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密封厌氧发酵池 - 在中国养猪场的应用

Covered Anaerobic Lagoons—Application to Swine Farms in China

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- Ecological Energy Administration Bureau of Yueyang County

- 海东生态农业公司
- Haidong Ecological Agriculture Company

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议程
Agenda

- 简介 Introduction
  - 甲烷市场化合作伙伴（M2M） The Methane to Markets Partnership (M2M)
  - 研讨会目标和内容Objectives and content of the workshop
- 第1天 Day 1
  - 第1部分：牲畜粪便管理选项 Section 1: Options for livestock manure management
  - 第2部分：厌氧发酵过程基础 Section 2: Anaerobic digestion process fundamentals
  - 第3部分：厌氧发酵器选项 Section 3: Options for anaerobic digesters
  - 第4部分：密封发酵池设计 Section 4: Covered lagoon design
- 第2天 Day 2
  - 第5部分：施工 Section 5: Construction
  - 第6部分：启动，操作和维护 Section 6: Start-up and O&M
  - 第7部分：疑难问题处理 Section 7: Troubleshooting
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甲烷市场化合作伙伴
The Methane to Markets Partnership

- “甲烷市场化合作伙伴”是一种国际化的创意，它提出经济的短期甲烷回收方法并作为一种清洁能源使用。
- The Methane to Markets Partnership is an international initiative that advances cost-effective, near-term methane recovery and use as a clean energy source.

- 这个“合作伙伴”的目的是，降低全球甲烷排放量，从而促进经济发展、加强能源的安全性、改善空气质量、提高工业安全性，降低温室气体的排放量。
- The goal of the Partnership is to reduce global methane emissions in order to enhance economic growth, strengthen energy security, improve air quality, improve industrial safety, and reduce emissions of greenhouse gases.

- “合作伙伴”协助各国开展一项实施计划并提供必要的支持，从而提高实施该计划的能力，作为此项努力的部分内容。可以通过多种形式支持发展能力，包括技术支持和理解清洁发展机制（CDM）要求。
- As part of the effort, the Partnership assists countries in developing an implementation plan and provides the necessary support to develop the capacity and ability to implement the plan. Support to develop capacity can be in many forms including technical assistance and understanding the Clean Development Mechanism (CDM) requirements.

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甲烷市场化（M2M）计划（续）
The Methane-to-Markets (M2M) Program (continued)

甲烷市场化（M2M）合作伙伴国家有：

M2M Partner countries are:

阿根廷，澳大利亚，巴西，加拿大，智利，中国，哥伦比亚，厄瓜多尔，埃塞俄比亚，欧盟委员会，芬兰，德国，加纳，印度，意大利，日本，哈萨克斯坦，墨西哥，蒙古，尼日利亚，巴基斯坦，菲律宾，波兰，韩国，俄罗斯，泰国，乌克兰，英国，美国，越南。

Argentina, Australia, Brazil, Canada, Chile, China, Colombia, Ecuador, Ethiopia, European Commission, Finland, Germany, Ghana, India, Italy, Japan, Kazakhstan, Mexico, Mongolia, Nigeria, Pakistan, Philippines, Poland, Republic of Korea, Russia, Thailand, Ukraine, United Kingdom, United States, Vietnam.

http://www.methanetomarkets.org

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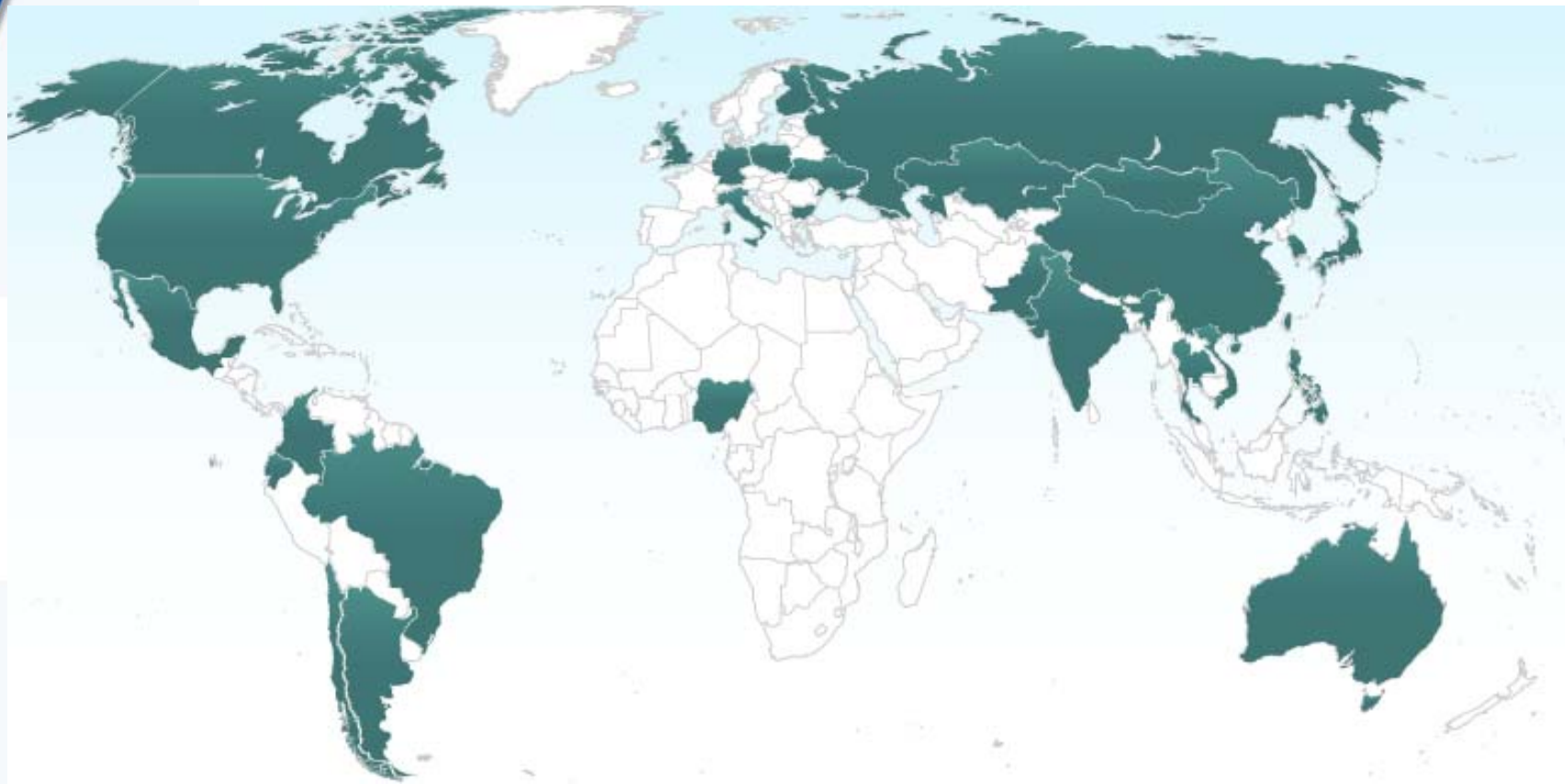
甲烷市场化（M2M）合作伙伴国家
M2M Partner Countries

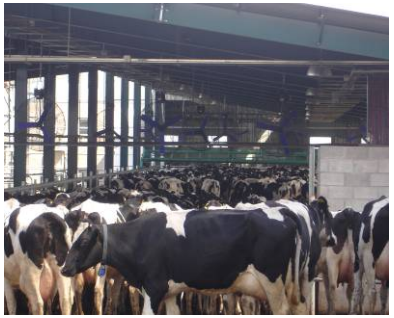


甲烷市场化（M2M）部门
M2M Sectors

甲烷市场化（M2M）合作伙伴关注4个关键部门：

The M2M Partnership focuses on 4 key sectors:

- 农业 Agriculture
  - 牲畜生产
  - Livestock Production
  - 农工经营项目
  - Agro-industrial Activities
- 垃圾填埋 Landfills
- 石油和煤气 Oil and Gas
- 煤矿 Coal Mines



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研讨会目标
Workshop Objectives

- 介绍密封厌氧发酵池，作为处理牲畜废物的一种方法；
- To introduce covered anaerobic lagoons as an option for treating livestock wastes,

- 为在养猪场设计和运行密封厌氧发酵池提供指导；
- To provide guidance for designing and operating covered anaerobic lagoons on swine farms,

- 在猪粪便管理系统中，结合厌氧发酵可行性的初步现场评估，提出一种方法；
- To present a methodology for preliminary site assessments of the feasibility of incorporating anaerobic digestion in swine manure management systems, and

- 讨论如何通过减少温室气体排放，使具有沼气采集功能的厌氧发酵创收。
- To discuss how anaerobic digestion with biogas capture can generate revenue through the greenhouse gas emissions reductions realized.

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猪和牛粪便稳定性的选项
Options for Swine and Dairy Manure Stabilization

- 首先是传统的厌氧发酵池，随后是土地利用或者鱼池，然后是土地利用或者地表水排放
- Conventional anaerobic lagoons followed by land application or fish ponds and then land application or surface water discharge

- 有害气味
- Noxious odors

- 甲烷排放
- Methane emissions

- 随着地表水排放，水质下降
- Water quality degradation with surface water discharge

- 在夜间和多云的白天，可能很难在鱼池中保持剩余溶解氧浓度
- Possible difficulty in maintaining a residual dissolved oxygen concentration in fish ponds at night and during cloudy days

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猪和牛粪便稳定性的选项（续）
Options for Swine and Dairy Manure Stabilization (continued)

- 在受控情况下的厌氧发酵
- Anaerobic digestion under controlled conditions

- 良好的气味控制
- Good odor control

- 水污染的可能性降低
- Reduced water pollution potential

- 甲烷排放量降至最低
- Minimal methane emissions

- 提供一种有用能源，能够减少与二氧化碳排放有关的矿物燃料
- Provides a usable source of energy that can reduce fossil fuel related carbon dioxide emissions

- 通过使用沼气和销售碳排放信用额，实现抵消成本创收的可能
- Potential to generate revenue to offset costs through biogas use and sale of carbon credits

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厌氧发酵过程基础
Anaerobic Digestion Process Fundamentals

- 沼气是一种甲烷和二氧化碳的混合物，是在无氧的情况下由微生物还原复合有机化合物（各种碳水化合物，蛋白质和脂肪）形成的。
- Biogas, a mixture of methane and carbon dioxide, is formed by the microbial reduction of complex organic compounds (carbohydrates, proteins, and fats) in the absence of oxygen.

- 这个过程产生微生物细胞维持和成长所需的能量和有机碳。
- The process yields energy and organic carbon for microbial cell maintenance and growth.

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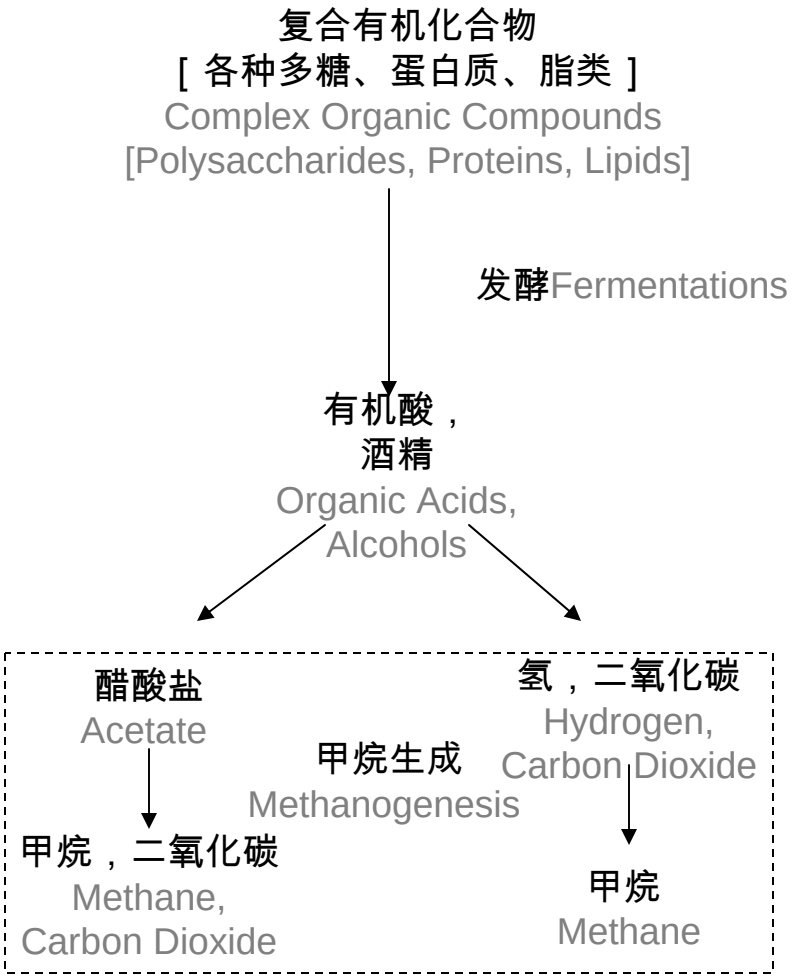
沼气的形成 - 三步过程
Biogas Formation - A Three Step Process

- 第1步 - 水解不可溶解和复合可溶解化合物，形成有机酸和酒精 。
- Step 1 - Hydrolysis of insoluble and complex soluble compounds to form organic acids and alcohols.

- 第2步- 将第1步中形成的有机酸和酒精还原成为醋酸盐、氢和二氧化碳。
- Step 2 - Reduction of organic acids and alcohols formed in Step 1 to acetate, hydrogen, and carbon dioxide.

- 第3步- 将第2步中生成的产品进一步还原成为甲烷和二氧化碳。
- Step 3 - Further reduction of the products produced in Step 2 to methane and carbon dioxide.

有机物质转化，形成甲烷
Organic Matter Transformations Resulting in Methane Formation



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过程稳定性
Process Stability

- 负责第1步和第2步的微生物比甲烷形成细菌繁殖得快。
- The microorganisms responsible for Steps 1 & 2 reproduce more rapidly than the methane forming bacteria.

- 如果甲烷形成细菌的数量不足以还原它们产生的有机酸和酒精，则发生积聚。
- If the population of methane forming bacteria is not adequate to reduce the organic acids and alcohols as they are produced, accumulation will occur.

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过程稳定性（续）
Process Stability (continued)

- 虽然有机酸在低浓度时是能量和碳的来源，但是，在较高浓度时却变得有毒。
- Although the organic acids are sources of energy and carbon at low concentrations, they become toxic at higher concentrations.

- 这样，发酵和甲烷形成细菌数量之间的不平稳会抑制甲烷的形成。
- Thus, the absence in balance between the fermentation and methane forming bacterial populations can cause methane formation to be inhibited.

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猪和牛粪便厌氧发酵选项
Options for the Anaerobic Digestion of Swine and Dairy Manures

发酵器类型 Type of Digester	技术水平 Level of Technology	总固体浓度 Total Solids Concentration	所允许的固体 Solids Allowable	辅助热 Supplemental Heat	HRT (1) (天) (days)
密封发酵池 Covered lagoon	低 Low	0.1-2%	细 Fine	无 No	20+(2)
完全混合 Complete mix	中 Medium	2-10%	粗 Coarse	有 (3) Yes(3)	15+
附着生长 Attached growth	中 Medium	0.5-2%	可溶解 Soluble	有 (3) Yes(3)	2+
活塞式 (4) Plug-flow (4)	低 Low	11-13%	粗 Coarse	有 (3) Yes(3)	20+

1. HRT =水力停留时间=发酵器容积/日进水容量
   HRT = Hydraulic retention time = digester volume/daily influent volume
2. 依照气候而定 Depends on climate
3. 在热带气候条件下可选 Optional in tropical climates
4. 只限于牛奶场Dairies only

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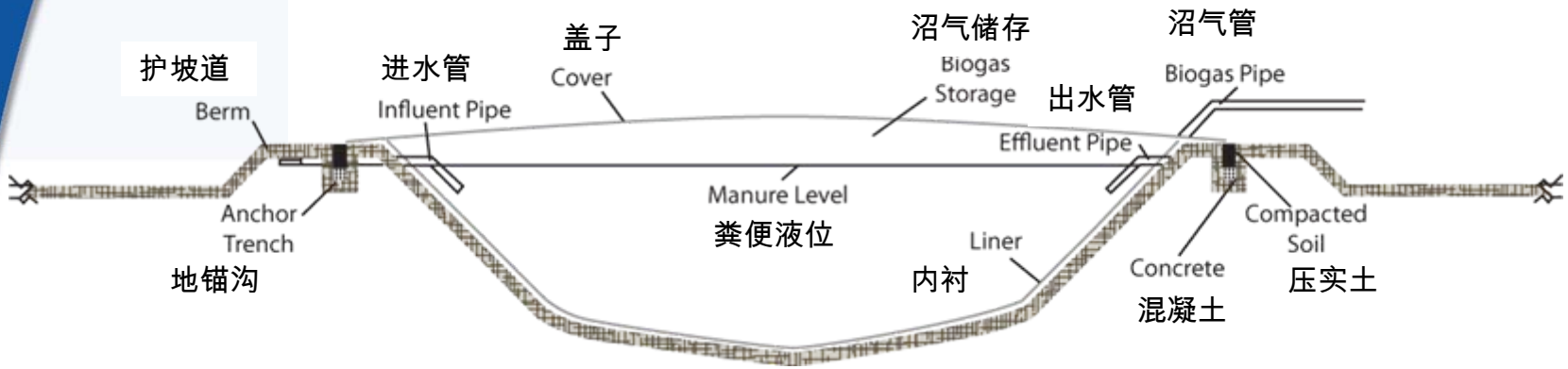
密封发酵池示意图
Covered Lagoon Schematic

仅用于总固体质量分数为0.5～3% 的粪便

only for Manure with 0.5 to 3% Total Solids

密封发酵池示意图



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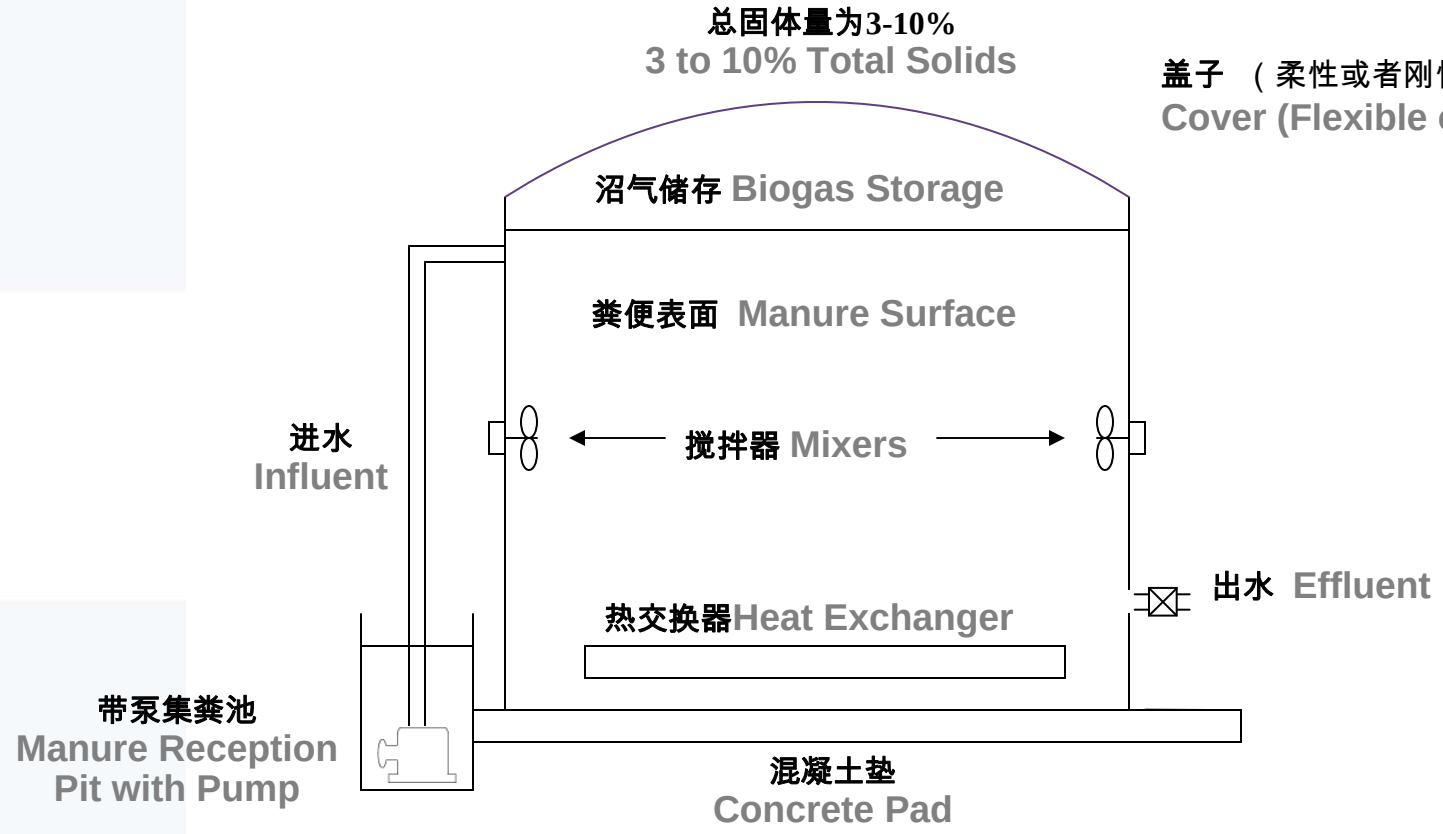
密封发酵池照片
Photograph of a Covered Lagoon

混合发酵器示意图
Mixed Digester Schematic



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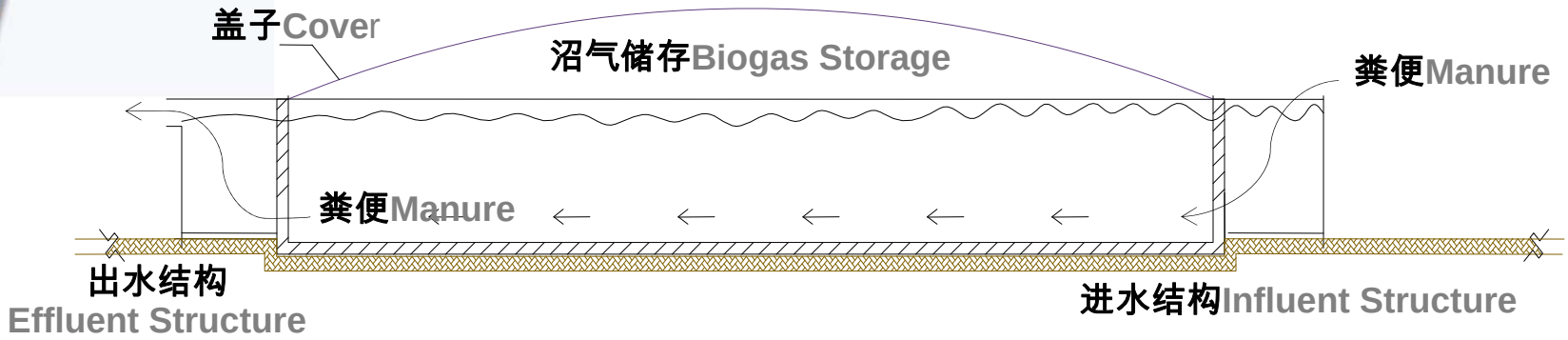
混合发酵器照片
Photograph of a Mixed Digester

活塞式流动发酵器示意图
Plug-flow Digester Schematic

仅适用于最小总固体质量分数为11-13%的废弃奶牛粪肥
ONLY FOR SCRAPED DAIRY MANURE WITH A MINIMUM OF 11 TO 13% TOTAL SOLIDS



罐体必须长而窄
MUST BE A LONG NARROW TANK

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活塞式流动发酵器照片
Photograph of a Plug-Flow Digester

活塞式流动发酵器

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中国发酵器
A Chinese Digester

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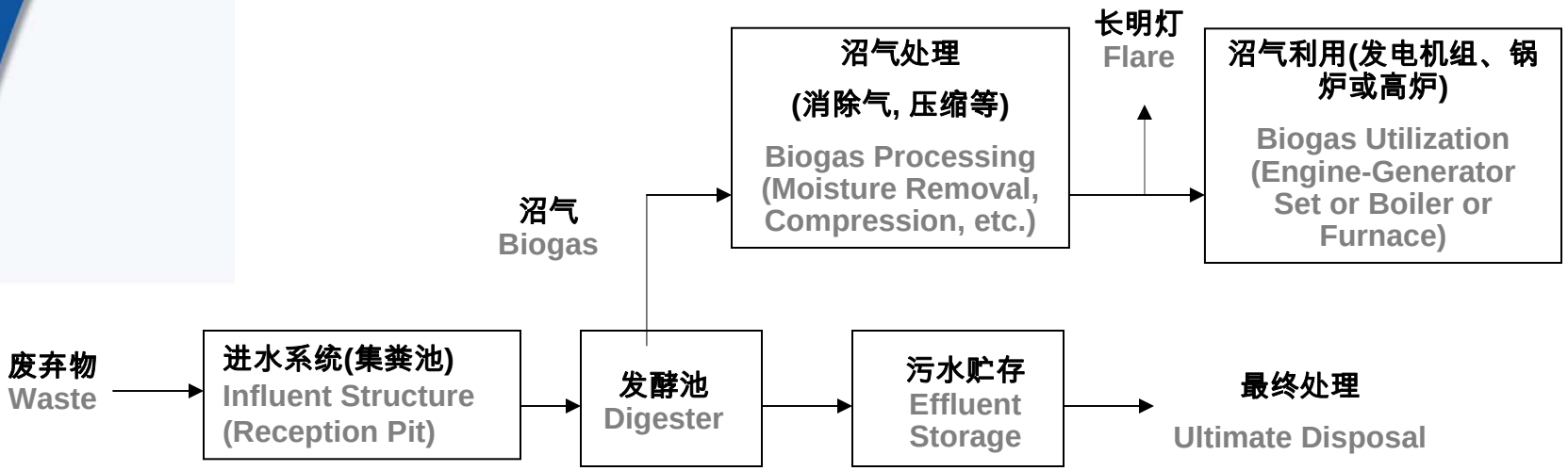
沼气系统构成
Biogas System Components



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太阳能引燃的、能采集数据的长明灯
Flare with Solar Powered Ignition and Data Collection

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以沼气为燃料的发电机组
Biogas Fueled Engine-Generator Set

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密封发酵池设计
Covered Lagoon Design

- 操作容积的设计应以每日每千立方米最高挥发性固体负荷率，或是生产适量甲烷所需的最少水力停留时间为基础。
- Design operating volume should be based on either the maximum daily volatile solids (VS) loading rate per 1,000 m^3 or the minimum hydraulic retention time (HRT) required for adequate methane production.

- 最高挥发性固体负荷率和最少水力停留时间均随气候变化，见如下两个公式。
- Both the maximum VS loading rates and minimum HRTs vary with climate as shown in the following figures.

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流程设计：确定发酵池所需的操作容积
Process Design: Determining the Required Lagoon Operating Volume

以挥发性固体负荷率为基础:

Based on VS loading rate:

- 所需操作容积, m^3 = (挥发性固体负荷率, kg/天) / 最大设计挥发性固体负荷率, kg/1,000 m^3/天
- Required operating volume, m^3 = (VS loading rate, kg/day)/maximum design VS loading rate, kg/1,000 m^3/day

以水力停留时间为基础:

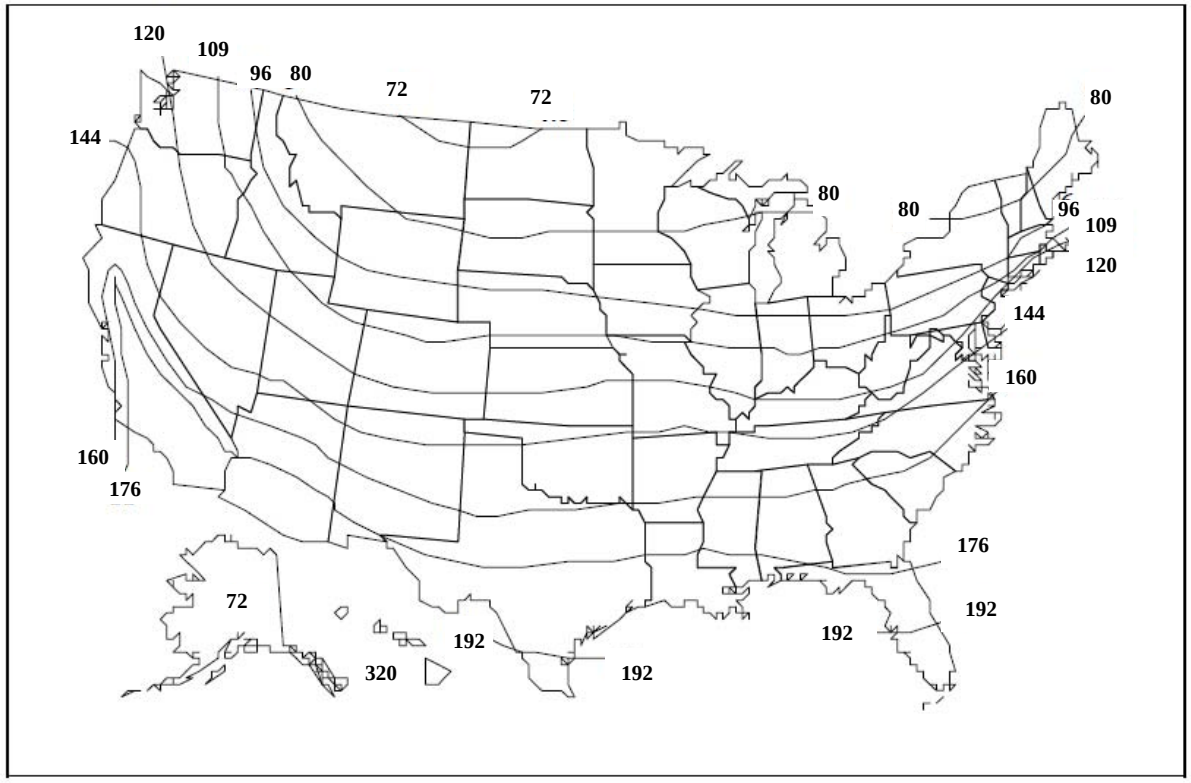
Based on HRT:

- 所需操作容积，m^3 = (进水流量, m^3/天)/(最少设计水力停留时间, 天)
- Required operating volume, m^3 = (influent flow rate, m^3/day)/(minimum design HRT, days)

- 设计的操作容积应是以上两个值中较大的一个。
- The design operating volume is the larger of the two values.

美国密封厌氧发酵池最高挥发性固体负荷率，kg挥发性固体/1,000 m^3/天

Covered Anaerobic Lagoon Maximum Volatile Solids Loading Rates for the U.S., kg VS/1,000 m^3/day.



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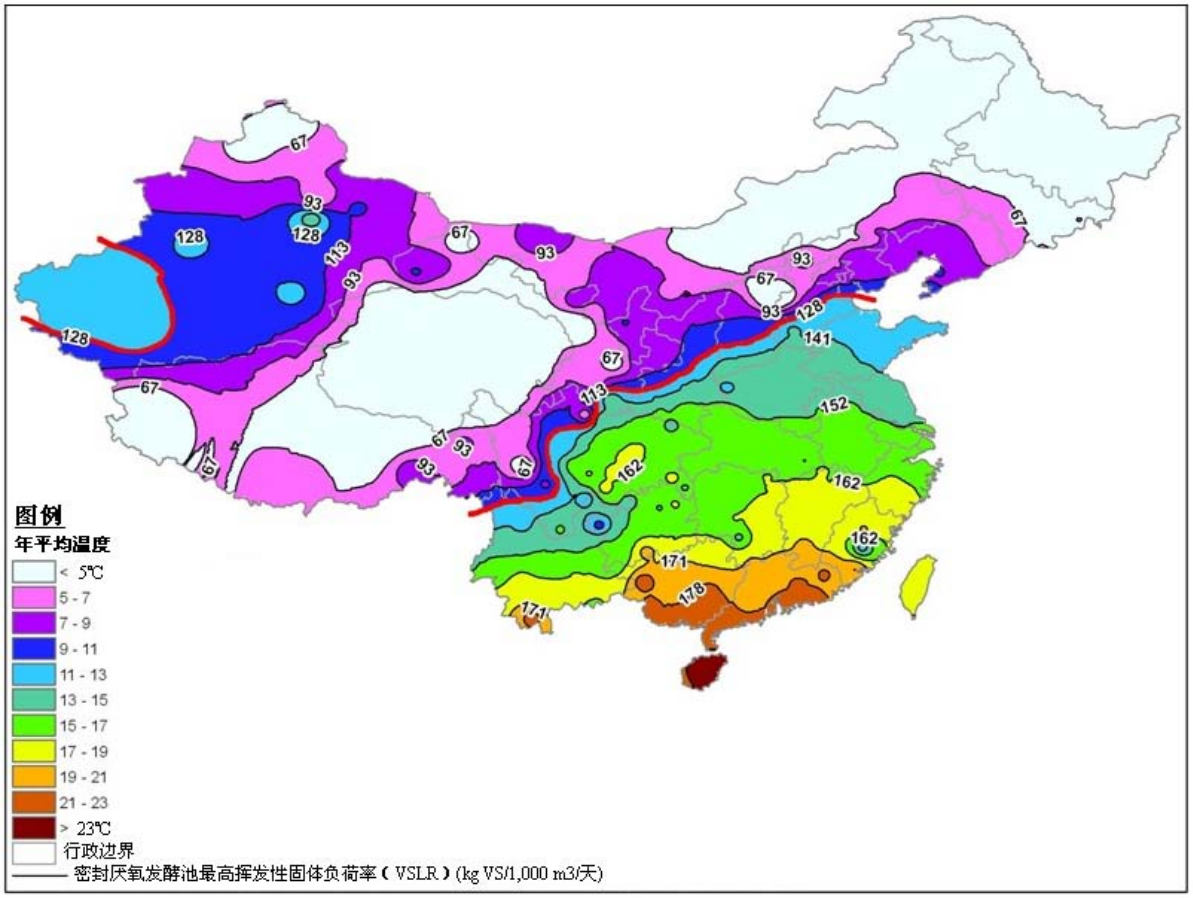
中国密封厌氧发酵池最高挥发性固体负荷率，kg挥发性固体/1,000 m^3/天。

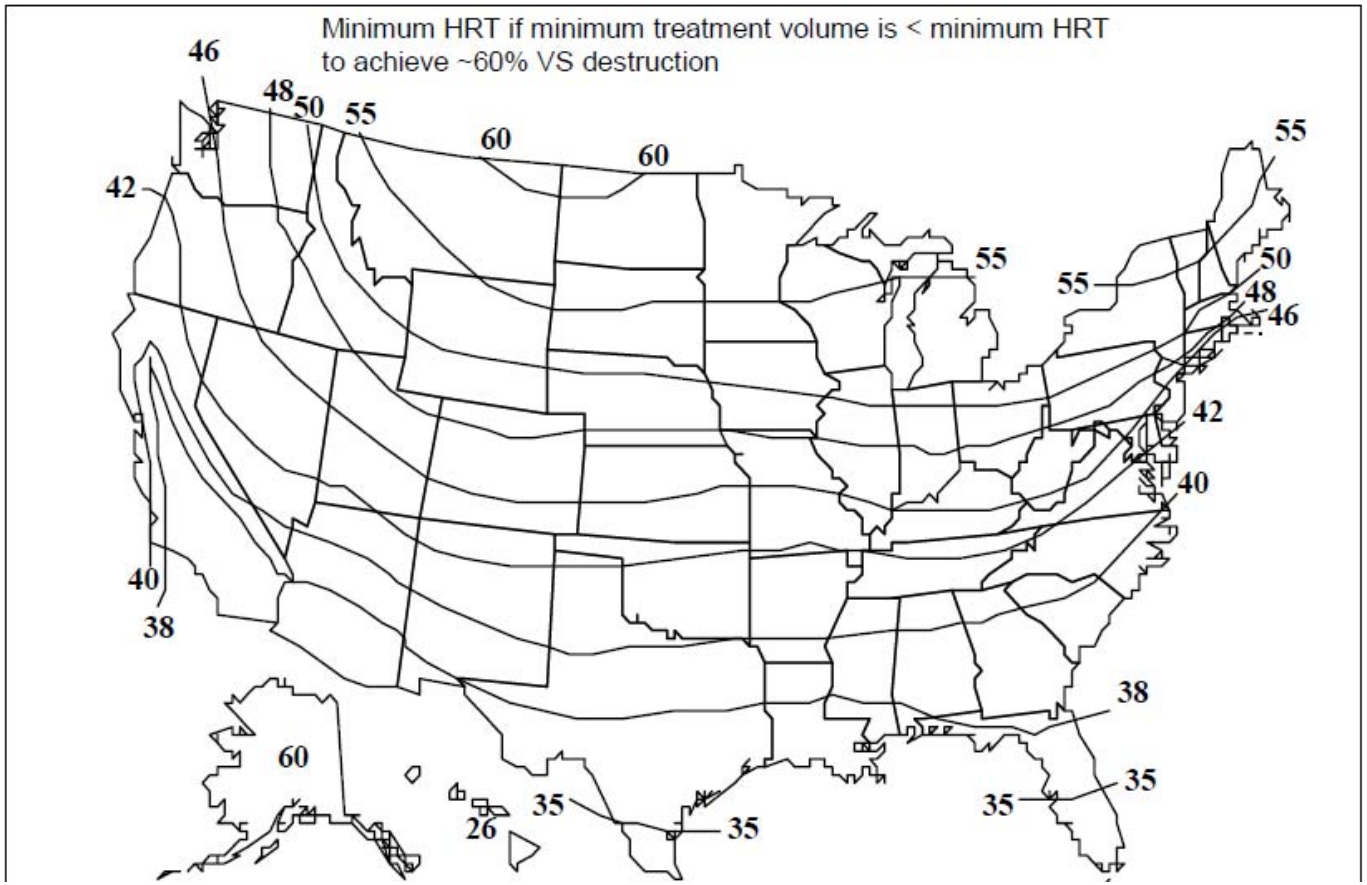
Covered Anaerobic Lagoon Maximum Volatile Solids Loading Rates for China, kg VS/1,000 m^3/day.



美国密封厌氧发酵池最少水力停留时间，天

Covered Anaerobic Lagoon Minimum Hydraulic Retention Times for the U.S., days.

要实现破坏约60%的挥发性固体，如果最小处理量小于最少水力停留时间（HRT），所需的最少水力停留时间（HRT）



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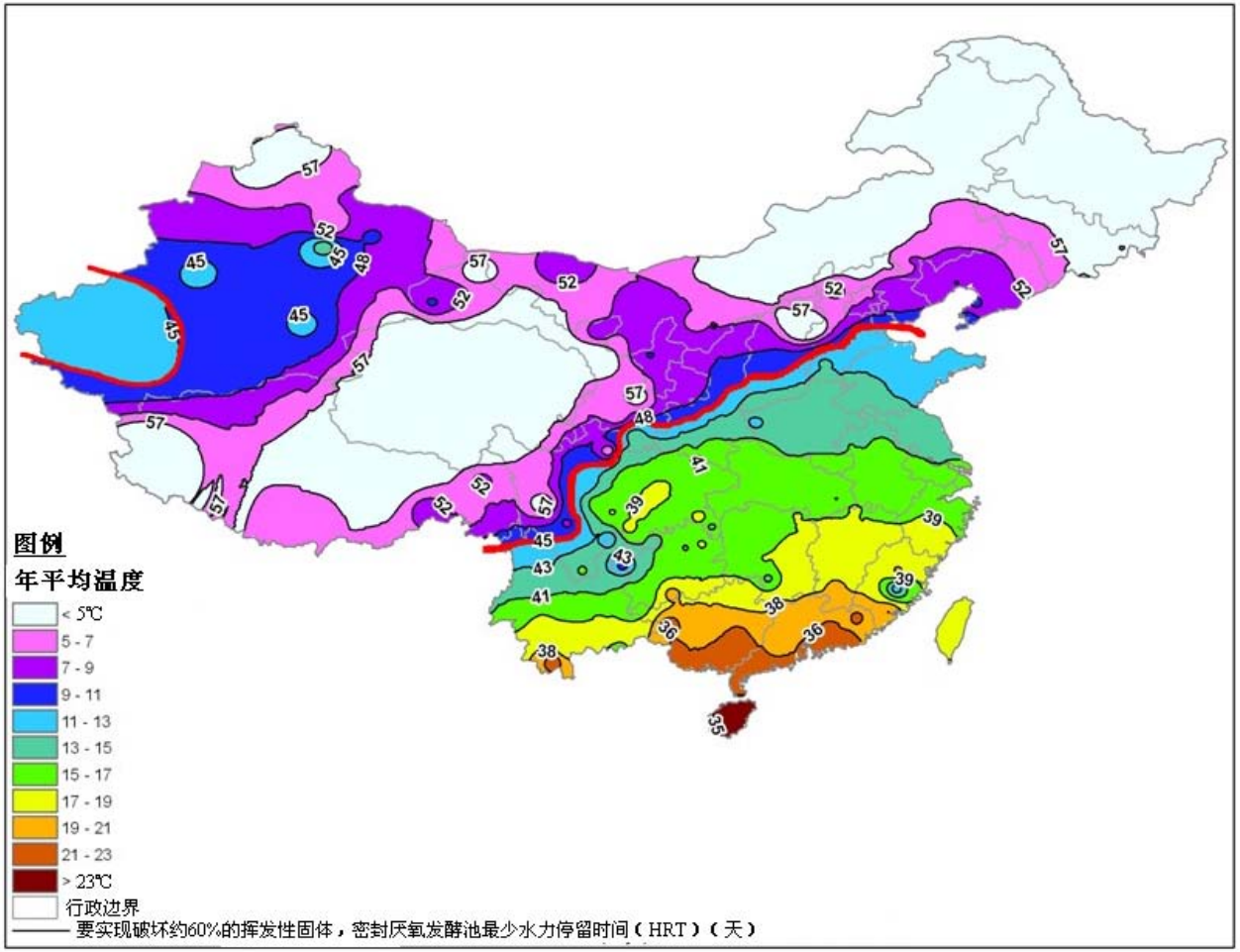
中国密封厌氧发酵池最少水力停留时间，天。

Covered Anaerobic Lagoon Minimum Hydraulic Retention Times for China, days.



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外观设计
Physical Design Parameters for Covered Lagoons

- 超出水面高度- 最少 0.6米以容纳可能生成的泡沫。
- Freeboard - A minimum of 0.6 m to accommodate possible foaming.

- 长宽比例- 至少 4:1以防止短路循环，如果场地条件允许。
- Length to width ratio - At least 4:1 if site conditions permit to prevent short circuiting.

- 操作深度 – 至少 3.7 米，超过发酵池底部面积的50% 或更多。
- Operating depth - At least 3.7 m over 50% or more of the area of the bottom of the lagoon.

- 内部倾斜度-典型地，坡度不大于2（水平）:1（垂直）。
- Interior slopes - Typically, no steeper than 2 horizontal to 1 vertical.

- 盖子 – 用以清除积水，防止沉淀
- Cover - Provision for removing accumulated water from precipitation

设计环境温度密封发酵池所需的信息
Design Information Required for Ambient Temperature Covered Lagoons

- 粪便每日排泄量, m^3
- Manure volume excreted daily, m^3

- 挥发性固体浓度, kg/m^3
- VS concentration, kg/m^3

- 每日平均卫生设施、蒸发冷却用水量、流失量等, m^3
- Average daily water use for sanitation, evaporative cooling, spillage, *etc.*, m^3

- 气候特征以确定最大设计挥发固体负荷率和最少水力停留时间。
- Characterization of climate to determine the maximum design VS loading rate and minimum HRT.

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密封发酵池出水处理选项
Covered Lagoon Effluent Disposal Options

- 灌溉农田（植物重新获得养分：氮、磷、钾）
- Application to cropland (to recover the plant nutrients; nitrogen, phosphorus, potassium present)

- 排放到鱼池，养分利用和过滤，然后再进行地表水排放
- Discharge to fish ponds for nutrient utilization and polishing before surface water discharge

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果园
Orchard

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鱼池
Fish Ponds

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项目类型
Types of Projects

- 新农场
- New farms

- 使用一个现有的存储出水用的发酵池或者鱼池，改造一个新的密封发酵池的结构
- Retrofits with construction of a new covered lagoon with the use of an existing lagoon for effluent storage or a fish pond

- 将一个现有的发酵池变成密封发酵池，比如在海东生态农业公司进行的改造
- Retrofits where an existing lagoon is converted into a covered lagoon such as at the Haidong Ecological Agriculture Company

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海东农业公司养猪场的粪便特征和容量（假定）

Waste Characteristics and Volume Assumed for the Haidong Ecological Agriculture Company Swine Operation

猪类型 Animal type	粪便容量, m^3/年 Manure volume, m^3/yr	总固体量, kg/年 Total solids, kg/yr	挥发性固体, kg/年 Volatile solids, kg/yr
妊娠母猪 Gestating sows	1,721	168,459	153,144
泌乳母猪 Lactating sows	695	67,880	62,450
保育猪 Nursery pigs	436	49,895	43,409
待肥育猪 Feeder pigs	7,363	707,604	583,773
合计 Total	10,215	993,838	842,776

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海东农业公司养猪场的进水容量、总固体量、挥发性固体量、浓度和负荷率（预计）
Expected Influent Volume, Total and Volatile Solids Concentrations and Loading Rates for the Haidong Agriculture Company Swine Operation

参数 Parameter	浓度 Concentration	负荷率 Loading rate
总固体量 Total solids	8.3 g/L	2,723 kg/天/day
挥发性固体量 Volatile solids	7.0 g/L	2,309 kg/天/day
容积 Volume	不详n/a	328 m^3/天/day

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中国湖南与美国北卡罗莱纳州纳什县的环境温度比较, °C
Comparison of Average Ambient Temperatures for Hunan, China and Nash County, North Carolina, °C

月份 Month	中国湖南（2008） Hunan, China (2008)	北卡罗莱纳州纳什县 Nash County, NC
一月 January	2.2	4.9
二月 February	5.0	6.5
三月 March	14.4	10.4
四月 April	18.9	15.2
五月 May	24.4	19.6
六月 June	26.7	23.8
七月 July	30.6	26.2
八月 August	28.9	25.3
九月 September	26.1	22.3
十月 October	20.6	13.1
十一月 November	13.3	8.8
十二月 December	8.3	4.2
平均 Average	18.3	15.0

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海东农业公司养猪场环境温度密封发酵池的初步设计参数

Preliminary Design Parameters for the Haidong Ecological Agriculture Company Swine Operation Ambient Temperature Covered Lagoon.

进水量 Influent volume	328 m^3/天/day
挥发性固体负荷 Volatile solids loading	2,309 kg/天/day
操作容量 Operating volume	16,035 m^3
挥发性固体负荷率 Volatile solids loading rate	144 kg/1,000 m^3/天/day
水力停留时间 Hydraulic retention time	49 天/days
盖子类型 Cover type	边到边 Bank-to-bank
平均沼气产量 Average estimated biogas production	1,297 m^3/天/day

Methane to Markets

预测沼气生产能力的若干假定
Assumptions for Estimating Biogas Production Potential

- 挥发性固体的 60% 被破坏
- A 60% destruction of VS

- 每千克被破坏的挥发性固体中含有 0.94 m^3 沼气
- 0.94 m^3 of biogas per kg VS destroyed

- 从猪粪中产生的沼气中含有65%的甲烷
- Biogas from swine manure contains 65% methane.

Methane to Markets

海东生态农业公司养猪场发电的可能性
Potential for Generating Electricity at the Haidong Agriculture Company Swine Operation

- 平均kWh/天：~2,800 (117 kW)
- Average kWh per day: ~2,800 (117 kW)

- 假设： Assuming:
  - 沼气生产：1,297 m3/天
  - Biogas production: 1,297 m^3 per day

  - 沼气甲烷含量： 65%
  - Biogas methane content: 65%

  - 甲烷较低热值：2,614 Btu/100 m3
  - Methane lower heating value: 2,614 Btu per 100 m^3

  - Btu/kWh: 3,412
  - Btu per kWh: 3,412

  - 热转换效率： 35%
  - Thermal conversion efficiency: 35%

- 为了完全利用夏季沼气产量峰值而推荐的发电机组的容量： 150 kW
- Recommended generator set size to fully utilize summer time peak in biogas production: 150 kW

Methane to Markets

维持沼气生产
Maintaining Biogas Production

良好的做法： Good practices:

- 避免粪便的质量（斯勒格）载荷。理想情况是，每天均添加粪便 。
- Avoid slug loads of manure. Ideally, manure should be added daily.

- 粪便应无土、石块以及其他异物，只含有极少量的垫草。
- Manure should be free of soil, rocks, and other foreign matter and contain only a minimal amount of bedding.

- 避免过度使用有毒的化合物，比如与粪便混合在一起的消毒杀菌剂和杀虫剂。
- Avoid excessive use of toxic compounds such as sanitizers and pesticides that will mix with manure.

- 每日测量和记录沼气产量。
- Measure and record biogas production daily.

- 最好每周测量出废水pH值和总的挥发性酸浓度。
- Measurement effluent pH and total volatile acid concentration weekly is desirable.

Methane to Markets

维持沼气生产（续）
Maintaining Biogas Production (continued)

问题出现的征兆
Indicators of Problems

- 沼气产量的大幅降低
- A sharp reduction in biogas production.

- 排出污水的PH值降至 7.0以下
- A decline in effluent pH to less than 7.0

- 排出物种含碱量的降低
- A reduction in effluent alkalinity

解决方法 Solutions

- 减少或暂时停止加粪
- Reduce or temporarily stop loading

- 添加碱的来源例如石灰
- Add a source of alkalinity such as lime.

Methane to Markets

评估过程绩效
Evaluating Process Performance

量化和报告牲畜粪便厌氧发酵系统绩效的甲烷市场化国际指导方针

Methane to Markets International Guidance for Quantifying and Reporting the erformance of Anaerobic Digestion Systems for Livestock Manures

Methane to Markets

过程绩效评估选项
Process Performance Evaluation Options

- 第I级：背景信息汇编，评估甲烷排放的减少，以及测量沼气产量和成分。
- **Level I**: Assembly of background information, estimation of reduction in methane emissions, and measurement of biogas production and composition.

- 第 II级：第I级加上测量沼气利用：发电、通过直接燃烧、发电机组废热回收或者某些组合替代矿物燃料。
- **Level II**: Level I plus measurement of biogas utilization for generating electricity or replacing fossil fuels by direct combustion or engine-generator set waste heat recovery or some combination thereof.

Methane to Markets

过程绩效评估选项（续）
Process Performance Evaluation Options (continued)

- 第III级：第II级加上经济分析。
- **Level III:** Level II plus economic analysis.

- 第IV级：第III级加上废物稳定程度的量化。
- **Level IV:** Level III plus quantification of the degree of waste stabilization.

Methane to Markets

确定潜在的项目
Identifying Potential Projects

- 收集相关信息
- Collection of relevant information

- 分析收到的信息，从而
- Analysis of the information collected to:

  - 根据废物量和现行的管理方法，估计甲烷排放减少的潜力。
  - Estimate the methane emission reduction potential based on the amount of waste and current management practices.

  - 确定使用沼气代替矿物燃料的选项，完全表征甲烷回收的潜在经济利益的特点。
  - Identify options for using biogas in place of a fossil fuel to fully characterize the potential economic benefits of methane recovery.

  - 确定实现合理规模经济的潜力。
  - Identify the potential for realizing a reasonable economy of scale.

- 确定可能的融资选项。
- Identifying possible financing options

甲烷市场化养猪场摘要工作表
The M2M Swine Farm Summary Worksheet

- 第1部分 -一般信息
- Section 1 - General Information

- 第2部分 -养猪场位置
- Section 2 - Farm location

- 第3部分 -养猪场类型：分娩到育成，分娩到断奶等。
- Section 3 - Farm type: farrow-to-finish, farrow-to wean, *etc*

- 第4部分 -存栏数：种畜群、保育和育成猪产量
- Section 4- Livestock population: breeding herd and feeder (nursery) and fed (finished) pig production

Methane to Markets

甲烷市场化养猪场摘要工作表（续）

The M2M Swine Farm Summary Worksheet (continued)

- 第5部分- 分娩方法
- Section 5 - Method(s) of confinement

- 第6部分- 水的使用和粪便管理惯例
- Section 6 - Water use and manure management practices

- 第7部分- 现场能量使用
- Section 7 - On-site energy use

- 第8部分-其他信息，包括饲养惯例、现有发酵池的大小、存储罐和池
- Section 8 -Additional information including feeding practices and sizes of existing lagoons and storage tanks and ponds

Methane to Markets

在清洁发展机制（CDM）下，使甲烷排放减少货币化
Monetizing Methane Emissions Reductions under CDM

已认证排放减少额度的基础
The Basis for Certified Emissions Reduction Credits

$$ER_Y = BE_Y - PE_Y - LE_Y$$

其中： Where:

ERY =在项目界限内任一给定年中的排放减少量

ER_Y = the emission reduction in any given year within the project boundary

BEY =基线排放总和

BE_Y = the sum of baseline emissions

PEY =项目排放总和

PE_Y = the sum of project emissions

LEY =泄漏

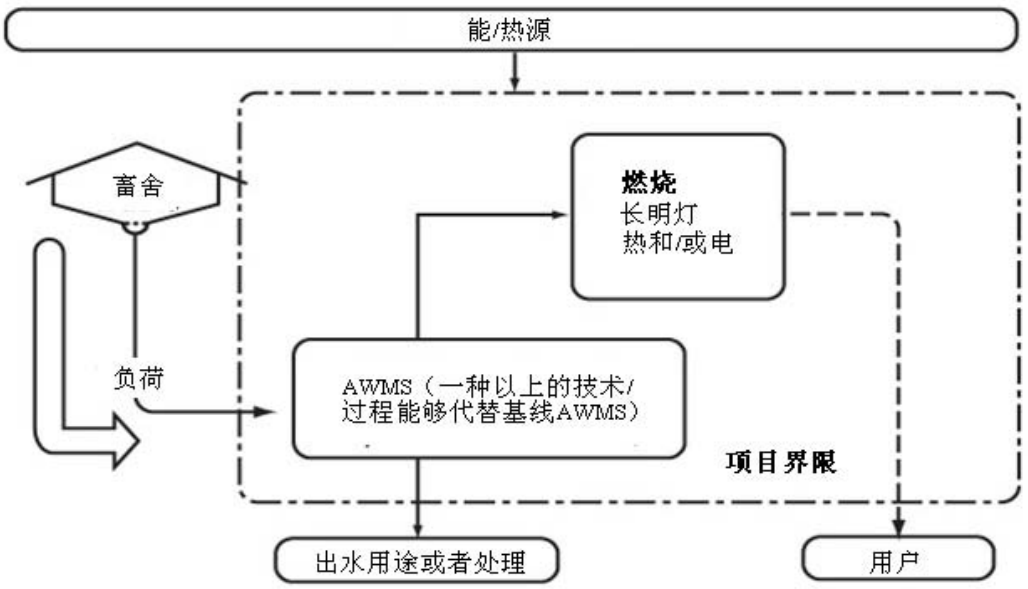
LE_Y = leakage

项目界限
The Project Boundary

在项目发展过程中的第1步正在勾勒出项目界限。

Step 1 in the project development process is delineating the project boundary.

项目界限



Methane to Markets

包含或者不包含在项目界限之中的基线排放
Baseline Emissions Included in or Excluded from the Project Boundary

来源 Source	气体 Gas	
从废物处理过程中直接排放 Direct emissions from waste treatment processes	甲烷（CH_4）	包含 Included
	一氧化二氮（N_2O）	包含 Included
	二氧化碳（CO_2）	不包含 Excluded
从消耗电/发电中排放 Emissions from electricity consumption/ generation	二氧化碳（CO_2）	包含 Included
	甲烷（CH_4）	不包含 Excluded
	一氧化二氮（N_2O）	不包含 Excluded
从产生热能中排放 Emissions from thermal energy generation	二氧化碳（CO_2）	包含 Included
	甲烷（CH_4）	不包含 Excluded
	一氧化二氮（N_2O）	不包含 Excluded

Methane to Markets

验证AWMS项目所要求的监测
Monitoring Required for Verification for AWMS Projects

- 牲畜存栏数
- Animal population

  - 月平均牲畜存栏数
  - Average monthly animal population

  - 每年在这个系统中牲畜居留的天数
  - Number of days animals resident in the system per year

- 系统中使用的废物的百分比
- Percent waste used in the system

- 沼气产量，m^3/月
- Biogas production, m^3/month

- 沼气成分，%甲烷（CH4）和 %二氧化碳（CO2）
- Biogas composition, %CH_4 and %CO_2

- 燃烧设备效率（如适用）
- Combustion equipment efficiency (when applicable)

- 长明灯效率
- Flare efficiency

Methane to Markets

监测方法
Monitoring Methodologies

针对监测所要求的每个参数，均存在着一个规定的清洁发展机制（CDM）方法。例如：EB 28会议报告中的附件13，为从含有甲烷的燃烧气体中确定项目排放量提供指导方针：

For each parameter for which monitoring is required, there is a CDM methodology specified. For example Annex 13 of the EB 28 meeting report provides guidance for determining project emissions from flaring gases containing methane as follows:

- 开放式燃烧 —
- Open flares —

  - 如果可行，则为默认效率值的50%。
  - If operational, a default efficiency value of 50% applies.

  - 如果不可行，默认效率值则为0%。
  - If not operational, the default efficiency value is 0%.

Methane to Markets

监测方法（续）
Monitoring Methodologies (continued.)

- 封闭式燃烧 —
- Enclosed flares—
  - 持续监测是否与制造商的规定相符（温度和气体流速），可使用90%的默认效率值。对于参数不符的任何特定时段，应该使用50%的默认值，或者
  - With continuous monitoring of compliance with manufacturer's specifications (temperature and gas flow rate), a 90% default efficiency value can be used. For any specific hour with any parameter out of compliance, a 50% default value should be used for that hour or
  - 连续监测甲烷破坏效率的实际效率。
  - Actual efficiency with continuous monitoring of methane destruction efficiency.

Methane to Markets

额外性
Additionality

由于项目进展、满足规章的要求（比如禁止将未经处理的废物排放到地表水中）而导致的甲烷排放减少，不具备已认证排放减少额度的资格。

Reductions in methane emissions resulting from projects developed to meet a regulatory requirement, such as the prohibition of discharge of untreated wastes to surface waters, are not entitled to certified emission reduction credits.

Methane to Markets

谢谢

Thank-you

有问题吗？

Questions?