine Brickyard of Hunan Chenzhou City Farm Scientific Research Institute	He Licai	13907354098	Qiaokou Town, Suxian District	423042	Sinter common brick	1500	
166			Building Material Branch of Hunan Provincial Zhixingtangdong Coal Co Ltd	Xu Yongzhi	0735-3324246	Tianxin Village, Dongjiang Town, Zhixing, Chenzhou City	423400	Sinter common brick	1000	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
167			Changsha Municipal New Wall Material Development Company	Tan Jianjun	0731-5138205	No 457, Shuyuan Road, Tinxin District, Changsha City	410138	Common oncrete minitype hollow block	0.08-0.10 million m^3	
168			Changsha Municipal Kaifu District Laodaohe Town Zhongliang No 2 Brickyard	Zhang Yingjie	0731-6672177	Zhongliang Village, Laodaohe Town, Kaifu District, Changsha City	410153	Sinter perforated brick	1800	
169			Changsha Municipal Kaifu District Heqi Cement Brickyard	Xia Jianguo	0731-4806009	Heqiwaihouhe, Kaifu District, Changsha City	410003	Common oncrete minitype hollow block	50000m^3	
170			Hunan Provincial Chenzhou City Guiyang County No 2 Building Material Works	Deng Qibo	13973547200	Jianxichong, Songmutng, ChengguanTown, Guiyang County, Chenzhou City	424400	Sinter common brick	2000	
171			Hunan Provincial Chenzhou City Beihu District, Mingfu Machine Brickyard	Zhang Caitie	0735-2154217	Hunan Provincial Chenzhou City Beihu District, Mingfu Machine Brickyard	423000	Sinter common brick	2000	
172			Hunan Provincial Changde Xidongqing Jinfeng Brick-tile Co Ltd	Liu Duoxia	0736-7508300	Xidongqing Jinfeng Brick-tile Co Ltd	415137	Sinter common brick & tile	15.40 million pieces & 8 million pieces	
173			Hunan Provincial Changde Xidongqing Jinfeng Brick-tile Co Ltd	Zhao Longwei	0736-7508226	Zhufeng Town, Xidongqing Administrative Division	415137	Sinter common brick & tile	8 million pieces & 8 million pieces	
174			Changde Xidongqing Jinlong Machine Brick & tile -making Yard	Xong Ruifeng	0736-7503086	Longquan Office, Xidongqing Administrative Division	415137	Sinter common brick & tile	10 million pieces & 3.5 million pieces	
175			Hunan Provincial Changde Xidongqing Brick-tile Co Ltd	Li Zhuqiao	0736-7508391	Zhufeng Town, Xidongqing, Changde City	415137	Sinter common brick & tile	9 million pieces & 8 million pieces	
176			Changde Xidongqing Jinshan Brick-tile Co Ltd	Yao Biqing	0736-7505521	Changde Xidongqing Jinshan Brick-tile Co Ltd	415137	Sinter common brick & tile	14.50 million pieces & 8 million pieces	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
177			Changsha Municipal Kaifu District Laodaohe Town Daming Machine Brickyard	Wang Wu	0731-6672161	Daming Village, Laodaohe Town, Kaifu District	410153	Sinter perforated brick	1500	
178			Hunan Provincial Chenzhou City Mingsheng Building Material Co Ltd	Li Guihua	0735-2831668	No 3, Industrial Road, Chenzhou City (Inside Ceramics Plant)	423000	Concrete colored tile	0.20 million pieces	
179			Changsha County Luositang Hollow Machine Brickyrd	Chen Peiwu	0731-4081723	Dacun Group, Dingjia Village, Xingsha Town, Changsha County	410138	Sinter perforated brick	3200	
180	Hubei Province	1	Hubei rovincial Laohkou City Baihuashan Forest ry Brickyard	Li Jinhan	0710-8247053	Laohkou City, Hubei Province	441800	Sinter common brick	1500	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
181	Zhejiang Province	32	Zhejiang Jiangshn City Plain Roofing Tile Co Ltd	Wang Zhiming	0570-4995250	Xidi Village, Shimen Town, Jiangsha City, Zhejiang Province	324107	Common brick, perforated brick & hollow brick	6000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
182			Quzhou City Qujiang District Lianhua Building Material Co Ltd	She Cheng	13587103338	Gengshaqing, Lianhua Town, Qujiang District, Quzhou City	324019	Sinter common brick	3000	
183			Hengjian Group Brick-tile Co Ltd	Lu Chunqing	0579-6573305	Gangshabei, Hengjian Town, Dongyngshi, Jinhua City, Zhejiang Province	322118	Common brick, perforated brick & hollow brick	5000	
184			Zhejiang Guangxia Group No 2 Building Material Co Ltd	Lou Xiangsen	0579-6686800	Xingshanbei, Luze Village, Wuning Town, Dongyang City	322100	Sinter common brick & perforated brick	2600	
185			Zhejiang Provincial Dongyang City Shanglu New Building Material Works	Xu Zhigang	0579-6750218	Shanglu Village, Shanglu Town, Dongyang shi, Jinhua City, Zhejiang Province	322134	Sinter common brick & perforated brick	2600	
186			Zhejiang Guangxia Group No 1 Building Material Co Ltd	Jiang Tousheng	0579-6686435	Dongqili, Luze, Dongyang City	322100	Sinter common brick	1200	
187			Zhejiang Provincial Dongyang City Weishan Town Ying Village Brick-tile Yard	Zhao Shenghua	0579-6962668	Ying Village, Weishan Town, Dongyang City, Jinhua City, Zhejiang Province	322109	Sinter common brick	800	
188			Zhejiang Provincial Dongyang City Baiyungangjing Building Material Works	Wang Nenghua	0579-6360066	Gangjing Village, Baiyun Street, Dongyang shi, Jinhua City, Zhejiang Province	322100	Sinter common brick & perforated brick	2600	
189			Jinhua City Xiaohuang Village Brick-tile Yard	Ye Youlian	0579-289200	Dongqianlu Village, Caoze Town, Jindong District, Jinhua City, Zhejiang Province	321031	Sinter perforated brick	2500	
190			Jinhua City Pukou Brick-tile Yard	Yu Jiegeng	0579-2960185	Pukou Brick-tile Yard, Shoushun Town, Jindong District, Jinhua City, Zhejiang Province	321035	Sinter common brick	2000	
191			Jinhua City Kaihua Brick-tile Yard	Teng Yaowei	0579-2720031	Kaihua Village, Jiangtangzhen, Lichng District, Jinhua City, Zhejiang Province	321071	Sinter common brick & tile	15 million pieces & 4 million pieces	
192			Lanxi City Duntou Colored Face Brickyard	Zhu Gaofei	13600360319	Duntou Town, Lanxi City, Jinhua City, Zhejiang Province	321117	Sinter common brick	1500	
193			Lanxi City Yonchang Brick-tile Yard	Jiang Miansen	13806776615	Yonchang Town, Lanxi City, Jinhua City, Zhejiang Province	321100	Sinter common brick	1800	
194			Lanxi City Hualiu Brick-tile Yard	Ye Hanliang	0579-3885777	Lanxi Street Sub-district, Lanxi City, Jinhua City, Zhejiang Province	321100	Sinter common brick	1500	
195			Lanxi City Gaochao Brick-tile Yard	Zhou Xueling	0579-8277201	Mada Town, Lanxi City, Jinhua City, Zhejiang Province	321109	Sinter tile	4 million pieces	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
196			Wuyi County No 1 Brick-tile Yard	Yan Yongkun	0579-7619700	Baiyang Village, Baiyang Street Sub-district, Wuyi County, Jinhua City, Zhejiang Province	321200	Sinter common brick & perforated brick	1600	
197			Wuyi County Wangze Town Yangjian Brick-tile Yard	Fang Pinwei	0579-7790275	Yangqi Village, wangze Town, Wuyi County, Jinhua City, Zhejiang Province	312100	Sinter common brick & perforated brick	2800	
198			Wuyi County Guangming Building Material Co Ltd	Liu Shuchang	0579-7611228	Chashan Village, Litan Town, Wuyi County, Jinhua City, Zhejiang Province	321200	Sinter perforated brick	1500	
199			Zhejing Wuyi Building Material Industrial Co Ltd	Chen Shuiyao	0579-7736366	Xiayanger Village, Yuyuan Township, Wuyi County, Jinhua City, Zhejiang Province	321205	Sinter common brick & perforated brick	5500	
200			Zhejing Tongxiamg City Songling Brick-tile Co Ltd	Li Binzhong	0573-8361619	Nanshisongling Road, Tujian Town, Tongxing City, Zhejiang Province	314503	Sinter perforated brick	3000	
201			Zhejiang Provincial Tongxiang City Heshan No 1 Brick-tile Yard	Wei Songkui	0573-8677117	Huangtianyang, Heshan Town, Tongxiang City, Jiaxing City, Zhejiang Province	314512	Sinter perforated brick & hollow brick	3600	
202			Tongxiang City Xianxing Joint Brick-tile Yard	Zhong Zhengfu	13355835879	North Gaoyngqiao Bridge, Tongxiang City, Jiaxing City, Zhejiang Province (Shimen Town)	314512	Common brick, perforated brick & hollow brick	4200	
203			Tongxiang City Lingan Brick-tile Co Ltd	Shen Yuanfu	0573-8361619	Shumiao, Lingan Town, Tongxiang City, Jiaxing City, Zhejiang Province	314505	Sinter perforated brick & hollow brick	3625	
204			Zhejiang Provincial Dongyang City West of Hengjian Town Brick-tile Yard (Weifeng Building Material Works)	Zhang Hailiang	13706794991	Mikuang Village, Hengjian Town, Dongyang City, Zhejiang Province	322118	Sinter common brick	1500	
205			Haining City Huaduo New Wall Material Co Ltd	Yao Ronghua	0573-7533387	No 1037, Beiboru Village, Zhouwangmiao Town, Haining City	314407	Sinter perforated brick & hollow brick	1500	
206			Haining City Lihua Industrial Co Ltd	Zhng Risong	0573-7274643	Shuanghahuoju Village, Xiashi Town, Haining City	314401	Common brick, perforated brick & hollow brick	8427	
207			County Chngxi Brick-tile Yard	Zhang Hechang	0573-6191669	Nanyang, Kaijiaqiao Bridge, Haiyanchengxi Tonship, Jiaxing City, Zhejiang Province	314300	Sinter perforated brick & hollow brick	5200	
208			Haiyan County Yucheng Town No 2 Brick-tile Yard	Lu Yuping	0573-6459199	Jiangwei Village, Yucheng Town, Haiyan County	314308	Sinter common brick & perforated brick	2600	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
209			Pinghu City Xincang Brick-tile Co Ltd	Xu gengming	0573-5700072	No 12, Luchuanxin Street Xincang Town, Pinghu City, Jiaxing	314200	Sinter perforated brick & hollow brick	2520	
210			Pinghu City Haiji Industrial Co Ltd	Lv gengliang	0573-5922084	Chenjiang Village, Linli Town, Pinghu City, Jiaxing	314202	Sinter perforated brick, etc.	5700	
211			Pinghu City Guanglun Brick-tile Co Ltd	Wang Maichun	0573-5788062	Yueendu, Guangchen Town, Pinghu City, Jiaxing	314207	Sinter perforated brick & hollow brick	6000	
212			Zhejiang Kaihua County Xintai Industrial Co Ltd	Tong Zhanping	0570-6121181	Luowukou Village, Chengguan Town, Kaihua County, Quzhou City	324300	Sinter common brick & perforated brick	2800	
213	Hebei Province	14	Hebei Handan County Jinchi Building Material Co Ltd	Zhou Shiming	0310-4136141	Hucun Town, Handan County, Hebei Province	056105	Sinter perforated brick & hollow brick	6000	
214			Hebei Chengde Caidi Building Material Co Ltd	Mao Ruilong	0314-7088653	Longhua County Chende City	068150	Sinter perforated brick & hollow brick	1740	
215			Hebei Provincial Mengcun Hui Autonomous County Brick-tile Yard	Zhang Shufa	0317-6721449	Mengcun County Seat Exit, Hebei Province	061400	Sinter common brick	2000	
216			Chengde Xinxia Building Material Co Ltd	Li Xinchun	0314-2160272	Shangdaohzi Brick-tile Yard, Chengde City	067000	Sinter common brick	4000	Enterprise survey questionaire
217			Longhua County Lonhua Town Brickyard	Li Ronghai	0314-7085658	Lonhua Town Brickyard	068150	Sinter common brick	600	
218			North Branch of Longhua County Brickyard	Sun Netian	0314-7066269	North Branch of Longhua County Brickyard	068150	Sinter common brick	1000	
219			Chengde County Building Material Works	Zhou Xianrui	0314-3011259	Xiabncheng Town, ChengdeCounty	067400	Sinter common brick	4000	
220			Fuzhou Brick-making Co Ltd	Liu Fuzhou	0314-8583969	Sandigu, Lianping Town	068250	Sinter common brick	800	
221			Fengning Man Autonomous County Sanfeng Brick-tile Yard	Zhu Wenfu	0314-8012391	Zhenfeng Road, Dage Town, Fengning Man Autonomous County	068350	Sinter common brick	1100	
222			Fengning Liudaogou Joint Brickyard	Li Jianxiang	13932413268	Liudaogou Village, Dage Town, Fengning Man Autonomous County	068350	Sinter common brick	1000	
223			Pingguo County Dangba Town Dajikou Brickyard	Han Huojin	0314-6359267	Group 7, Dajikou Town, Dangba Town, Pingguo County	067511	Sinter common brick	800	Enterprise survey questionaire
224			Pingquan County Xiba Building Material Works	Yao Baoqing	0314-6023913	Xiba Village, Pingquan Town	067500	Sinter common brick	800	
225			Pingquan County Siheyuan Brickyard	Zhao Zongwen	0314-6101159	Siheyuan Village, Pingquan Town	067500	Sinter common brick	800	
226			Hnmaying Town Shibalipai Machine Brick-mking Yard	Su Wanhong	0314-7210012	Shibalipai Village, Hnmaying Town	068151	Sinter common brick	500	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
227	Hebei Province	3	Weichang Men & Mongolian Nationalities Autonomous County Siheyong Town Zhenxing Brickyard	Wang Jiazhen	13603142401	Siheyongying zi Village	068451	Sinter common brick	800	Enterprise survey questionaire
228			Weichang Men & Mongolian Nationalities Autonomous County Yaozhan Township Brickyard	Jin Hai	13831419385	Yonghe jian Village, Yaozhan Township, Weichang Men & Mongolian Nationalities Autonomous County	068451	Sinter common brick	800	
229			Weichang County Longtoushan Township Dazhi No 2 Brickyard	Li Jinshan	13831416006	Village, Longtoushan Township, Weichang County	068450	Sinter common brick	1300	
230	Chongqing Municipality	12	Chongqing Municipality Shapingba District Chenjiaqiao Coal Waste Brickyard	Zhao Mingquan	023-65633195	Yanjinggou, Wanghe Village, Chenjiaqiao Town, Shapingba District Chenjiaqiao Town, Shapingba District	401331	Sinter common brick	1800	
231			Chongqing Municipality Tianyuan Building Material Co Ltd	Liu Dongfa	023-58582288	5th Floor of Tianyuan Building, Baian Road,	404020	Sand-lime brick & rock brick	3514.5, 2296	Enterprise survey questionaire (2 copies)
232			Chongqing Honchang New Wall Material Making Co Ltd	Xiang Wendi	023-65251353	Group 4, Xinfu Village, Huayan Town, Jiulongpo District, Chongqing Municipality	400052	Sinter common brick	3000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
233			Chongqing Yuheng Building Material Co Ltd	Tong Qiyu	023-67644084	No 288, Wannian oad, Renhe Town, Beibu New District, Chongqing Municipality	401121	Sinter common brick & hollow brick	6000	
234			Chongqing Maanshan Building Material Co Ltd	Luo Yuanhai	023-68925188	Huzhu Village, Baqiao Town, Dadukou District, Chongqing Municipality	400084	Sinter common brick & hollow brick	3620	
235			Chongqing Yongchuan Dongnan Building Material Works	Zeng Deyuan	023-49808418	Group 4,Wazi Village, Zhongsha Road Sub-district, Yongchuan City, Chongqing Municipality	402160	Sinter common brick	2200	
236			Chongqing Municipality Changshou District Yugu Building Material Works	Yu Zhonxiao	023-40611352	Pengjiaping, Fengchenggufo, Changshou District, Chongqing Municipality	401256	Sinter common brick	3000	
237			Chongqing Municipality Changshou District Yanjia Shale Brickyard	Nie Linzhang	023-40711315	Lanjia Village, Yanjia Town, Changshou District, Chongqing Municipality	401221	Sinter common brick	4500	
238			Chongqing Sixong Building Material Co Ltd	Chen Deqin	023-68974940	Dukou Village, Zhujia Town, Changshou County, Chongqing Municipality	401254	Clinker brick & air entrainment concrete building blocks, etc.	9000	Enterprise survey questionaire (2 copoies) Annual product quality random sampling work sheets in 2003
239			Chongqing Municipality Liangkou Coal Waste Brickyard	Su Dingfu	023-68238009	Dashu Village, Fuxing Town, Beipai District, Chongqing Municipality	400713	Sinter common brick	10000	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
240			Chongqing Municipality Beipai District Chengjiang Coal Waste Brick-making Co Ltd	Deng Runbin	023-68227415	Bolin Village, Chengjiang Town, Beipai District, Chongqing Municipality	400701	Sinter common brick & hollow brick	4800	
241			Chongqing Qiushi Building Material Co Ltd	Zhou Lun	023-6892228	Huzhu Village, Baqiao Town, Dadukou District, Chongqing Municipality	400084	Sinter common brick	3800	
242	Guizhou Province	10	Guizhou Liupanshui Hengyuan Building Material Co Ltd	Deng Qianning	0858-8966099	South Ring Road, Zhongsha District, Liupanshui City, Guizhou Province	553001	Sinter common brick	5000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
243			Shuicheng Shengda Building Material Co Ltd	Lin Daiyong	0858-6450126	Domuluo Village, Shuangga Township, Shuicheng County	553001	Sinter common brick	1500	
244			Guizhou Liupanshui Zhongshan District Dahe Town Yudu Shale Brickyard	Qiu Zongnan	0858-8771268	Guizhou Liupanshui Zhongsha District Dahe Town Yudu Shale Brickyard	553000	Sinter common brick	1300	
245			Guizhou Duyunchangxin Building Material Co Ltd	Nie Chunhua	0854-8282957	No 65, Daoyujing, duyun City, Guizhou Province	558000	Sinter common brick & perforated brick	5000	
246			Guizhou Linjiang Shale Brickyard	Shen Zongxiang	0855-2623017	Baidiqiao, Majiang County, Guizhou Province	557600	Sinter common brick	1800	
247			Guiyang Xincun Brickyard of Guiyang Economic & Technologic Development Zone	Sun Mingming	0851-3401416	Inside Qianjiang Machinery Works, Guiyang City	550009	Sinter common brick	1500	
248			Guiyang City Huaxihengfeng Shale Brickyard	Guo Lanfang	0851-3911003	Wongyan Village, Huaxi Township, Guiyang City	550025	Sinter common brick	3500	
249			Guiyang Huaxilianban Building Material Co Ltd	Su Hua	0851-2856142	Dawozhai, Yangzhong Village, Huaxi Township, Guiyang City	550028	Sinter common brick & hollow brick	9250	
250			Liupanshui Zhongshan District Yuezhaopingshun Shale Brickyard	Wang Chengshun	13086973233	Enterprise dminitrative Station, Yuezhao Township Government, Zhongshan District, Liupanshui City	553000	Sinter common brick	1000	
251			Building Material Branch of Shuigng Group Jinhe Mine Co Ltd	Lu Xuhong	0851-6246171	Laoyingshan Town, Zhongshan District, Liupanshui City	553024	Sinter common brick	1800	Enterprise survey questionaire
252	Anhui Province	9	Hefei City Changfeng County New Building Material Works	Gu Taiming	0551-6471176	Xiatang Town Changfeng County, Hefei City, Anhui Province	231121	Common brick, perforated brick & hollow brick	16000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
253			Feixi County Nangang Town Building Material Industrial Company	Wang Yuehua	0551-8561238	Nangang Town, Feixi County	231283	Common brick, perforated brick & hollow brick	4000	
254			Hefei City Shushn Building Material Works	Zhang Daocang	0551-5383324	Xiaoputou, West of Daputou, Hefei City	230031	Sinter common brick & hollow brick	2340	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
255			Liuan City Yongfa New Building Material Co Ltd	Chen Rongfa	0564-2140038	Jiangjiadian Town, Yuan District, Liuan City	237142	Common brick, perforated brick & hollow brick	1600	
256			Liuan City Yuan District Dushan Town Ring Kiln	Ewang Chenglin	0564-2911898	Dushan Town, Yuan District, Liuan City, Anhui Province	237131	Sinter common brick	1200	
257			Anhui Provincial Liuan City Jinan District Xianshengjian Township Xiashi Brick-tile Yard	Chen Lixuan	13966308138	Xianshengjian Township, Jinan District, Liuan City	237009	Sinter common brick	1200	
258			Heqiu County Jilong Building Material Co Ltd	Chen Zhongxuan	0564-6841438	Longtou Village, Yaoli Town, Heqiu County	237422	Sinter common brick & hollow brick	6000	
259			Liuan City Hongyun Building Material Co Ltd	Ye Hongyun	13705648686	East Side of Electric Motor Plant, Liuan City	237009	Sinter common brick	1400	
260			Shou County Jiangouminsheng Building Material Works	Hong Shaoshun	0564-4377051	Jiangou Township, Shou County	232291	Sinter common brick	1200	
261	Shandong Province	7	Jining Zhanshan New Building Material Co Ltd	Cao Hua	0537-2589668	Zhangshan, Changtang Town, Rencheng District, Jining City	272057	Sinter perforated brick & hollow brick	8400	
262			Taian Huatai Building Material Co Ltd	Wang Hongwei	0538-7844036	Huafengqingda Industrial Park, Ningyng County, Shandong Province	271413	Sinter perforated brick	3500	
263			Gunzhou City Jiemai New wall Material Co Ltd	Guo Huigeng	0537-3865175	Huangyuan Residential Area, Yuhong Road, Gunzhou City	272100	Sinter perforated brick & hollow brick	3000	
264			Zibo Zhangjian Jinkun New Type Brickyard	Zhang Xinsheng	0533-2901604	Ningjia Village, Fujia Town, Zhngjian District, Zibo City	255063	Common brick, perforated brick & hollow brick	2800	
265			Zibo Xinkai New Building Material Co Ltd	Huang Hong	0533-2972975	Fujia Town, Zhngjian District, Zibo City	255063	Sinter perforated brick	6000	
266			Zibo Luwang Building Material Co Ltd	Shen Yuangang	0533-6692888	No 68, Xinhua Road, Wangcun Town, Zhoucun District, Zibo City	255311	Sinter perforated brick & hollow brick	6000	
267			Qingdao Jiaozhou City Friendship Building Material Co Ltd	Wu Lincheng	0532-8271018	West of Hexitun, Jiaozhou Town, Jiaozhou City	266317	Common brick, perforated brick & hollow brick	5000	
268	Jiangxi Province	5	Jiangxi Provincial Zhangshu City Yongtai New Wall Material Works	Yang Yunqing	0795-7899096	Yangzhuang Village, Guanshan, Yongtai Town, Zhangshu City	336000	Sinter common brick & perforated brick	900	
269			Nanchang City Wangcheng Hollow	Lu Xianwei	0791-3680388	Shengzhuang, Wangcheng Town, Nanchang City	330103	Sinter common brick	1500	
270			Nanchang Xinxing Wall Material Co Ltd	Wang Xinlin	0791-3821886	No 13, South Lushan Road, Nanchang City	330013	Concrete block	0.03 million m^3	
271			Jiangxi Provincial Jinxian County, Wuhe Brick-tile Yard	Wu Jiangeng		Wuzhouan, Wenjiazhen, Jinxian County, Jiangxi Province	331721	Sinter common brick	600	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
272			Jiangxi Provincial national Jinxian County Maogang Building Material Works	Tao Jieying	13607043699	Maogang Town, Jinxian County, Jiangxi Province	331726	Sinter common brick	1300	
273	Jiangxi Province	1	Jiangxi Xinneng Building Material Co Ltd	Zhang Jian	0791-8619432	No 102, North Qinshan Road, Nanchang City	330029	Steam pressure air entraining concrete building blocks	0.07 million m^3	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
274	Guangxi	6	Guangxi Tiandong County Silin Town No 2 Building Material Works	Zhao Jian	0776-5151455	Silin Town, Tiandong County	531504	Sinter perforated brick	800	Enterprise survey questionaire
275			Shale Sintered Product Works of C	Huang Renjie	0776-5856338	Lianhai Village, ChengCheng Chngguan Tonhip	531400	Sinter perforated brick	1080	
276			Guangxi Youjiang Mines Bureau Brickyard	Tan Yuncai	0776-5305130	Xinzhou, Xingzhou Town, Tindong County	531501	Sinter common brick & perforated brick	1800	
277			Guangxi Guilin City Linchuan County Jiajun Shale Brickyard	Yi Shisheng	0773-2171753	Dingjiang Town, Lingchuan County Guilin City	541213	Sinter common brick	4000	
278			Nanning City Jintou Brickyard	Wei Chengren	0771-5614473	Jiaoiao Village, Jintou Township	530023	Sinter common brick & perforated brick	2700	
279			Guangxi Guigong City Huanggongling Common Brick Works	Huang Zhijia	0775-4327715	Huanggongling, Guigong City	537100	Sinter perforated brick	2500	
280	Henan Province	8	Xinyang City Huibin County Qisi Town No 1 Brickyard	Wang Jie	13608478335	Qisi Town, Huibin County, Xinyang City	464008	Sinter common brick	1600	
281			Xi County Xiaohui Town Brickyard	Zhang Jun	139039759181	Xiaohui Town, Xi County, Xinyang City	464317	Sinter common brick	1500	
282			Gusi County State-run No 1 Brickyard	Zhu Wenxue	13903977557	Nanshantou, Chengguan Town	465200	Sinter common brick	2000	
283			Shangyougang Township Brickyard	Li Zhenrong	0397-563989	Shngyougangji, Shngyougang Township, Hengchuan County	450100	Sinter common brick	1600	
284			Henan Provincial Shangqiu City Liangyuan District Lizhuang Township Dengbinkou Brickyard	Yang Xiucang	13513706883	Dengbinkou Village, Lizhuang Township, Liangyuan District, Shangqiu City, Henan Province	476000	Sinter common brick	1900	
285			Pingdingshan City Xinxing Building Material Works	Song Xianfa	13937541919	Pingdingshan City	467000	Sinter common brick	2000	
286			Henan Provincial Yucheng County Sheji Town Bricyard	Yang Qincai	0370-4871028	Sheji Town Industrial Park, Yucheng County	476334	Sinter common brick & tile	7 million pieces & 5 million pieces	Enterprise survey questionaire

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
287			Henan Provincial Gusi County Seat Exit Town No 2 Bricyard	Zhu Wenxue	0397-4652566	Huzu Town, Gusi County	465245	Sinter common brick	1600	Annual product quality random sampling work sheets in 2003
288			Henan Provincial Jiaozuo Kangyu Building Material Co Ltd	Su Ziying	0391-8698885	West of 50m to North of Interunction of Bowen Rod and Zhanhui Road, Boai County	454450	Ligh tlight partition wall board 0.08 million m^2	0.08 million m^2	
289	Inner Mongolia	2	Inner mongolia Hohhot Sanhe Building Material Co Ltd	Yang Shiping	0471-8624182	No 99 Post Box, Hohhot Keto County	010020	Sinter common brick & perforated brick	11000	
290			Inner mongolia Erdaohe Building Material Co Ltd	Sun Yuwen	0471-5697159	Erdaohe Village, Huhehaote City (No 2010 Postbox)	010070	Sinter common brick & perforated brick	15000	
291	Gansu Province	2	Yumen Xiangyang Building Material Co Ltd	Xu Yelin	0937-6715107	Jiayuguanhaishahu	735105	Sinter common brick	4000	
292			Lanzhou Shajingyi Building Material Industrial Company	Yang Long	0731-7782997	No 446, Yuantaizi, Anning District, Lanzhou City	730079	Sinter perforated brick & hollow brick	24000	
293	Qinghai Povince	2	Qinghai Xifa Hydroelectric Equipment Manufacture & Installation Co Ltd	Yu Shaohua	0971-6315508	No 108, South Xichuan Road, Xining City	810029	Sinter common brick, perforated brick & hollow brick	12000	Enterprise survey questionaire (2 copies) Annual product quality random sampling work sheets in 2003
294			Qinghai New Building Material Works	Jia Baocheng	0971-8809362	No 195, Delingha Road, Xining City	810007	Sinter common brick & perforated brick	8000	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
295	Xinjiang	5	Xinjiang Shihezi City Tianxingm Industry & Trade Co Ltd Building Material Works	Zhang Haishun	013909934686	No 46-88, Xiyanghong Street, Shihezi City	832000	Sinter common brick & perforated brick	2300	
296			Xinjiang Changjidejiang Building Material Production Co Ltd	Ma Dejiang	0994-2514276	No 5, Changnin Road, Changji City	831100	Sinter common brick	2500	
297			Urumqi City Toutunhe District Wuwu Brickyard	Yu Fuqiang	0994-2352318	No 5 Team, May Day Farm, Toutunhe District, Urumqi City	830074	Sinter perforated brick	1200	
298			Xinjiang Shufu County Buildin Material Company	Wang Liqun	0998-3252424	No 58, South People's Road, Shufu County	844100	Sinter common brick	1500	
299			Urumchi Tianyan New Building Material Co Ltd	Jiang Jianwei	0991-4642475	No 11, Liudowen Road, Urumqi City	830063	Sinter perforated brick	800	Enterprise survey questionaire
300	Ningxia Hui Autonomous Region	6	Ningxia Guanmahu Brickyard	Wang Xuwen	0953-2661054	Hojiawen, Wuzhong City	751102	Sinter common brick, perforated brick & hollow brick	2950	Enterprise survey questionaire Annual product quality random sampling work sheets in 2003
301			Ningxia Yinchuan Pingguo Orient Building Material Works	Li Shunliang	0952-6506061	Area of 11 km to Yaoxi Road	753402	Sinter common brick & perforated brick	6000	

No	Region	Quantity (piece)	Enterprise name	Contact	Contact mode	Add	Post code	Leading product	Scale of production (converted to 10,000 pieces of stndard brick)	Document
302			Ningxia Qingtongxia Xingban Building Material Co Ltd	Li Xingban	0593-3045188	Xiaxi Street, Daba Town, Qingtongxia City	751603	Sinter common brick	5000	
303			Ningxia Yongning County Wangtai Jianming Machine Brickyard	Ma Jianming	0951-8400158	Yongning County	750015	Sinter common brick	1600	
304			Ningxia Yongning County Bohewang Qunfangdong Brickyard	Fang Dong	0951-5043901	Wangquan No 7 Team, Yanghe Township	750015	Sinter common brick	1800	
305			Ningxia Lingwu City Wanshilong Building Material Co Ltd	Wang Ping	13909509058	Linhe Town, Lingwu City	751100	Sinter common brick	1600	Enterprise survey questionaire

Catalogue of Statistical Table of Wall Material Industry Background

No	Province & city name	Filling in unit	Add	Post code	Contact phone	Contact	Remarks
1	Jiangxi Provincial Nanchang City	Jiangxi Provincial Brick-tile Industry Association	No 309, West Hefang Road, Nanchang City	330001	0791-5210434	Liu Detao	
2	Sichuan Provincial Chengdu City	Chengdu Wall Material Innovation Construction Energy Conservation Office	3rd Floor of 12th Building, No 3, South Yulin Road, Chengdu City	610041	028-85530497	Xie Paiyu	
3	Sichuan Provincial Penzhihua City	Honghe District Xiaohexingwang Shale Machine Brickyard	Yakoushe, Tuanshan Village, Zhongba Township, Honghe District	617067	0814-2905326	Zhu Wenwu	
4	Tianjin Municipality	Tianjin Construction Industry Association	No 85-3, Liuwei Road, Hedong Distict, Tianjin Municipality	300012	022-24015026	Gong Yilun	
5	Nanjing City	Nanjing Quality Technical Supervision Building Material Product Test Station	No 12, Dabai Lane, Xuanwu District, Nanjing City	210018	025-4502246 & 4519567	Zhou Wunning	
6	Hebei Provincial Chengde City	Chengde Wall Material Innovation Office	Chengde Government Integration Office Building	067000	0314-2050042	Zhang Jiansheng	
7	Fujian Provincial Xiamen City	Xiamen Construction Works New Materials Association	2nd Floor of Ziwu Building, No 52, South Hubin Road	361003	0591-2214752	Hong Gushi	
8	Hunan Provincial Changsha City	Changsha New Wall Material Office	No 637, Shuyuan Road, Tianxin District	410002	0731-5128392	Feng Guanghui	
9	Xinjiang Uygur Autonomous Region	Xinjiang Building Material Research Institute	No 74, South Frienship Road, Urumqi City, Xinjiang	830000	0991-4511759	Guo Daguang	

Annex 8:

Energy Conservation and GHG Emission Reduction in Chinese TVES—Phase II—Provision of Services for the Execution of Brick-making Sub-sector Survey Project—Summary of Meeting on Draft Final Report

The brick making industry survey project team organized and held the symposium on "*Project Draft Final Report*" on 9 February 2004. The director Xiao Hui, deputy director Yan Kaifang of Xi'an Research & Design Institute of Wall & Roof Materials, Zhou Xuan, the deputy chief of the Wall & Roof Material Quality Supervision, Inspection & Test Center of the State Building Material Industry, the technologists of brick-tile industry and the project working personnel attended the symposium. Director Xiao Hui presided over the meeting and the contents of the project draft final report were carefully discussed in it.

All the members participating in the meeting listened to the explanation concerning the project survey process, summary of the survey outcome and the report contents, etc. made by the brick making industry survey project team. All the attendants carefully finely discussed the contents of the project draft final report and they raised some modification opinions and proposals for some contents in the draft final report. At the symposium, all the specialists considered that the project team did a great deal of work. The scope of survey is wide, covering 26 provinces, cities and autonomous regions throughout the country. The survey contents are complete and they basically reflect the fundamental state of brick-tile enterprises in villages and towns of our country. The data are true and reliable. The contents in the draft final report of the project are quite abundant, offering full and accurate condition. The reflection of fact is clear and typical. The members of the project team scientifically strictly have analyzed the existing problems. The expressed viewpoint is bright and object. The development status of China brick making industry has been systematically reflected.

Via full discussion of the specialists and project team personnel at the meeting, they raised the following modifications and proposals to the draft final report. The title in the fourth part (IV) of Annex 2 should be revised as "Existing Problems in Policy, Laws & Regulations and Future Development Prospect in Brick Making Industry" so as to conform the annex content. In addition, give clear indication that the output in China brick making industry adopts the converted standard brick quantity (size 240mm × 115mm × 53mm) to avoid the different meaning generated for the contents.

The part of "*General Situation of China Brick Making Industry*" in Annex 3 describes the development history, brick making technology and equipment status in China brick making industry in detail and brick-tile quality standard control and implementation condition in China. The specialists have made proposals that the report should further protrude from the first wall material renovation in the 1960s and twice wall material renovation in the 1980s & the 1990s of 20th century. The solid brick is renovated as hollow brick and perforated brick. The enhancement of hollow brick hole rate has made great contribution to GHG emission reduction. The consistency of data in various parts in the whole report has been checked to avoid the generated error due to different understanding.

In Annex 5 on the "*Schedule of China and International Brick-Tile & New Wall Material Equipment Manufacturers, Design Institutes, Association, Societies and Network Stations*", Italy Morando Corporation with greater influence power and overseas other associations have been added in the contents of China standard brick-tile manufacturers.

As to the part in Annex 6 on the "*Situation Report of Energy Conservation and Environmental Protection Demonstration Enterprises in China Brick Making Industry*", the selection principle

should be: The main products should be hollow brick and the main raw materials are gangue & fly ash, without clay and preferable technical skill. The energy conservation indices are higher than the industry average level and better plant environment. The selected 8 enterprises can basically meet the above-mentioned requirements. The draft final report should farther stress the adoption of energy conservation and environmental protection technical measures.

According to the opinions and proposals above, the draft final report of the project should be modified, being more perfect and abundant of the report contents.

Annex 9:

Dear Mrs. Mounira Latrech:

I have got your letter and clearly know all about it. As to some questions you have mentioned in the letter, I would like to give you a desired written reply.

I. For the investigation & survey findings of 305 brickyards, about 20% of them are the answer sheets of enterprise survey via letter form, 80% are got by the investigators of our institute to make a site survey in enterprises and in which, half of them were taken back by the investigators in our institute after the enterprises filled in the questionnaires. And the other half investigation & survey findings come from that the investigators of our institute helped or asked for the enterprises to fill in the questionnaires. All the investigated enterprises are better enterprises nearby big & middle cities. Each of the enterprises has the output of over 20 million pieces of brick yearly. They are all the production enterprises with energy conservation reform ability.

II. Source of the data

1. The data in page 23 come from the articles of related trade under China Brick-Tile Industry Association. Partial data are from the Economical Operation Analysis in 2003 and Prospect in 2004 of China brick-tile industry.

2. "Knowing from the sampling survey results throughout the country..." in page 24, the annual survey was one sampling survey result of raw fuel survey project in 2000~2002 China brick making industry of the State Economy & Trade Committee carried out by our institute.

3. The contents in page 25 are Chengdu municipal project survey made by the project working personnel and the result of symposium in 2004 during the project implementation.

4. Page 41 is about the investigation and survey findings of China brick making industry made by China Brick-Tile Industry Association. The data in the last few years are the inference data via random inspection.

5. That the energy conservation in China brick making industry has reached 60 million T standard coal selects from "*Wall Material Innovation '10th Five-Year Plan' Programming*" issued by the State Economy & Trade Committee.

6. The brick price is processed information based on the results of industry survey made by China Brick-Tile Industry Association and 305 production enterprises' survey carried out by our institute in 2003.

III. The content in Annex 6 has been revised and please see it in detail.

IV. The electronic version of Annex 7 has been submitted to PMO, refer to it please.

Xuan Zhou
March 25th, 2004