CEMS Issues Discussed with KECO

Yue-Shih Chen, Yi-Peng Jen and Tsung-Wen Chien

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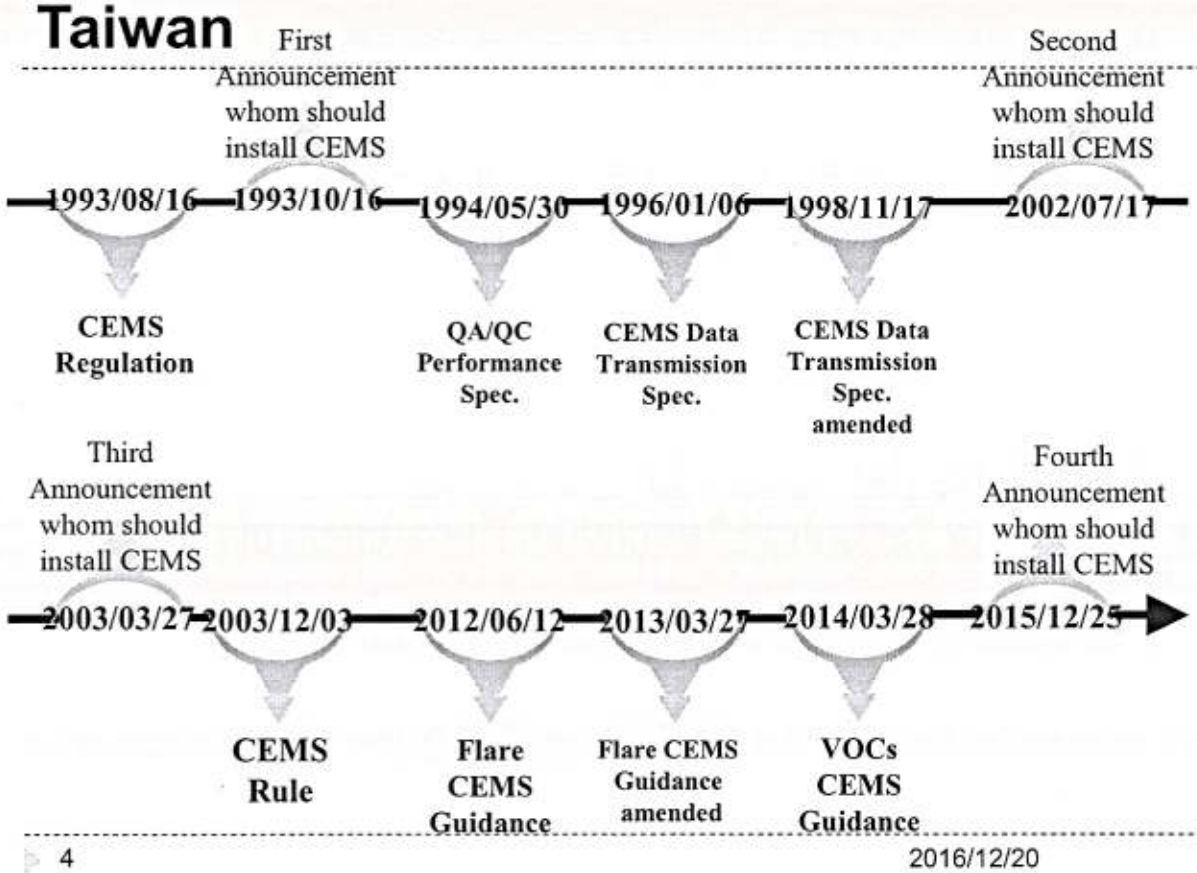
- Ms. Yue-Shih Chen (陳月詩)
  - **Environmental Technical Specialist**, Department of Air Quality Protection and Noise Control, Environmental Protection Administration, Executive Yuan, R.O.C. (Taiwan)
  - Contact person of the CEMS project
- Ms. Yi-Peng Jen (任怡芃)
  - **Associate Technical Specialist**, Department of Air Quality Protection and Noise Control, Environmental Protection Administration, Executive Yuan, R.O.C. (Taiwan)

Chronology of CEMS management in Taiwan

- 1993: CEMS regulation promulgated
- 1994: Performance Specification of QA/QC
- 2001: CEMS data online reporting
- 2003: CEMS regulation amendment
- 2016: CEMS regulation amending

Chronology of CEMS management in Taiwan



- 1993: First Announcement whom should install CEMS
- 2002: Second Announcement whom should install CEMS
- 2003: Third Announcement whom should install CEMS
- 2002: Air Pollution Control and Emissions Standards for the Semiconductor Industry (NMHC & Flow CEMS)
- 2006: Optoelectronic Material and Element Manufacturing Industry Air Pollution Control and Emission Standards (NMHC & Flow CEMS)
- 2007: Adhesive Tape Manufacturing Industry Air Pollution Control and Emission Standards (NMHC & Flow CEMS)
- 2011: Volatile Organic Compounds Pollution Control and Emissions Standards for the Stationary Pollution Source (Flare CEMS: NMHC, HRVOCs, Flow)
- 2015: Fourth Announcement whom should install CEMS
- 2016: CEMS data open to the public

- There are 324 installed CEMS required by 1st ~ 3rd announcements in Taiwan Now
  - There are 13 of CEMS for 4th announcement whom should install CEMS. They have to be installed and certified before 2017/12/24
- There are 144 installed Flare CEMS
- There are 134 installed NMHC & Flow CEMS in Optoelectronic Material and Element Manufacturing Industry
- The CEMS data are reporting **to local authorities (EPB)** real-time, daily and monthly.

Monitoring Items (1/3)

Announcement	Industries	Sources	Capacity	OP	SO_2	TRS	NO_X	HCl	CO	O_2	Flow & T
1	All industries	Solid Fuel-fired or oil-fired units (boilers, non-traffic gas turbines, non-traffic engines)	For same exit stack, Gross heat input rate ≥ 10^8 Kcal/Hr in the operation permit	√	√		√			√	√
1		Gas-fired units (boilers, non-traffic gas turbines, non-traffic engines)	For same exit stack, Gross steam generation rate ≥ 130 T/Hr in the operation permit				√			√	√
1	Cement manufacturing industry	Rotary kiln calciner and mills		√			√			√	√
1		Clinker coolers		√							
1	Iron and steel smelting industry	Electric arc furnace		√							
2	All industries	Municipal and general industrial waste incinerators	Design Capacity ≥ 10 T/Hr in the operation permit	√			√	√	√	√	√

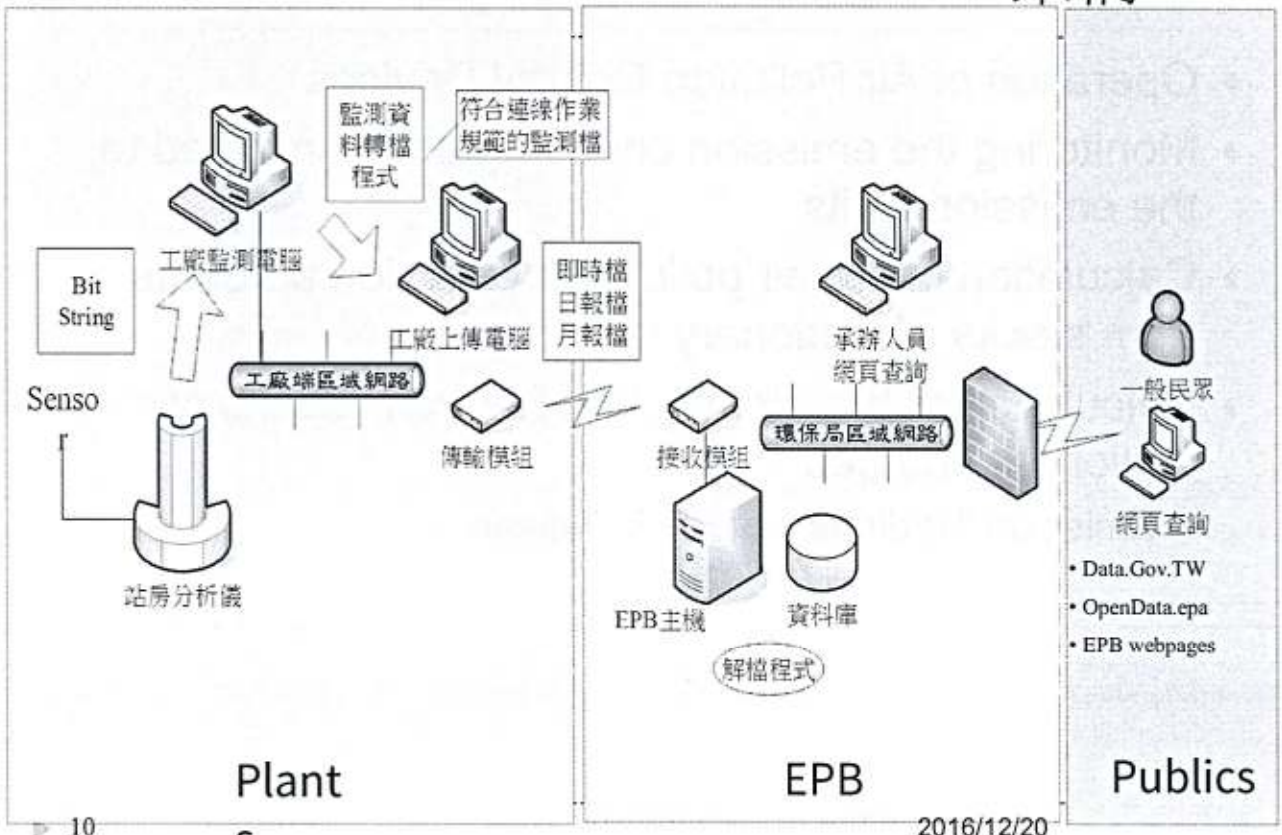
Monitoring Items (2/3)

Announcement	Industries	Sources	Capacity	OP	SO_2	TRS	NO_X	HCl	CO	O_2	Flow & T
3	All industries	Solid Fuel-fired or oil-fired units (boilers, non-traffic gas turbines, non-traffic engines)	For same exit stack, Gross heat input rate is equal to or greater than 6.15×10^7 Kcal/Hr, but less than 10^8 Kcal/Hr in the operation permit	√	√		√			√	√
3		Gas-fired units (boilers, non-traffic gas turbines, non-traffic engines)	For same exit stack, Gross stean generation rate is equal to or greater than 80 T/Hr, but less than 130 T/Hr in the operation permit				√			√	√
3	Petroleum refining and petrochemical manufacturing	Solid Fuel-fired or oil-fired reheating furnaces and cracking furnaces	For same exit stack, Gross heat input rate ≥6.15×10^7 Kcal/Hr in the operation permit	√			√			√	√
3		Gas-fired reheating furnaces and cracking furnacess, Gas fuel mixing ratio is equal to or greater than 60% of total fuels	For same exit stack, Gross heat input rate ≥ 10^8 Kcal/Hr in the operation permit				√			√	√

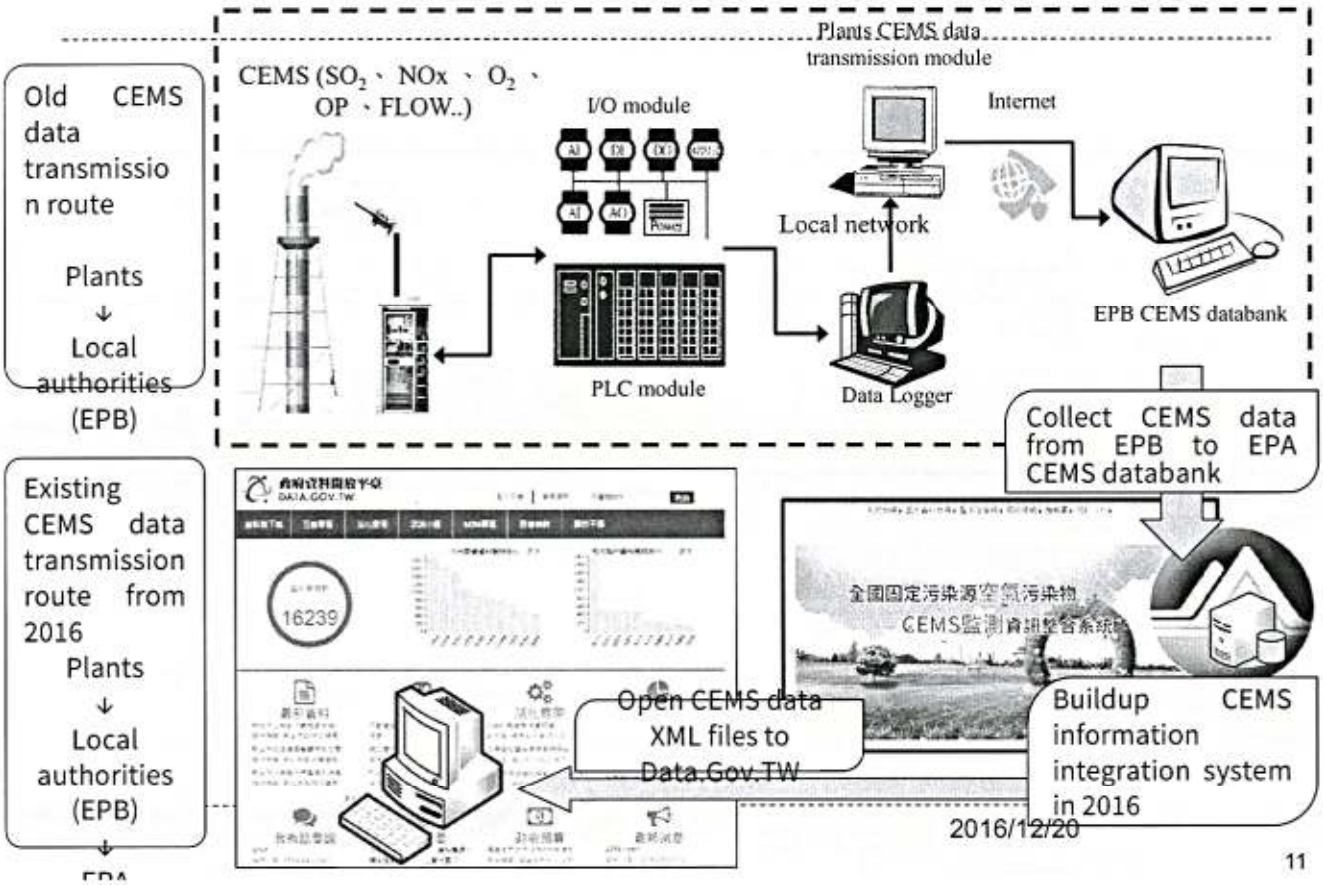
Monitoring Items (3/3)

Announcement	Industries	Sources	Capacity	OP	SO_2	TRS	NO_X	HCl	CO	O_2	Flow & T
3	Iron and steel smelting industry	Coke ovens	All	√	√		√			√	√
3		Sintering furnaces	All	√	√		√			√	√
4	Pulp manufacturing	Recovery boilers	All	√		√				√	√
4		Lime kilns	All			√				√	√
4	All industries	Municipal and general industrial waste incinerators	Design Capacity is equal to or greater than 4 T/Hr, but less than 10 T/Hr in the operation permit	√	√		√	√	√	√	√

CEMS Data Transmission Route架構



建置全國CEMS資訊整合系統



Purpose and Usage of CEMS in Taiwan

- Operation of Air Pollution Control Devices
- Monitoring the emission concentration compared to the emission limits
- Calculation of the air pollutants emission amounts from stacks of stationary sources
- Calculation of the air pollution fee from stacks of stationary sources
  - Emission Trading? Not yet in Taiwan

SO_2 emission from flue gases in Taiwan

	M_{total} (tonne/a)	M_{EF} (tonne/a)	$M_{testing}$ (tonne/a)	M_{CEMS} (tonne/a)
2007	122,326.05	5,960.43	30410.02	**85927.65**
2008	109,909.62	5,374.47	26783.19	**77736.3**
2009	101,111.86	5,947.9	29922.04	**65194.62**
2010	114,860.73	14,879.35	30381.79	**69599.56**
2011	110,825.95	6,971.51	30845.96	**73008.41**
2015	86,830	4,677	18,356.3	**63,706.5**

	M_{EF}/M_{total} (%)	$M_{testing}/M_{total}$ (%)	M_{CEMS}/M_{total} (%)
2007	4.87%	24.86%	**70.24%**
2008	4.89%	24.37%	**70.73%**
2009	5.88%	29.59%	**64.48%**
2010	12.95%	26.45%	**60.59%**
2011	6.29%	27.83%	**65.88%**
2015	5.49%	21.14%	**73.37%**

Number of SO_2 CEMS Stacks: 242 (2.17%), Total number of stacks: 11,163 in 2015

NO_X emission from flue gases in Taiwan

	M_{total} (tonne/a)	M_{EF} (tonne/a)	$M_{testing}$ (tonne/a)	M_{CEMS} (tonne/a)
2007	186,669.6	14,626.08	35135.6	136878.61
2008	177,685.74	16,705.23	35495.44	125474.21
2009	169,783.16	15,076.17	37264.12	117401.72
2010	192,914.16	27,294.32	40318.32	125301.43
2011	200,770.88	22,387.36	51096.06	127286.73
2015	157,110	8,112.1	33,461.5	115,536.6

	M_{EF}/M_{total} (%)	$M_{testing}/M_{total}$ (%)	M_{CEMS}/M_{total} (%)
2007	7.84%	18.82%	73.33%
2008	9.40%	19.98%	70.62%
2009	8.88%	21.95%	69.15%
2010	14.15%	20.90%	64.95%
2011	11.15%	25.45%	63.40%
2015	5.16%	21.30%	73.54%

Number of NO_X CEMS Stacks: 288 (1.98%), Total number of stacks: 14,505 in 2015