



Emission and Reduction of Methane in Taiwan – The Present and Future

**Environmental Protection Administration
Taiwan**

March 13, 2013



Outline

- I. Major sources of methane emission in Taiwan**
- II. Current status of methane emission in Taiwan**
- III. Control measures and achievements**
- IV. Future developments**
- V. Conclusion**

Presenter's Bio

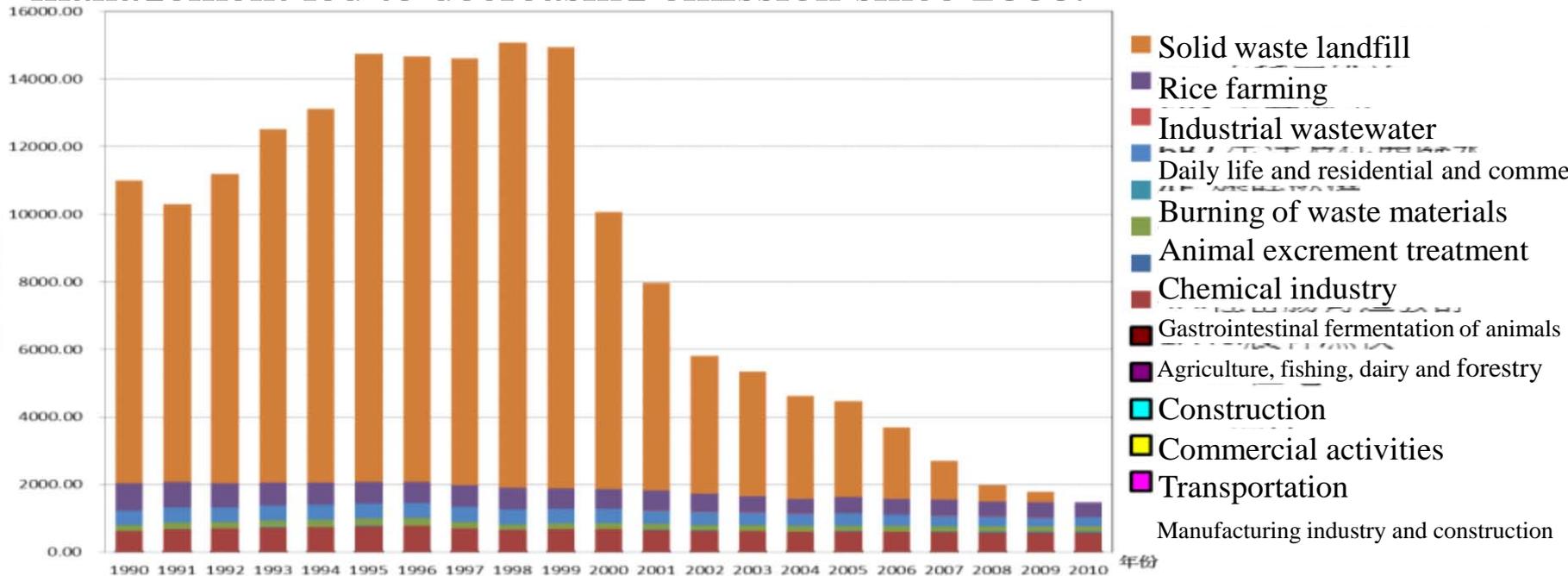
Name	Jin-Wei Tsai
Current position	Associate Technician , Bureau of Environmental Inspection, Environmental Protection Administration, Taiwan
Education background	Master of Science, The Institute of Environmental Health, National Taiwan University, Taiwan. 2008
Specialty	Environmental sanitation
Experience	<ul style="list-style-type: none">● Dec. 2009 ~ Oct. 2011: substitute service in Bureau of Health Promotion, Department of Health; in charge of human health affairs in relation to environmental sanitation, such as the fire of the Sixth Naphtha Cracking Plant of Formosa Plastics, the plasticizer incident, nuclear disaster in Japan and dioxin pollution.● Dec. 2011 to date: working for the Bureau of Environmental Inspection, Environmental Protection Administration; in charge of landfill management and projects entrusted and to provide technical assistance in energy and resource related projects.



I. Sources of methane in Taiwan

2. The trend of methane emission from 1990 to 2010

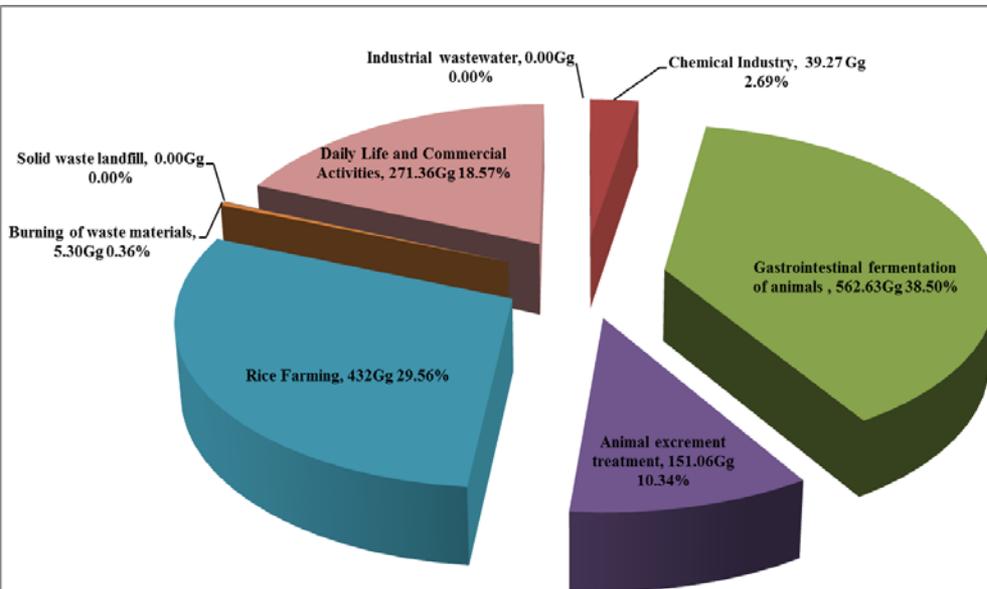
- The amount of methane emission reached a peak in 1995 due to improper waste management and loose regulation of GHG.
- Implementation to the GHG regulations and the policies of waste management led to decreasing emission since 2000.



I. Sources of methane in Taiwan

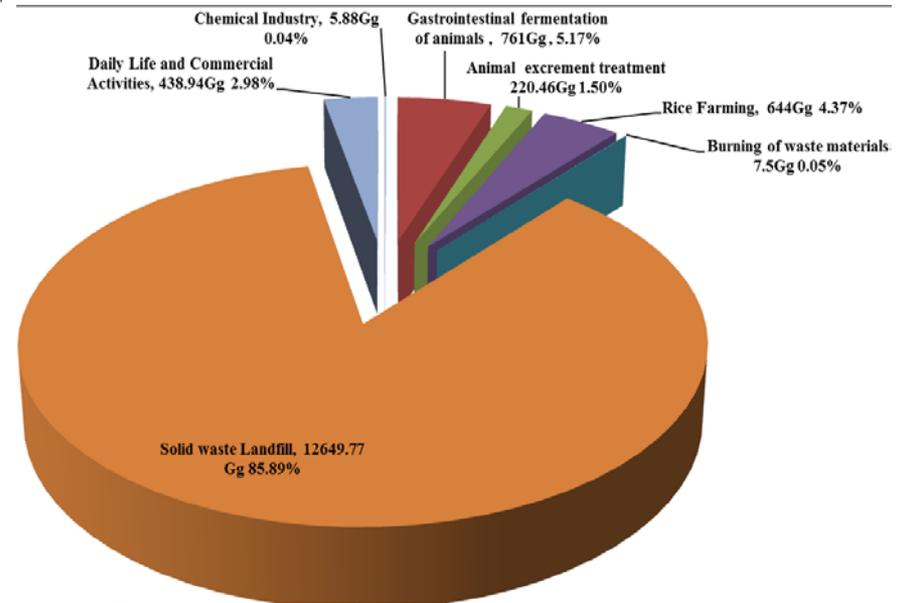
3. The sources and the contribution of methane emission in 1995 and 2010

The amount of methane emission in 2010



Percentage of the amount of emission from each sector in 2010

The amount of methane emission in 1995



Percentage of the amount of emission from each sector in 1995

Gg : Giga Grams (Thousand metric tons)

Note : the confirmation for the amount of emission from solid waste landfill and industrial wastewater in 2010 is pending.

the confirmation for the amount of emission from industrial wastewater in 1995 is pending

I. Sources of methane in Taiwan

4. Comparison of Methane Emission between 1995 and 2010

Solid waste landfills Gastrointestinal fermentation of animals	1995 methane		2010 methane	
	Gg	%	Gg	%
Solid waste landfills	12649.77	85.89	325.5 *	0.18 *
Gastrointestinal fermentation of animals	761.2	5.17	562.63	38.49
Emission from rice farming	644	4.37	432	29.56
Wastewater from daily life and residential and commercial activities	438.94	2.98	271.36	18.57
Burning of waste materials	7.5	0.05	5.3	0.36
Chemical industry	5.88	0.04	39.27	2.69
Industrial wastewater	---	---	18.85 *	0.01 *

Source: Methane Emission in Taiwan, Environmental Protection Administration (2013)

Note: “...”: to be confirmed
“ * ”: number of 2009

II. Current status of methane emissions in Taiwan

2. Current status of animal excrement treatment

- The number of pigs in November of 2012 was about 6 million.
- The daily average is 26,857 tons, and the yearly average of animal manure is 9,802,825 tons.
- More methane comes from conventional 3-stage sewage treatment .



III. Control measures and achievements

2. Animal excrement reduction measures and achievements

- The concentration of solids in pig excrements is increased for better gas production, thus achieving zero discharge of pig farming wastewater, effective improvement water quality in rivers and the benefits from recycling methane gas for energy production.
- In 2012, the number of sanitized pigpens reached to **18,081** and they have collected **2,020 tons of excrements daily** from **452,025 pigs**. It is estimated to have saved 48% of water and more than 38% of manual labor.

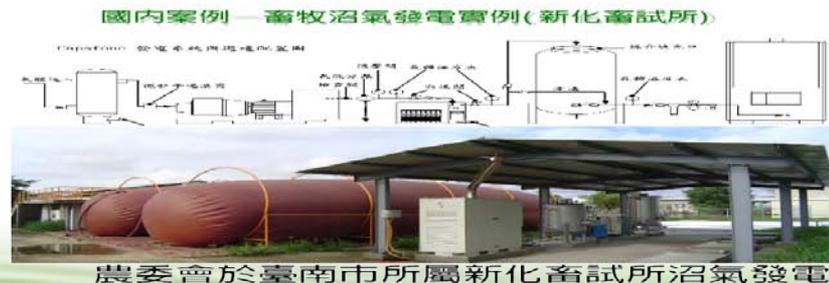


Pigpens before and after installation of pig restroom

III. Control measures and achievements

2. Animal excrement reduction measures and achievements

- Agricultural Department has installed sanitized pigpens at Livestock Research Institute at **Xinhua, Tainan City** as well as **bio-gas power generation equipment** for effective reduction of wastewater and excrements.
- Replacement of air conditioning with sun shades and water in animal farming facilities for lower air temperature and energy use and costs
- Improvement of feed efficiency for less production of excrement, or additives in feeds to the reduction of methane generation during food digestion.



資料來源:行政院環保署

III. Control measures and achievements

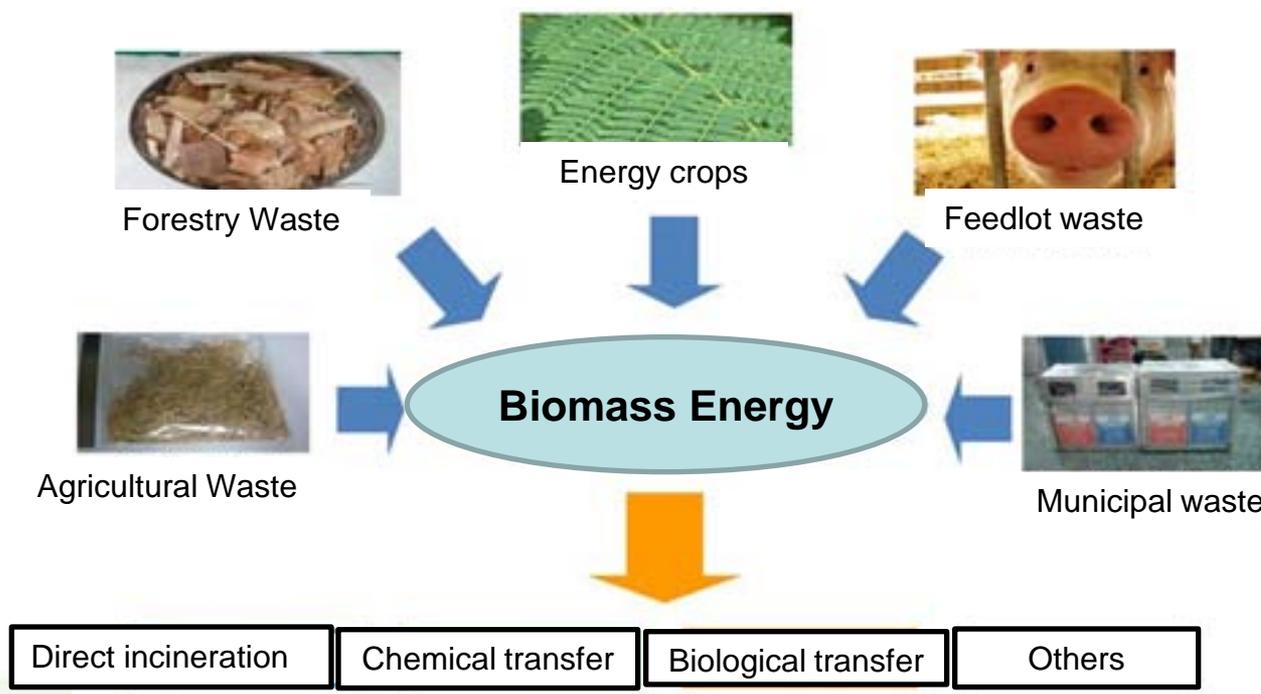
3. Reduction measures and achievements for rice farming

- The amount of waste straw was 1,745,000 tons in 2001, and the amount was 1,666,000 tons in 2012.
- **The size of rice farming** was 450,000 hectares in 1990 and dropped to 243,000 in 2010.
- Collection of international GHG estimation specifications and revision of relevant local coefficients to establish the GHG estimation, survey and monitoring system for agricultural sector
- Encouraging the use of farming machines and equipment powered by **clean energy**, such as **solar or wind power**, for better energy conservation and CO₂ reduction through agriculture loan policies



IV. Future Developments

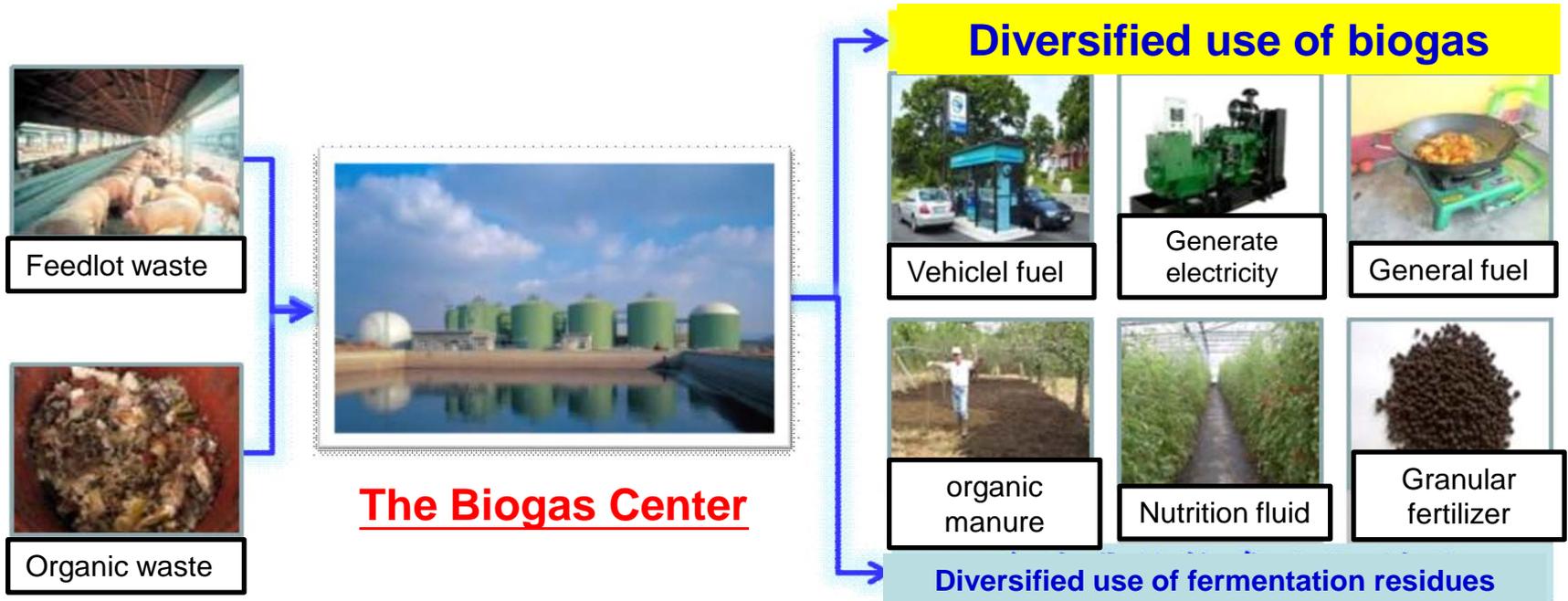
- In July 8, 2012 the Ministry of Economic Affairs promulgated the “**Regulations for Renewable Energy Development**” to promote the use of renewable energy, increase energy diversity, improve environmental quality, facilitate relevant industries and enable the sustainable development of the country
- “**Bio-energy**” is energy generated by directly using or processing from agricultural and forestry products, bio-gas and organic wastes produced domestically. The power generation from bio-energy in Taiwan is expected to reach 1,030MW in 2020



IV. Future Developments

1. The Biogas Center

(1) Continue to promote biogas centers in Taiwan



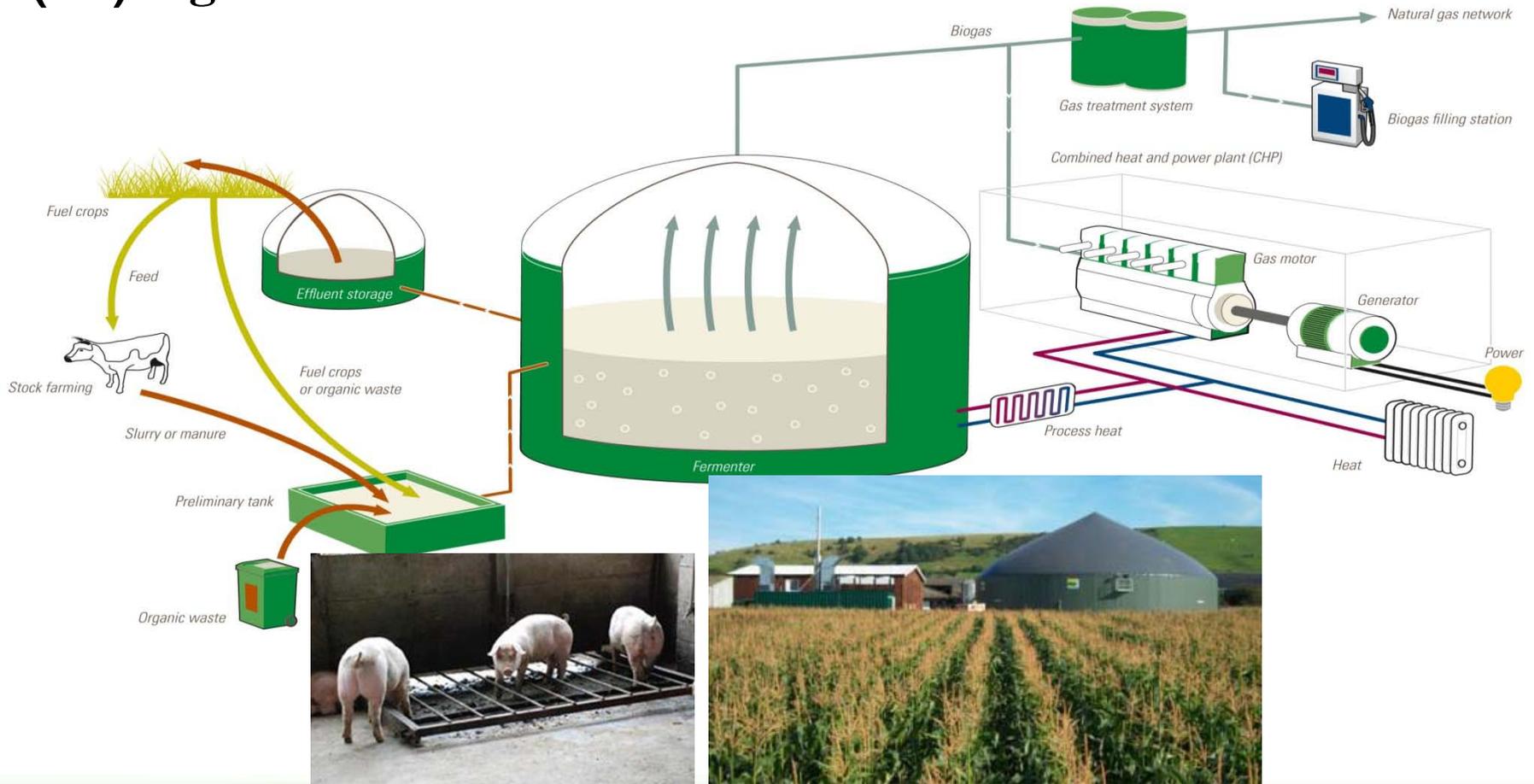
Future of animal excrement bio-gas centers

Source: EPA

IV. Future Developments

1. Anaerobic Digestion

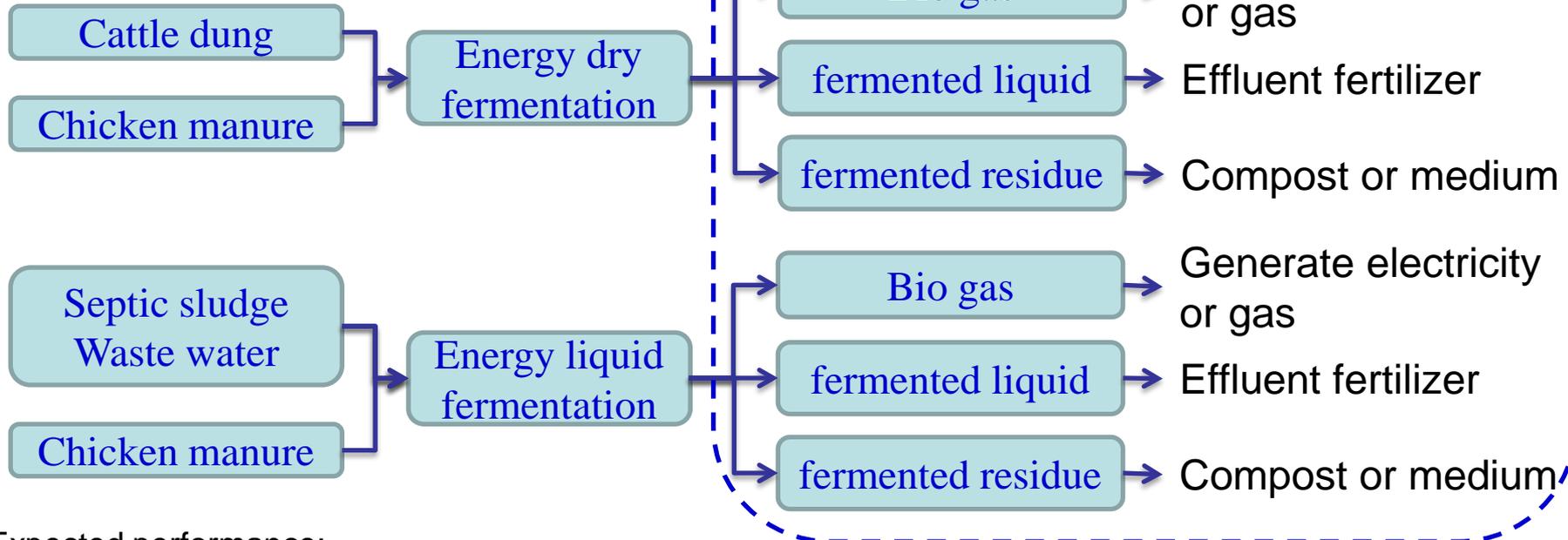
(2) Agricultural Waste Treatment in the future



Source: <http://www.tetaproject.co.uk/en/biogas.html>

IV. Future Developments

1. Anaerobic Digestion (3) Green Ranch



- Expected performance:
100% resource utilization, zero emission, GHG reduction.
Initiate to combine processing to increase production.
Increase employment opportunities.

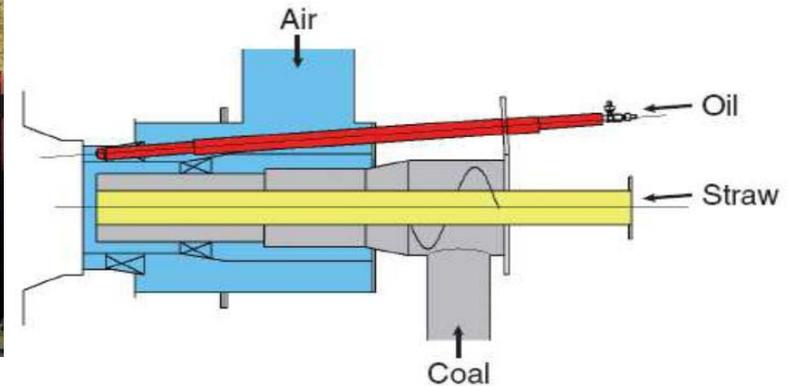
100% resource utilization

IV. Future Developments

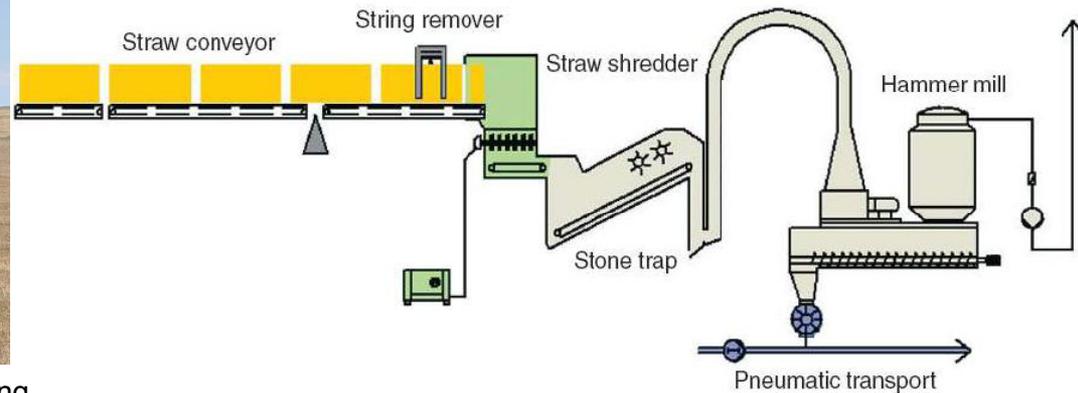
4. Pelletizing



Combined coal/straw burner



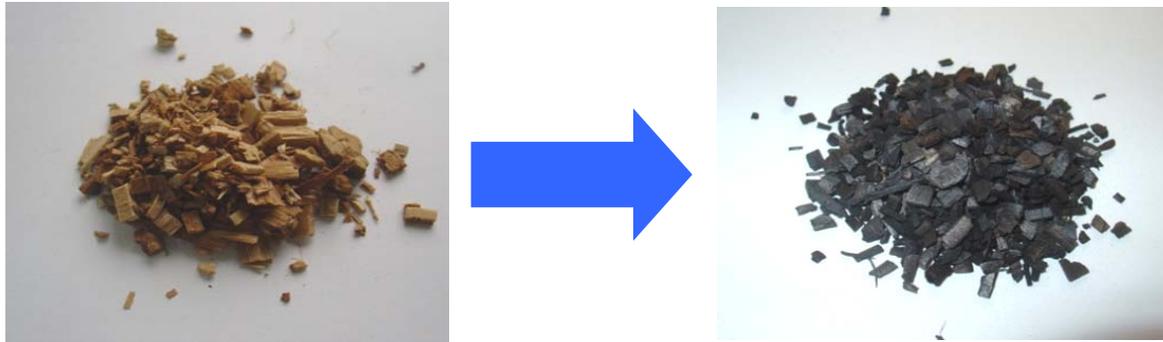
Straw handling plant



Source: 2012 Conference on Renewable Heating and Cooling.

IV. Future Developments

4. **Torrefaction** : It's processed under regular pressure and hypoxia within 200-300 °C to reduce the volume and water, etc., so heating value becomes higher to increase the effectiveness of storage and transportation.



V. Conclusion

Future Objectives:

- Continue the research of carbon reduction and recycling technologies of methane, analyze the advanced technologies around the world, and introduce new processing technologies and investment.
- Strengthen economic incentives and the Greenhouse Gas reduction strategy to benefit energy conservation and carbon reduction.
- Promote the applied technologies and create a better future for future generations by combining the efforts of government and industry.

EPAT partnership with US EPA through American Institute in Taiwan



**Information available at:
www.epa.gov/oita**





Thank You