STRATEGY DEVELOPMENT OF SLUDGE TREATMENT AND DISPOSAL IN BEIJING BASED ON THERMAL HYDROLYSIS ADVANCED DIGESTION

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Abstract
In this paper, strategy development of sludge treatment and disposal in Beijing is described. Over the last twenty years, nine WWTPs have been constructed to treat around 2.7 million m$^3$/d of wastewater in Beijing, and produce around 2700 t/d dewatered sludge with partial treatment by digestion, drying, and composting. Due to the increasing demand of wastewater treatment as a result of increasing urbanisation and tighter effluent standards, an additional 1.5 million m$^3$/d of wastewater will require treatment, and this is expected to produce totally 6000 t/d dewatered sludge. The Asian Development Bank commissioned a report to investigate the potential for thermal hydrolysis in Beijing as a means to deal with current site constraints and future sludge production. The report, in combination with detailed technology reviews and due diligence resulted in the recommendation of Advanced Anaerobic Digestion of sludge based on Cambi® Thermal Hydrolysis pre-treatment in preference to thermal drying that had been their previous direction. Subsequently a strategic cooperation between Beijing Drainage Group and Cambi Group has been formulated to implement five sludge projects in Beijing. These are based on two upgrades and expansions of Gaobeidian and Xiaohongmen WWTPs, and three brand new sludge projects either adjacent to Huaihaiyang and Qing II WWTPs or Gaoantun Sludge center. The strategic decision to adapt Thermal Hydrolysis for advanced anaerobic digestion may have profound impact for sludge treatment in mega-cities in China, based on an emphasis of low carbon impact, green development and renewable energy generation. In this paper, a detailed description of the new sludge strategy and the estimated effects will be presented.

Keywords
Beijing Drainage Group, WWTP, Sludge Strategy, Advanced Digestion, Thermal Hydrolysis.

Introduction

More than 3000 WWTPs and 30 million tons sludge per year in China
A dramatic increase in construction of wastewater treatment plants (WWTPs) has occurred over the last twenty years to treat wastewater from urban areas and sub-urban areas due to rapid urbanization. More than 3000 WWTPs have been constructed in China with total wastewater treatment capacity of up to 130 million m$^3$/day. However, construction of the
supporting infrastructure to treat the sludge produced from wastewater treatment has lagged behind with minimal treatment resulting in high proportions of landfilled sludge. Dewatered sludge amounts to around 30 million tons per year and most of it (about 70%) is not well treated before disposal in simple landfills or even dumped on land.

Only around 50 anaerobic digestion plants built, but fewer than half operate well
Although anaerobic digestion of sludge is widely applied worldwide, it is not widely used in China for many reasons. Only around 50 WWTPs have installed anaerobic digestion systems, but fewer than half of them are in normal operation. This is due to a number of reasons, including: very low volatile solids content in the sludge (typically 50% or below); lower fat (and therefore calorific) content compared to European sludges; high levels of sulphide; sand and other particulate impurities; lack of standardisation regarding design; poor design of mixing systems; lack or insufficient co-generation providing sufficient heat for process needs.

Wastewater treatment in Beijing and “Three-year (2013-2015) action plan for environmental issues in Beijing”
A dramatic increase in wastewater treatment plant construction in Beijing since the 1980s has resulted in 9 WWTPs in operation, with wastewater treatment capacity of 2.72 million m³/d (0.993 billion m³/a) nowadays, producing 2740 tons dewatered sludge per day (at approx. 20% DS). There are today 5 sludge treatment facilities in operation, treating 664,000 tons of dewatered sludge yearly, whereas the rest lacks sufficient treatment. The treatment processes include anaerobic digestion in Gaobeidian and Xiaohongmen WWTPs, lime stabilization in Xiaohongmen WWTPs followed by landfilling, partial drying in Qinhe WWTP, with co-firing in a cement kiln, and composting at Pangezhuang. Sludge in Beijing is mainly characterized by relatively high VS content, low in heavy metals, rich in nutrients like N, P, K and organics, and high in heat value: up to 2800 kcal/kg at 90% DS.

According to the new master plan and “Three-Year (2013-2015) action plan for environmental issues in Beijing” launched by Beijing Municipality, four new wastewater treatment plants will be constructed and all existing plants will be upgraded to new effluent quality as well. Furthermore, all wastewater treatment plants will be redefined as Water Reclamation Plants, resulting in a dramatic increase in sludge production as a result of an increase in wastewater quantity and higher effluent standards. Estimated wastewater treatment capacity and sludge production after the three-year action plan will amount to 4.2 million m³/d of total wastewater treatment and 6300 tons/d of dewatered sludge cake (ca 1200 tDS/d) on average.

Strategy shift for sludge treatment and disposal in last decades in China
Sludge treatment and disposal strategy has undergone changes in Beijing in the last decades: Sludge treatment for wastewater treatment plants larger than 200,000 m³/d should adapt for anaerobic digestion for sludge stabilization. But the focus for wastewater treatment has not been on sludge stabilization, but concentrated on wastewater treatment for BOD, COD, SS, TN, TP, and NH4-N removal. Most of sludge has been just dewatered prior to landfilling. The landfill situation has become worse due to difficult landfill practice, unstable landfill sites, health risks, and last but not least, landfill space is becoming very limited due to fast increase in municipal solid waste disposal.
In order to reduce the sludge volume and improve conditions for landfill, development in high DS dewatering with addition of lime and other chemicals has prevailed during the last few years in China, but problems with this outlet have included strong odours due to incomplete stabilization, and potential conflict with downstream thermal processing.

Therefore, highly automated composting with advanced odour control has gained in popularity lately. But the drawbacks, including the need for supporting materials (such as green waste), and need for an outlet for the compost itself, remain challenging. Nevertheless, compost has been successfully used for gardening, such as the Olympic Park in Beijing, World Expo for Horticulture in Qingdao, etc. Theoretically, the consumption of soils for gardening in urban area should be one of the largest reuse outlets for compost, but the reality is still far from the ideal situation, and the demand for compost is volatile. Therefore, the treatment and reuse of increasing amounts of sludge has become a critical issue for decision makers in Beijing.

Shift of Sludge Strategy and its Impacts on Sludge Treatment and Disposal in Beijing

Existing sludge treatment facilities in Beijing

There are five existing sludge treatment facilities in Beijing:

1) The anaerobic digestion plant in Gaobeidian WWTP, constructed in two phases of two stage digestion with a total of 16 digesters at 7850 m³ each, operating at 35-37 °C. The first phase was built in the early 1990s, and second phase in the early 2000s. The structure in the first phase digesters is uncertain for further use.

2) The anaerobic digestion plant in Xiaohongmen WWTP, consisting of three egg-shaped digesters at 12,000 m³ each, operating at 35-37 °C. The digesters are treating primary sludge only, and the secondary sludge is lime stabilised.

3) Lime stabilisation in Xiaohongmen: Due to digester constraints, the secondary sludge from this plant is treated by lime stabilisation, by first dewatering to around 20% DS and then followed by lime addition for further dryness for landfill.

4) Partial sludge drying in Qinghe I, for further disposal in cement kilns or other co-incineration.

5) Pangezhuang Composting, a small amount of sludge is composted for land application.

The potential problems for existing sludge treatment facilities include:

- low and unstable digestion efficiency and dewaterability for further disposal mean that drying is required to meet regulations and disposal needs;
- limited space for expanding digestion capacity in existing plants;
- lime stabilisation still causes problems for landfill with limited available volume;
- composting requires a large footprint and has unstable odour control, resulting in public acceptance issues;
- drying and co-incineration is limited by the lack of incineration capacity, costs, and potential moving out of Beijing city.

In sum, existing facilities are not able to deal with increased amounts of sludge in a proper way.

The following tables show the changes of treatment capacity in existing WWTPs and new WWTPs. In Table 1, current sludge production and treatment/disposal routes are listed. In Table 2, current and future sludge production and potential treatment are listed.

**Table 1: Existing Water Reclamation Plants and Sludge treatment facilities**

<table>
<thead>
<tr>
<th>Project name</th>
<th>WWTP capacity (m³/d)</th>
<th>Dewatered Sludge Production (wet t/d)</th>
<th>Drying</th>
<th>Cement plant</th>
<th>Lime stabilization</th>
<th>Composting</th>
<th>Digestion</th>
<th>Land-fill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qinghe I</td>
<td>550,000</td>
<td>570</td>
<td>400</td>
<td>170</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beixiaobe</td>
<td>100,000</td>
<td>100</td>
<td></td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jiuxianqiao</td>
<td>200,000</td>
<td>200</td>
<td></td>
<td>200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lugouqiao</td>
<td>100,000</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Wujiacun</td>
<td>80,000</td>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Fangzhuang</td>
<td>40,000</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Gao-beidian</td>
<td>1,000,000</td>
<td>900</td>
<td></td>
<td>220</td>
<td>400</td>
<td></td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>Xiaohongmen</td>
<td>600,000</td>
<td>700</td>
<td></td>
<td>700</td>
<td></td>
<td></td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>Xiaojiahe</td>
<td>50,000</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,720,000</td>
<td>2740</td>
<td>400</td>
<td>470</td>
<td>700</td>
<td>250</td>
<td>700</td>
<td>940</td>
</tr>
</tbody>
</table>

**Table 2: Existing and New Water Reclamation Plants and Sludge treatment facilities**

<table>
<thead>
<tr>
<th>Project name</th>
<th>WWTP capacity (m³/d)</th>
<th>Existing or new</th>
<th>Dewatered sludge production (t/d)</th>
<th>Thermal hydrolysis advanced digestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Qinghe I (including sludge drying)</td>
<td>550,000</td>
<td>Existing</td>
<td>767</td>
<td></td>
</tr>
<tr>
<td>Beixiaobe</td>
<td>100,000</td>
<td>Existing</td>
<td>137</td>
<td></td>
</tr>
<tr>
<td>Jiuxianqiao</td>
<td>200,000</td>
<td>Existing</td>
<td>271</td>
<td></td>
</tr>
<tr>
<td>Lugouqiao</td>
<td>100,000</td>
<td>Existing</td>
<td>130</td>
<td></td>
</tr>
<tr>
<td>Wujiacun</td>
<td>80,000</td>
<td>Existing</td>
<td>153</td>
<td></td>
</tr>
<tr>
<td>Fangzhuang</td>
<td>40,000</td>
<td>Existing</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td>Gao-beidian (including sludge digestion center)</td>
<td>1,000,000</td>
<td>Existing</td>
<td>1358</td>
<td>1358</td>
</tr>
<tr>
<td>Xiaohongmen (including sludge digestion)</td>
<td>600,000</td>
<td>Existing</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>Huaitiang (including sludge digestion center)</td>
<td>600,000</td>
<td>New</td>
<td>878</td>
<td>1220</td>
</tr>
<tr>
<td>Gaoantun (including sludge digestion center)</td>
<td>100,000</td>
<td>New</td>
<td>141</td>
<td>1836</td>
</tr>
<tr>
<td>Beiyuan</td>
<td>60,000</td>
<td>New</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td>Dingfuzhuang</td>
<td>200,000</td>
<td>New</td>
<td>407</td>
<td></td>
</tr>
<tr>
<td>Qinghe II (incl. sludge digestion)</td>
<td>650,000</td>
<td>New</td>
<td>814</td>
<td>814</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4,680.00</td>
<td></td>
<td>6128</td>
<td>6128</td>
</tr>
</tbody>
</table>
Drying and cement plant disposal by co-incineration are strongly associated with energy consumption with external fuel demand, and cement plants are sensitive to the quantity of sludge added. In addition, due to relocation of potential cement plants, this option will not be available. Lime stabilised sludge is still landfilled without real sludge reduction (actually there is an increase in total DS amount). Composting is used, but will be limited in the future. Therefore the existing facilities are limited for treating more sludge in the future with higher quality requirement regulated by relevant national standards.

Table 2 describes the overall sludge production after upgrading of existing WWTPs and incorporation of the new WWTPs in the future. From this table, it is clear the total sludge production will almost double. Therefore existing sludge treatment facilities will face the following issues:

1) There is limited landfill space for disposal of sludge, even though this may be an option.
2) There are no more potential cement plants nearby to handle any dried or dewatered sludge for co-incineration.
3) There is a stringent requirement concerning hygienic quality of biosolids for land application, although heavy metal content in sludge is already low.
4) There is a critical limit for thermal drying for sludge treatment due to both energy demand and limited access to first grade fuel like nature gas, and requirement of high temperature drying to meet hygienic need for land application.
5) There is a need to develop a baseline for sludge treatment and disposal in the long term.
6) Although land application of biosolids for crop cultivation is limited, there is great potential for gardening, land reclamation, and landscaping.

As shown in table 2, a sludge treatment strategy based on thermal hydrolysis was chosen following various studies.

**Consideration of various sludge treatment options**

A viable sludge strategy shall address the following aspects to evaluate different short term and long term effects:

1) From an energy point of view: all sludge strategy options except for anaerobic digestion are energy negative, meaning, it is impossible to support sludge treatment and disposal without external energy input. The lower the VS content in sludge, the higher the demand for external energy. So anaerobic digestion is key in reducing energy needs. Among the different types of anaerobic digestion, advanced digestion has the most potential for stable and relatively high energy efficiency. Both enzymatic advanced digestion and thermal hydrolysis pre-treated digestion can achieve higher energy efficiency due to higher conversion of organic matter to biogas, as well as more stable digestion.

2) From a final biosolids volume point of view: Dewatering properties of biosolids after different types of digestion vary, with the best dewaterability from thermal hydrolysis pre-treated sludge, as evidenced by numerous projects world-wide.

3) From a final biosolids hygienic quality point of view: the requirement for biosolids for land application in the national standards has defined a more stringent Total Fecal Coliform number at less than 100 MPN/g DS. This requirement is even stricter than Class A requirement in Part 503 of US EPA. After a profound study and comparison, only high temperature drying, incineration, and treating all sludge by thermal hydrolysis and digestion are able to meet this requirement. However,
drying and incineration demand tremendous amount of energy and are therefore very unlikely options for sustainable operation in the long run.

4) From a land application point of view: there is a need for adequate moisture in final biosolids for land application, not too low for extra watering, but not too high for large amount of tonnages for transport and handling. Extra dry biosolids for land application will demand watering while water is in shortage in Beijing area. There are numerous areas in the surrounding area of Beijing that are suitable for land application, but which requires political and overall arrangement.

**Sludge Strategy Based on Thermal Hydrolysis Advanced Anaerobic Digestion and Gaobeidian as an example**

Beijing Drainage Group Co Ltd is the sole company taking care of wastewater and sludge treatment for Beijing Municipality and has acquired a 30-year concession for investment, upgrading, and operation of all existing and new water reclamation plants with sludge treatment.

Gaobeidian Wastewater Treatment Plant (WWTP) is the largest in Beijing. It has a treatment design capacity of 1,000,000 m³/d, and is in the process of upgrading. A proposal for the upgrade has been approved by the government. At this stage, preliminary design is complete and the project is moving into the procurement phase (BMEDi, 2011). The upgrade involves increasing capacity to 2,000 tons of dewatered sludge (80% water content).

This project, RSC-C13352 (PRC): Support to Evaluation of Sludge Treatment Technologies for Beijing Drainage Group in the People’s Republic of China, aims to assist BDG in optimizing their sludge treatment project at the Gaobeidian WWTP. Currently, Gaobeidian has 16 anaerobic digesters which were built in two phases of 8 digesters. However, the original digesters, built in 1993 are being decommissioned due to construction issues. Subsequently, in order to fully utilize Gaobeidian’s existing anaerobic digestion plant and increase biogas production, the Beijing General Municipal Engineering Design and Research Institute (BMEDi) was engaged to develop a feasibility study of sludge treatment by thermal hydrolysis, anaerobic digestion and heat drying. This feasibility study report was submitted in October, 2011. Ongoing upgrades to the liquid stream based on Annamox deammonification mean that there is little space for expansion as shown in Figure 1.
Thermal hydrolysis was recommended as a proven technology to allow digestion of all of Gaobeidian’s sludge (inclusive of expected increases in throughput) using the 8 newer digesters as the older ones are decommissioned.

The application of thermal hydrolysis process (THP) prior to anaerobic digestion gives rise to an easily digestible feed, resulting in the following advantages:

- An improved anaerobic digestion process as the thermal hydrolysis produces a less viscous sludge, which allows for higher dry solids content and lower retention times leading to increased digester capacity
- Increased sludge biodegradability leading to enhanced production of high quality biogas during anaerobic digestion, which can be utilized in gas engines with generators to produce electricity
- Improved dewaterability after digestion to 30% to 50% solid content, leading to significant mass reduction and reduced materials handling and transport
- Improved stabilized digested sludge cake by eliminating negative odour and pathogens, with no risk of regrowth or reactivation of bacteria, leading to production of a more marketable end product which can be used for application purposes without restriction.

Therefore, a further study commissioned by the Asian Development Bank (ADB), executed by AECOM, was proposed to determine the potential for thermal hydrolysis at Gaobeidian. It was suggested that thermal hydrolysis be installed at Gaobeidian to enable all sludge produced to be fed to the 8 newer digesters due to the decommissioning of the older units as they are nearly 20 years old. After digestion a new centrifuge dewatering facility would be installed and be followed by a belt-type drying plant sized at 1100 m³/d of input cake.
at 20% dry solids. A belt dryer had been chosen to enable flexibility with a range of dried solids outputs.

Once the dried sludge has been produced a number of potential outputs exist including: (1) industrial fuel – there is a neighbouring coal-fired power station which may use the dried sludge for co-combustion, (2) construction material; and (3) land application. As the final disposal approach is currently uncertain, the desired dried solid of the sludge will be a minimum of 90% to allow flexibility (BMEDi, 2011).

Table 3 shows the specific benefits of thermal hydrolysis when applied at Gaobeidian.

<table>
<thead>
<tr>
<th>Benefit of Thermal Hydrolysis</th>
<th>Driver for Gaobeidian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased capacity of existing facility</td>
<td>Yes. It is desired to process all sludge through only 8 digesters from 16 originally</td>
</tr>
<tr>
<td>Increased volatile solids destruction</td>
<td>Yes. Less solids exiting the digestion plant reduces downstream processing requirements and costs.</td>
</tr>
<tr>
<td>Increased biogas production and renewable energy generation</td>
<td>No. High maintenance costs for co-generation have meant that renewable energy generation is not considered a driver by Beijing Drainage Group</td>
</tr>
<tr>
<td>Pathogen free biosolids for agricultural recycling</td>
<td>No. Sludge contains heavy metal contaminants and is not considered viable for land recycling. In addition, baseline proposal is based on drying the sludge prior to burning in a coal-fired power station</td>
</tr>
<tr>
<td>Improved dewaterability</td>
<td>Yes. Dewatering is a critical factor due to the proposed installation of a drying plant downstream. Increased dry solids reduces water evaporation requirements and processing costs</td>
</tr>
</tbody>
</table>

The report looked at 5 process configurations (Technical Routes) and compared performance to the baseline operation. The configurations are described as follows:

**Technical Route 1**

As initially proposed, only the secondary sludge will be centrifuge thickened and processed via thermal hydrolysis. The primary sludge thickness will remain at 5%. For this option it is assumed that co-generation in the form of combined heat and power engines is installed and operating and that all of the sludge exiting the digestion plant is dewatered and then dried before being transported off site.

**Technical Route 2**

This is essentially a prediction in performance of the technical route offered previously. As the vast majority of the sludge entering the digestion plant is primary, and therefore not thermally hydrolysed, it is necessary to thicken it further to achieve the required loading rates to the existing digestion plant. In this case the primary sludge is thickened to 7.5% in addition to the secondary sludge being thickened and processed via thermal hydrolysis.
As for Technical Route 1, it is assumed that co-generation in the form of combined heat and power engines are installed and operating and that all of the sludge exiting the digestion plant is dewatered and then dried before being transported off site. However, in this Route it is assumed that the volatile destruction provided previously is correct.

**Technical Route 3**

Similar to Technical Route 1, but in this case both the primary and secondary sludge is processed via thermal hydrolysis. This is proposed in order to obtain a sufficient loading rate required for the digestion plant. As before, it is assumed that co-generation in the form of combined heat and power engines are installed and operating and that all of the sludge exiting the digestion plant is dewatered and then dried before being transported off site.

**Technical Route 4**

Similar to Technical Route 1, but in this case the sludge is composted instead of being dried. This is determined to highlight the differences between sludge outlets. As before, it is assumed that co-generation in the form of combined heat and power engines are installed and operating and that all of the sludge exiting the digestion plant is dewatered.

**Technical Route 5**

Identical to Technical Route 1 but in this case there is no co-generation, and all of the biogas generated is burnt in a flare to produce carbon dioxide. The purpose of this Technical Route is to highlight the impact of renewable energy generation via co-generation. As for Technical Route 1, all of the sludge exiting the digestion plant is dewatered and then dried before being transported off site.

The salient findings of the report are as follows:

- By pre-conditioning the secondary sludge alone, the 8 digesters could not process the design throughput of sludge. However, the desired throughput in the digesters could be met by separately thickening the primary sludge to (preferably) 8.5% dry solids; by pre-conditioning both the secondary and primary sludges; or by addition of more digestion capacity;

- If primary sludge is also pre-thickened to 8.5% dry solids, post-digestion dewatering requirements reduce by approximately a third. If all of the sludge is thermally hydrolysed, post digestion requirements reduce by half;

- The sizing of the downstream dryer proposed is intrinsically linked to both the quantity of volatile solids destroyed in the digester and also the presence of thermal hydrolysis. For the proposed dryer size of 1100 m$^3$ of cake dried from 18% dry solids, a combination of 50% volatile solids destruction and a dry solids content of 22% exiting the dewatering plant are required to meet the design throughput of the dryer assuming 8000 hours operation per year. Dewatering performance needs to achieve greater than 23% dry solids based on historical performance of the digestion plant for the drying plant to be sufficiently sized. If dewatering falls below 20% dry solids, the dryer will be undersized irrespective of the level of volatile solids destruction in the digestion plant;

- The carbon footprint of the facility at Gaobeidian will increase by between 15 and 50% (based on configuration) with the proposed upgrades compared to the existing situation. This is due to the installation of the drying plant with the consumption of natural gas responsible for nearly half of the overall carbon
impact. The carbon impact of the thermal hydrolysis plant is below 10% of the overall carbon emission. Installation of only the thermal hydrolysis plant will cause a decrease in carbon footprint compared to the existing scenario, due to increased performance in the digestion plant resulting in additional production of renewable energy, and improved dewatering resulting in lower carbon impacts downstream:

- The carbon impact of the proposed upgrade is critically dependent on the performance of the dewatering plant which controls the carbon footprint of the dryer. Improving the dewatering between 20% and 24% dry solids (with performance of all other plant processes kept the same) will reduce carbon footprint of the entire plant by nearly 8% due to lower energy demands in the drying plant;

In addition to the recommendations of previous studies, Beijing Drainage Group did further due diligence and international site visits to existing commercially operating facilities. Based on this they decided that the use of thermal hydrolysis, specifically by Cambi, could address the numerous issues they faced. Due to high energy costs and the possibility of taking pathogen-free cake to land application, they finally decided not to add drying, and instead use chamber filter-press for high dry-solids dewatering. Figure 2 shows the proposed layout of the plant upgrades.

![Diagram of plant upgrades](image)

**Figure 2:** Layout after upgrading with THP, Anammox and Chamber filter press

Cambi has been awarded with the contract for THP delivery and strategic long term cooperation between Beijing Drainage Group Co Ltd and Cambi has been initiated. Gaobeidian sludge project is aimed to commissioning within 2016.
Advantages of Cambi® Thermal Hydrolysis Pre-treatment (THP) with Advanced Anaerobic Digestion in China

Practices in advanced anaerobic digestion with Cambi® thermal hydrolysis pre-treatment THP globally and various types of thermal hydrolysis in China have brought new perspectives for sludge treatment and disposal strategies in Beijing and potentially in other big cities as well. Thermal hydrolysis based advanced anaerobic digestion has been proven to be a reliable upgrading (paradigm shift) strategy for existing digestion for sludge treatment and for brand new sludge projects with unique advantages compared with traditional digestion, i.e.:

1) high VS reduction and organic stabilization, much less digester volume for higher treatment capacities (especially for expansion and upgrading of existing plants);
2) excellent efficiency in pathogen kill;
3) achievable high DS dewatering to reduce total final cake weight with chamber press type;
4) high biogas production for bioenergy utilization; and
5) Class A final cake with little odor for various land application when possible.

Reliable global experience from large scale Cambi thermal hydrolysis technology projects has provided Beijing with confidence that they can meet and surpass their objectives for volume reduction, organic stabilization, hygienization, energy utilization, and nutrient resource recycling for sludge treatment. This will allow a varied and sustainable land application outlet for future years and provide a means to move away from less sustainable outlets such as landfilling and thermal oxidation.

A future overview of sludge strategy in Beijing after “Three Year (2013-2015) Action Plan” is described previously in Table 2 and will incorporate 5 new projects as also shown in Figure 3.

In total, around 6000 t/d dewatered sludge shall be treated through Cambi® Thermal Hydrolysis Advanced Anaerobic Digestion, and this will probably set a new standard for sludge treatment for mega-cities in China.
Concluding remarks

As the Capital of China, Beijing represents a leading role in exemplifying advanced technologies for wastewater and sludge treatment. Beijing Drainage Group Co Ltd has in the last decades led the development in those fields. After more than 5 years of extensive and in-depth investigations and site visits to various sludge treatment facilities, a strategy based on thermal hydrolysis pre-treatment combined with advanced anaerobic digestion and high dry solids dewatering has been adopted by Beijing to realize all five goals for sludge treatment and disposal, i.e.: increased biogas production, pathogen kill and stabilization for safe land-application, sludge volume reduction, energy recovery, and recycling of resources. During the extensive studies it was noticed that choice of supplier plays a crucial role in the potential success of the project. Cambi® Thermal Hydrolysis Pre-treatment (THP) advanced digestion was chosen since it will reduce anaerobic digester volume, result in higher biogas production, meet Class A requirements, and reduce downstream processing requirements.

References

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