有效能的轉化有機廢水成生質能源

EFFECTIVE TRANSFORMATION OF ORGANIC WASTE WATER TO BIOENERGY

主講人(Speaker)：白陽泉(PAI, YANG-CHUNG)
台灣區環境保護工程專業營造業同業公會
常務理事
Taiwan Environment Engineering Association
Executive Director

主講人學經歷 Biography of speaker

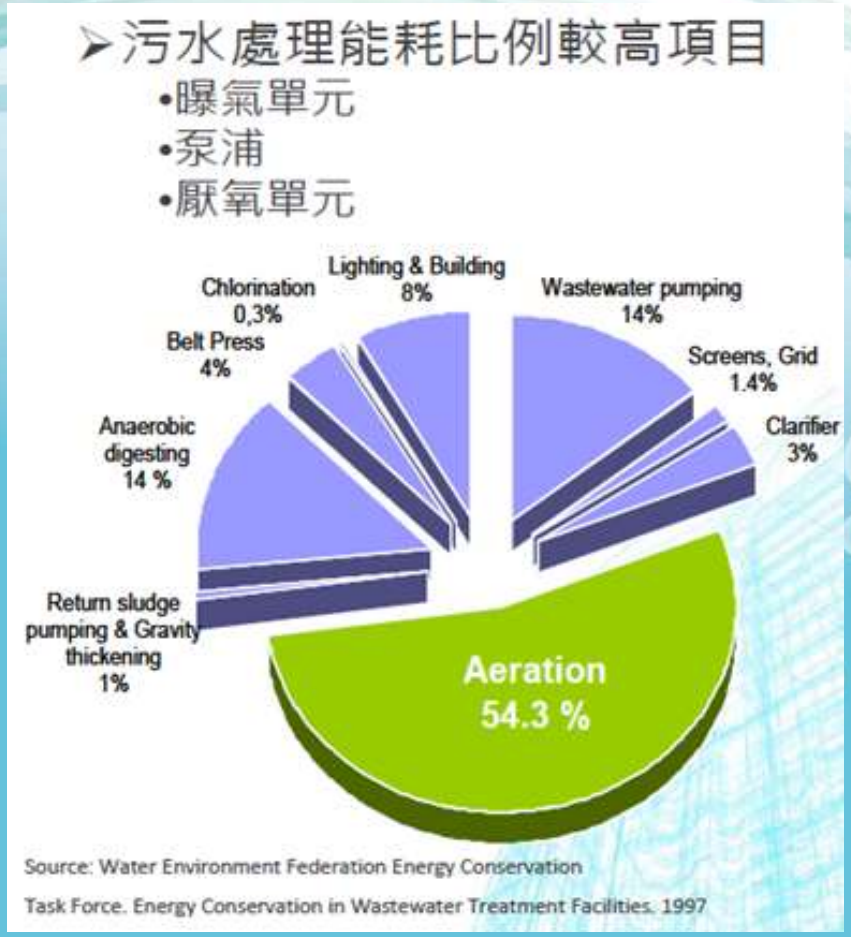
從事水之淨化及環保工作近45年

- Executive Director
  Taiwan Environment Engineering Association **(2018 -2021)**
- General Manager
  Star Enprotech CORP.**(1977 –up to now)**
- Chairman
  Sunray Science & Technology CO., LTD. **(1986-up to now)**
- Chairman
  Taiwan Environmental Manufacturers Association **(2003-2009)**
- Master of Science in Sanitary Engineering
  I.H.E. DELFT,The Netherlands **(1991-1993)**
- Materials and Mineral Resources Engineering Department of National Taipei University of Technology**(1966-1971)**

台灣處理單位污水用電量與國外比較
Comparison of power consumptions for sewage water processing

sewage capacity (CMD)		5,000	10,000	50,000	100,000	200,000	500,000
		ELECTRICITY PER CM (KWH/CM)					
DIFFERENT PROCESS	Japan	0.7	0.5	0.4	0.3	0.3	0.3
	Taiwan	0.7	0.54	0.30	0.23	0.18	0.13
STANDARD ACTIVATED PROCESS	United State	0.62	0.44	0.30	0.28	0.28	0.27
	Taiwan	0.80	0.64	0.38	0.30	-	-

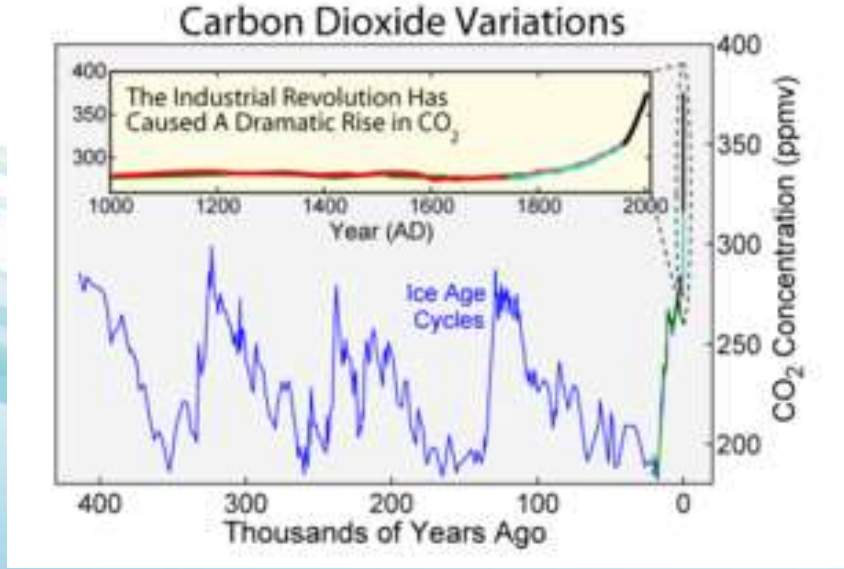
污水處理相關能耗概況
Energy consumption for water processing

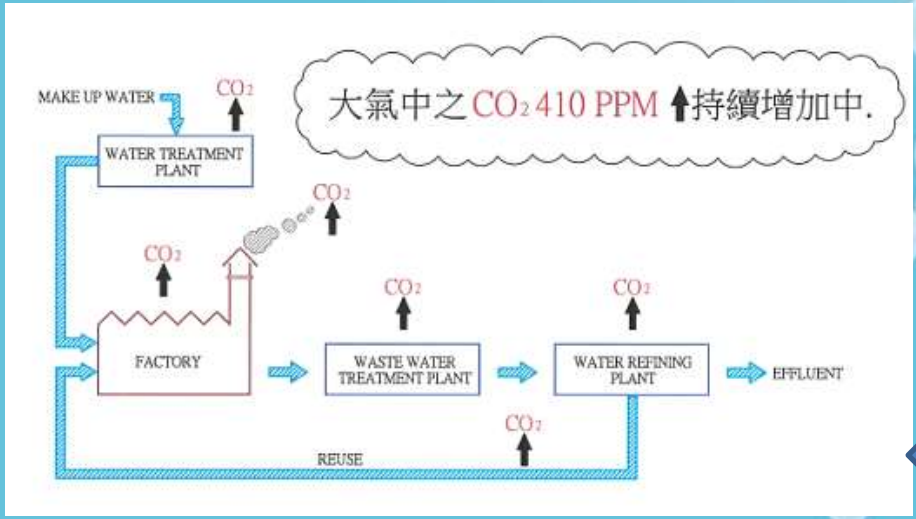


54.3%
COMSUMPTION
FOR AERATION

所有的淨水處理、廢水處理均消耗能源及增加二氧化碳排放，一方面解決了水的污染，另一方面卻增加空氣污染。

All water processing methods consume energy and increase CO_2 emission. The water pollution is reduced while increasing the air pollution and global warming





生產過程產生CO_2
用廢水處理再產生CO_2
生產及環保均大量排出CO_2

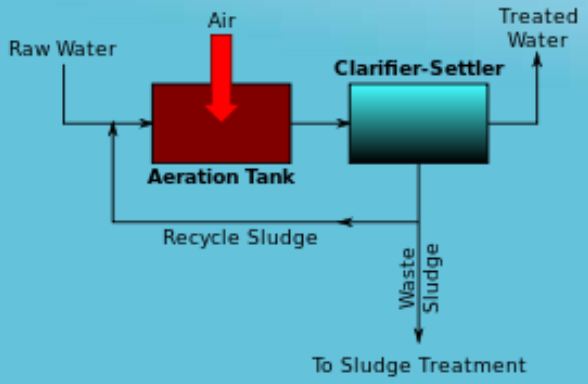
CO_2 is generated during:
Both manufacturing and recycling

工業生產及廢水處理流程示意圖

傳統的有機廢水處理包括都市生活污水，均採用活性污泥法（純氧曝氣、深渠、 接觸氧化各式各樣），其使用鼓風機注入空氣，使培養之喜氣菌生長並分解水中之有機物，最終產物成為CO_2及生物污泥、水。

如何減碳排放也是淨水處理、廢水處理及回收水處理的重要工作！！

Traditional organic waste water processing, including those for urban sewage, employ the **activated sludge** approach: Air will be pumped into an aeration tank to activate aerobic microorganisms for sewage digestion.
And final products are
CO_2 + Organic Sludge + H_2O



目前的處理技術停留在頭痛醫頭腳痛醫腳，未能根本解決整體環境問題。而且是惡性循環。
以製造更多整體污染來解決眼前的局部污染

The contemporary approach has long been one merely treating the symptoms but not the disease. Even worse, it could result in a vicious cycle.

1977年荷蘭LETTINGA教授發現厭氧的顆粒化污泥ANAEROBIC GRANULAR SLUDGE 及發展UASB (Upflow Anaerobic Sludge Blanket)技術，使厭氧技術被漸漸推廣應用，改變了過去對厭氧系統低效率、佔地大及處理時間長的觀念。也開啟了厭氧微生物了解及應用的發展。

In 1977, Prof. Lettinga of Wageningen university at The Netherlands discovered the anaerobic granular sludge and developed the UASB technique. It was gradually accepted by the community and has changed people's mind on the anaerobic system, which was originally considered as low-efficient, space and time consuming for waste water processing.

1993年在荷蘭與大師合影

PHOTO WITH MY TEACHER IN 1993 AT THE NETHERLANDS

爾後雖有許多新型新改良技術，但仍有待突破，目前仍處於某些瓶頸，且一般大眾不太了解。台灣產學研各界對厭氧菌之應用僅少數單位及人才投入且無進展。

Although there are many followed-up works, the anaerobic technology still need certain breakthroughs to be applicable. The investment and research of such technology in Taiwan are also very limited.

厭氧微生物（Anaerobic bacteria）是不須付薪水確可努力工作的勞工，它不須要氧氣，它可分解有機物成CH_4、H_2，即所謂的生質能源，可轉為熱能或電能，最終才生成CO_2，也就是我們可以在處理廢水中有機物時不再須投入太多耗能卻能產生可應用之能源。

Anaerobic bacteria don’t need the supply of oxygen, which means that they can be viewed as free labors. They can also decompose organic materials into CH_4 and H_2, which suggests that they are a form of bioenergy source that can generate heat and electricity. Therefore, we no longer need much energy input for organic waste processing, rather, we can further generate energy from the process.

厭氧微生物分解有機物之後產生的生物污泥，只有喜氣污泥的十分之一，大量的減少污泥處理成本，也是減少後續處理時CO_2排放。

The sludge caused by anaerobic microorganisms is only 10% of their aerobic counterparts, which reduces the cost of sludge processing as well as CO_2 emission.

厭氧處理技術仍有許多可發展空間。
There are some anaerobic process technique can be developed.

A.(穩定混合)利用產生沼氣之過程，沼氣上升作為廢水與厭氧微生物之間之攪拌、混合、產氣過激或產氣太少，如何因應 。
(STABLE MIXING)

B.(充份接觸)如何使廢水所含有機質與厭氧生物充分接觸。
(COMPLETE CONTACT)

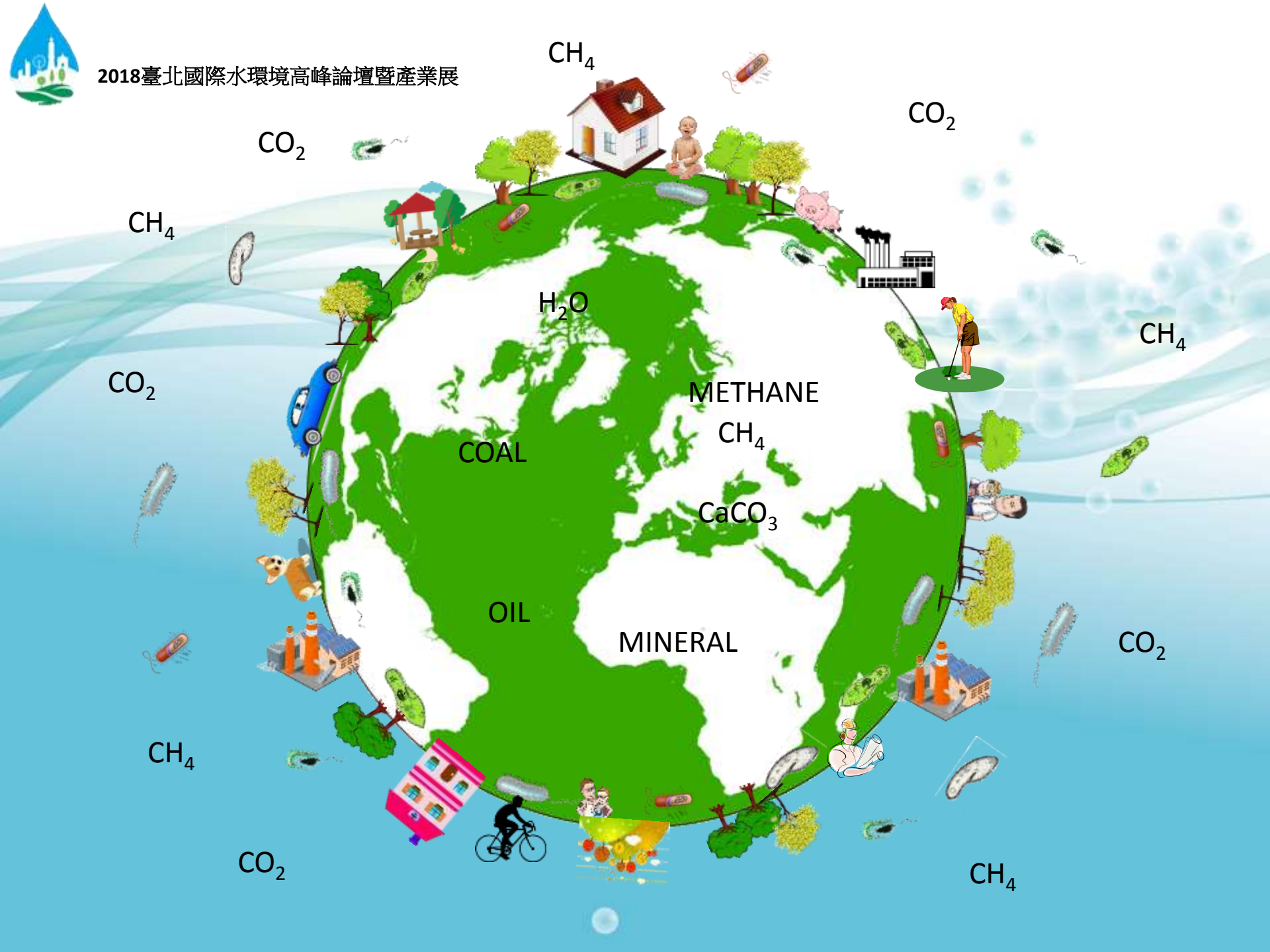
C.(有效分離)如何使厭氧微生物不隨沼氣wash out，增加SRT(SLUDGE RETENTION TIME)(三相分離技術可提升)
(EFFECTIVE 3 PHASE SEPARATION)

D.(提升效率)如何使厭氧微生物分解不易分解之有機物，生物有無限可能，並挑戰突破生物可分解性之限制。
(OVERCOME THE BIODEGRADABILITY LIMIT)

E.(低有機濃度)對於低含量有機生物廢水厭氧處理技術亦可有效處理。
(LOW ORGANIC CONTENT WASTE WATER ALSO CAN BE TREATED.)

F.沼氣之收集及淨化。
(BIOGAS COLLECTION AND PURIFICATION)

G.沼泥之應用。
(APPLICATION OF ANAEROBIC SLUDGE)


CH_4
CO_2
CO_2
CH_4
H_2O
CH_4
CO_2
METHANE
CH_4
COAL
$CaCO_3$
OIL
MINERAL
CO_2
CH_4
CO_2
CH_4

The ideal waste water treatment: Reducing water pollution without creating energy waste and CO_2 emission.

理想的廢水處理只能減少水污染，且不能增加耗能及二氧化碳排放。

Dream the impossible dream.

讓我們向不可能的夢想前進！

只有厭氧微生物能解救地球及人類。

我們向厭氧微生物致敬！

Only the anaerobic microorganism can save the earth and mankind!
Salute to the anaerobes!

謝謝聆聽!!
Thanks for listening.