P.I.A.N.O.
Policies, Innovation And Network for enhancing Opportunities for China-Europe water cooperation
中欧水源合作机会增进政策，创新和联网

Strengthening China Europe Water Innovation Cooperation

Cambi Advanced Digestion and Progress in China

Brussels 2018.05.15

CAMBI®
-recycling energy

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廖足良 博士

Cambi Group
康碧集团

Contents

- CambiTHP® Advanced Digestion
- Cambi 1-2-3-4-5
- Wastewater and Biosolids Management in Beijing
- New development in Chongqing and Xi’an
- Acknowledgement

Thermal Hydrolysis Advanced Digestion

Fundamental change in sludge properties (non-reversible reduction in viscosity)

- **Higher loading rates to digesters**
  - Minimize or eliminate digester upgrades
  - New digestion significantly smaller

- **Improving dewaterability**
  - Less Biosolids out
  - Less energy needs for downstream

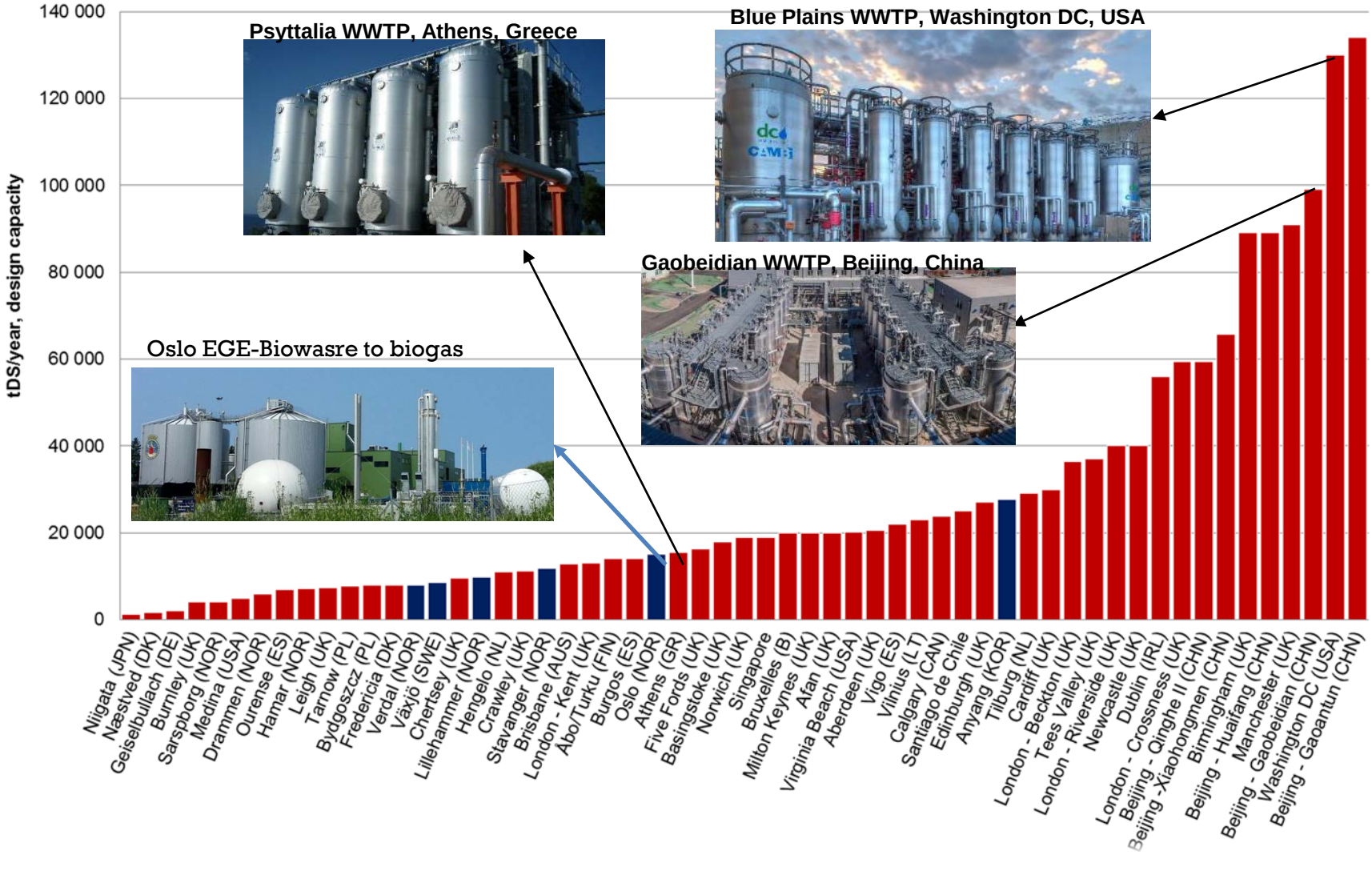
More

- Sterilization with Class A Biosolids
- No pathogen regrowth
- Stable digestion performance
- More biogas production
- Minimized foaming
- Minimum odor
- Homogenous cake easy to spread
- Reduced carbon footprint

✓ CambiTHP® - Proven technology

✓ Exceeds regulatory standards

Cambi – A World Leader in Thermal Hydrolysis Advanced Digestion



Cambi Supplies for 60+ M for Sludge Treatment

BEIJING北京

WASHINGTON DC华盛顿特区

LONDON伦敦

SINGAPORE新加坡

SEOUL首尔 – DUBLIN 都柏林– OSLO奥斯陆 – BRUSSELS布鲁塞尔 – ATHENS雅典
SANTIAGO DE CHILE圣地亚哥 – EDINBURGH爱丁堡 – CARDIFF卡迪夫 等– AND 20+ OTHER CITIES

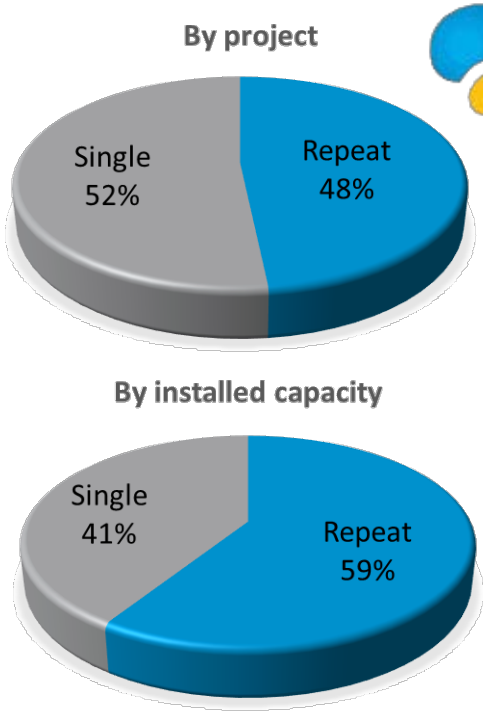
Cambi Thermal Hydrolysis – Repeat Clients
康碧热水解的重复（重要）客户

Thames Water x 7

suez x 4

United Utilities x 3

VEOLIA x 2



北京排水集团 BEIJING DRAINAGE GROUP CO.,LTD x 5

Dŵr Cymru Welsh Water x 3

NORTHUMBRIAN WATER x 2

anglianwater x 2

Cambi 1-2-3-4-5
康碧1-2-3-4-5

- One (1) Core Technology一个核心技术: Thermal Hydrolysis热水解
- Two (2) main application areas两个主要应用领域:
  - **Sludge污泥**
  - Biowaste有机垃圾
- Three (3) Process Solutions三条工艺路线:
  - **CambiTHP-Full康碧所有物料热水解**
  - CambiTHP-WAS康碧生化污泥热水解
  - Cambi SolidStream康碧热水解高干度热脱水

Cambi 1-2-3-4-5
康碧1-2-3-4-5

- Four (4) capacity scales四个处理规模
  - **Xtra Large scale超大规模: >200 tDS/d (>1 million m3/d ww)**
  - **Large scale大规模: 60-200 tDS/d (0.3-1 million m3/d ww)**
  - Medium scale中规模: 20-60 tDS/d (0.1-0.3 million m3/d ww)
  - Small scale小规模: 5-20 tDS/d (<0.1 million m3/d)
- Five (5) Business Units五个业务区域
  - America美洲
  - **APAC亚太**
  - Europe欧洲大陆
  - UK & Ireland 英伦三岛
  - Emerging Markets新兴市场

Sewage sludge production in China

- 2010-2015: 30-40 million wet tons/y (6-8 million tDS/y)
- 2016-2020: 60-90 million wet tons/y (12-18 million tDS/y)
  - Increase in wastewater capacity
  - Increase in effluent requirement
  - Increase in treatment percentage
  - Black and dirty water bodies elimination
  - Sponge city construction
  - Dramatic upgrading of environmental facilities
- Urgent and high demand with need to speed up at high level
- Low VS in sludge from Southern China, calls for advanced and co-digestion
- High sand content requires optimisation

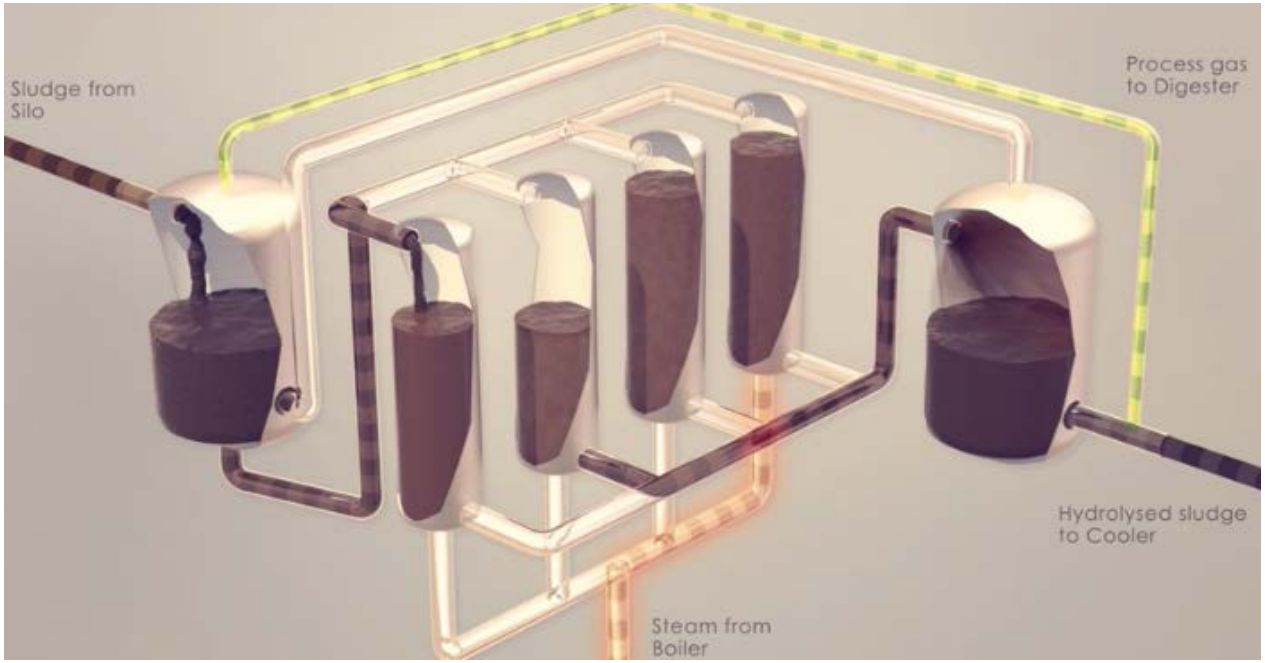
Five objectives for treatment
污泥处理的五个目标

- **Stabilization稳定化: degrade organic matters降解有机物**
- **Reduction减量化: remove water content减少水分（尽量少添加物料）**
- **Hygenisation安全化: kill pathogens杀灭病原菌（生物安全）**
- **Energy recycling能源化: biogas /thermal energy production沼气或热能**
- **Resources utilisation资源化: Organics & Phosphorous and micro-nutrient recycling to land 有机质、磷和微量营养回归大地**

Principle of Cambi Thermal Hydrolysis
康碧热水解原理

- Batch heat sterilization 批次加热消毒
  - Meets all known safety standards worldwide, USEPA alternate 1 time/temp Class A batch – no reactivation满足所有国际已知的安全标准，美国时间温度规定的A级，批次处理，无（病原菌）再生
- Destruction of Extra Cellular Polymer – ECP摧毁胞外聚合物
  - Sludge becomes compressible for dewatering (10% DS% gain) and less viscous (10% hydrolysed =~ 5% conventional)污泥易于脱水，提高10%的含固浓度，降低粘稠度，易于搅拌（热水解的10%相当于传统的5%）
- Hydrolysis of insoluble COD非溶解性COD的水解
  - 30-50% solubilisation enables very rapid digestion, 10 days HRT, 60% VSR。30%到50%的溶解度促进快速消化，达到10天停留时间，60%的降解率
- Steam disintegration of particulate matter颗粒物质通过蒸汽爆破解体
  - Increases digestion rate and reduces viscosity further进一步提高消化和降低粘稠度

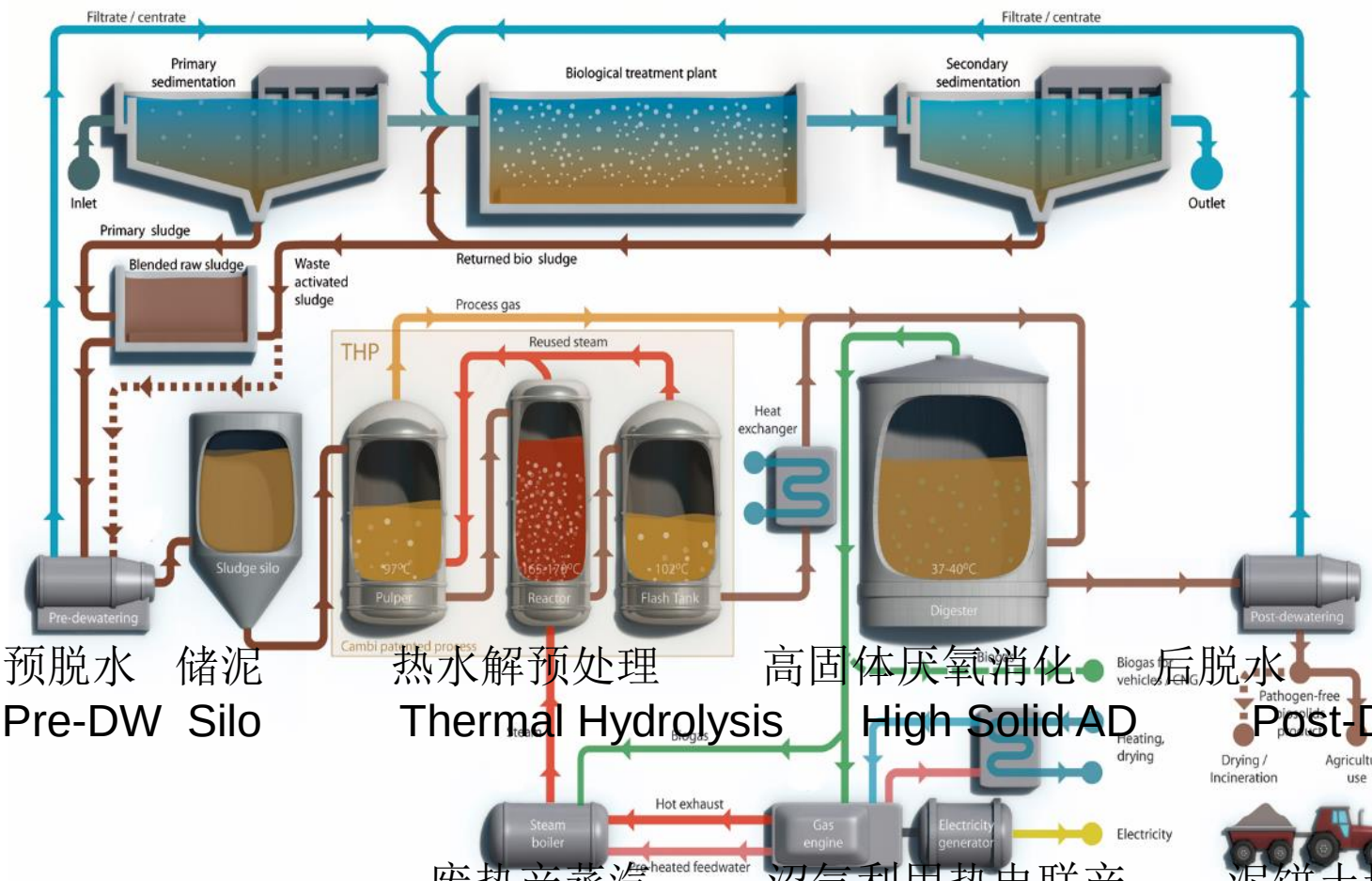
Cambi Thermal Hydrolysis Process



- Configuration: Pulper + Reactors + Flashtank
- Continuous feeding to Pulper, BUT batch feeding to reactors
- Steam injection and pressure cooking 20-30 mins at 150-170 °C
- Flashing under pressure for cell disintegration
- Waste heat from flashtank back to pulper for pre-heating
- Process waste gas to condensation and further to digestion
- Cyclic operation mode

Thermal Hydrolysis Advanced Sludge Digestion Flow Sheet

热水解污泥高级厌氧消化典型工艺流程



预脱水 储泥
Pre-DW Silo

热水解预处理
Thermal Hydrolysis

高固体厌氧消化
High Solid AD

后脱水
Post-DW

废热产蒸汽
Steam Boiler

沼气利用热电联产
Biogas use, CHP

泥饼土地利用
Final cake to land

Cambi Value for Municipal Sludge and Biowaste Treatment
康碧对市政污泥和有机垃圾处理带来价值

- Recover nutrients and produce Class A Biosolids & Fertilizer.回收营养物，生产优质生物固体肥料 (黑金）

- Generate clean, renewable energy from waste.从废物生产清洁再生能源（蓝金）

- Reduce or eliminate residual waste disposal.减少或消除剩余废物的处置（黄金）

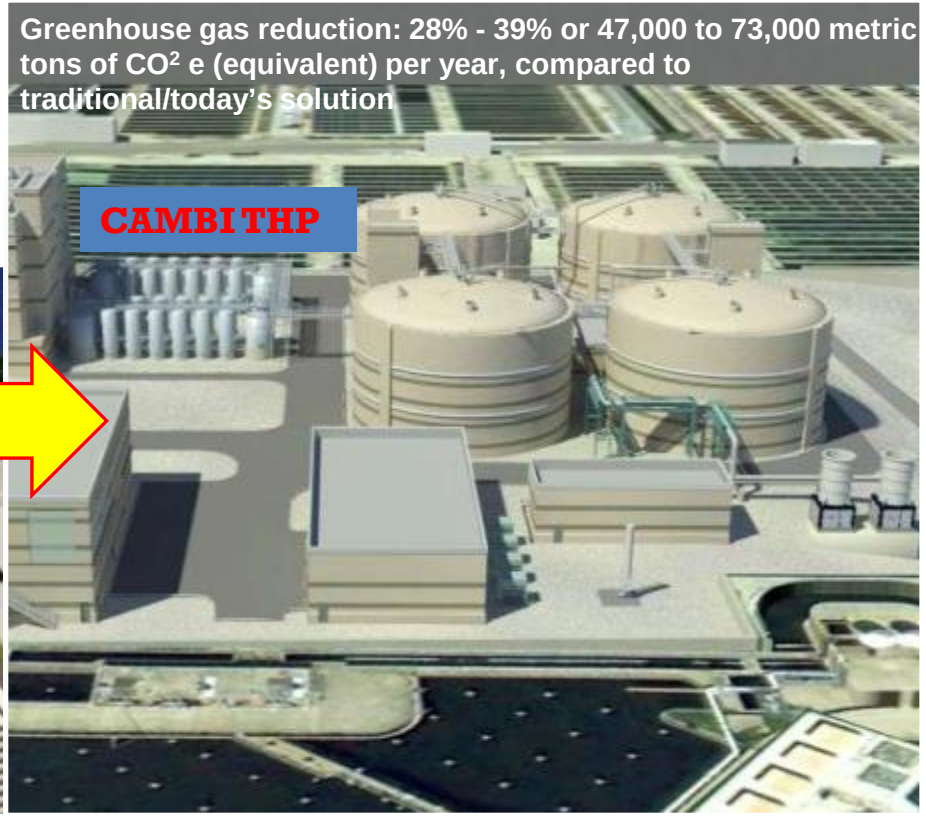
- Save millions in annual costs for the cities.节约运行成本（黄金）

- Cut greenhouse gas emissions dramatically.大幅度削减温室气体排放（绿金）

Conventional vs Cambi Digestion for sludge

Conventional ⬅	Parameters	➡ Cambi
3-6%	Digester Feeding DS%	9-12%
20-25	Digester HRT (d)	15-18
Big	Digester volume	Small
Low	Digester Loading rate	High
33-37	Digester Temp (°C)	38-42
6.5-7.5	Digester pH	7.5-8.0
30-45%	Organic VSR%	50-65%
Low	Biogas production (m3/tDS)	High
High	Biogas H_2S	Low
20%-25%-30%	Dewatered Cake DS%	30%-35%-40%
Class B (partial)	Biosolids hygienization	Class A (pathogen Kill)
More	Viscosity	Less

Smaller Digester volume:
DCWATER- from 174000 m^3 to 58000 m^3



Planned traditional design: + 8 egg-shaped digesters (174,000 m^3) **CANCELLED**
传统设计，8个蛋罐174000立方米，项目取消

CAMBI Design Chosen: Cambi THP (600 m^3) + 4 digesters, each of 3.8 MG* = 58,100 m^3 (1/3 of traditional volume)
35% overall CAPEX savings compared to traditional design
OPEX savings = 20 mill. $/year from today's solution
康碧设计，热水解，4个柱罐，传统的1/3体积，投资节约35%，运行费比现有石灰稳定少2千万美元每年

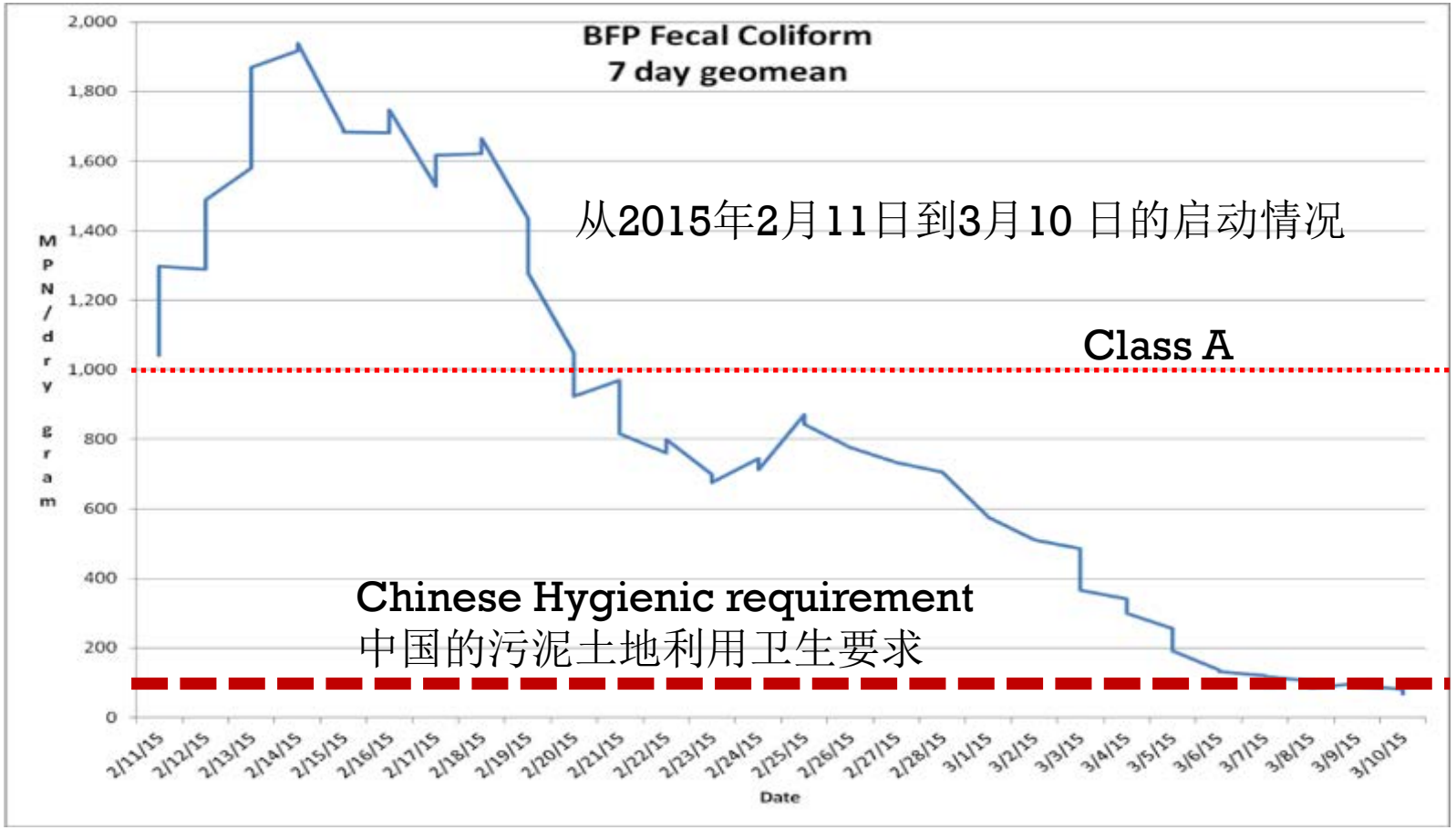
消化（19世纪）到堆肥和石灰稳定（20世纪）到高级消化（21世纪）

Cake volume reduction :
Kapuciska from 20000 tpy to 10000 tpy
沼渣减量：Kapuciska从每年20000吨减到10000吨

Before CAMBI原有:
20,000 tpy, **20-22%** DS,
Smelly, high level of pathogens

After采用康碧后：
10,000 tpy Cambi cake
30-33% DS
Low odour
Free of pathogens

DC Water: Fecal Coliform Results (Biosolids)
华盛顿特区水务高级消化脱水泥饼卫生学指标

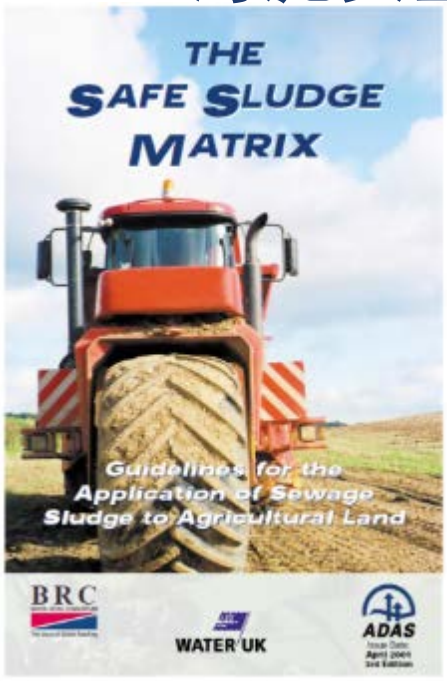


Biosolids Quality:
from sticky and smelly to particulates and soily
生物固体品质：从粘稠有臭味到颗粒状和泥土味

1 颗粒状，多孔granules, porous
2 松散，透气，微氧后整理discrete, airy, micro-aeration
3 自然堆肥现象natural composting
4 全面杀灭病原菌kill pathogens
5 A级生物固体Class A Biosolids

SAFE RECYCLING OF BIOSOLIDS TO FARMLAND (UK)

污泥安全回归农地的英国规定



Conventionally treated sludges : **99%** pathogen removal

传统处理病原菌杀灭**99%**

Enhanced treated sludges : **99,9999%** pathogen removal

强化处理病原菌杀灭**99,9999%**

THE SAFE SLUDGE MATRIX

CROP GROUP	UNTREATED SLUDGES	CONVENTIONALLY TREATED SLUDGES	ENHANCED TREATED SLUDGES
FRUIT	✗	✗	✓ (10 month harvest interval applies)
SALADS	✗	✗ (30 month harvest interval applies)	✓ (10 month harvest interval applies)
VEGETABLES	✗	✗ (12 month harvest interval applies)	✓ (10 month harvest interval applies)
HORTICULTURE	✗	✗	✓ (10 month harvest interval applies)
COMBINABLE & ANIMAL FEED CROPS	✗	✓	✓
GRASS & FORAGE - *GRAZED*	✗	✗ (Deep injected or ploughed down only)	✓ (3 week no grazing and harvest interval applies)
GRASS & FORAGE - *HARVESTED*	✗	✓ (No grazing in season of application) (3 week no grazing and harvest interval applies)	✓ (3 week no grazing and harvest interval applies)

NOTE : ✓ *All applications must comply with the Sludge (Use in Agriculture) Regulations and DETR Code of Practice for Agricultural Use of Sewage Sludge (to be revised during 2001).*

✗ *Applications not allowed (except where stated conditions apply)*

DC WATER TURN SLUDGE INTO A PRODUCT
华盛顿水务变污泥为沃土产品

- VISION: Transform DC Water's biosolids from $7 million/year liability into a $3 million/year asset
- 目标是变每年7百万美元的处置成本为3百万美元的收益

Bloom soil from USA

HØST Minorga from Norway

Carbon Footprint
碳足迹

生产，加工，运输，药剂，人工，能源，运行，处置，土地，植被

Production, fabrication, transport, chemicals, manpower, energy, operation, disposal, land use, plant

Thermal Hydrolysis Advanced Digestion – lowest carbon footprint

热水解高级厌氧消化位居低碳前列

Table 2: Carbon footprints of 15 technical routes for sludge treatment and utilization (Source: AECOM Asia Co Ltd (2011)).

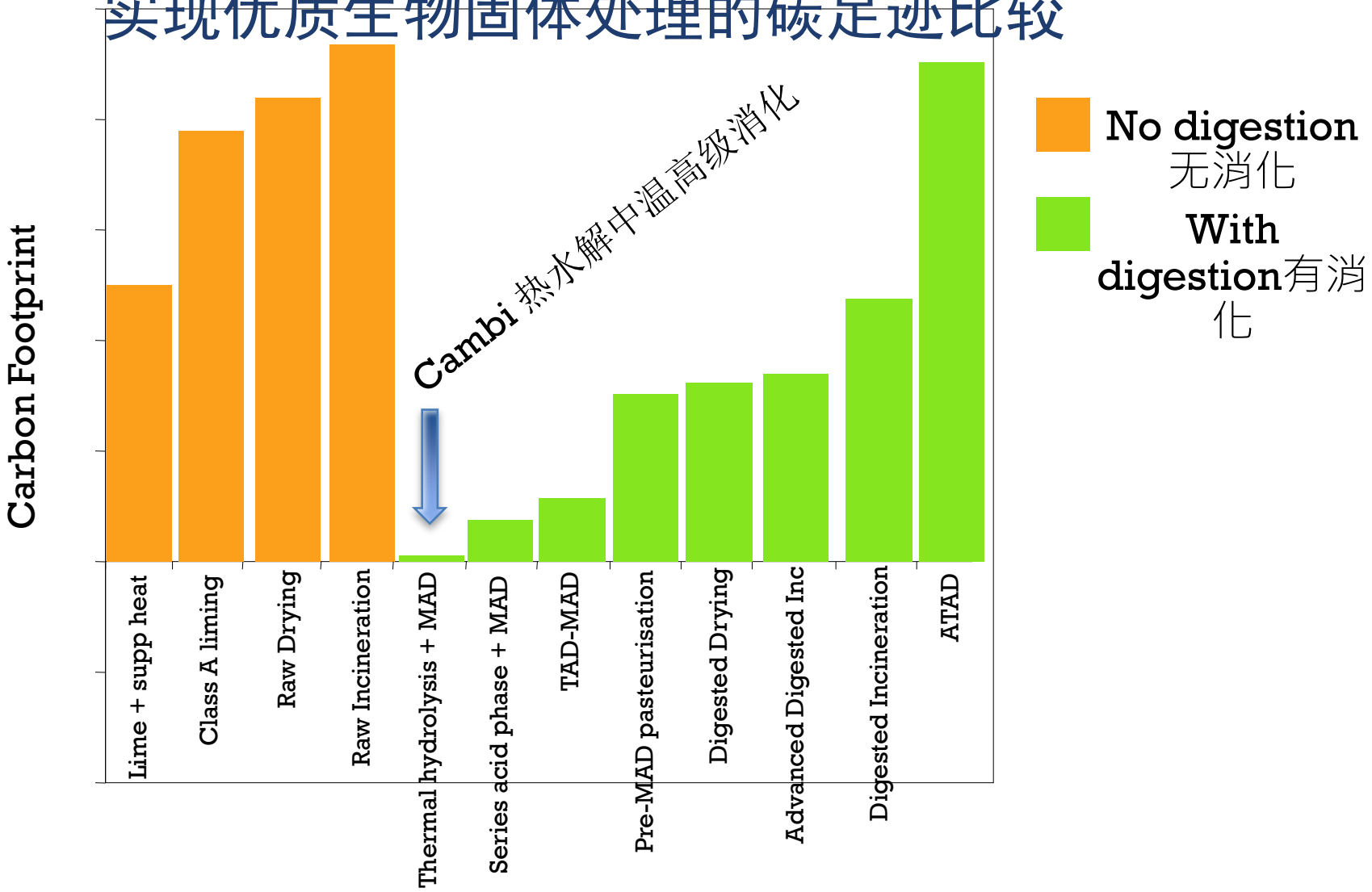
Ref	Technical route	Carbon footprint [t CO_2e per year]
1	Thermal hydrolysis, anaerobic digestion, biogas utilization, heat drying (10% moisture content), coal substitution (e.g. in a power plant or cement kiln)	-500
2	Anaerobic digestion, biogas utilization, landfill with landfill gas utilization	0
3	Thermal hydrolysis, anaerobic digestion, biogas utilization, land application	200
4	Anaerobic digestion, biogas utilization, compost, land application	450
5	Anaerobic digestion, biogas utilization, land application	950
6	Heat drying (10% moisture content), coal substitution	1300
7	Composting, land application	2400
8	Heat drying, gasification, energy recovery	4750
9	Lime stabilization, land application	4900
10	Heat drying, incineration, heat recovery	5900
11	Lime stabilization, land application	6200

热水解-高级消化-沼气能源利用-沼渣土地利用

THP-AAD-Biogas-Biosolids to land

Carbon Footprint of Class A Biosolids treatment

实现优质生物固体处理的碳足迹比较



Cambi Practice for Carbon Reduction and Green Recycle Goals
康碧的碳减排绿色循环目标的实践

- 2017: 21 countries, 62 projects, 1.700.000 tDS/y total treatment capacity
截至2017年，21个国家62个项目年处理一百七十万吨干固体。
- 3660 GWh/year (610 mill. m3) of renewable biogas capacity in all Cambi biogas plants, when used for electricity, replaces 1,500,000 tons/year of CO2 emissions compared to using fossil fuels.年产六亿立方沼气，相当于三十六亿度电能，碳减排一百五十万吨二氧化碳当量。
- Total CO2 saving for replacing 5,663,083 Mg coal.替代五百七十万吨煤
- Low odor during treatment and final Class A Biosolids product for for green production process污泥处理过程和最终优质生物固体产品实现低臭味，达到绿色生产工艺过程
- Biogas to replace fossil fuel, biosolids for land application to replace chemical fertilizer and micro nutrients, dramtically reduce landfill and incineration, realise recycle economy沼气利用替代化石能源，生物固体土地利用替代肥料和微量元素，大幅度减少填埋焚烧，实现循环经济的目标。

Cambi Advanced Digestion in Mega-cities: centralized treatment for multiple disposal
康碧高级消化对大都市的影响

- London伦敦
  - Thames Water泰晤士水务: Renewables, Reduction, incineration, biosolids quality, land bank and safety
- Manchester曼切斯特
  - Unitied Utilities联合公用: Renewables, reduction, incineration, biosolids quality, land bank and safety
- Washington DC华盛顿特区
  - DCWASA特区水务: Renewables, reduction, Class A biosolids, land bank
- Beijing北京
  - Beijing Drainage Group北京排水集团: Reduction, renewables, biosolids quality, land bank and safety

Thames Water Sludge Management Strategy
泰晤士水务的污泥管理战略

- To increasingly adopt treatment processes that will maximise the generation of renewable energy and minimise the volume of sludge produced. 不断采用各种成熟的新工艺，实现再生能源最大化，污泥产量最小化。

- To ensure safe and sustainable recycling, to give confidence to farmers and food producers, but also to reduce our reliance on farm land by using other forms of treatment and energy generation.确保安全和可持续的循环利用，为农户和食品生产商提高信心，同时通过其他形式的处理和能源减少对农用的依赖。

- We are on track with the £250 million programme which started in 2010 to increase our sludge processing capacity by installing 'thermal hydrolysis' plants (THP) at our Beckton (Newham), Crossness (Bexley), Riverside (Barking and Dagenham), Basingstoke, Oxford, Crawley and Chertsey Sewage Treatment Works (STWs). 从2010年来，确定投入**2.5**亿英镑，通过建设8个热水解项目（Beckton, Crossness, Riverside, Basingstoke, Oxford, Crawley Chertsey）提高污泥处理能力。

Sludge treatment in Thames Water in London
伦敦泰晤士水务的污泥处理

- Serving Greater London and surrounding areas for 15 million P.E. with around 350 plants and stations, producing ca 1000 tDS/d.服务大伦敦区域和周边地区，人口一千五百万人，350余污水厂站，污泥总量1000tDS/d.

- There are around 20 incineration plants in UK including Beckton and Crossness. There will be 7 THP facilities in 2016 treating 520 tDS/d and producing 318 GWh. 有20余座消化焚烧设备（含Beckton和Crossness2座焚烧），到2015年有7座有热水解THP设备，共约520 tDS/d,发电318 GWh

1.	Chertsey	40 tDS/d	(1998)
2.	Riverside	110 tDS/d	(2014)
3.	Crawley	31 tDS/d	(2015)
4.	Beckton	100 tDS/d	(2015)
5.	Crossness	100 tDS/d	(2015)
6.	Long Reach	81 tDS/d	(2015)
7.	Basingstoke	54 tDS/d	(2017)
8.	Oxford	67 tDS/d	(2014 Bio-Thelys)

- 2020年前，还有约400tDS/d热水解扩能，基本处理所有污泥。Until 2020, there will be 400 tDS/d to expand with THP to treat all sludge.

Sludge treatment in Thames Water in London
伦敦泰晤士水务的污泥处理

- THP is installed for advanced digestion for better dewatering performance 在采用热水解高级消化前提下，消化污泥较容易脱水。
- Implementing membrane filter press to achieve high DS采用以膜压过滤工艺为主，达到更高的干度。
- Chamber filter press + Bucher press 板框压滤 + Bucher脱水。
- THP cakes are suggested to incinerated with partial PS in SPG unit. THP泥饼建议和部分初沉污泥泥饼混合送烧。

DCWASA: Nutrient and Carbon Recycling and Green Energy Biorenewables
华盛顿特区水务营养物和碳循环及绿色能源再生利用

Blue Plains: One of the Largest Water and Sewer Utilities on the East Coast

蓝原：美国东海岸最大的污水处理系统

- Wastewater treatment for over 2.2 million population人口当量
- District of Columbia + portions of Maryland and Virginia哥伦比亚特区和马里兰及弗吉尼亚的一部分
- CSO flows河流制污水
- Excellent history of treatment performance 优秀表现和业绩 (8 yrs of NACWA gold award)

Blue Plains: 1.5 BLD - largest AWTP in the world
蓝原处理能力每天150万吨全球最大高级污水处理项目

BLUE PLAINS WWTP WASHINGTON DC
华盛顿特区水务蓝原项目

CambiTHP热水解系统
处理能力400tDS/d

Reserve space for预留
400 tDS/d处理能力

Beijing: Population and Wastewater Treatment 1970s-2010s

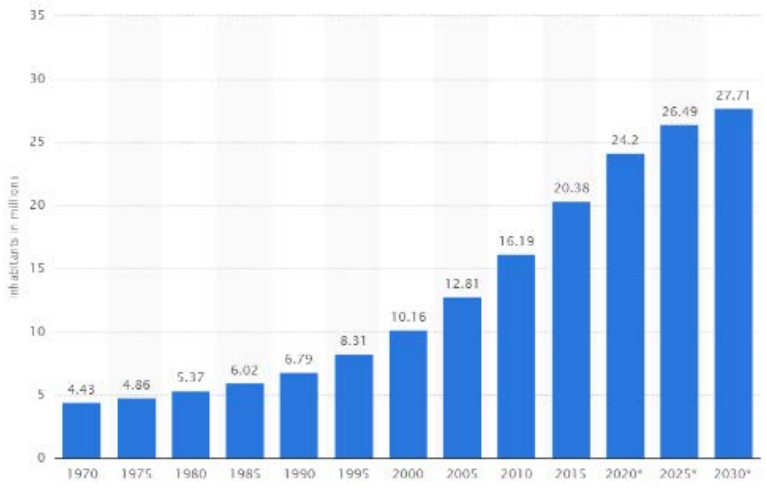
- From 4.4 million p.e. to 20 million p.e.
- From primary treatment to tertiary treatment for water reclamation

https://www.statista.com/statistics/466949/china-population-of-beijing/

Society › Demographics › Population of Beijing in China 1970-2030

China: population of Beijing from 1970 to 2030 (in millions)

PREMIUM



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Show further information

Complete Source Details

Data visualized by tableau

Wastewater treatment

- Before 1900s: mostly primary treatment
- 1993-1999: Gaobeidian as the first biological treatment
- 2000-2010: Capacity to 2.5 million m3/d (Gaobeidian, Xiaohongmen, Qinghe, etc), two large plants with digestion
- Before 2013: sludge management: digestion, drying, composting, liming, landfill
- 2013-2017: three year action plan--capacity evaluation to 4.2 million m3/d and advanced treatment for water reuse and biosolids application

Beijing: Wastewater treatment and Sludge Treatment

Before 2013—

2.5 million m^3/d; sludge digestion, drying, composting, co-firing in cement, landfill

- Gaobeidian (1993 and 1999) 1 million m^3/d, digestion
- Xiaohongmen (2008) 0.6 million m^3/d, digestion
- Qinghe (2008) 0.4 million m^3/d, drying for cement
- Composting 350 t/d
- Cement drying
- Liming 400 t/d
- Rest to landfill

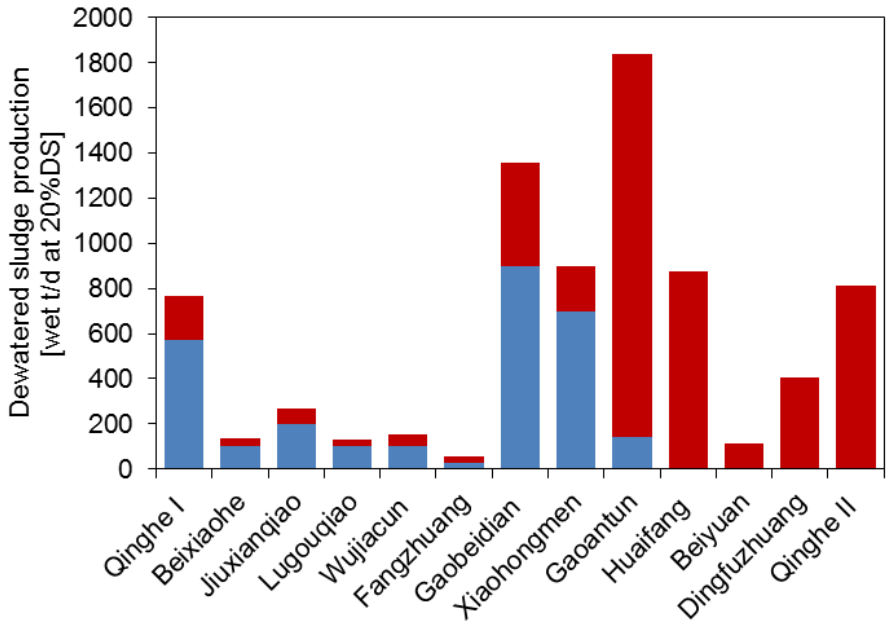
2013-present—

4.2 million m^3/d; five sludge THP digestion plants (6128 t/d), composting, land application

- Gaobeidian 1358 t/d
- Xiaohongmen 900 t/d
- Huaifang 1220 t/d
- Qinghe II 814 t/d
- Gaoantun 1836 t/d
- Composting remains

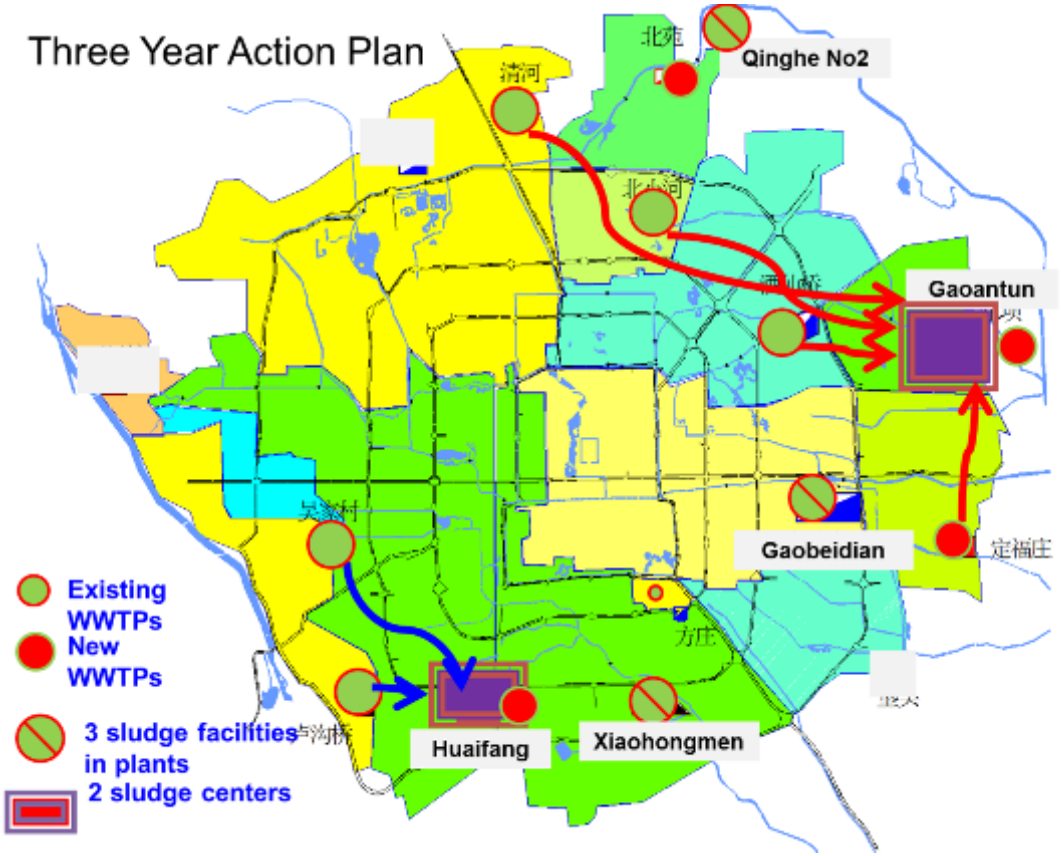
Beijing: Three Year Action Plan for Biosolids Management

- Wastewater: From 2.5 million m^3/d (9 plants before 2013) to 4.2 million m^3/d (13 plants in 2017)
- Sludge: From ca 2800 t/d (2013) to 6128 t/d (2017)
- “1-5-1”strategy: **1** process solution THP-AD-FilterPress-ReNoCar, **5** plants, **1** disposal way to land application



Beijing: Three Year Action Plan for Biosolids Management

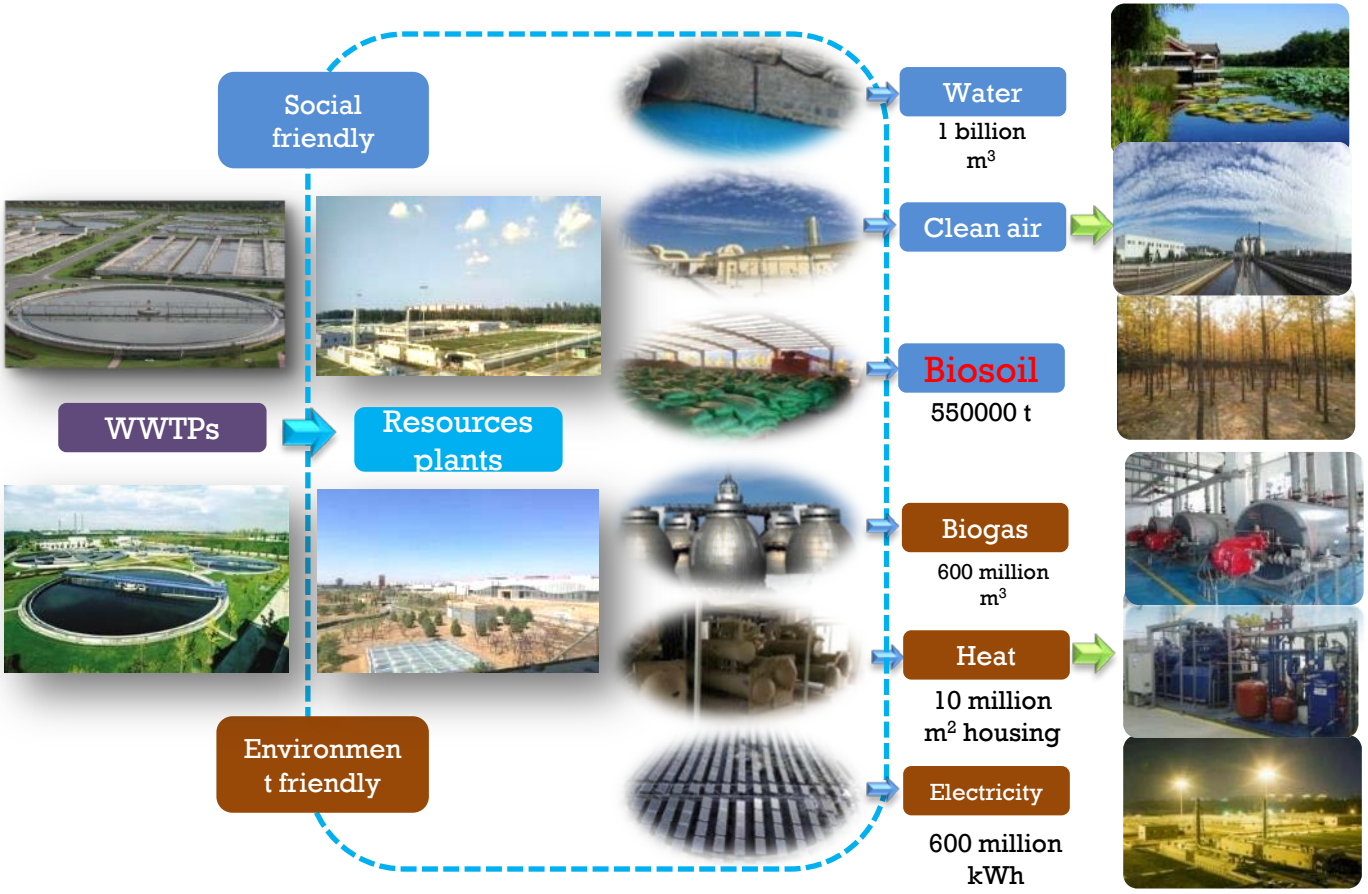
- Locations of 5 Advanced Digestion plants



Five Plants: Capacity, Process, Sludge origins

Projects	Capacity (@80% water content)	Process	Sludge source
Gaobeidian	1358 t/d	❑ THP ❑ AD ❑ Filter Press* ➢ Cake to land ➢ Reject water to ReNoCar process	From this plant
Xiaohongmen	900 t/d		From this plant
Huifang	1220 t/d		From this plant + Wujiacun + Lugouqiao
Qinghe II	814 t/d		From this plant
Gaoantun	1836 t/d		From Qinghe, Beixiaohe, Jiuxianqiao, Dingfuzhuang
Total	6128 t/d	* To meet 40%DS by government	

Beijing: Overall Wastewater and Biosolids Strategy

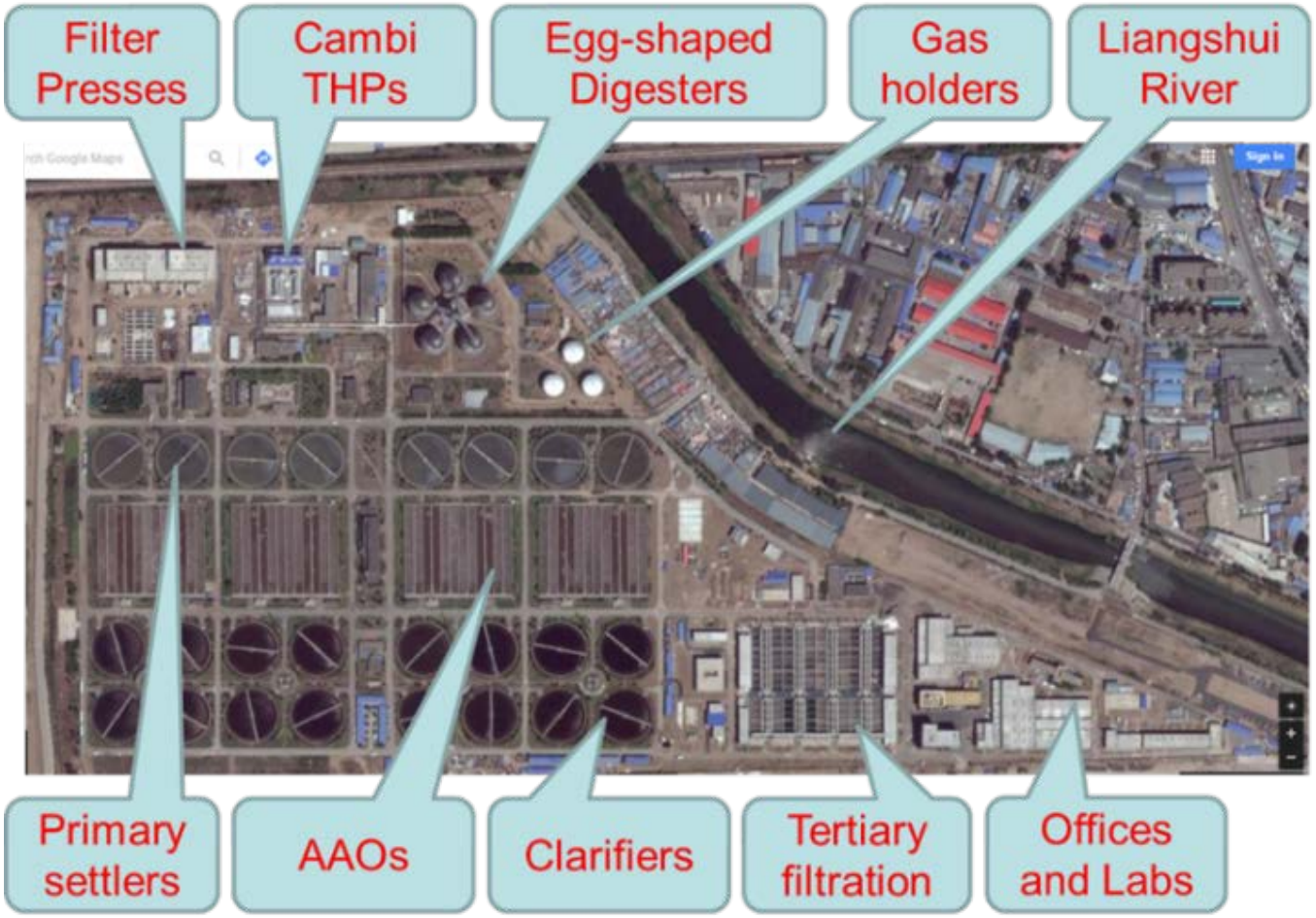


Converting wastewater treatment to resources plants

Xiaohongmen (XHM) water reclamation plant

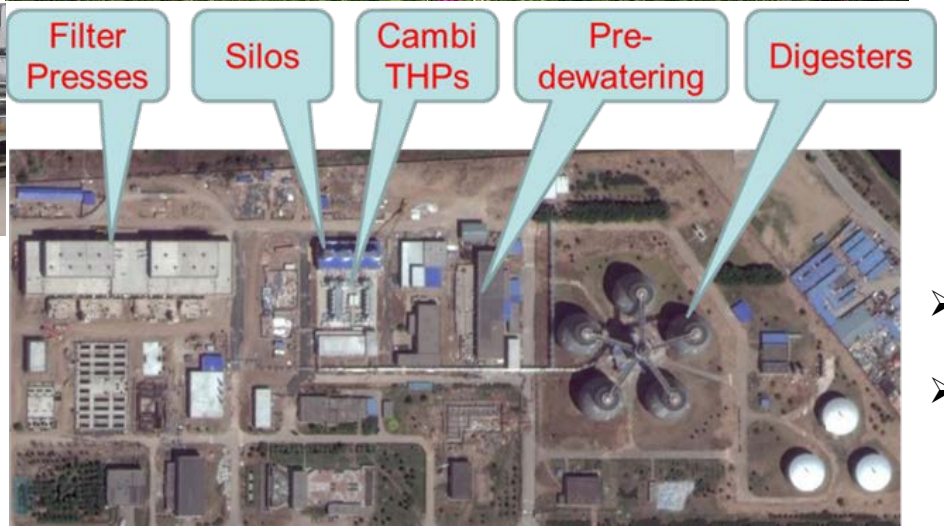
- Built up from 2005, fully operation since 2008, traditional AAO processes with primary settling.
- From 2016, the plant was upgraded to meet stringent local effluent requirement with installation of tertiary treatment and reuse.
- From 2016, the plant is upgraded with Thermal Hydrolysis Advanced digestion for sludge treatment.

Xiaohongmen (XHM) water reclamation plant



Xiaohongmen (XHM): Sludge Treatment

- Chamber filter presses



- biogas sequence mixing
- external recirculation and heating in pipe-in-pipes

Xiaohongmen (XHM): Thermal Hydrolysis Advanced Digestion

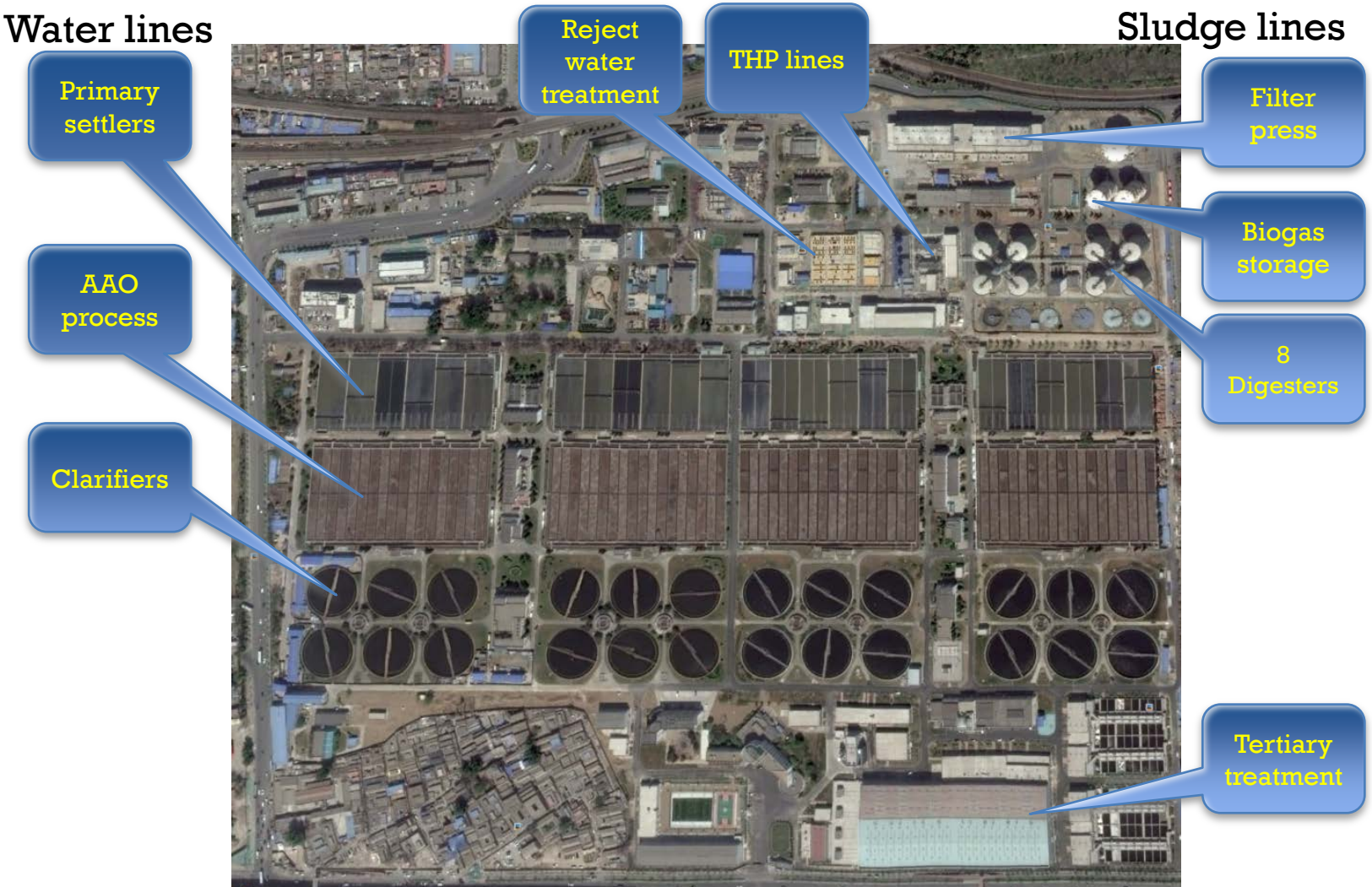
- Treatment capacity PS 90 tDS/d + WAS 90 tDS/d
- Thickening and pre-dewatering to 16.5%DS
- Three lines of CambiTHP® B12-5 system
- 4 of 5 digesters in use
- 12 units of filter press dewatering
- Reject water to ReNoCar® deammonification

Xiaohongmen (XHM): Commissioning Opening Ceremony—Norwegian PM Erna Solberg visited 7 April 2017

Gaobeidian (GBD) Water Reclamation Plant

- Built up 1 million m^3/d from 1990 (0.5 million m^3/d) and 1995 (0.5 million m^3/d) with secondary treatment processes.
- From 2016, the plant was upgraded to meet stringent local effluent requirement with installation of tertiary treatment and reuse.
- From 2016, the plant is upgraded with Thermal Hydrolysis Advanced digestion for sludge treatment.
  - Reduce digester volumes by 50%, from 16 down to 8 digesters @7850 m^3 each.
  - Treatment capacity increases by 50%.
  - Rapid start-up and stable operation of THP and AD.
  - VS reduction and conversion to biogas 450 Nm^3/tDS exceed the design parameters

Gaobeidian (GBD) Water Reclamation Plant



Gaobeidian (GBD): Sludge Treatment

Reject water treatment

Chamber filter dewatering

4 THP lines

8 digesters from original 16 digesters

Gaobeidian (GBD): Sludge Treatment operated since May 2017

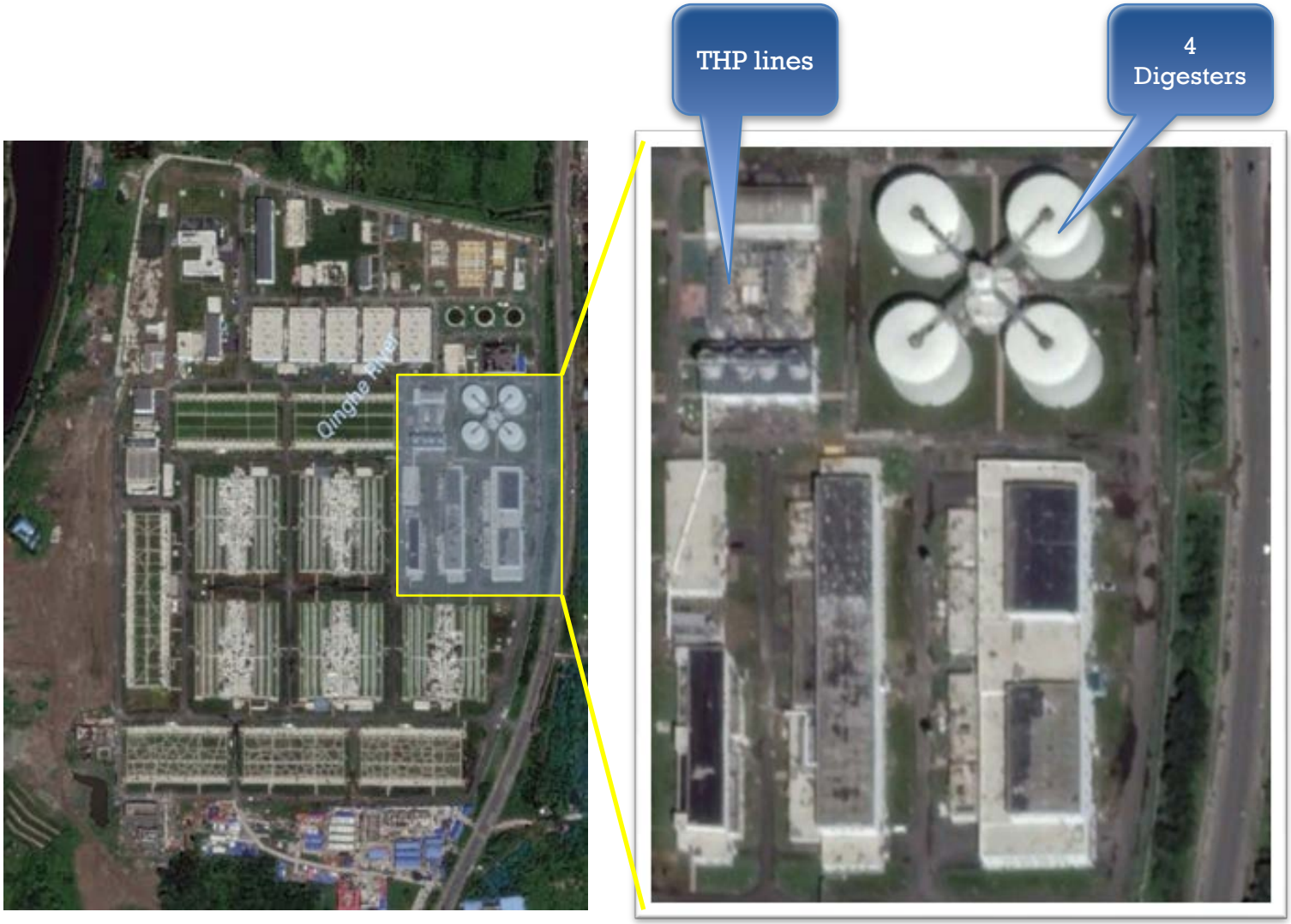
Huaifang (HF) Water Reclamation Plant

- Built up in 2016, treating 0.6 million m3/d, biggest underground MBR plant in China, wetland park
- THP Advanced digestion

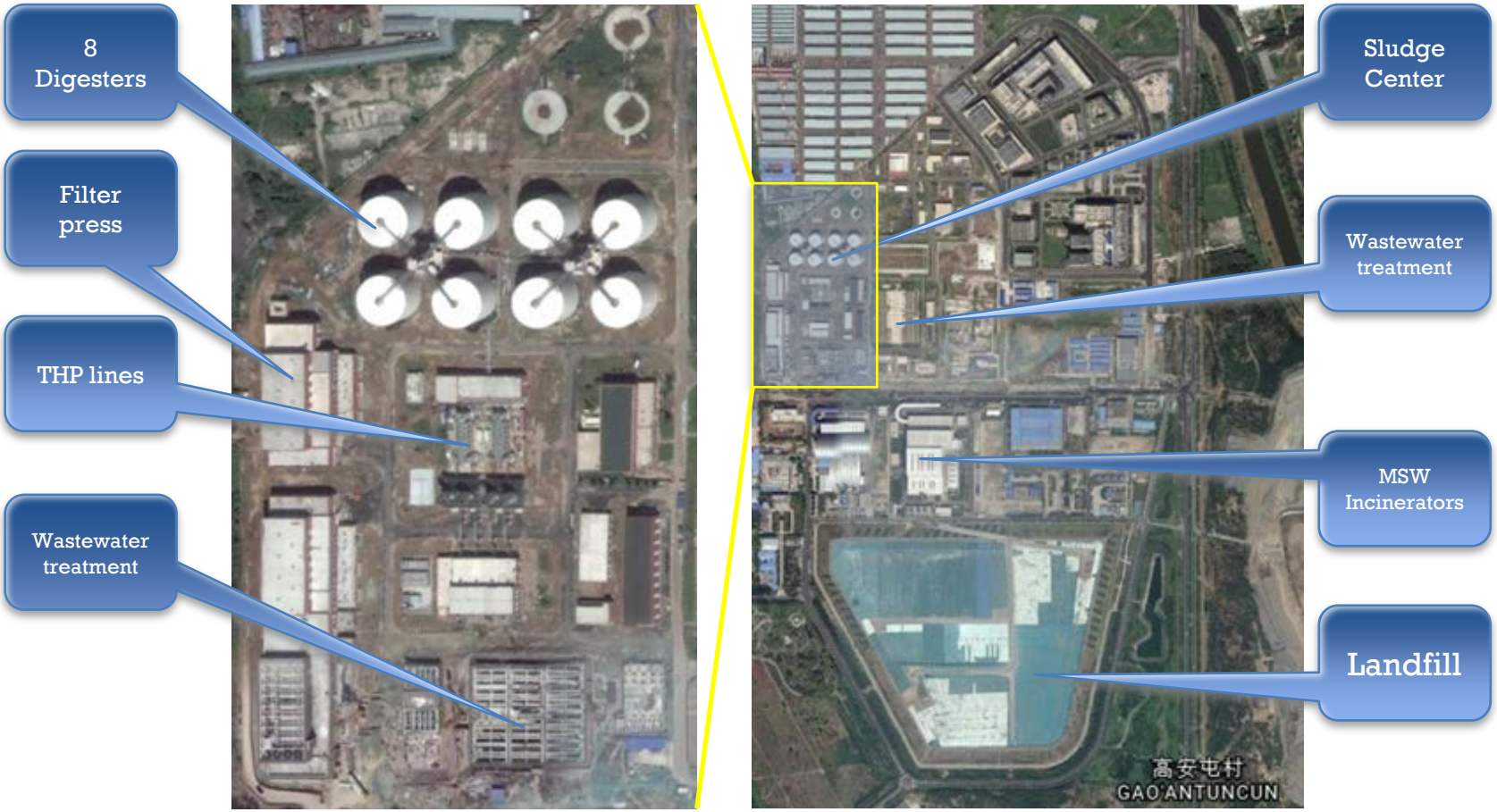
Huaifang (HF): Sludge Treatment

THP in house

Qinghe II Water Reclamation Plant



Gaoantun Solid Waste & Sludge Center (biggest THP AD in China so far)



Beijing: First operational results

- Three plants in operation
  - Gaobeidian GBD
  - Xiaohongmen XHM
  - Huaifang HF
- Specific biogas production: average 358 Nm^3 Biogas/tDS or 599 Nm^3 Biogas/tVS.
  - Compare without THP: lower than 200 Nm^3 Biogas/tDS.

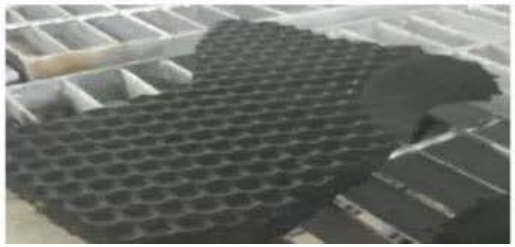
City and Plant	Total AD	Total AD volume	Sludge feeding to Pulper				%DS to ADs	Total Biogas	Specific Biogas production		VSR	VSR_MB	HRT
Beijing	units	m^3	DS (%)	VS (%)	tDS/d	tVS/d	DS (%)	Biogas m^3/d	SBP (m^3/tDS)	SBP (m^3/tVS)	Van Kleek	Mass balance	d
GBD	8	62800	16,6%	65,4%	185,4	121,2	7,2%	70123	378,2	578,7	41,9%	50,30%	20
XHM	4	48000	11,4%	61,0%	205,0	125,1	7,9%	69944	341,2	559,3	31,9%	52,7%	39
HF	5	55000	13,1%	54,0%	92,5	50,0	6,1%	32899	355,7	658,6	41,0%	52,0%	24

Dewatering with Filter Press
XHM as example

- Chemical preparation
  - 8 units of 240 m^3
  - 2 storage tanks for chemicals
- Filter press
  - 12 units of filter press machines
  - Each 800 m^2
- Capacity
  - 180 tDS/6000 m^3 thickened sludge @3%DS
- Chemicals
  - HQQY-DS8110@8130

Dewatering with Filter Press
First results

Samples	Water%	HQZK dosing	Cake Water%	Capacity
样品编号	原泥含水率（%）	HQZK药剂总投加量（m^3）	平均含水率（%）	单批次平均进泥量（m^3）
1	95.4	3.8	58.3	77.8
2	95.6	3.8	60.9	77.0
3	95.6	3.8	55.3	78.9
4	95.2	3.8	59.5	86.6
5	95.3	3.8	61.4	86.3
6	95.6	3.8	56.8	80.1
7	95.4	3.8	58.4	79.7
平均值	95.5	3.8	62.2	85.2

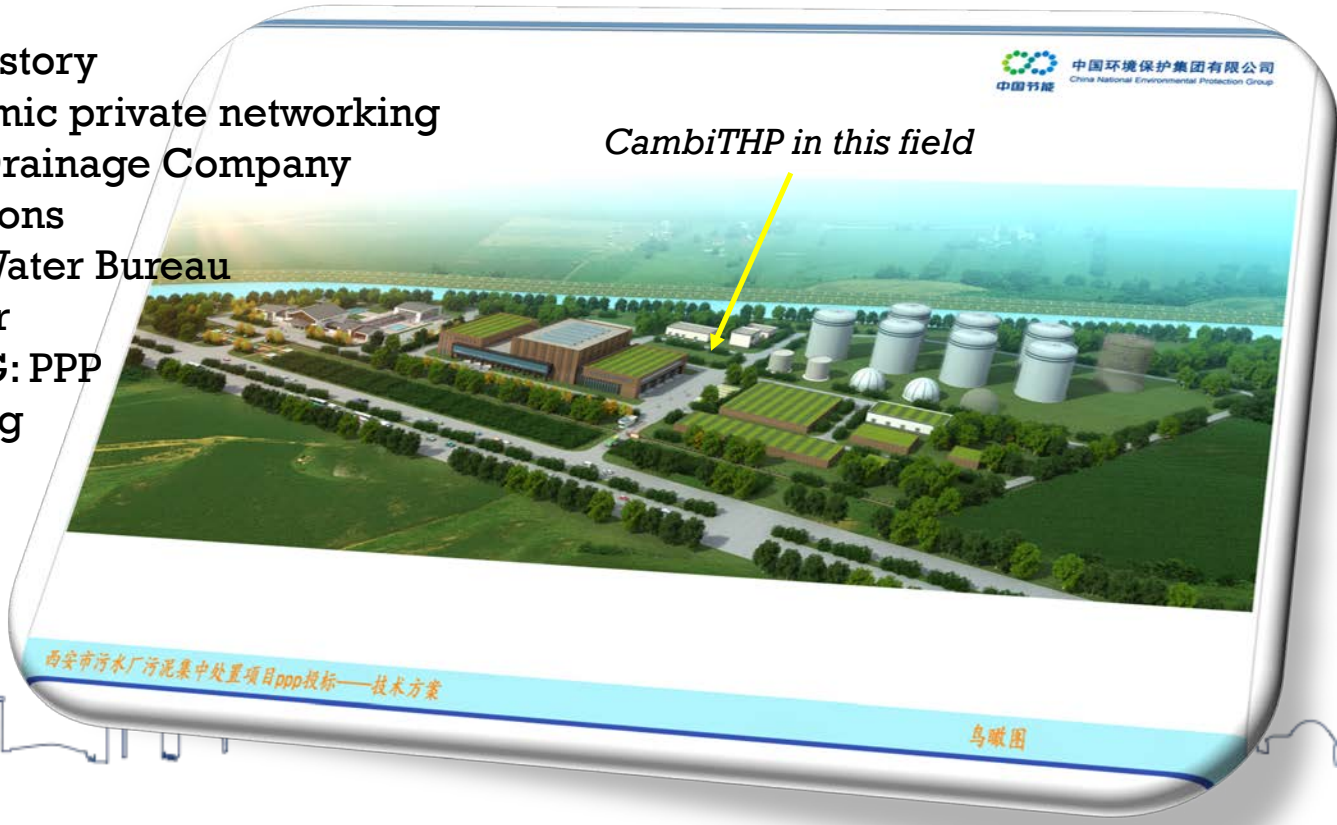


Chongqing Luoqi Biowaste Plant —Biowaste & Sludge Co-digestion
重庆洛碛餐厨垃圾处理厂 - 餐厨污泥联合消化

- Chongqing Environment & Sanitation Group重庆环卫集团
- Capacity 设计规模为“1500t/d天biowaste餐厨垃圾+300t/d天Sludge市政污泥”
- Global largest co-digestion国际上规模最大的餐厨垃圾和市政污泥联合厌氧消化项目
- Thermal hydrolysis for sludge, then thermophilic digestion市政污泥经过高温热水解工艺预处理后联合餐厨垃圾进行高温厌氧发酵
- Biogas 100000 m3/d production日产沼气10万立方以上
- European technologies采用欧洲高温协同厌氧消化技术和市政污泥热水解技术
- Operation in the end of 2019投产2019年底

Xi'an Sludge Center

- A sludge Center to treatment all sludge from existing WWTPs with capacity 1000 t/d @20%DS or 200 tDS/d. Expansion to double capacity in 5 years.
- China National Environmental Protection Group (CNEPG) as PPP owner
- Main processes: Dewatered sludge from WWTPs – CambiTHP – AD – Dewatering – Partial Drying (to ca 60%DS) – various disposal including land application
- Project development history
  - 2000-2014: Academic private networking
  - 2014-2015: Xi'an Drainage Company
    - Different options
  - 2015-2016: Xi'an Water Bureau
    - Sludge center
  - 2017-2018: CNEPG: PPP
  - 2019: Comissioning



Location of WWTPs and sludge center

Ring Express Highway could be used for transporting dewatered sludge from WWTPs to sludge center

Cambi Advanced Digestion in China

Beijing
5 projects
20 M

Xi'an
1 project
8 M

Chongqing
1 project
2 M

Centralized Co-digestion of sludge and biowaste in a region: Ecopro as example

Design parameters

- 52 communities
- 9100 tDs/year
- 40% Biosolids
- 60% Food waste
- Start-up 2008
- VSR% >65%
- Cake DS% >32%
- H_2S < 50 ppm

Struvite crystalization in biosolid cake

Concluding Remarks

- Anaerobic digestion of sewage sludge is widely used worldwide
- Thermal hydrolysis advanced digestion has been established in sludge (biosolids) management worldwide
- Thermal hydrolysis advanced digestion has been successfully implemented in Beijing for biosolids management with five plants
- Advanced co-digestion of sludge with biowaste is feasible for many cities
- Big potential for emerging markets such as India, Brazil, etc
- Cooperation and influence of technologies and engineering crossing continents (i.e. Belgrade in Serbia, Ulaanbaatar in Mongolia).

Acknowledgement

- MoHURD
- Beijing Drainage Group
- Chongqing Environment & Sanitation Group
- China National Environmental Protection Group
- China Association for Biosolids
- China Water Industry Association
- Cambi Group
- PIANO

Thank You for Attention

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足迹footprint

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