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Biogas Technology

&

DEWATS Technology

BORDA—ZUT Project Office

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ZUT

Z hejiang
U niversity of
T echnology

Prof. Ma Chi

Coordinator Cn

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B remen
O verseas
R esearch and
D evelopment
A ssociation

Dipl.-Ing. Stefan Reuter

Director

25 Years BORDA

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Greetings from the ZUT,
City of Hangzhou

Cooperation with BORDA since 1987

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Biogas Technology Application in Zhejiang Province

沼气技术在浙江省的应用

- Brief information of Zhejiang Province
  浙江省简介
- Biogas technology
  沼气技术

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Brief information of Zhejiang Province

浙江省简介

- 46 million population（4千6百万人口）
- 100,000 square kilometers（10万平方公里）
- Semitropical climate（亚热带气候）
- Fast but unbalanced economic development（经济发展迅速但发展不平衡）

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Biogas technology
沼气技术

- Household biogas digesters
  （户用沼气池）
- Medium sized biogas plant
  （中型沼气工程）
- Large biogas plant with modern technology
  （大型沼气工程）

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Household biogas digesters
户用沼气池

Till the end of 2003,（到2003年为止）

- There are 85,652 household biogas digesters
  户用沼气池共有85652户
- The total biogas yield is around 17.7million m^3 per year, e.g. 313 m^3 per family in average.
  每年沼气总产量为1.77亿立方米，平均户产沼气量313立方米

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Household biogas digesters
户用沼气池

- Technology:
  fully mixed water pressure digester with semi-automatic discharging function
  技术：半自动出料全混合水压式沼气池

- Structure:
  Underground concrete drum shape
  结构：地下混凝鼓形结构

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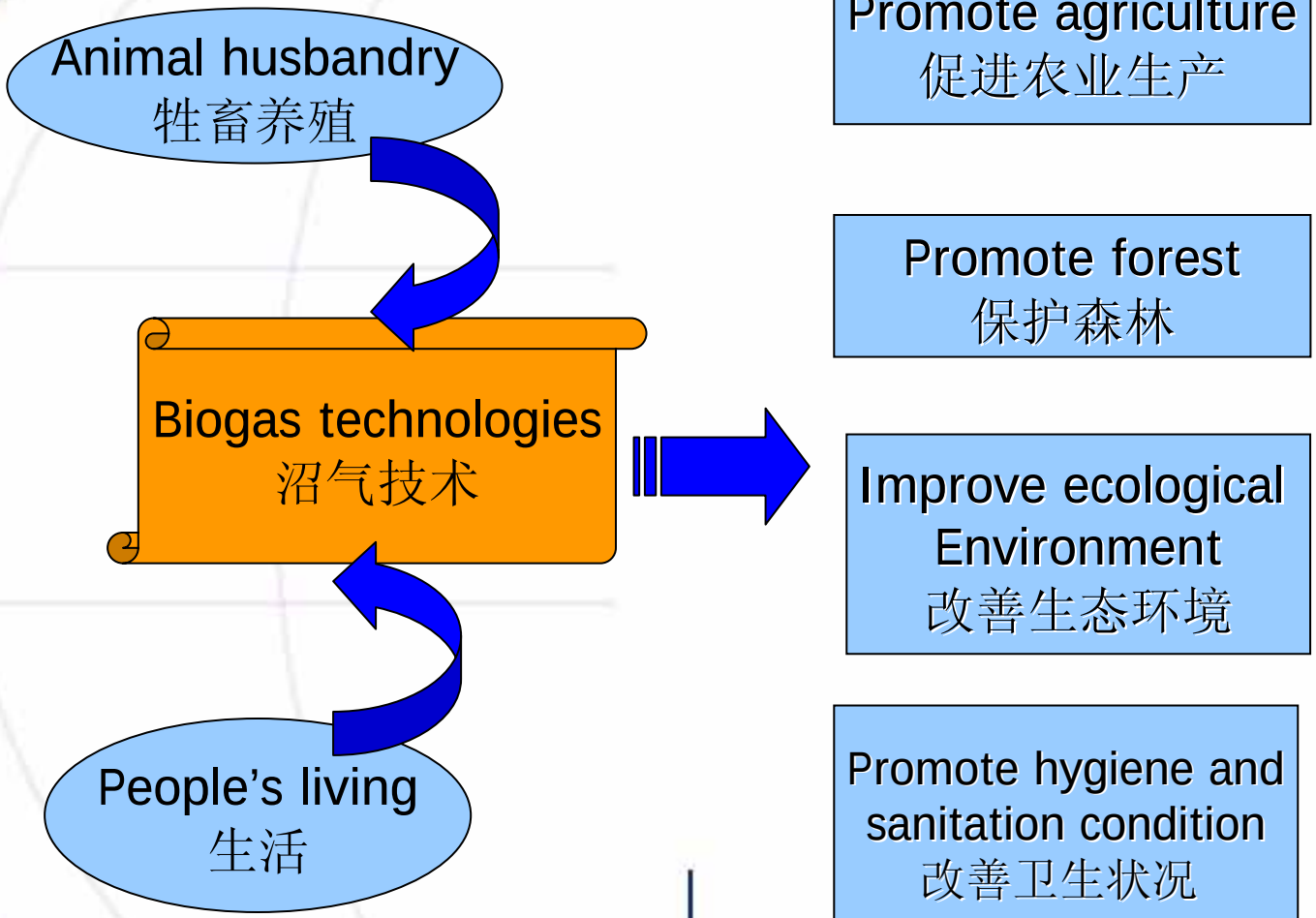
Animal husbandry
牲畜养殖
Biogas technologies
沼气技术
People's living
生活
Promote agriculture
促进农业生产
Promote forest
保护森林
Improve ecological Environment
改善生态环境
Promote hygiene and sanitation condition
改善卫生状况

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Application and Development Tendency
利用和发展趋势

- This technology is appropriate for individual farmer families with small scale husbandry, e.g to raise 3~5 pigs

  小型的个体养殖农户可以采取该技术
- The farmers with small scale husbandry are mainly in the mountainous and semi-mountainous areas in middle, western and southern parts of Zhejiang Province, in which the local economy is less developed

  这些农户主要分布在浙江省经济欠发达的山区和半山区

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- In the northern plains and eastern coastal area in Zhejiang Province, the intensive animal livestock farms in medium and large scale tend to be main type of the husbandry. In these areas, the household biogas digesters become less dominated in the biogas technology development.

  在浙北平原和东部沿海地区，大中型集约化养殖场是养殖业的主要形式,户用沼气技术应用逐渐减少。

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The household biogas digester plays an important role for income generation in the less developed rural area, due to the following function:

户用沼气池给农民带来了实惠，主要有以下原因：

- Saving the expenditure in fuel, or, saving the labor for fuel wood collection
  节省了燃料费用和打柴的劳动力
- Saving the expenses on chemical fertilizer
  节省了化肥费用
- Increasing the agricultural yield
  增加了农业产量
- Improve the quality of products
  提高了农产品质量

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Large and Medium Sized Biogas Plants
大中型沼气工程

- General description
  概述
- Technologies applied in the large and medium sized biogas plants
  技术

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General description
概述

- There are 114 biogas plants, each volume is larger than 100 m^3
  容积超过100立方米的沼气工程有114座
- The total volume is 37808 m^3
  总容积是37808立方米

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Technologies applied
技术应用

- Fully mixed anaerobic digestion
  全混合厌氧发酵
- UASB+UASB 二级上流式厌氧污泥床
- UASB+SBR
  上流式厌氧污泥床+连续性间歇式反应器

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Applicable condition for medium sized biogas plant

中型沼气工程的应用条件

- In the animal livestock farms with less than 5000 pigs, the appropriate technology is the fully mixed anaerobic digestion and the relevant structure could be underground concrete cylinder type or underground concrete tunnel type

  少于5000头猪的养殖场，应采用全混合厌氧消化技术和相应的地下水泥圆筒式或地下混凝土隧道式消化池

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Applicable condition for Medium sized biogas plant
中型沼气工程的应用条件

- The reactors volume is less than 500 m^3
  反应器容积小于500立方米
- The integrated utilization of the biogas resources could be realized for supplying fuel gas for households and/or production, providing fertilizer and so on.
  提供户用燃料和肥料等沼气综合利用得以实现
- Since all residues discharged from the plant are used, there is no request to satisfy the environmental standard for the waste water discharging.
  由于所有的残余物得到应用，对环境没有负面影响

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Applicable condition for Medium sized biogas plant
中型沼气工程的应用条件

- Since all residues discharged from the plant are used, there is no request to satisfy the environmental standard for the waste water discharging.

  由于所有的残余物得到应用，对环境没有负面影响

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Example 1
biogas plant built in Xinxin livestock farm in Jiaxin
嘉兴欣欣养殖场的沼气工程

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Brief introduction
项目简介

- Built in 2002 建于2002年
- Technology: fully mixed anaerobic digestion
  技术：全混合厌氧发酵
- Volume: 300 m^3 容积：300立方米
- Total investment: 420,000 yuan RMB
  总投资：42万元
- Annual treatment capacity : 15000 tons
  每年处理废水能力：15000吨
- Annual biogas yield: >20000 m^3
  每年产沼气大于20000立方米

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Resources utilization
资源利用

- Biogas for fueling the boiler for steam generation

  沼气用于锅炉
- Sludge and slurry for fertilizing the rice land and vegetable growing

  沼渣和沼液用于稻田和蔬菜种植
- Transferring the waste into energy and other useful resources.

  变废为能源和其它有用资源

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Example 2

biogas plant built in Sanlian Farm in Haining
海宁市三连农场的沼气工程

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Brief introduction
项目简介

- Built in 2002 建于2002年
- Fully mixed anaerobic digestion
  技术：全混合厌氧发酵
- Volume: 350 m^3 容积：300立方米
- Annual treatment capacity: 18000 tons
  每年处理废水能力：18000吨
- Total investment: 250,000 yuan RMB
  总投资：25万元
- Daily biogas production: 66 m^3
  每天产沼气大于66立方米

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Resources utilization
资源利用

- Biogas used as fuel for farmer households
  沼气用于农户的燃料
- Sludge and slurry used for fertilizing and irrigating 27 hectares of mulberry trees.
  沼渣和沼液用于27公顷的桑园灌溉和施肥料
- Creating a chain of “husbandry-biogas plant-mulberry trees”
  建立了“畜牧业－沼气工程－桑树”的生态链

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Applicable condition for large biogas plant
大型沼气工程的应用条件

- In the animal livestock farms which have over 5000 pigs, the appropriate technologies are UASB, UASB+SBR and the main structure could be ground cylinder tanks made of concrete or steel

  超过5000头猪的养殖场，应采用UASB, UASB+SBR 技术和地面水泥或钢式结构
- The reactors' volume is > 500 m^3

  反应器容积大于500立方米
- In some cases there is no environmental request due to full use residues discharged from plant.

  由于所有的残渣得到应用，对环境没有负面影响
- In other cases, there are discharging standard for the treated effluence (second grade of National standard).

  在有些工程中，有处理量的排放标准要求（达到国家二级排放标准）

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Example 1
Large plant built in Fujingda Agriculture Co. in Shaoxing
绍兴市福佳达农业有限公司的大型沼气工程

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Brief introduction
项目简介

- Built in 2000 建于2000年
- Technology: fully mixed anaerobic digestion in medium temperature
  技术：全混合中厌氧发酵
- Total investment: 1.32 million yuan RMB
  总投资：132万元
- Volume: 600m^3
  容积：600立方米
- Daily treatment capacity: 150 tons/day
  每天处理能力为150吨

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Resources utilization

资源利用

- Biogas generated is supplied to 340 farmer families for their daily fuel consumption

  沼气可以满足340户农户的日常燃料消耗

- The sledge and slurry are discharged for irrigating and fertilizing over 50 hectares tea garden and 32 hectares of rice land.

  沼渣和沼液用于50公顷茶园和32公顷稻田灌溉和肥料

- Eliminating the pollutant source, promoting the agricultural production, saving the cost for fertilizer etc.

  减少了污染源，提高了农产品产量和质量，节省了肥料的费用。

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Example 2
Large plant built in
Zhengxin Husbandry Co. in Hangzhou
杭州市正信畜牧养殖有限公司的大型沼气工程项目

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Brief introduction
项目简介

- Built in 2003 建于2003年
- Technology: UASB in two stages
  技术：两级UASB
- Volume: 600m³ 容积：600立方米
- Total investment : 1.90 million yuan RMB
  总投资：190万元
- Daily treatment capacity: 150 tons/day
  每天处理能力为150吨
- Daily biogas yield: 180 m³
  每天产沼气180立方米

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Resource utilization
资源利用

- The biogas supplied for the canteen in the farm and the farmer households nearby
  沼气供给农场餐厅和附近农户作为燃料
- The sledge and slurry are used for irrigating and fertilizing the fruit trees, bamboo and vegetable fields
  沼渣和沼液用于果树，竹园和蔬菜的灌溉和肥料
- No pollutant discharged to the environment.
  对环境没有污染

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Example 3
Large plant built in
Xizi Animal Livestock Farm
西子畜牧养殖场的大型沼气工程

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Brief introduction
项目简介

- Built in 1997 建于1997年
- Technology: UASB+SBR
  技术： UASB+SBR
- Volume: 500m³ 容积：500立方米
- Total investment : 1.30 million yuan RMB
  总投资：130万元
- Daily treatment capacity: 100 tons/day
  每天处理能力为150吨
- Daily biogas yield: 500 m³
  每天产沼气500立方米

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Resource utilization
资源利用

- The biogas supplied for the canteen in the farm and for the power generation

  沼气供给农场的餐厅做燃料和用于发电
- Through UASB and SBR treatment, the effluent is discharged to an aerobic pond. From the outlet of the aerobic pond, the treated effluent satisfies with the second grade of National Standard.

  通过UASB 和 SBR 两道工序处理后，废水排入好氧池。经好氧处理后，废水达到国家二级排放标准排放。

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DEWATS

分散式废水
处理系统

de centralised

wa stewater

t reatment

s ystems

- Over 200 systems operating in India, Indonesia and China

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DEWATS

Planning, designing and construction of decentralised wastewater treatment systems.

Support of micro-, small- and medium-sized enterprises, public institutions

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dewats background

沼气技术25年
25 Years Biogas

- 1977: 1st Biogas projects in Maharashtra/India
  在印度开展沼气项目
- 1978: Biogas Technology Transfer India-Ethiopia
  沼气技术从印度转让到埃塞俄比亚
- 1979: 1st International Biogas Conference in Bremen, Germany with Chinese participation
  第一届国际沼气技术在德国不莱梅召开,中国派员参加
- 1980-1993: Intensive supra-regional Biogas dissemination
  跨地区的沼气技术深入推广
- 1994-1998 DEWATS research project in India and China
  在印度和中国开展分散式废水处理系统项目
- 1999-2004 DEWATS and CBS in Indonesia and Vietnam
  在印度尼西亚和越南开展分散式废水处理系统与社区公共卫生系统项目

DEWATS

Decentralised Wastewater Treatment in Developing Countries

Ludwig Sasse
1998

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Pequeñas Plantas de Tratamiento de Aguas Residuales Domesticas (Aplicacion en Paises Andinos)

Possibilities of Increasing Biogas Production by using Different Mixtures of Animal Wastes

Decentralised Waste Water Treatment Systems (DEWATS)

The Readers Survey

Evaluation of Biomethanation Potential of Selected Industrial Organic Effluents in India

Biogas Users Survey 1998/99 in Nepal

Remarks on Control Parameters for Decentralised Wastewater Treatment Plants (DEWATS)

Community vs the Engineer

including Wastewater

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Desired Future Structure
f the Biogas Sector in Nepal

xtension of Biogas in Nepal

tic Lighting through Biogas
in Tribal Areas of India

Purification Biogas Digester
reat Excrement and Sewage
spital of Infectious Diseases

iltration Pit for Dewatering
Biogas Plant Slurry in Hills

Biogas Pressure Regulator

GTZ

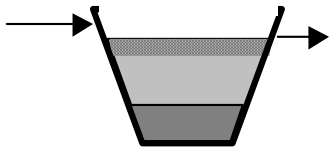
Sedimentation

Anaerobic digestion

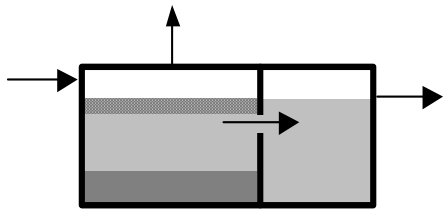
Aerobic and facultative decomposition

Post treatment

sedimentation pond

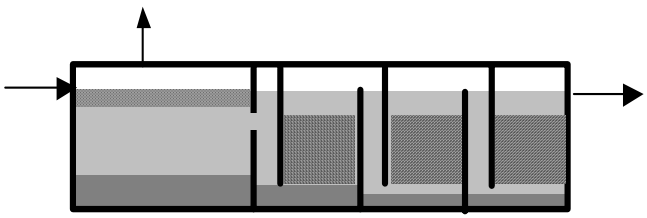


septic tank

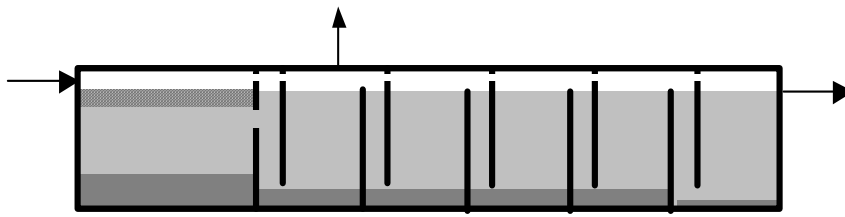


dewats

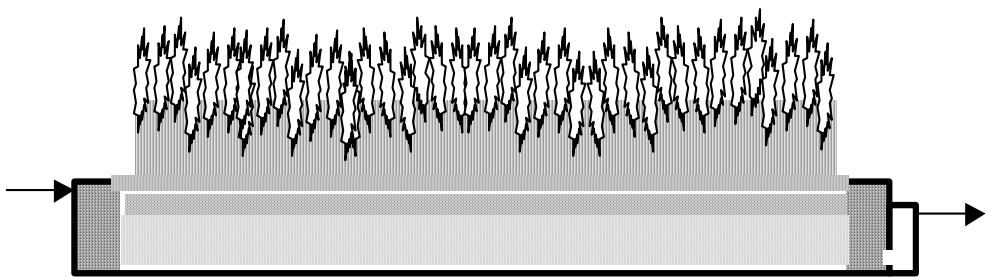
anaerobic filter



anaerobic baffled reactor



planted gravel filter



aerobic-facultative ponds and aerobic polishing ponds

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Technical Characteristics

- for organic wastewater from domestic and industrial sources
- for daily wastewater flows of 1 - 1000 m^3
- reliable, long lasting and tolerant towards inflow fluctuation
- ***dewats*** work without conventional energy when sufficient inclination is available -thus, is power-independent

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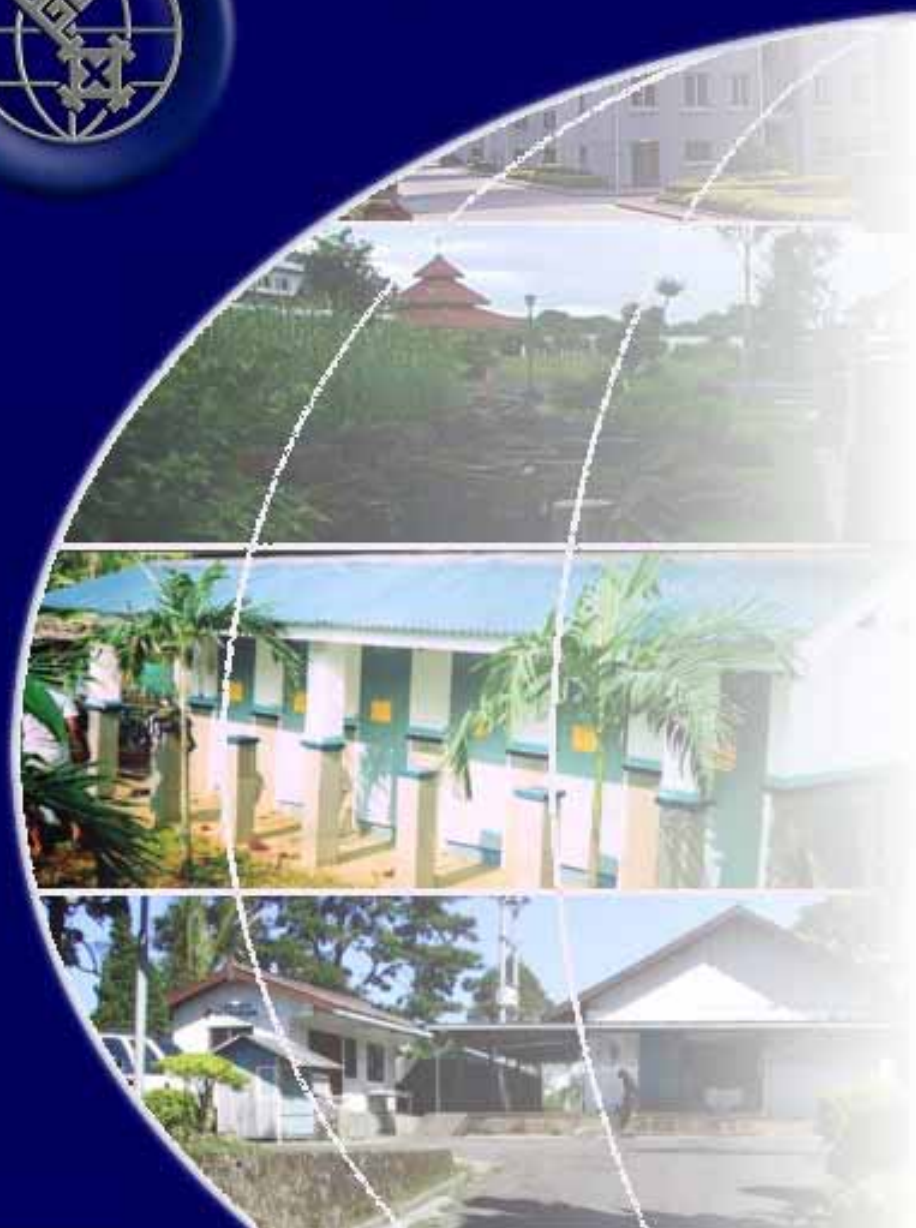

Application

- Settlements
- Hospitals
- Hotels
- Community sanitation units
- Agriculture and husbandry

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Sino-German Technical Academy Shanghai, China

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case studies

Sino-German Technichal Academy Shanghai, China

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Sino-German Technical Academy Shanghai, China

Initial problem identification

- 6 500 students & staff
- Offices and workshops
- Environmental standard GB/T 18921-2002 (2nd stage)
- Limited capital for investment
- Limited technical capacity
- Space only at the outskirts of the premises
- Little inclination

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case studies

Sino-German Technical Academy Shanghai, China

- Underground System: sedimentation, anaerobic digester & filter, horizontal sandfilter, irrigation tank , 766m³ for 138 m³ ww/day

- Total construction cost: ¥ 740 000.-

- ***dewats*** maintenance training for technical staff of the institution

- 1 year guarantee

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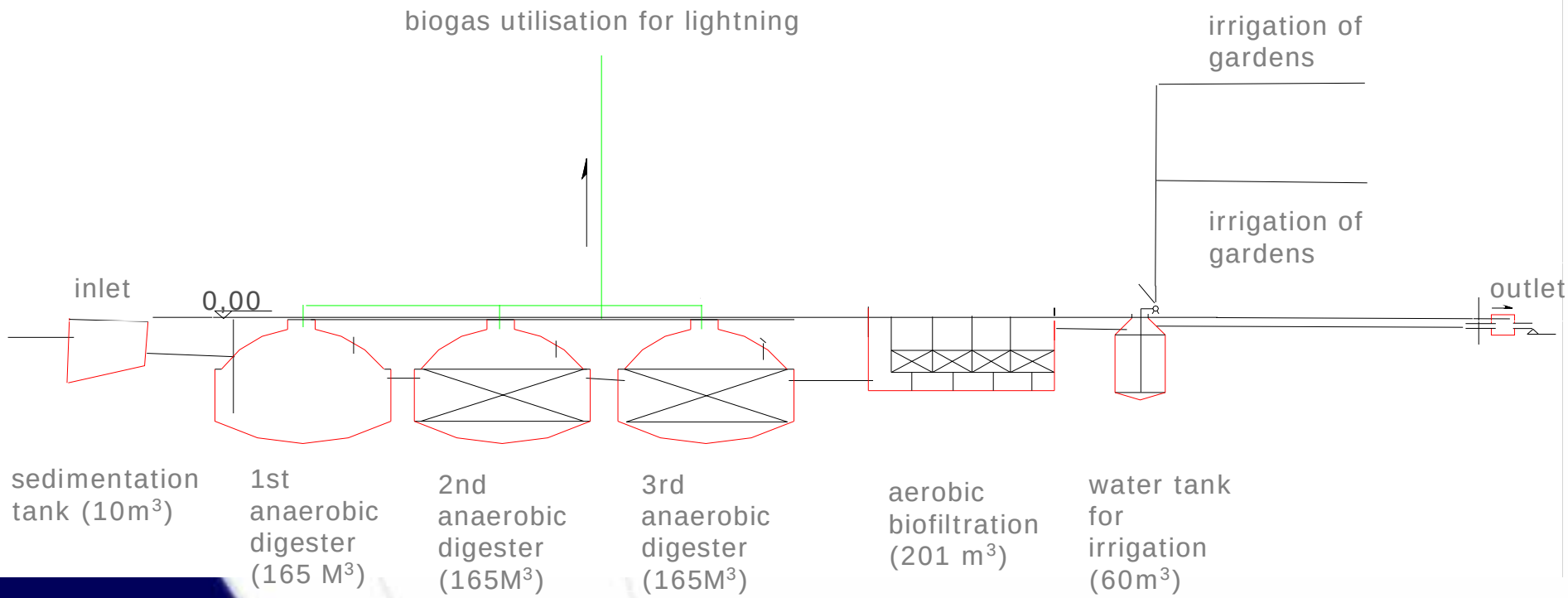
Sino-German Technical Academy Shanghai, China



System-Layout

Sino-German Technical Academy Shanghai, China

Construction of Infrastructure
underground settler, anaerobic treatment

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Sino-German Technical Academy Shanghai, China

Spherical Digester under construction

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Sino-German Technical Academy Shanghai, China

Biogas used for lightening

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New University Campus Wenzhou, China

Decentralised Wastewater Treatment Systems

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New University Campus Wenzhou, China

- Decentralised system
- Underground solutions
- Incremental approach: system grows stepwise with the buildings
- Individual primary, shared secondary treatment
- Discharge according to National Standard GB/T 18921-2002 (2nd stage)

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New University Campus Wenzhou, China

Administration Building & Guesthouse

- Underground System: sedimentation, anaerobic digester & filter, shared horizontal sandfilter, 950m³ for 186 m³ ww/day
- Total construction cost: ¥ 846 000.-
- ***dewats*** maintenance training for technical staff of the institution
- 1 year guarantee

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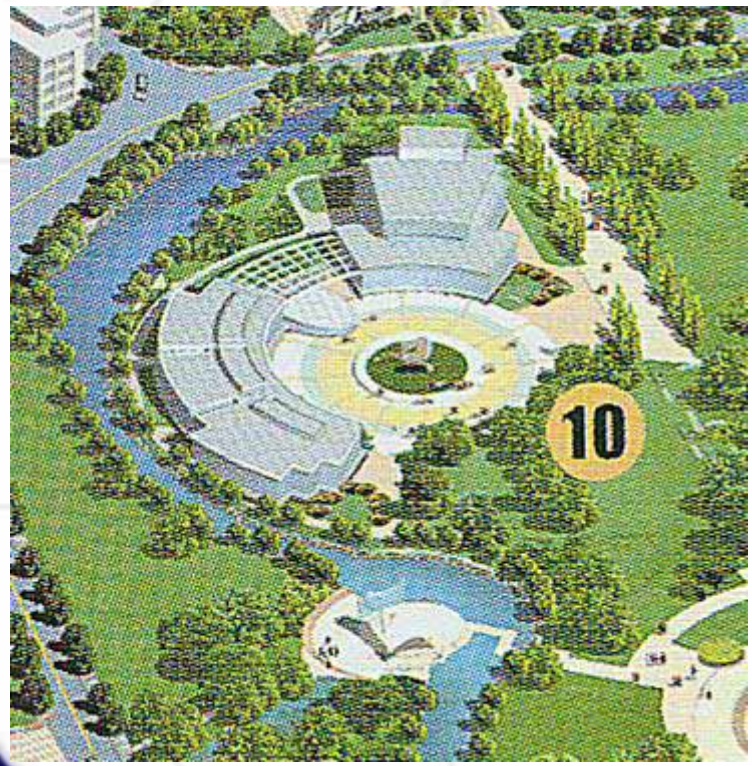
New University Campus Wenzhou, China

Normal University Dormitory



- Underground System: sedimentation, anaerobic digester & filter, shared horizontal sandfilter, 1100m³ for 215 m³ ww/day
- Total construction cost: ¥ 979 000.-
- ***dewats*** maintenance training for technical staff of the institution
- 1 year guarantee

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Contact

Should you require more information...

... please do not hesitate to contact us:

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overview

case studies

Place	People [P]	Volume [m³]	Construction Cost [¥ RMB]	Flow [m³/d]	Spec.Cost [¥ RMB/m³]	Consumption [l/P*d]
1. Shanghai Professional Academy	6 500	706	740.000	138	5 362	25
2. Wenzhou University Campus	49 000	24 500	18 420 000	3 275	5 625	65
a. Admin. Building & Guesthouse	2 300	450 + 500	846 000	186	4 548	80
b. Normal University Dormitory	2 700	500 + 600	979 000	215	4 553	80

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Headquarter: Industriestr. 20
28199 Bremen
Germany

fon: +49 421 137 18
fax: +49 421 165 5323
mail: office@borda.de
web: www.borda.de

China: Borda-Projectoffice
Zhejiang University of
Technology, Prof. Ma Chi

fon/fax: +86 571 88 32 07 94
mail: projectoffice@zjut.edu.cn

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