

글로벌 탄소감축을 위한 시장매커니즘 구축

Enhancing Market Mechanisms for Global Climate Change Mitigation

2013 개도국 온실가스 감축분석모형 국제포럼



2013 International Modeling Conference

2013년 7월 12일 (금) | 그랜드 힐튼 서울

July 12, 2013 | Grand Hilton Seoul

글로벌 탄소감축을 위한 시장매커니즘 구축
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2013 International Modeling Conference

WELCOMEING NOTE

From the President of Greenhouse Gas Inventory & Research Center of Korea

Immediately following its inauguration in June 2010, the Greenhouse Gas Inventory & Research Center of Korea (GIR) launched its international GHG mitigation analysis conference series (IMC), gathering experts from around the world to discuss the modeling efforts of both developed and developing countries. The purpose of IMC is to focus on developing countries' opportunities to adopt green growth and sustainable development patterns. We are focusing on technical issues, methodologies and approaches, including low carbon technologies, and energy efficiency solutions for different sectors responsible for GHG emissions.

This year's IMC will be held for the fourth time, with the theme of Enhancing Market Mechanisms for Global Climate Change Mitigation. The conference will consist of three sessions, and aims to take both a structural and practical approach to the broad topic of climate change mitigation. The first two sessions will focus on global market mechanisms and ETS design. Our expert speakers from UK, Japan, Australia, China and Korea will cover important issues relevant to the conference theme: carbon markets, Clean Development Mechanism, carbon pricing mechanisms and ETS. After touching upon the European carbon market perspective and CDM in the first session, Australia, China and Korea, all in the planning & design stage of introducing ETS, will present their country experiences consisting of key challenges and lessons. A panel discussion will follow, during which key steps to preparing a domestic carbon market will be discussed. Our hope is that this will provide valuable implications to non-Annex I countries under similar circumstances.

Our last session will be a special C2GMF session, in which C2GMF committee members will introduce their final country case reports on GHG mitigation scenarios in the power generation sector. The components in this particular session are the highlights from the 3rd C2GMF Technical Working Group which took place in Antigua, Guatemala in March this year.

We ask for your active participation in this year's program as a joint endeavor for global cooperation in response to climate change issues. We look forward to a productive time of mutual exchange, and encourage you to take advantage of the Q&A and networking opportunities with internationally-recognized experts in the field.



Dr. Seung Jick Yoo

President of Greenhouse Gas Inventory & Research Center of Korea

인사말

2010년 6월 15일 글로벌 온실가스 감축 싱크탱크로서 출범한 온실가스 종합정보센터는 지난 3년간 국가 온실가스 감축목표 구체화, 온실가스 통계관리 체계 구축, 온실가스 목표관리제의 안정적 운영 등 온실가스 관리에서 중추적인 역할을 수행해 왔습니다.

또한, 우리나라 녹색성장의 앞선 경험을 전파하고, 개도국의 능동적인 기후 변화 대응능력 제고를 위해 **개도국 녹색성장. 온실가스 감축모형 협력포럼(C2GMF)** 및 **통계. 감축모형 교육 프로그램** 등 다양한 국제협력 사업도 추진해 왔습니다.

특히, 매년 개최되는 **온실가스.감축분석모형 국제포럼(IMC)**은 선진국과 개도국 간 온실가스 감축모형 분석방법론을 교류하고, C2GMF의 연구성과를 점검, 보완하는 논의의 장으로 자리매김 하였습니다.

금번 제 4차 포럼은 “글로벌 탄소감축을 위한 시장 매커니즘 구축”을 주제로 개최되며, 이번 회의 주제의 중요한 관련 요소인 탄소 시장, 청정 개발 매커니즘, 배출권거래제 등에 대해 각국 전문가들의 발표의 심도 있는 논의를 진행하게 될 것입니다.

대한민국이 2015년부터 야심차게 추진할 배출권거래제를 앞둔 이 시점에서, 더 나은 전 세계 탄소 감축 방안을 모색하는 논의에서 필수 고려 요소인 시장 매커니즘 및 배출권거래제에 대한 국내.외 전문가와의 경험과 지식을 공유하는 이번 논의의 장에 여러분의 많은 관심과 적극적인 참여를 부탁드립니다.



유 승 직

온실가스종합정보센터장

PROGRAM

09:00 ~ 10:00	Registration
10:00 ~ 10:10	Opening Remarks <div>▶ SPEAKER Yeon Man Jung <i>Vice Minister, Ministry of Environment</i></div>
10:10 ~ 10:15	Photo Session
10:15 ~ 10:40	Morning Keynote : Time for New Commitment and Collective Action for Sustainable Development <div>▶ SPEAKER Jong-soo Yoon <i>Former Vice Minister, Ministry of Environment</i></div>
Session 1 – Global Trends toward Market Mechanisms 시장 메커니즘을 향한 글로벌 트렌드	
10:40 ~ 11:05	EU&UK Perspective on Carbon Market <div>▶ SPEAKER Liz Bossley <i>CEO, Consilience Energy Advisory Group Ltd.</i></div>
11:05 ~ 11:30	CDM Modalities and Procedures <div>▶ SPEAKER Kazuhisa Koakutsu <i>Principal Researcher, Institute for Global Environmental Strategies</i></div>
11:30 ~ 13:00	Luncheon
Session 2 – ETS Design: Introductory Phase ETS 설계 : 도입단계에 있는 국가사례	
13:00 ~ 13:25	Carbon Pricing Mechanism - Australia’s Experience in Designing and Introducing an Emissions Trading Scheme <div>▶ SPEAKER Alexander Caroly <i>Director, Economic Impacts and Analysis, Department of Industry, Innovation, Climate Change, Science Research and Tertiary Education</i></div>
13:25 ~ 13:50	Korea ETS Design Scheme: Key Issues & Challenges <div>▶ SPEAKER Hyung-sup Lee <i>Deputy Director, ETS Taskforce, Ministry of Environment</i></div>
13:50 ~ 14:15	ETS Market Design in China <div>▶ SPEAKER Maosheng Duan <i>Professor, Tsinghua University</i></div>

14:15 ~ 15:05	Panel Discussion – Joint Session of 1 & 2 : Key Steps to Preparing a Domestic Carbon Market <div>▶ SPEAKER - Chair: Seung Jick Yoo <i>President, GIR</i> - Panelists: Liz Bossley, Kazuhisa Koakutsu, Alexander Caroly, Hyung Sup Lee, Maosheng Duan</div>
15:05 ~ 15:25	Coffee Break
Special C2GMF Session – Country Case Studies in Power Generation Sector	
15:25 ~ 15:50	• Bangladesh Case Study - Utilization of Renewable Energy for Rural Population: Experiences of Bangladesh <div>▶ SPEAKER Md. Ziaul Haque <i>Deputy Director, Department of Environment Under Ministry of Environment and Forests, Bangladesh</i></div>
15:50 ~ 16:15	• Ghana Case Study - Emissions and Scenario Projections from the Power Generation Sector of Ghana <div>▶ SPEAKER Lawrence Kotoe <i>Programme Officer, Environmental Protection Agency, Ghana</i></div>
16:15 ~ 16:40	• Vietnam Case Study - GHG Inventory Emissions Scenario and Policy Analysis in the Power Generation Sector of Vietnam <div>▶ SPEAKER Huyen Thi Thu Nguyen <i>Manager of Environmental Department, Institute of Energy, Ministry of Industry and Trade, Vietnam</i></div>
16:40 ~ 17:10	Panel Discussion : GHG Mitigation Potential of Power Generation Sector in Non-Annex I Countries <div>▶ SPEAKER - Chair: Ahmad Rafti Endut <i>Fellow, Institute of Strategic International Studies (ISIS Malaysia)</i> - Panelists: Md. Ziaul Haque, Lawrence Kotoe, Huyen Thi Thu Nguyen</div>
17:10 ~ 17:15	Closing

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Jong-soo Yoon, *Former Vice Minister, Ministry of Environment*007
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SESSION 1007

Global Trends toward Market Mechanisms 시장 메커니즘을 향한 글로벌 트렌드

EU&UK Perspective on Carbon Market007
Liz Bossley, *CEO, Consilience Energy Advisory Group Ltd.*

CDM Modalities and Procedures007
Kazuhisa Koakutsu, *Principal Researcher, Institute for Global Environmental Strategies*

SESSION 2007

ETS Design: Introductory Phase ETS 설계: 도입단계에 있는 국가사례

Carbon Pricing Mechanism :007
Australia’s Experience in Designing and Introducing an Emissions Trading Scheme
Alexander Caroly,
Director, Economic Impacts and Analysis, Department of Industry, Innovation, Climate Change, Science Research and Tertiary Education

Korea ETS Design Scheme: Key Issues & Challenges007
Hyung-sup Lee, *Deputy Director, ETS Taskforce, Ministry of Environment*
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ETS Market Design in China007
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Panel Discussion – Joint Session of 1 & 2:007
Key Steps to Preparing a Domestic Carbon Market

Chair Seung Jick Yoo, *President, GIR*
유승직, 온실가스종합정보센터 센터장

Panelists Liz Bossley / Kazuhisa Koakutsu / Alexander Caroly / Hyung Sup Lee / Maosheng Duan

SPECIAL C2GMF SESSION007

Country Case Studies in Power Generation Sector C2GMF 개도국 발전부문 온실가스 배출전망 연구

Bangladesh Case Study :007
Utilization of Renewable Energy for Rural Population: Experiences of Bangladesh
Md. Ziaul Haque,
Deputy Director, Department of Environment Under Ministry of Environment and Forests, Bangladesh

Ghana Case Study :007
Emissions and Scenario Projections from the Power Generation Sector of Ghana
Lawrence Kotoe,
Programme Officer, Environmental Protection Agency, Ghana

Vietnam Case Study :007
GHG Inventory Emissions Scenario and Policy Analysis in the Power Generation Sector of Vietnam
Huyen Thi Thu Nguyen,
Manager of Environmental Department, Institute of Energy, Ministry of Industry and Trade, Vietnam

Panel Discussion007
GHG Mitigation Potential of Power Generation Sector in Non-Annex I Countries
Chair Ahmad Rafti Endut, *Fellow, Institute of Strategic International Studies (ISIS Malaysia)*
Panelists Md Ziaul Haque / Lawrence Kotoe / Huyen Thi Thu Nguyen

OPENING REMARKS

Friday, July 12 10:00 – 10:10

Yeon Man Jung

*Vice Minister
Ministry of Environment, Republic of Korea*

OPENING

Opening Remarks



Yeon Man Jung
Vice Minister
Ministry of Environment, Republic of Korea

2013.03 – present	14th Vice-Minister of Environment
2011.08 – 2013.03	Deputy Minister, Planning & Coordination Department, MOE
2009.09 – 2011.08	Director General, Nature Conservation Bureau, MOE
2008.03 – 2009.09	Director General, Resource Recirculation Bureau, MOE
2007.08 – 2008.03	Director General, Geum River Basin Environmental Office
2006.11 – 2007.08	Director General, Public Relations Bureau, MOE
2005.08 – 2006.08	Training abroad, University of Delaware, United States
2004.02 – 2005.08	Director General, Water Quality Conservation Bureau, MOE
2002.12 – 2004.02	Presidential Commission on Sustainable Development
2001.10 – 2002.12	Director, General Service Division, MOE
2001.04 – 2001.10	Director, Water Quality Policy Division, MOE
2000.06 – 2001.04	Director, Environmental Impact Assessment Division, MOE
1996.09 – 2000.06	Director, Climate & Air Quality Management Division, MOE
1995.07 – 1996.09	Dispatched to Prime Minister's Office
1994.02 – 1995.07	Deputy Director, Water Quality Policy Division
1983.03 – 1994.02	Deputy Director, MOE / Board of National Unification (passed 26th Civil Service Examination)

MORNING KEYNOTE

Friday, July 12 10:15 – 10:40

**Time for New Commitment and
Collective Action for Sustainable Development**

Jong-soo Yoon

*Former Vice Minister
Ministry of Environment, Republic of Korea*

MORNING KEYNOTE

Time for New Commitment and Collective
Action for Sustainable Development



Jong-soo Yoon

*Former Vice Minister
Ministry of Environment, Republic of Korea*

2011.07 – 2013.03	Vice Minister, Ministry of Environment, MOE
2010.04 – 2011.07	Deputy Minister, Environmental Policy Department, MOE
2008.03 – 2010.04	Director General, Climate & Air Quality Management Bureau, MOE
2007.01 – 2008.03	Director General, Water Supply & Sewerage Policy Bureau, MOE
2006.02 – 2007.01	Senior Executive Program at Central Officials Training Institute
2004.07 – 2006.02	Director General, Resource Recirculation Bureau, MOE
2003.06 – 2004.07	Officer of Spokesperson, MOE
2001.09 – 2003.06	Director, Global Environment Division, Waste Recirculation Policy Division, Planning and Budget Office, MOE
1998.08 – 2001.09	Counselor at the Permanent Mission of the Republic of Korea to the UN
1996.12 – 1998.08	Senior Secretary to the Minister, Director of Waste Recycling Division, MOE
1994.12 – 1996.12	Internship at California Environmental Protection Agency and Dep. of Ecology, State of Washington
1993.08 – 1994.12	Director, Legal Affairs Office, MOE
1984 – 1987	Discharged from Air Force (First Lieutenant)

SESSION 1&2

Friday, July 12 14:15 – 15:05*

Key Steps to Preparing a Domestic Carbon Market

* Panel Discussion to take Place after the end of Session 2

Chair

Seung Jick Yoo

President

Greenhouse Gas Inventory & Research Center, Republic of Korea

PANEL DISCUSSION. Joint Session of 1 & 2

Key Steps to Preparing a Domestic Carbon Market



Seung Jick Yoo / Chair

President
Greenhouse Gas Inventory & Research Center, Republic of Korea

2010.09 – Present	President, Greenhouse Gas Information & Research Center of Korea (GIR) Ministry of Environment, South Korea
2000.05 – Present	Member of Korean Government Delegation to UNFCCC
2007.02 – 2010.09	Senior Research Fellow, Division of Climate Change and Conservation Korea Energy Economics Institute
2006.02 – 2007.02	Visiting Scholar, Australian National University
2005.10 – 2006.06	Chief Advisor, Presidential Committee on Northeast Asian Cooperative Initiative
2004.10 – 2005.10	Managing Director, Center for Energy Research, Northeast Asia, Korea Energy Economics Institute
2004.10 – 2005.10	Director, Center for Energy Research, Northeast Asia,
1996.01 – 1999.02	Research Economist, Department of Agricultural and Resource Economics University of California, Berkeley

SESSION 1

Global Trends toward Market Mechanisms

Friday, July 12 10:40 – 11:30

1-1 EU&UK Perspective on Carbon Market

Liz Bossley, *CEO*
Consilience Energy Advisory Group Ltd, UK

1-2 CDM Modalities and Procedures

Kazuhisa Koakutsu, *Principal Researcher & Leader*
Climate and Energy Area, Institute for Global Environmental Strategies, Japan

Session 1

Global Trends toward Market Mechanisms

1-1 EU&UK Perspective on Carbon Market
Liz Bossley, *CEO*
Consilience Energy Advisory Group Ltd, UK

SESSION 1. Global Trends toward Market Mechanisms

EU&UK Perspective on Carbon Market



Liz Bossley

CEO

Consilience Energy Advisory Group Ltd, UK

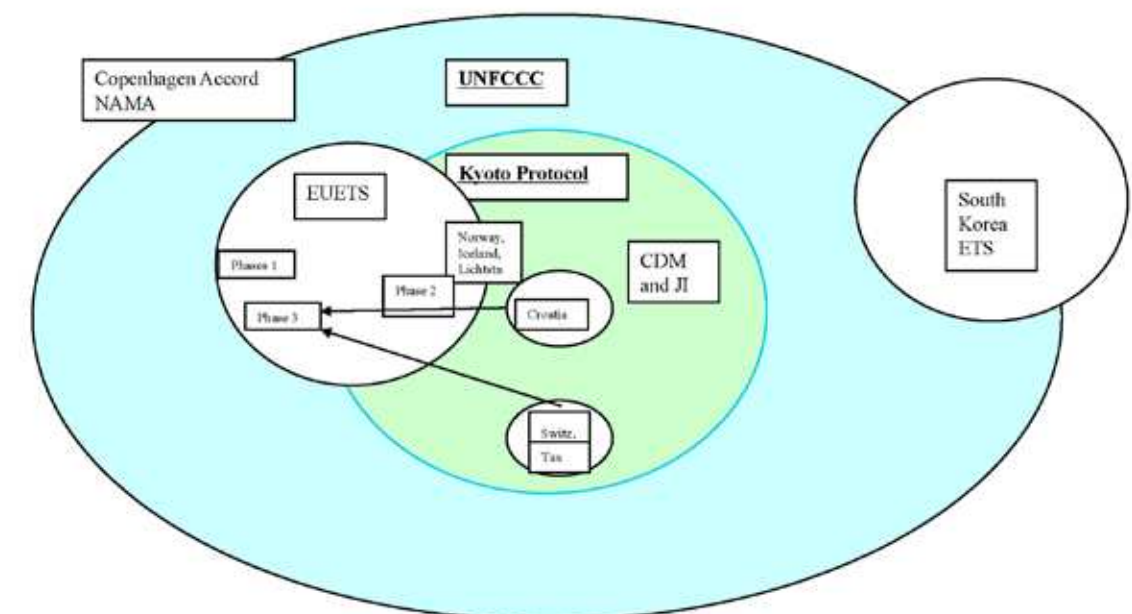
Liz Bossley has a 35 year career in international energy markets, spanning trading, risk management, marketing and extensive experience of contract negotiations. Liz is the CEO of the Consilience Energy Advisory Group Ltd, which she established in 1999. Consilience includes in its client list major and independent oil companies, utilities, shipping and pipeline transportation entities, regulatory authorities, taxation authorities, trade associations and futures exchanges. In addition to providing business advisory services, she has acted as an expert witness in a wide range of trading disputes. She is the principal author of "The Hole in the Barrel", "Trading Natural Gas in the UK", "Bossley's Guide to Energy Conversions", "BFO: The Future Market", "Project Finance Using the Forward Oil Curve", "Climate Change and Emissions Trading: What Every Business Needs to Know", "Emissions Trading and the City of London" and a new book published in May 2013 "Trading Crude Oil: the Consilience Guide." She was the joint author of a report to the G20 in October 2011 on oil price reporting agencies, on behalf of OPEC, the IEA, the IEF and IOSCO. She has acted as an adviser to both the UK HMRC and the Norwegian Norm Price Board on tax reference pricing issues. She has been a member of the UK Treasury's Carbon Market Expert Group, was a founding Director Carbon Markets and Investors Association and is a member of the Advisory Board of the Australian Climate Alliance.

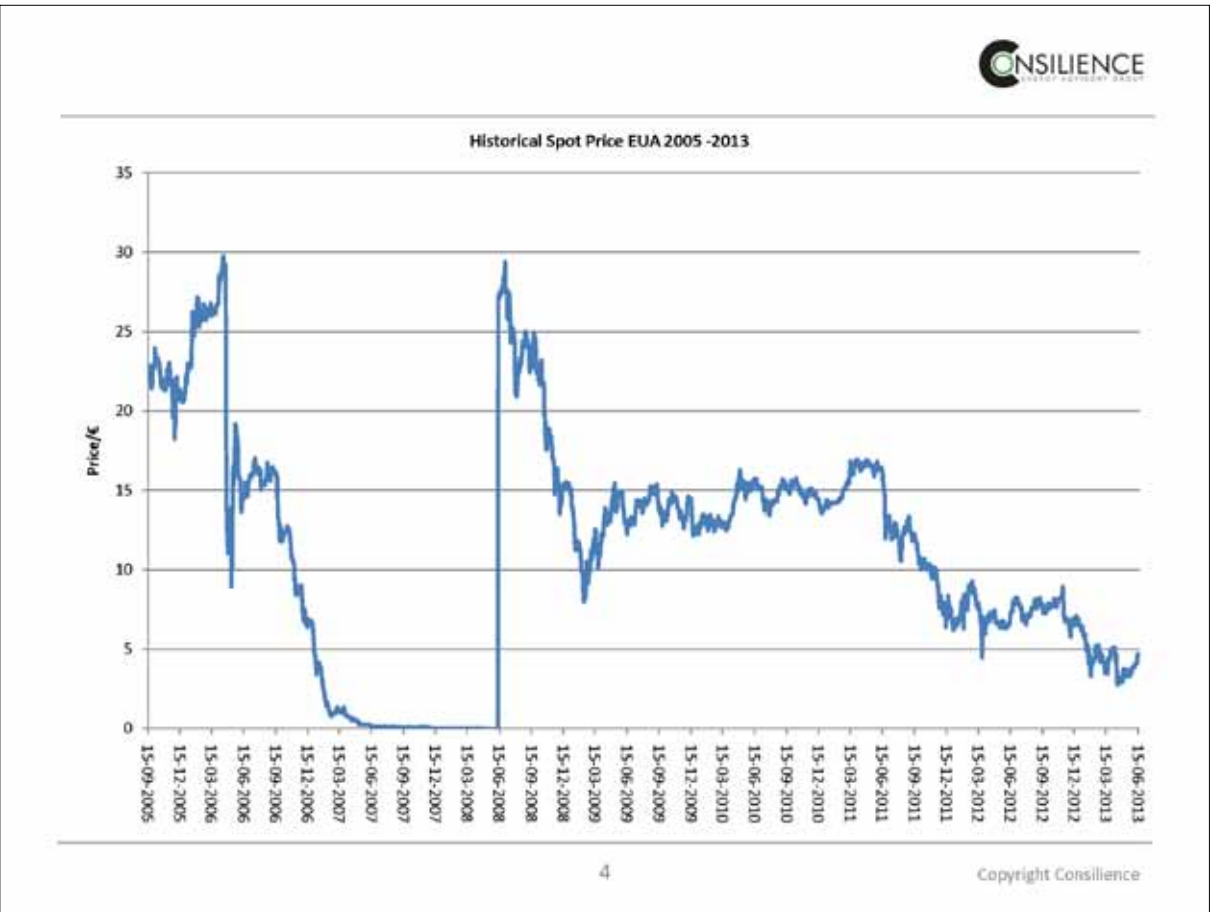
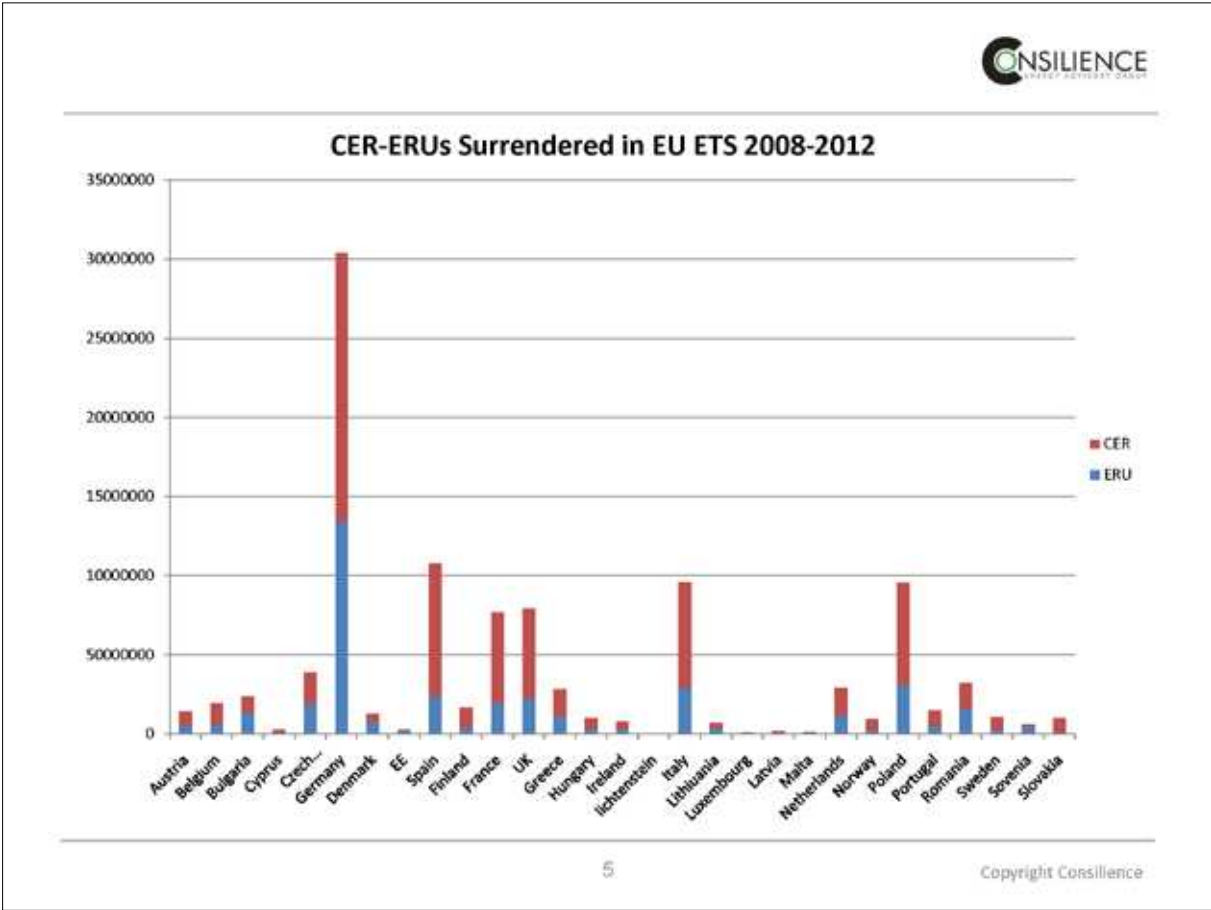
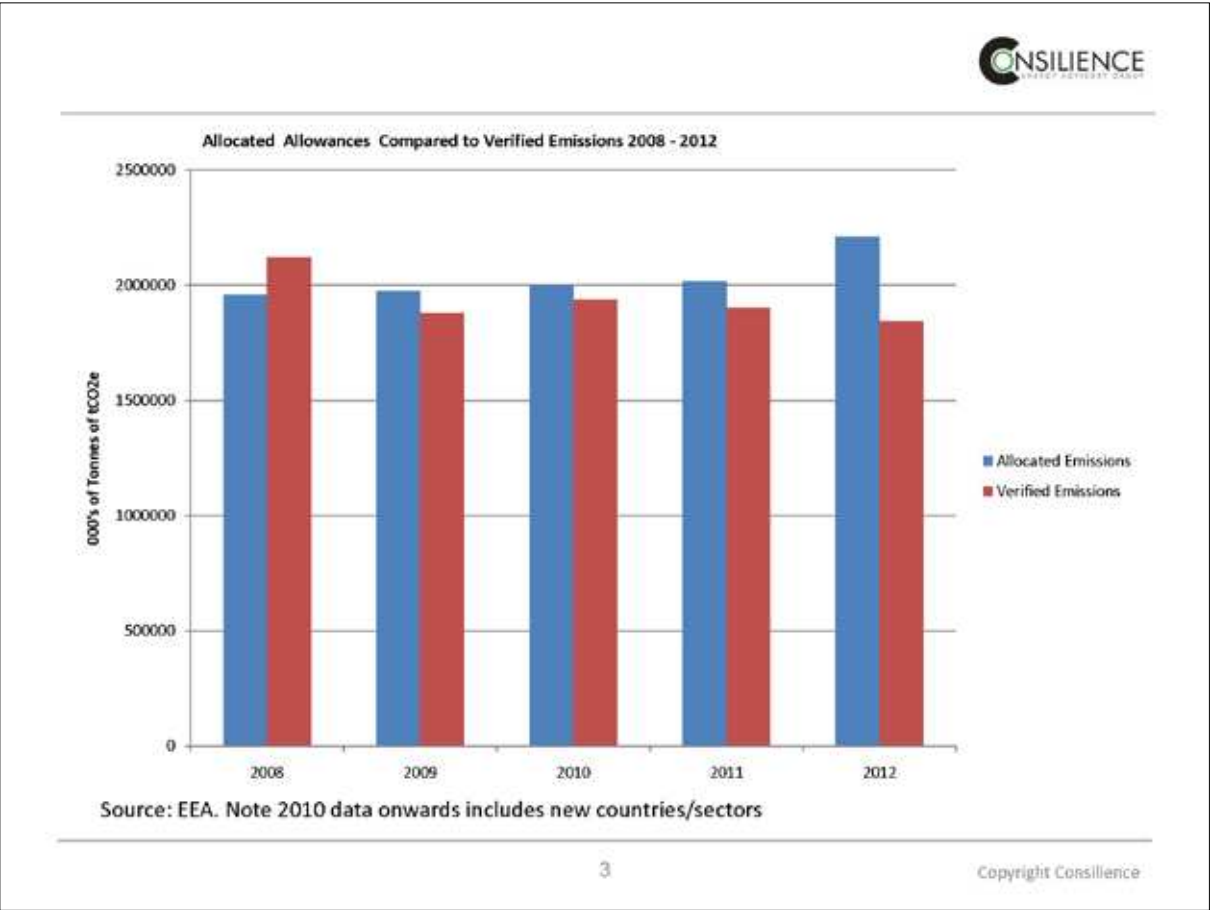
EU and UK Perspective on the Carbon Market

Liz Bossley
12th July 2013

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Where the EU ETS fits





Issues that Have Arisen

- VAT fraud- carousels
- Phishing attacks
- Recycled CERs
- General oversupply



Carbon Floor Price

- UK has set a carbon floor price to ensure that the price paid for carbon by electricity producers in the UK is around £15.70/tonne CO2e in 2013 rising in a straight line to £30/tonne CO2e in 2020 and £70/tonne CO2e in 2030.
- The floor price is levied at the point of sale of fossil fuels, and will be collected by fossil fuel suppliers.
- Government does not hypothecate taxes.



Liz Bossley, Consilience Energy Advisory Group Ltd,

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Fax + 44 (0) 20 7401 3838
Mobile + 44 (0) 7901 555556
Email lizbossley@ceag.org

Session 1

Global Trends toward Market Mechanisms

- 1-2 CDM Modalities and Procedures
- Kazuhisa Koakutsu, *Principal Researcher & Leader*
Climate and Energy Area, Institute for Global Environmental Strategies, Japan

SESSION 1. Global Trends toward Market Mechanisms

CDM Modalities and Procedures



Kazuhisa Koakutsu

Principal Researcher & Leader

Climate and Energy Area, Institute for Global Environmental Strategies, Japan

Kazuhisa Koakutsu has been engaging in the research activity on international climate policy related to market mechanisms such as the clean development mechanism (CDM), emission trading scheme (ETS) and Joint Crediting Mechanism. He has been implementing the capacity building activities in Asia on CDM and new market mechanism for the last 10 years. He is the author of several textbooks and research reports on the CDM and new market mechanisms, and has been specialized on the international rules and methodologies on the CDM. Currently, he is involved in the capacity building of MRV (monitoring, reporting, and verification) for the new market mechanism and is taking part in the international negotiations under the UNFCCC.

M.S in Environmental and Energy Policy, School of Urban Affairs and Public Policy
University of Delaware, USA, in 2002

Lessons learned from the CDM and perspectives for the future mechanisms

Kazuhisa KOAKUTSU
(koakutsu@iges.or.jp)
Principal Researcher
Leader, Climate and Energy Area, IGES

IGES CDM and MRV Capacity Building

■ CDM Capacity Building (FY2003-)

- Objective: To facilitate implementation of, and to further improve the CDM
- Proposal for CDM reform
- MOU with host country government



■ New Market Mechanism (NMM) Capacity Building (FY2011-)

- Objective: To propose a NMM and to facilitate preparation for implementation of NMMs in host countries
- Support for domestic market readiness,
- Support for Joint Credit Mechanism (BOCM)

■ Joint Credit Mechanism Capacity Building (FY2011-)

- Objective: To establish institutional framework and methodologies to implement MRV for JCM with international acceptability and feasibility in each host country

Database on Market Mechanism (incl. CDM)

- IGES has been developing its database for CDM and market mechanisms
- Institutional cooperation with UNFCCC secretariat

New Market Mechanisms



Kyoto Protocol Related Information



CDM Reform Reports & Papers



CDM Country Fact Sheet



CDM/JI Project Database (Updated every month)



Grid Emission Factors data / Emission Reductions Calculation Sheet Series



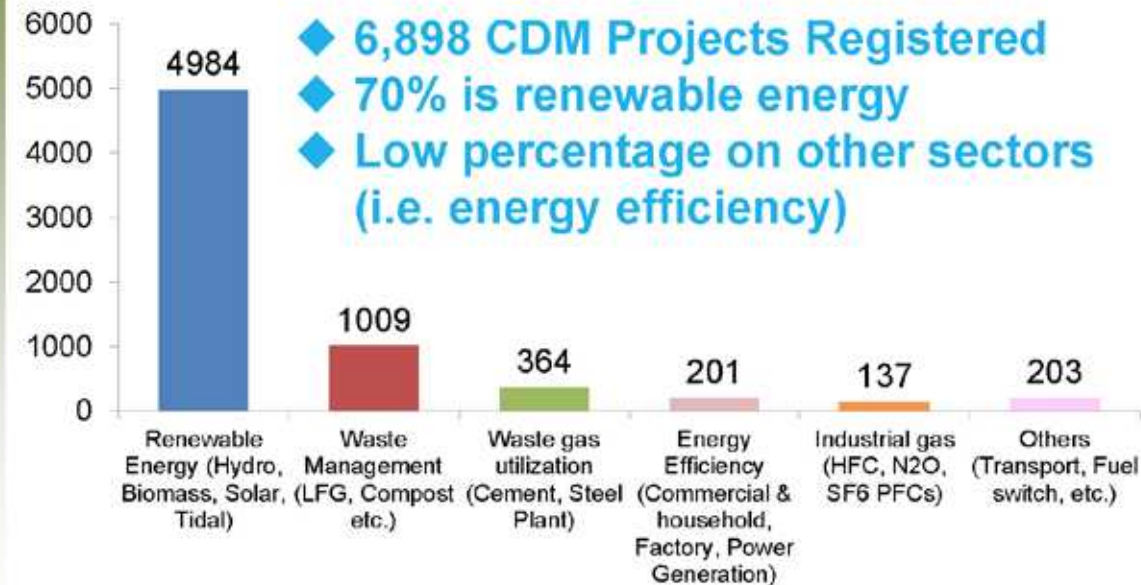
3

Illustration of CDM Project Cycle



5

CDM Project Distribution

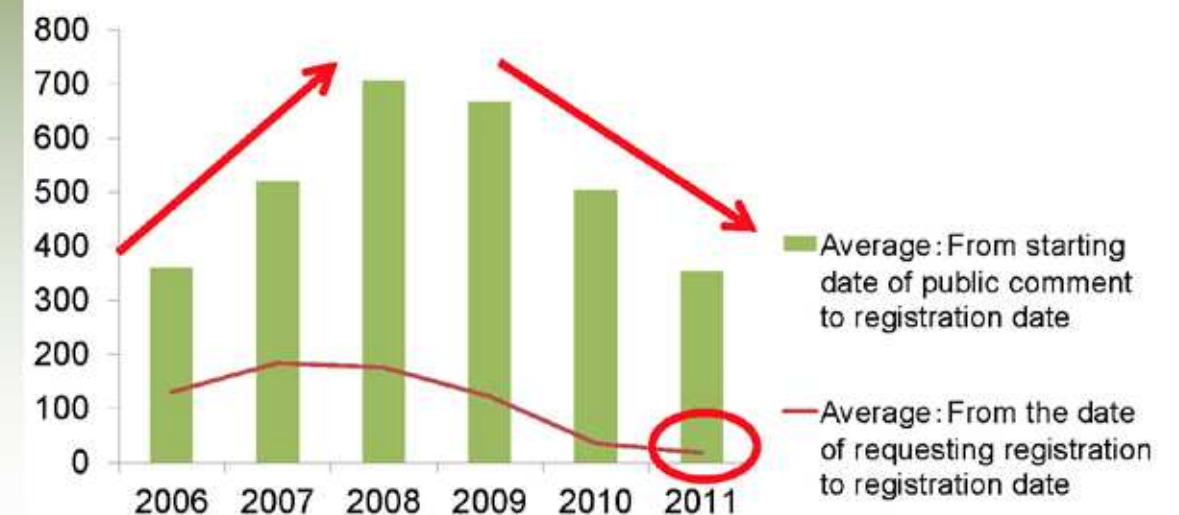


Source: IGES CDM Project Database (June 2013)

4

Improved CDM Registration Process

- ◆ It took 2 years for registration in 2008
- ◆ It is now 1 year and time lag for approval becomes almost zero.

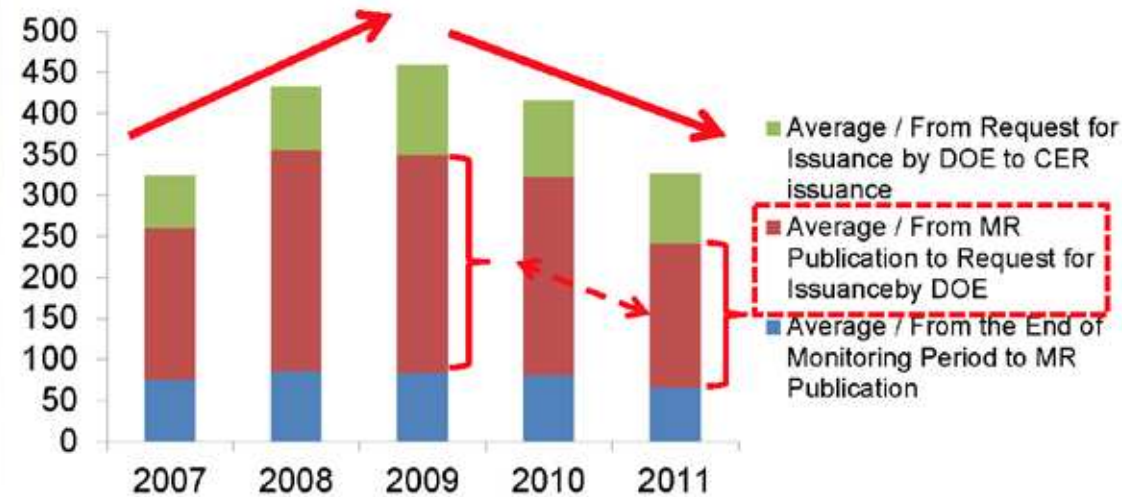


Source: IGES CDM Project Database (June 2013)

6

Improved CDM Monitoring Process

- ◆ It took 1 year for the CER issuance process
- ◆ Most of the improvement comes from administrative process.



Source: IGES CDM Monitoring Database (June 2013)

7

Definition of standardized baselines

Standardized baselines (SBs) is a baseline established for a Party or a group of Parties

Purpose

To facilitate the calculation of emission reduction and removals and/or the determination of additionality for clean development mechanism (CDM) project activities, while providing assistance for assuring environmental integrity

Expectations

- ☐ Reducing transaction cost
- ☐ Enhancing transparency, objectivity and predictability
- ☐ Facilitating access to CDM
- ☐ Scaling up the abatement of GHG emissions

Decision 3/CMP.6

9

IGES Proposal Towards CDM Reform

- Needs to reduce **“uncertainty”** from **judging** to **checking**.
 - Effective guidelines should contain specific actions with quantitative indicators.
- Needs to reduce **“manipulation”** by introducing **automation** to the process.
 - Country/Global default values (i.e. GEF, CER price)
 - Positive list for specific project types (i.e. Simplified additionality test)
 - Automatic ER calculation sheet (i.e. IGES ER Sheet)

8

Experience from Standardized Baseline

Applicability

Area: Cambodia

Sector: Rice mill sector

Output: Milled rice

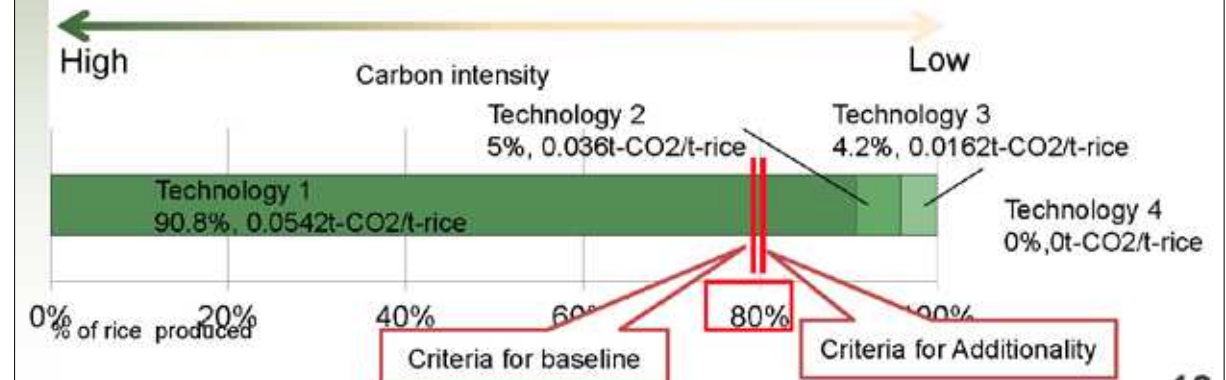
Measure: Switch of technology with or without change of energy source

Technology 1 Power-driven by a diesel engine

Technology 2 Electricity supplied from REE

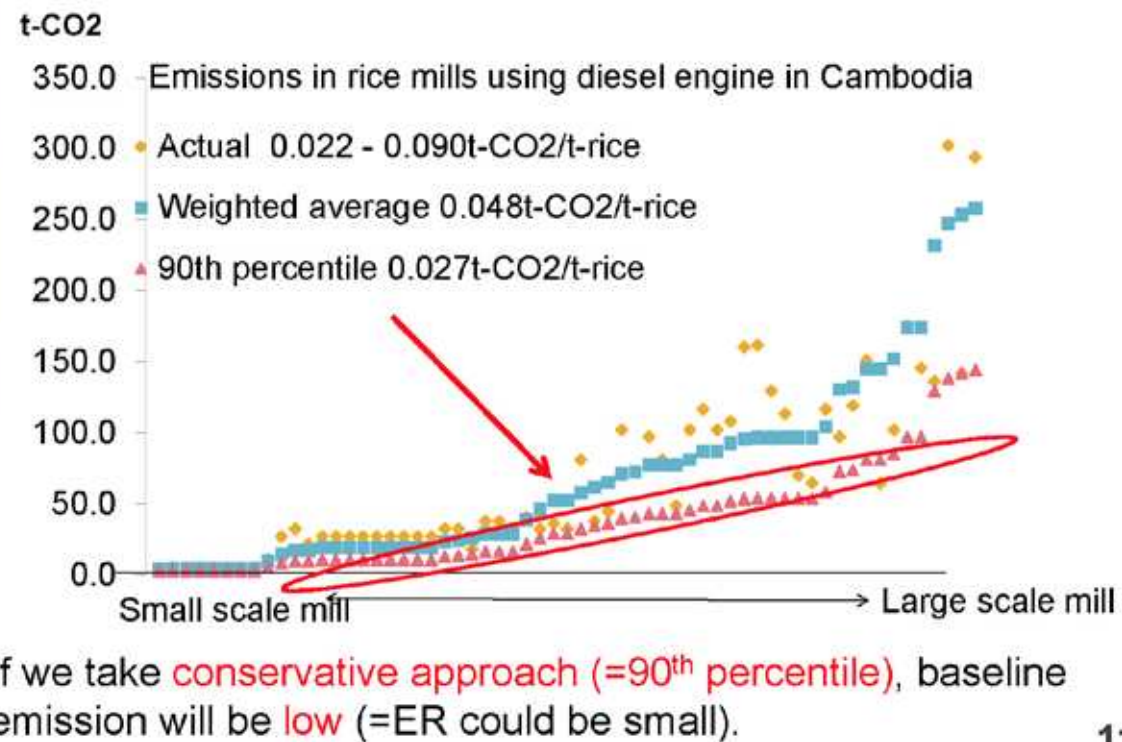
Technology 3 Power-driven by a dual mode engine and rice husk gasification

Technology 4 Electricity generated by steam turbine with combustion of rice husk



10

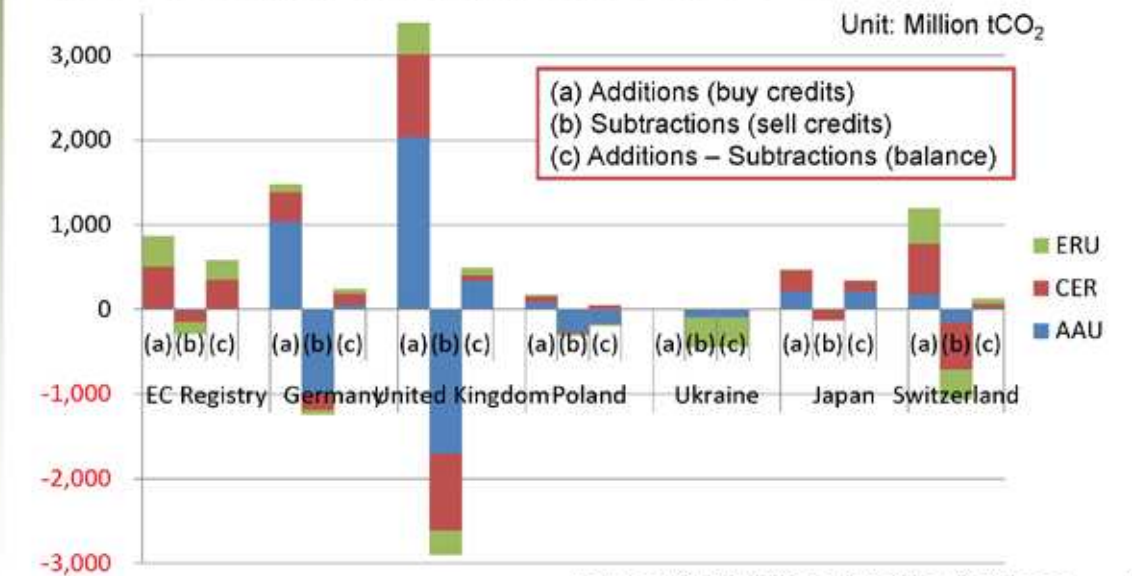
Balancing incentive will be challenge



11

UK, Germany, Switzerland, and Japan are key traders of Kyoto units

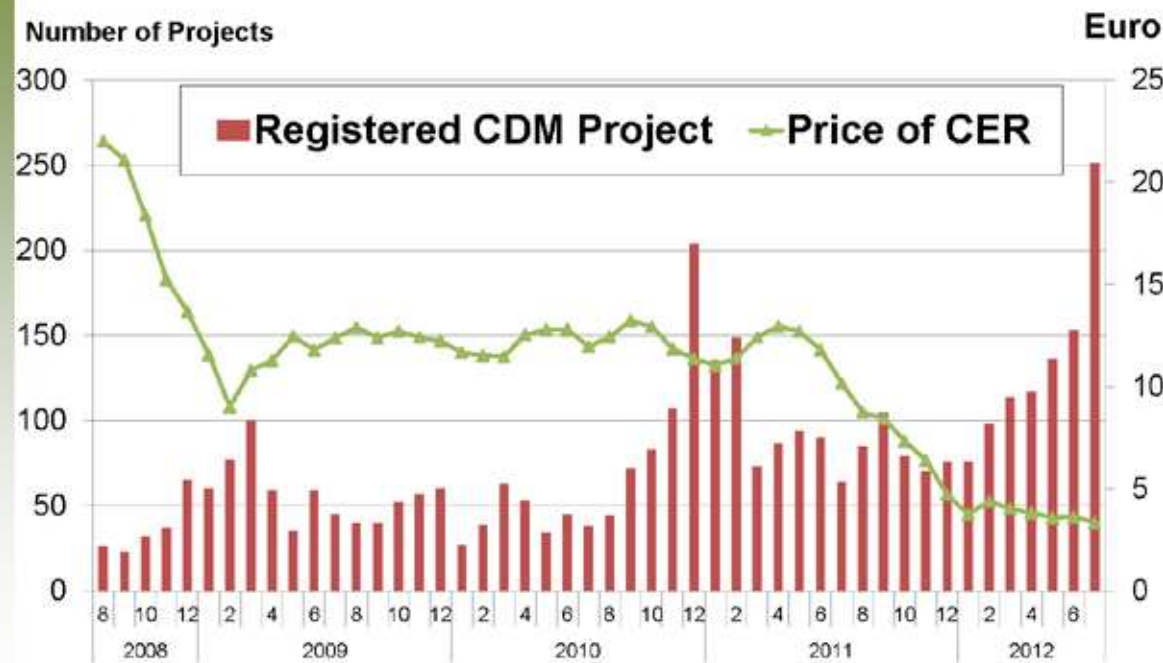
Balance of Kyoto unit transactions for 08-12



Source: IGES National Registry Database

13

Evolution of CDM and CER Price



Data: IGES CDM Project Database as of Dec. 2013

12

Most of CERs were transferred within EU, Switzerland, and Japan

Transaction of CERs for 2008-2012

Unit: 1,000 tCO₂

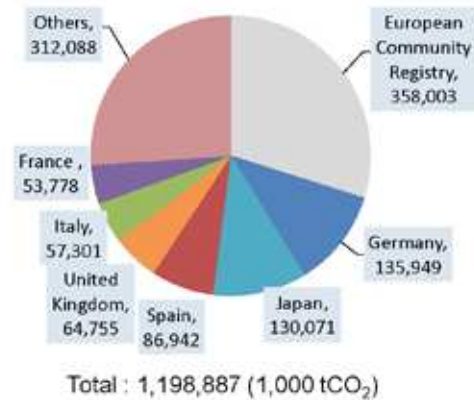
	EC registry	EU15	AU	JP	NZ	CH	Others
Addition	483,265	2,619,646	356	420,902	23,643	962,140	192,152
Subtraction	483,265	2,619,646	356	420,902	23,643	962,140	192,152
CDM Registry	1,402,045	164,242	617,061	127	179,105	5,443	415,899
EC registry	465,182	-	73,584	38	150,187	992	231,850
EU15	2,076,566	225,145	1,371,831	111	48,634	14,559	280,373
Australia	179	0	178	-	0	1	0
Japan	126,491	3,742	89,507	0	-	1,502	31,491
New Zealand	10,401	0	5,831	81	4,000	-	490
Switzerland	549,452	80,719	412,772	0	38,975	1,146	-
Others	71,787	9,417	48,881	0	0	0	2,037

Source: IGES National Registry Database

14

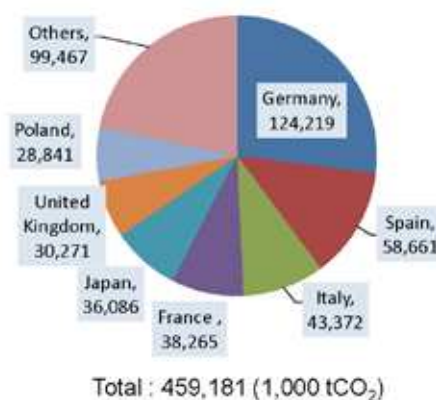
Japan and Germany as top 2 country to acquire CERs (130mil. each)

Net transacted CERs as of 2012
(1,000 t-CO₂)



Total : 1,198,887 (1,000 tCO₂)

CERs in retirement account as of 2012
(1,000 t-CO₂)



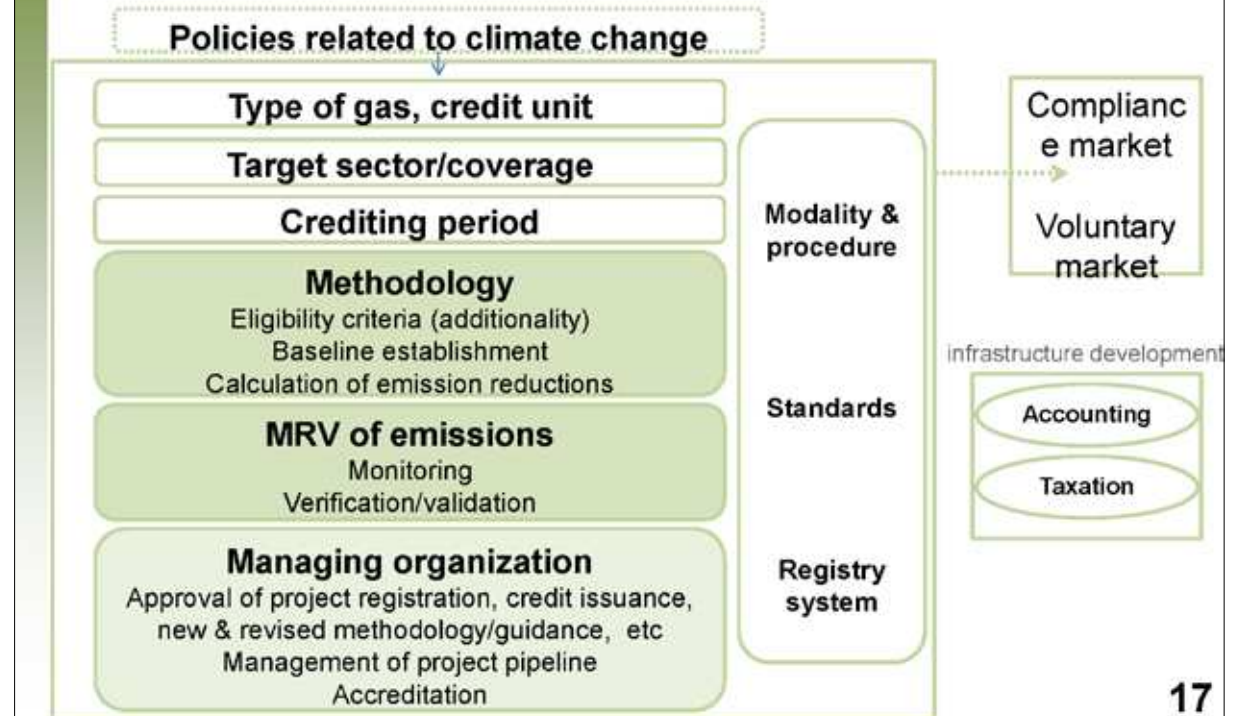
Total : 459,181 (1,000 tCO₂)

Source: IGES National Registry Database

Kyoto units, which can be used for compliance in the EU ETS can be held on ETS accounts in the Union (European Community) Registry
EU (2013) http://ec.europa.eu/clima/policies/ets/registry/faq_en.htm

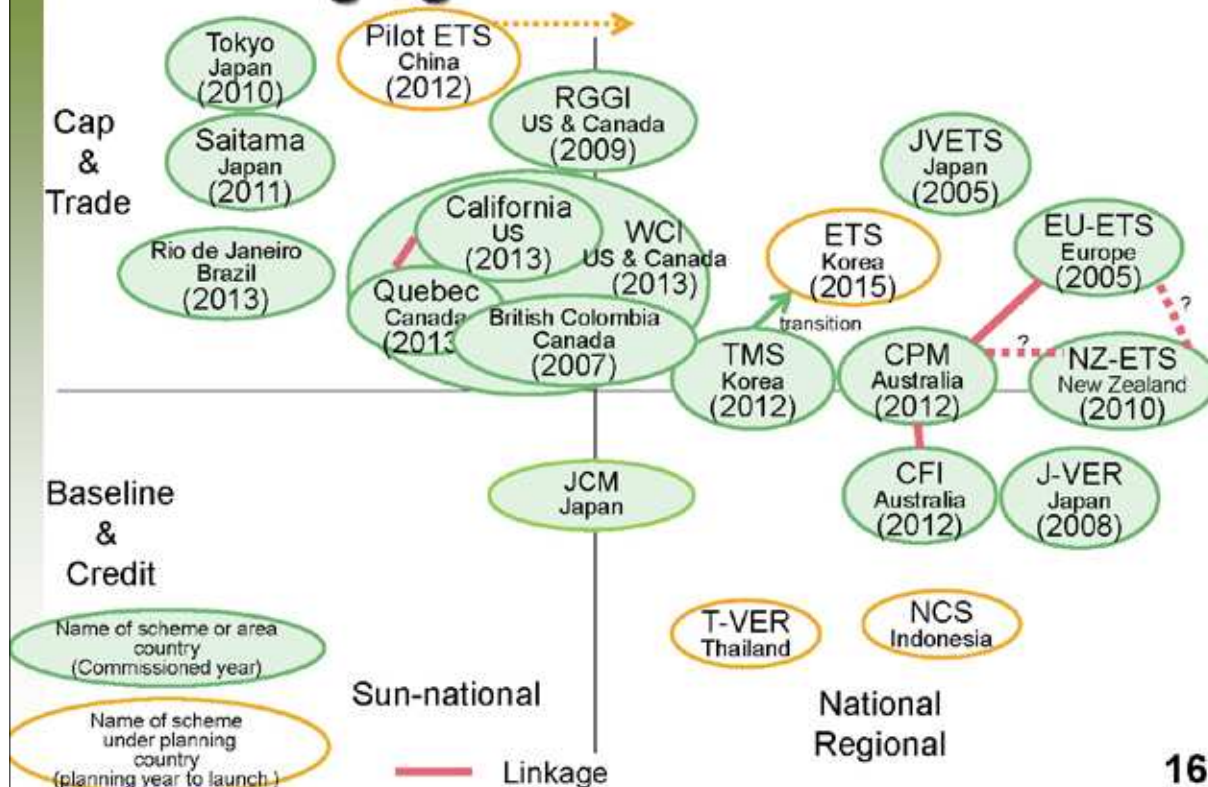
15

CDM as Standard of Mechanism



17

Emerging Market Mechanisms



16

Lessons Learned and A Way Forward

- ◆ The experience from the CDM suggest that the mechanism and its operational framework **can improve** (i.e. registration and issuance process) and reliability is the key for the market mechanism to operate effectively
- ◆ The lessons from the standardized baselines development suggest **"there is no silver bullet"** for market mechanism.
- ◆ The CDM (and Kyoto Mechanism) has proved that market mechanism would work with **predictable demand and robust accounting and registry system**.
- ◆ With the development of different market mechanisms in different region and country, the CDM will continue to be a **global standard of mechanism**.
- ◆ The role and effectiveness of the market mechanism will depend on the **overall framework and demand** for such mechanism.

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SESSION 2

ETS Design: Introductory Phase

Friday, July 12 13:00 – 14:15

2-1 Carbon Pricing Mechanism – Australia’s Experience in Designing and Introducing an Emissions Trading Scheme

Alexander Caroly, *Director*
Economic Impacts and Analysis, Climate Pricing and Markets Division
Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, Australia

2-2 Korea ETS Design Scheme: Key Issues & Challenges

Hyung-sup Lee, *Deputy Director*
ETS Taskforce, Ministry of Environment, Republic of Korea

2-3 ETS Market Design in China

Maosheng Duan, *Professor & Deputy Director*
Institute of Energy, Environment and Economy, Tsinghua University, China

Session 2

ETS Design: Introductory Phase

2-1 Carbon Pricing Mechanism – Australia’s Experience in Designing and Introducing an Emissions Trading Scheme

Alexander Caroly, *Director*
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Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, Australia

SESSION 2. ETS Design: Introductory Phase

Carbon Pricing Mechanism: Australia's Experience in Designing and Introducing an Emissions Trading Scheme



Alexander Caroly

Director

Economic Impacts and Analysis, Climate Pricing and Markets Division

Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, Australia

Alexander Caroly is the Director of Economic Impacts and Analysis in the Carbon Pricing and Markets Division in the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education. This Division is responsible for providing advice to the Australian Government on Australia's emission reduction targets and policies to meet these targets. Over the past five years, Mr. Caroly has led teams responsible for the developing the industry assistance measures under the Government's Clean Energy Future Plan (released in July 2011) and working to design and legislate the carbon pricing mechanism, which is the emissions trading scheme that has been in operation since 1 July 2012. Mr. Caroly has led teams working to develop and deliver assistance arrangements to reduce the risk of carbon leakage from emissions-intensive trade-exposed industries and to develop the energy security package under the carbon pricing mechanism. He has worked on modeling of the impact of emission trading on Australia's electricity supplies and modeling of Australia's sectoral emissions projections. Before working on climate change issues, Mr. Caroly worked in the areas of international trade and innovation policy with Australian and Japanese Government agencies. Mr. Caroly holds a Masters Degree in Japanese Business from the University of Sydney and Hosei University and a Bachelors Degree in Economics from the University of Sydney.



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Australia's Carbon Pricing Mechanism

Alexander Caroly, Director Economic Impacts and Analysis
Carbon Pricing and Markets Division
12 July 2013



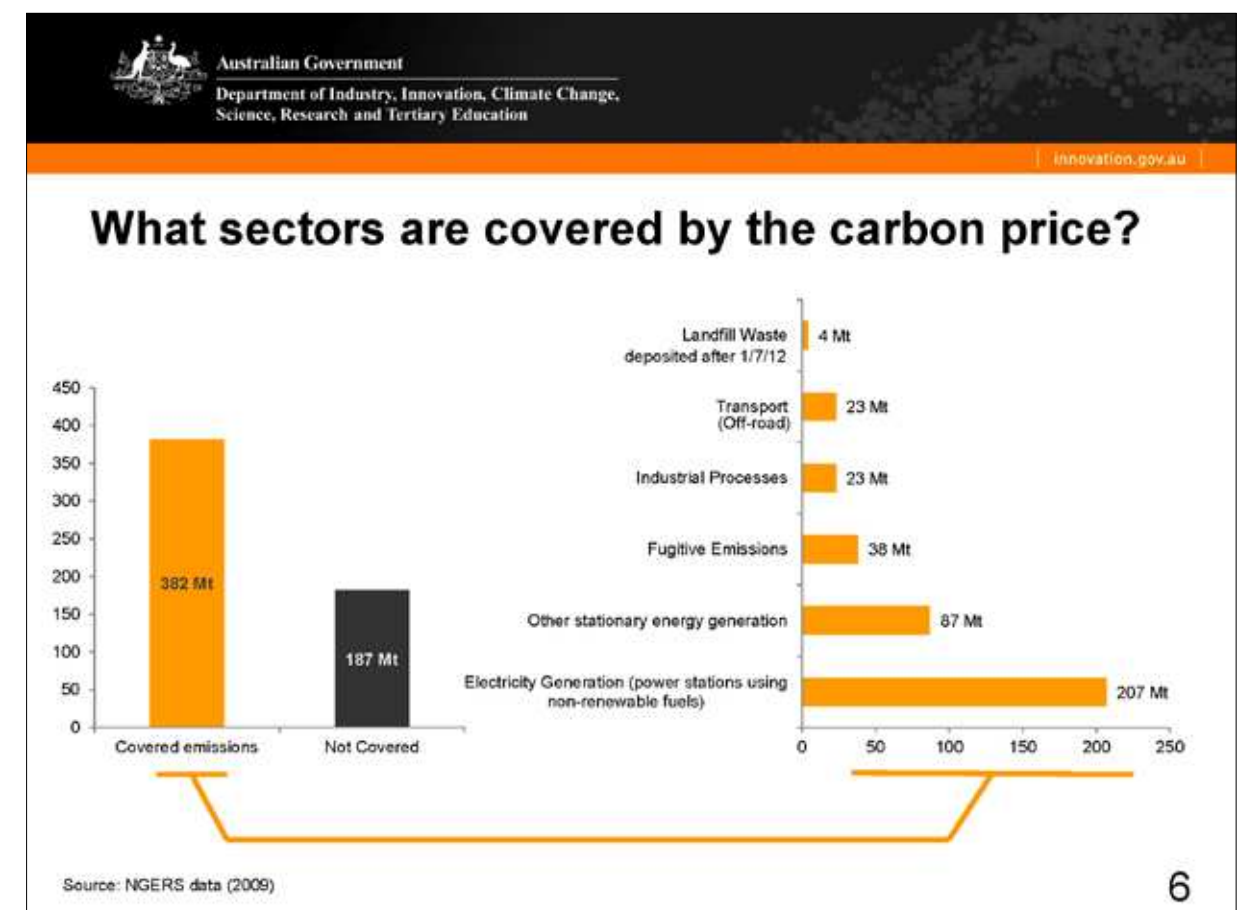
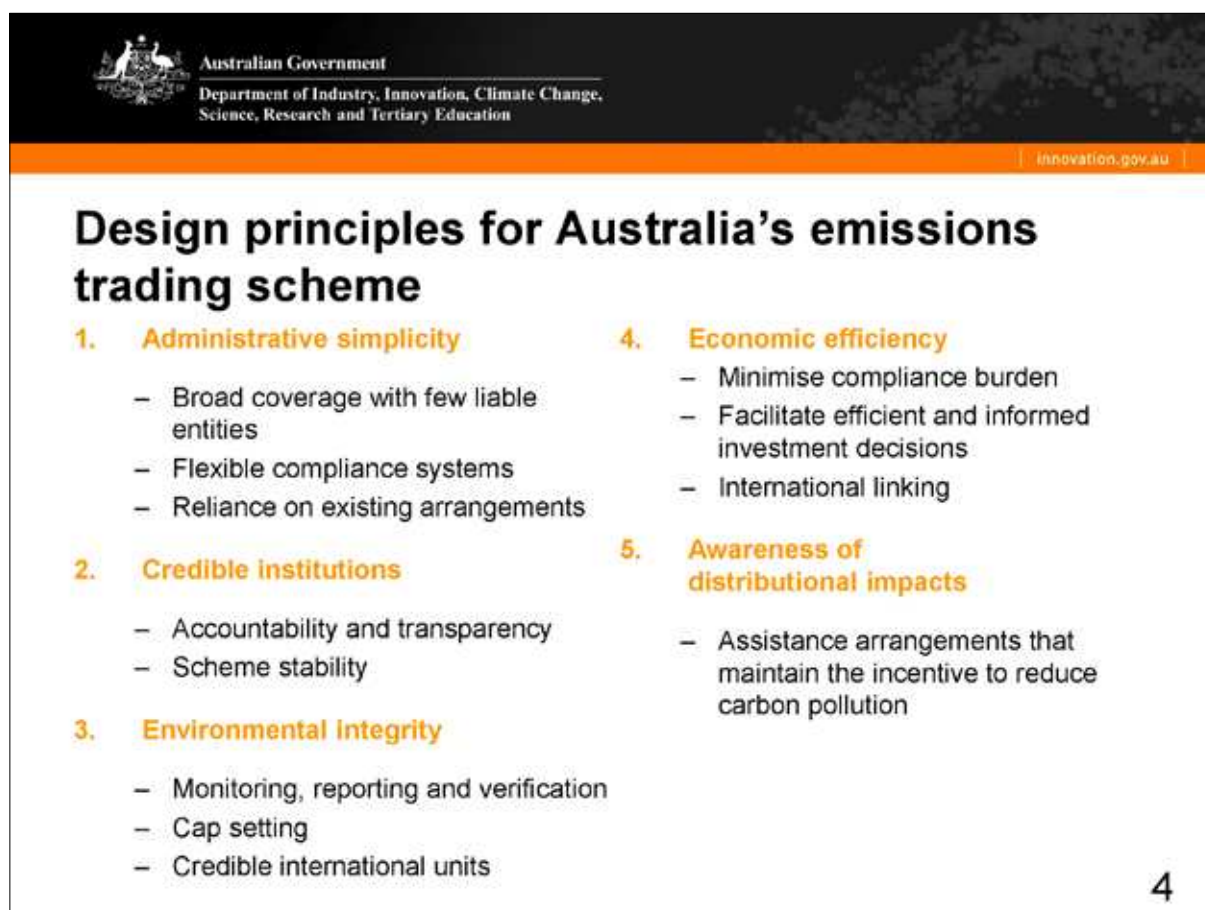
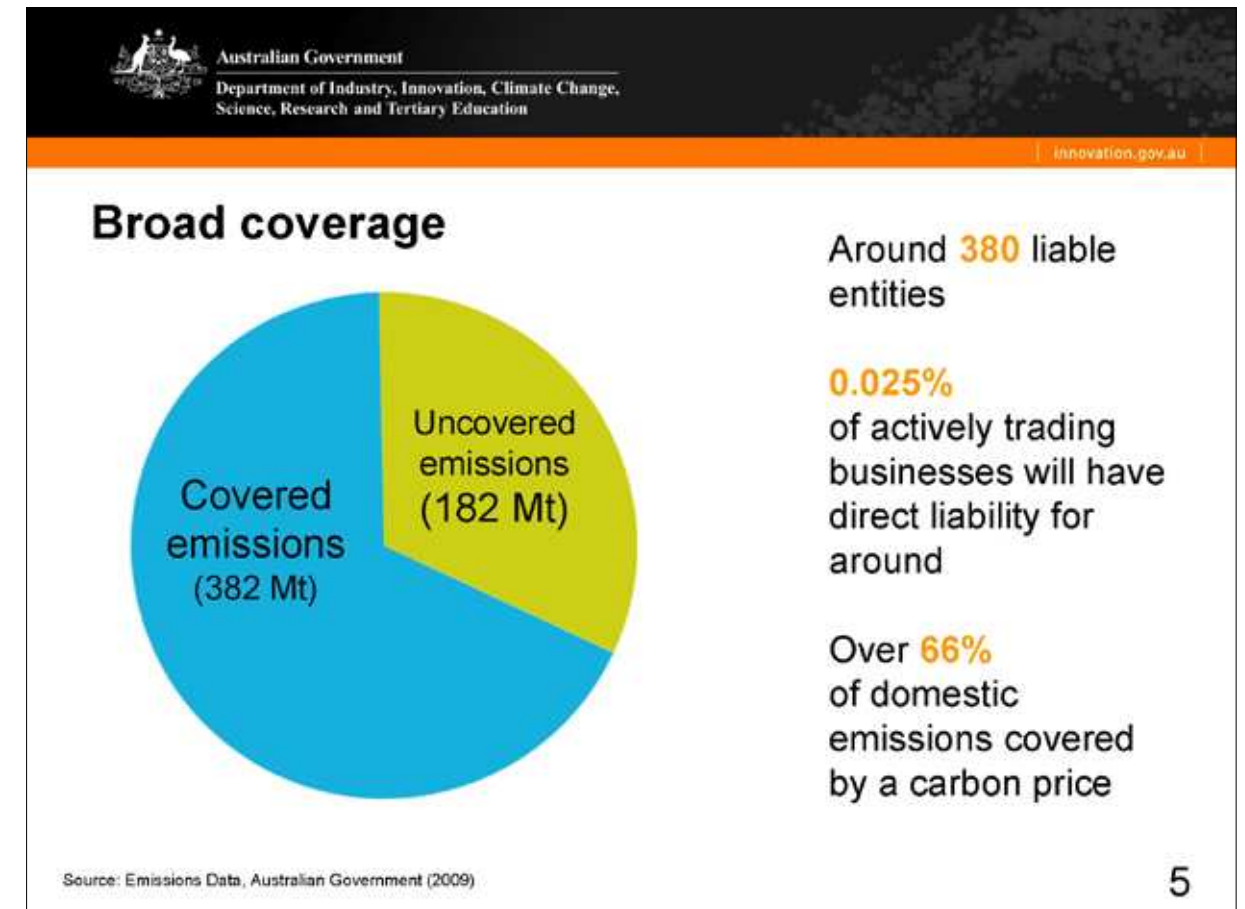
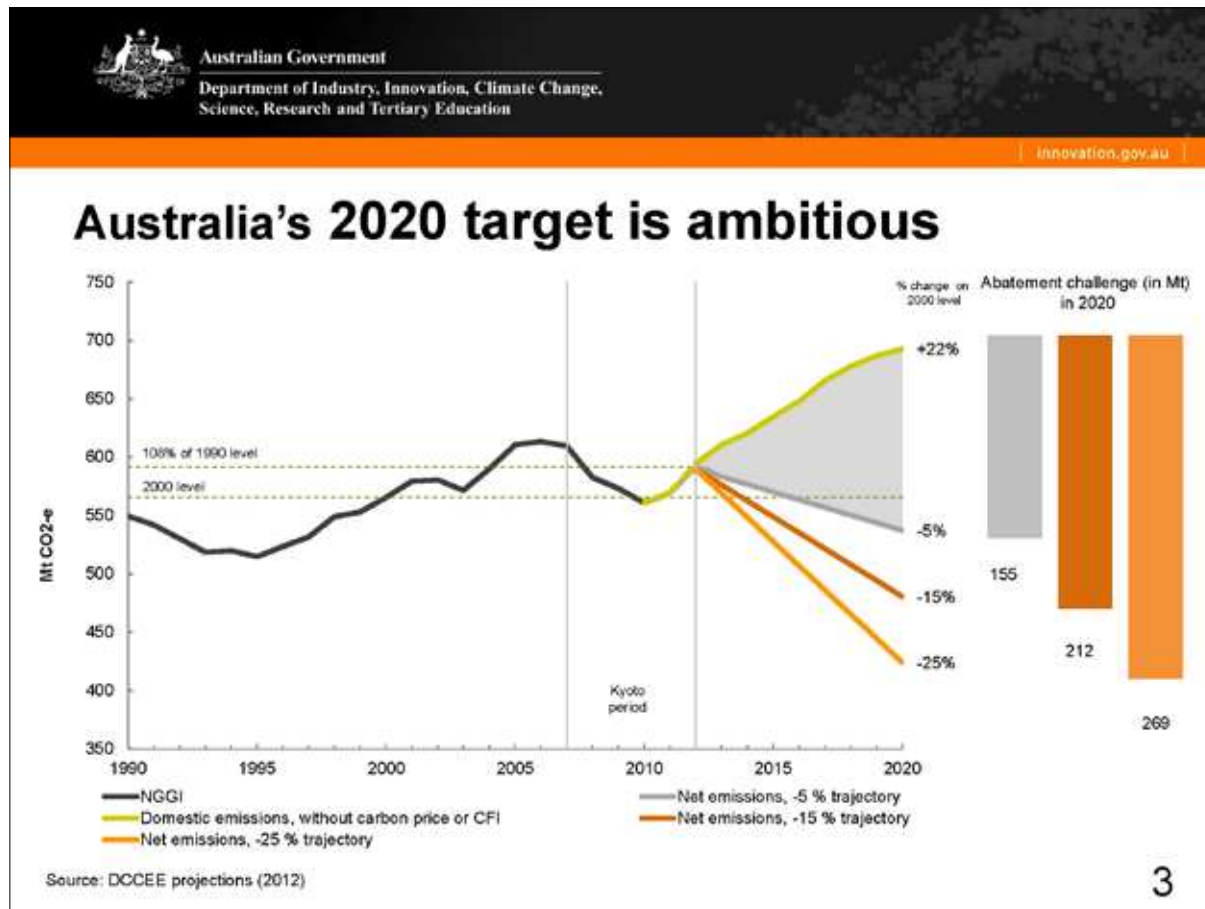
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Science, Research and Tertiary Education

innovation.gov.au

Agenda

- Australia's emissions reduction targets
- Emissions trading scheme
 - Central architecture of the system
 - Coverage
 - Liability
 - Implementation
 - International linking
 - Governance arrangements
 - Allocation and assistance measures

2



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Carbon price liability

Carbon pricing mechanism

- Electricity generation and stationary energy
- Industrial processes
- Waste
- Fugitive emissions

+

Equivalent carbon price

Applied through separate legislation to:

- Synthetic greenhouse gases
- Non-transport use of gaseous fuels

Liquid fuels used for domestic rail, aviation and shipping and some off-road fuel use

Abatement opportunities

The Carbon Farming Initiative provides incentives to the agricultural sector to sequester carbon

Gaseous Fuels (from 2013-14) and Natural Gas Suppliers

Liquid Fuel Opt-in (from 2013-14)

7

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International Linking

- The emissions trading scheme is designed to link to international carbon markets.
- Limits on linking
 - At least 50% of annual liabilities must be met with domestic permits
 - Up to 12.5% may be met with Kyoto units
- From 1 July 2015, international units are expected to be used by a significant number of liable entities.

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A staged process of introduction

2008-09 to 2011-12	2012-13 to 2014-15	2015-16 to 2017-18	2018-19 onwards
Reporting and regulatory frameworks	Fixed price period	Flexible price period with price ceiling, link to Kyoto market and partial linking to EU ETS	Fully flexible emissions trading with full link to EU ETS and link to Kyoto market
National Greenhouse and Energy Reporting Scheme Australian National Registry of Emissions Units	The Government sets the price to support the transition to emissions trading	Price ceiling acts to reduce risk of price spikes in the early years of the emissions trading scheme	The market sets the price and the sources of abatement

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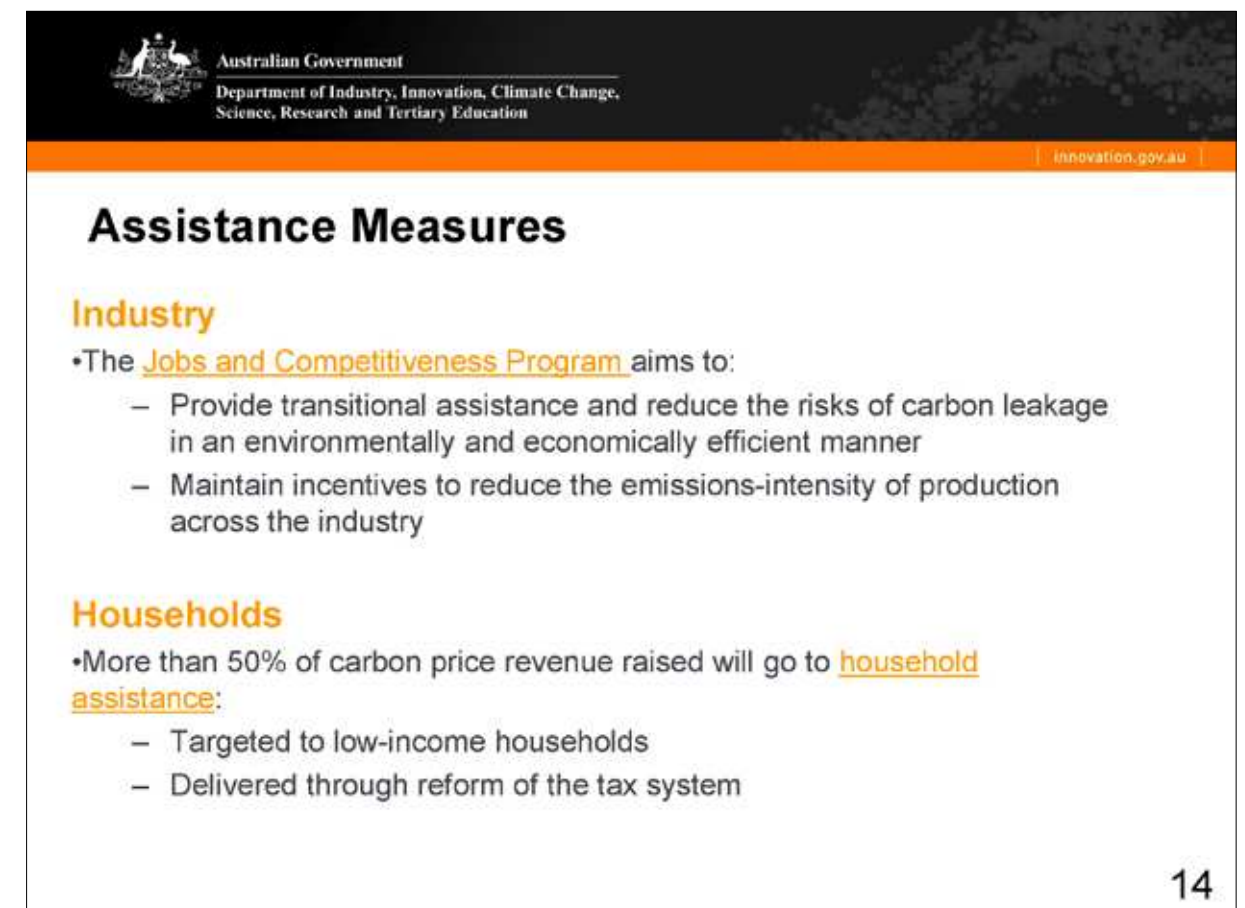
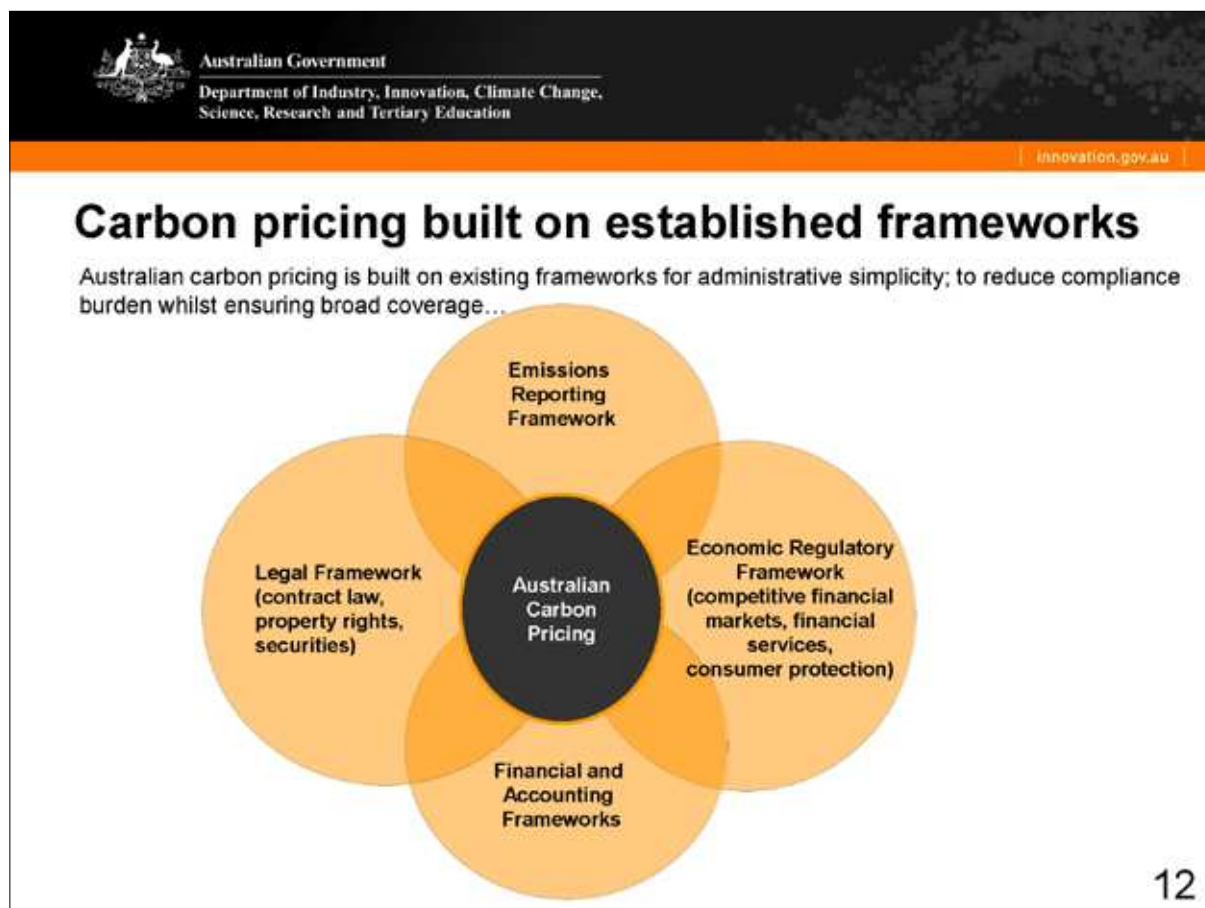
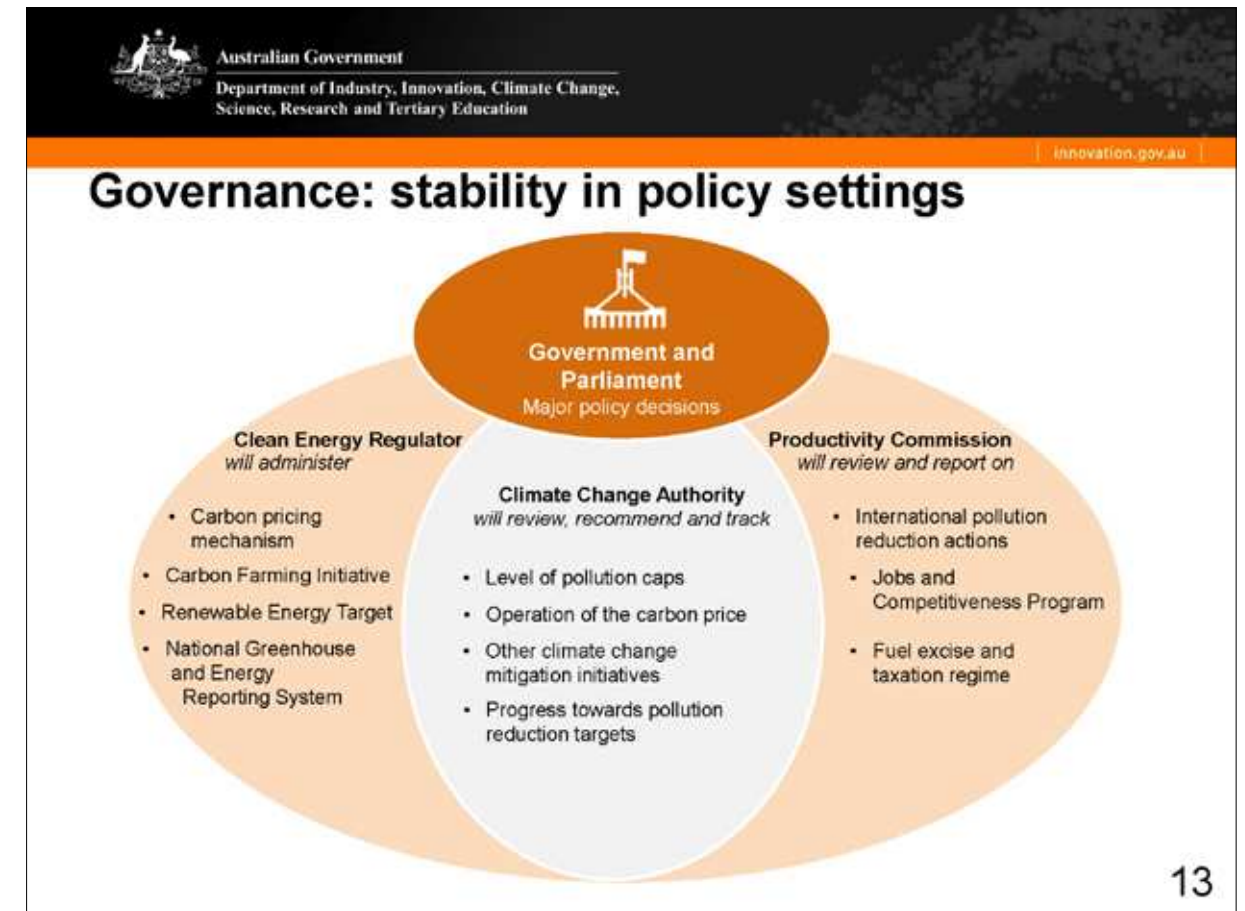
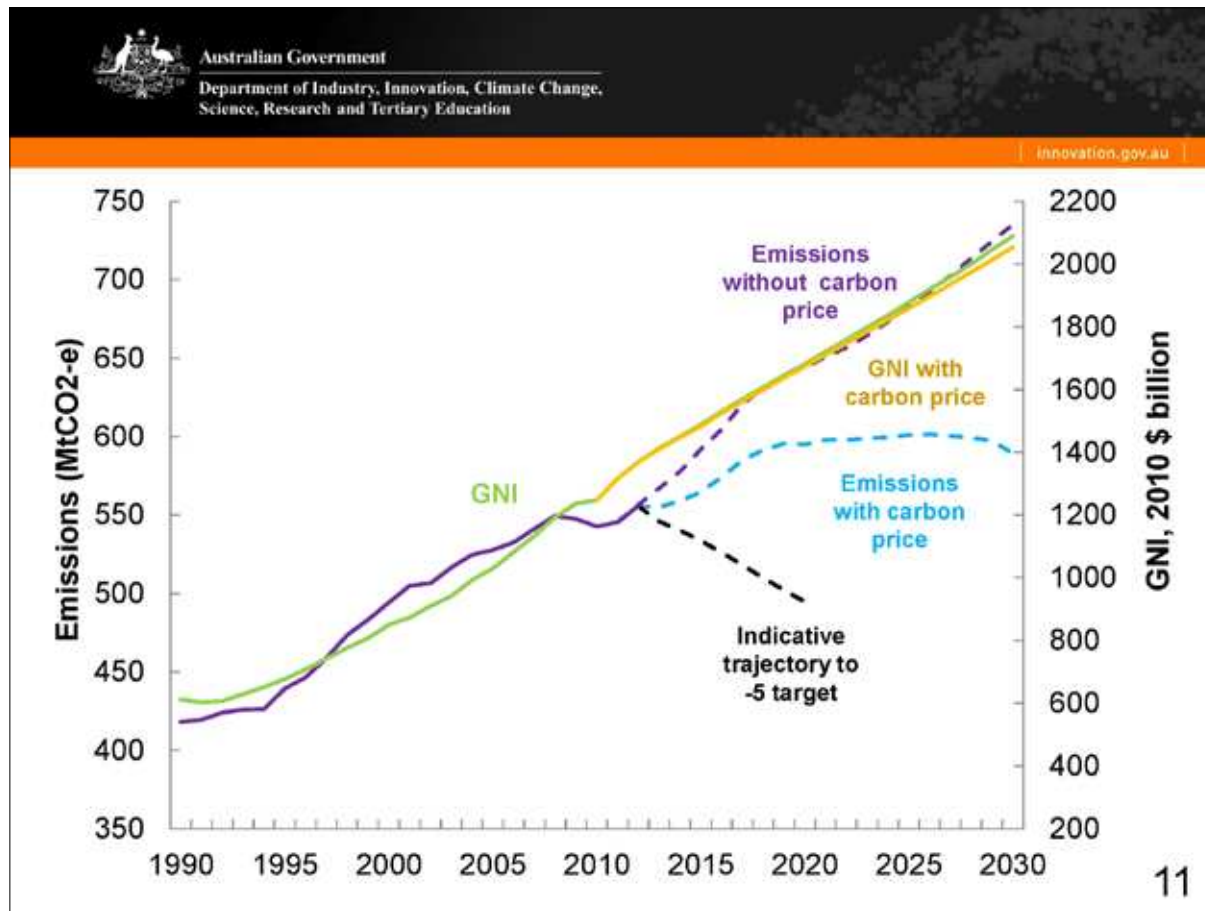
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Linking the Australian ETS and the EU ETS

- In August 2012, the Australian Government and the European Commission (EC) announced its intention to establish an interim (one-way) link to the EU ETS from 2015, with a full (two-way) link from 2018.
- In May 2013, the Australian Government and the EC agreed an indirect registry link would facilitate trade between the Australian and the European Union registries for the interim linking period.

The interim link with an indirect registry link and swap-back of AUs

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Jobs and Competitiveness Program: Features

Targeted	Abatement incentives	Linked to production	Reviews
Assistance is targeted towards traded goods with significant exposure to a carbon price.	Designed to maximise incentives for emissions-intensive, trade-exposed industries to transition to a low pollution future.	Assistance is directly linked to production and contingent on production continuing in Australia.	The Productivity Commission will review assistance arrangements in 2014-15.

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Questions?

Session 2

ETS Design: Introductory Phase

2-2

Korea ETS Design Scheme: Key Issues & Challenges

Hyung-sup Lee, Deputy Director
ETS Taskforce, Ministry of Environment, Republic of Korea

SESSION 2. ETS Design: Introductory Phase

Korea ETS Design Scheme: Key Issues & Challenges



Hyung-sup Lee
Deputy Director
ETS Taskforce, Ministry of Environment, Republic of Korea

2003 – 2013	Ministry of Environment
2007.09 – 2008.12	Deputy Director, Industrial Wastewater Division
2006.02 – 2007.09	Deputy Director, Minister’s Office
2004.10 – 2006.02	Deputy Director, Environmental Transportation and Policy Division
2003.11 – 2004.10	Deputy Director, Environmental Economy Division
2003.04 – 2003.11	Central Officials Training Institute

International Modeling Conference, 2013. 7. 12



Korean Emission Trading Scheme

Scheme design and the road ahead

2013. 7. 12

Hyungsup Lee
ETS Task Force

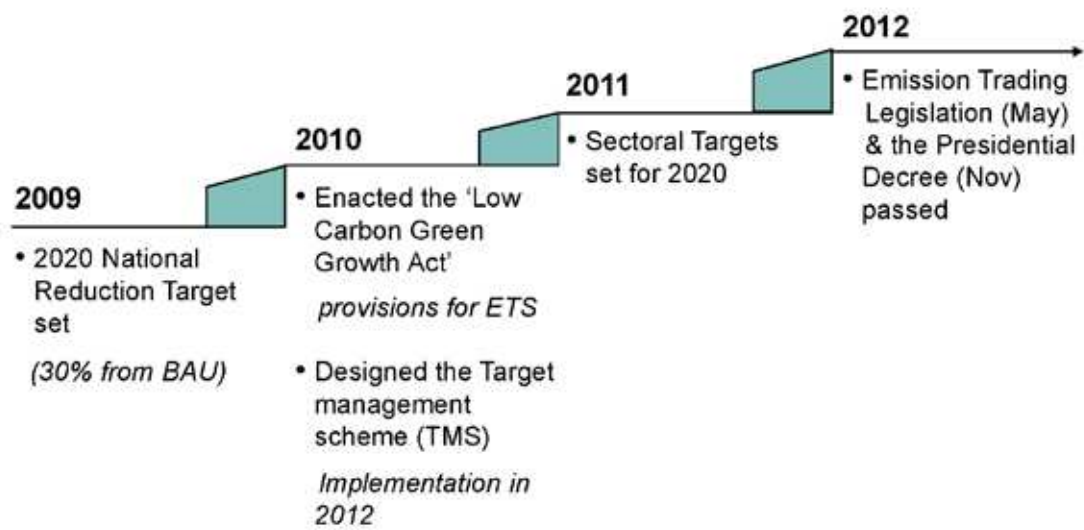
Ministry of Environment Republic of Korea

Table of Content

- I. Overview
- II. Recent landmark on GHG mitigation
- III. Target Management Scheme
- IV. Emission Trading Scheme Design
- V. Road Ahead and Challenges

Recent landmarks on GHG mitigation

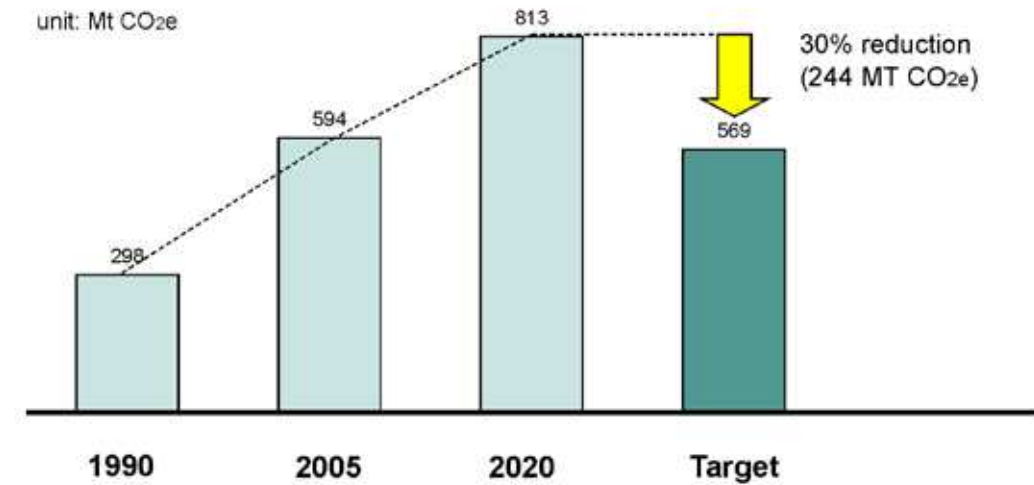
Substantial progress in mitigation policy in the last few years



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The national target (2009)

Estimated that such ambition could imply some 244MT CO_{2e} reduction in 2020 from the business-as-usual scenario



6

The national target (2009)

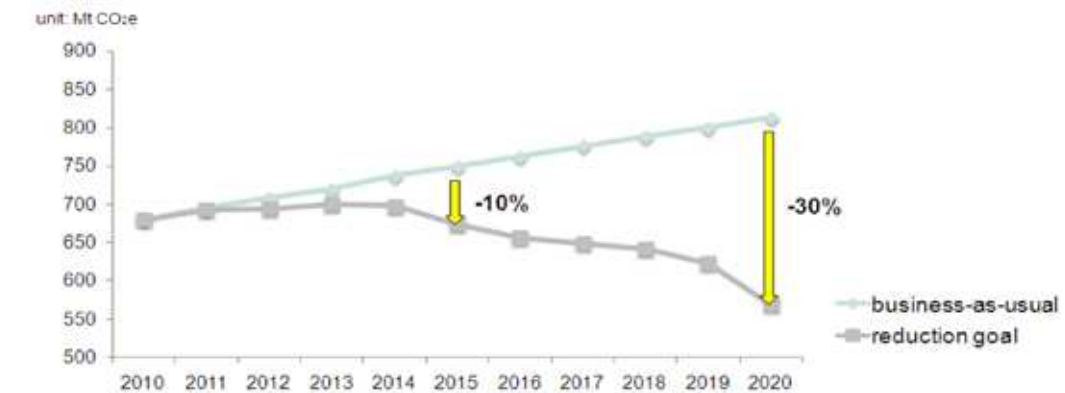
30% reduction from BAU was selected to adopt ambitious measures by 2020

	reduction policy	key reduction measures
BAU 21%	Adoption of cost-effective measures	green home, buildings LED & energy efficiency improvement sustainable transport ↑ renewable energy ↑
BAU 27%	Adoption of measures below estimated global average carbon price	F-gas ↓ hybrid vehicles ↑ bio-fuel mix ↑ CCS ↑
BAU 30%	Highest level of reduction for developing countries	EV, FCV ↑ high-tech efficiency measures ↑ CCS ↑↑

5

Sectoral targets (2011)

As a follow-up to the national target, emission pathway and sectoral reduction targets were set in July 2011

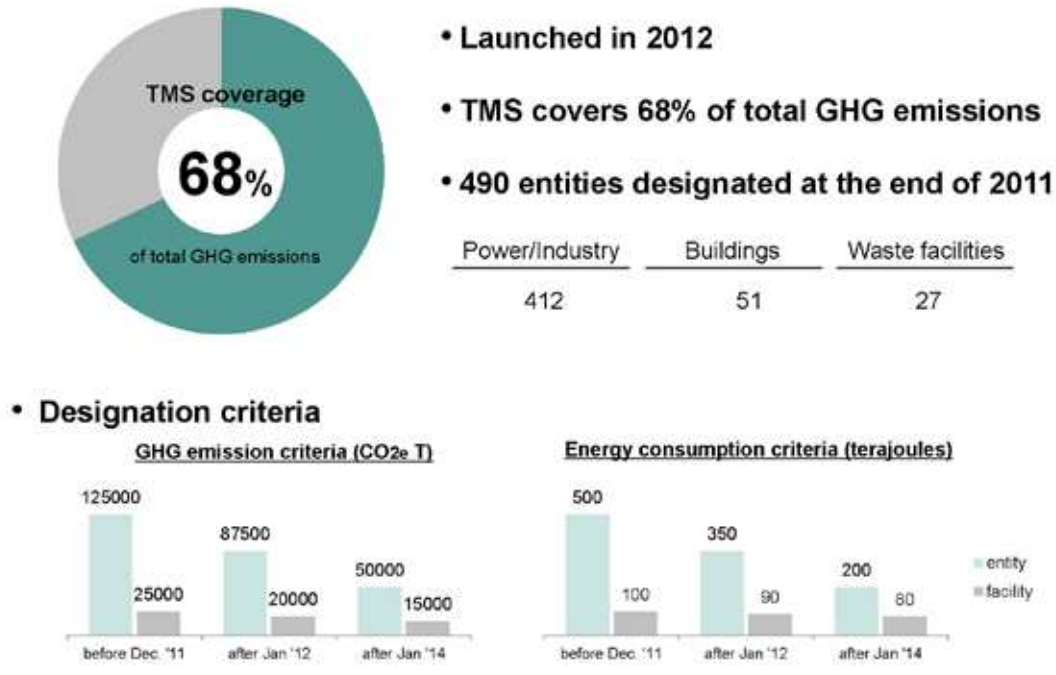


Sectoral targets (reduction from BAU)

Industry	Transport	Buildings	Agriculture & Fisheries	Waste	Public	Total
	34.3%	26.9%	5.2%	12.3%	25.0%	30.0%

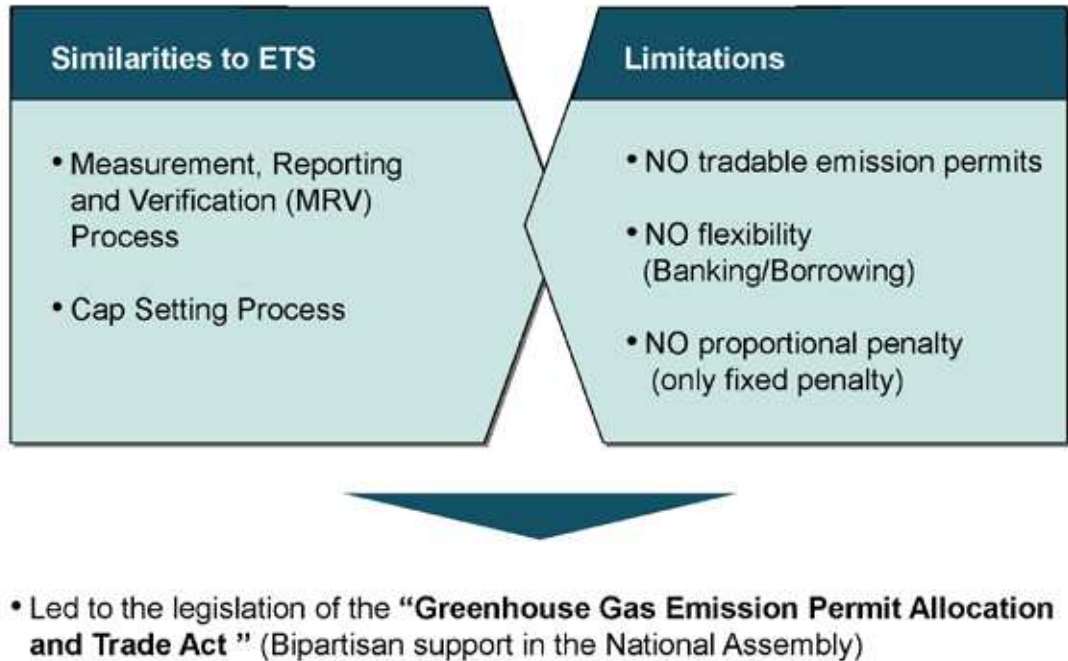
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Target Management Scheme (TMS)



8

Target Management Scheme (TMS)



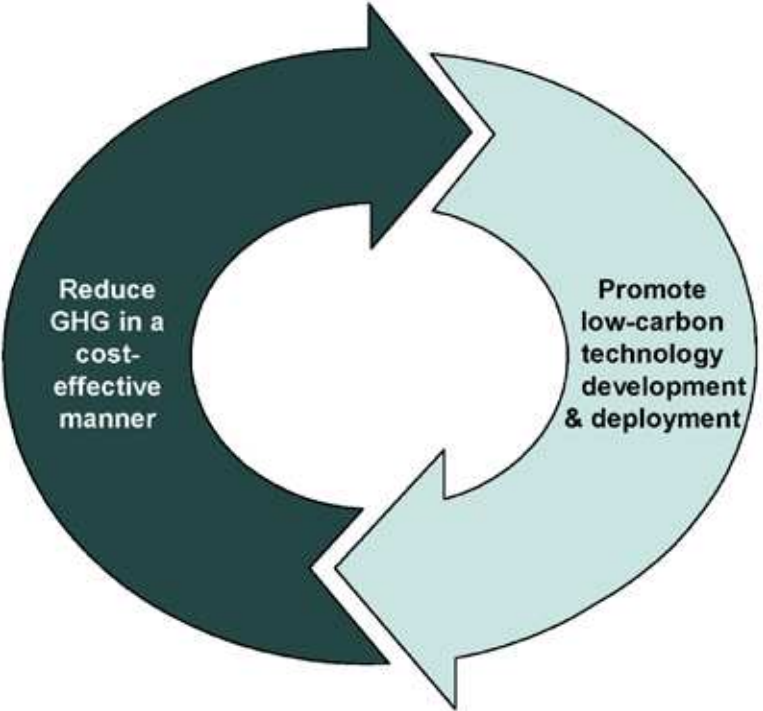
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Target Management Scheme (TMS)



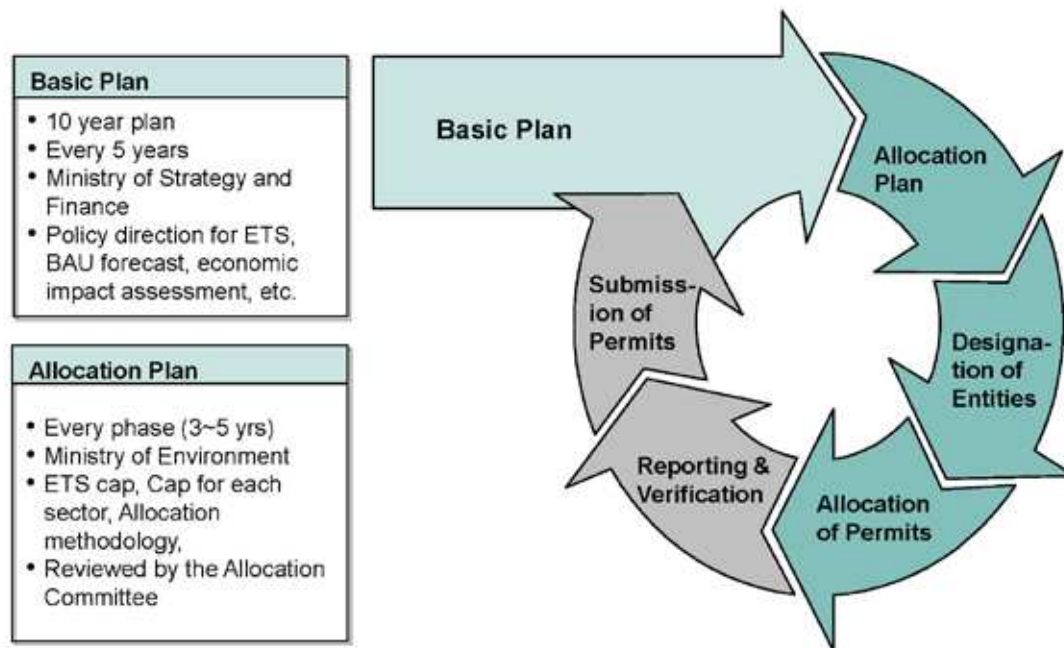
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Emission Trading Scheme (Key Objective)



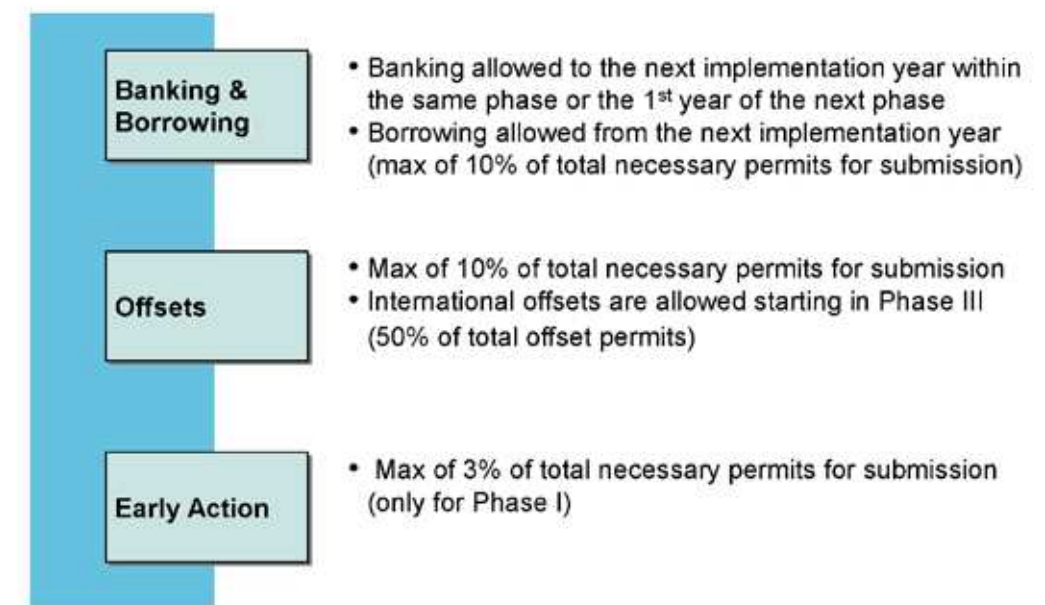
11

ETS (Key processes and legal plans)



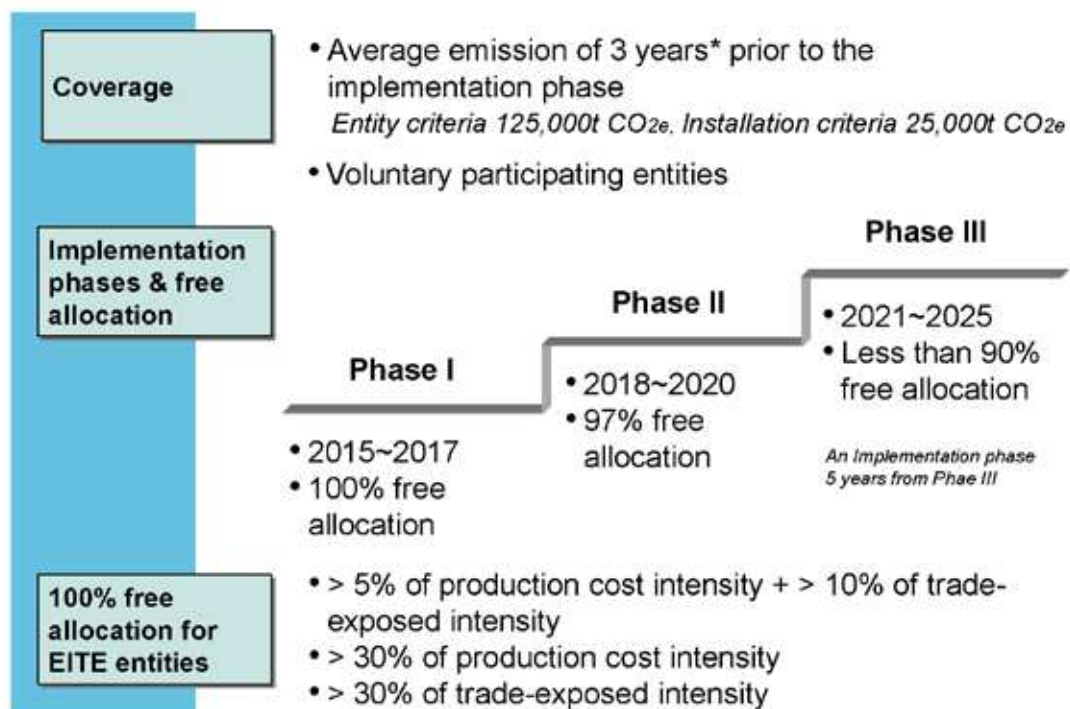
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ETS (Flexibility)



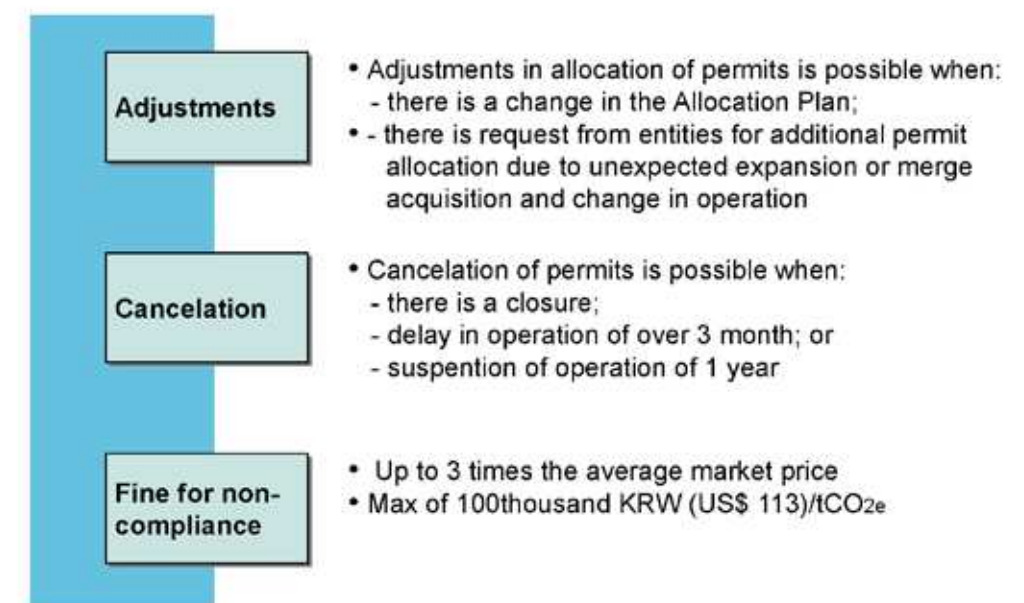
14

ETS (Scheme design)



13

ETS (Adjustment, cancelation & fine)



15

ETS (Timetable for Phase I)

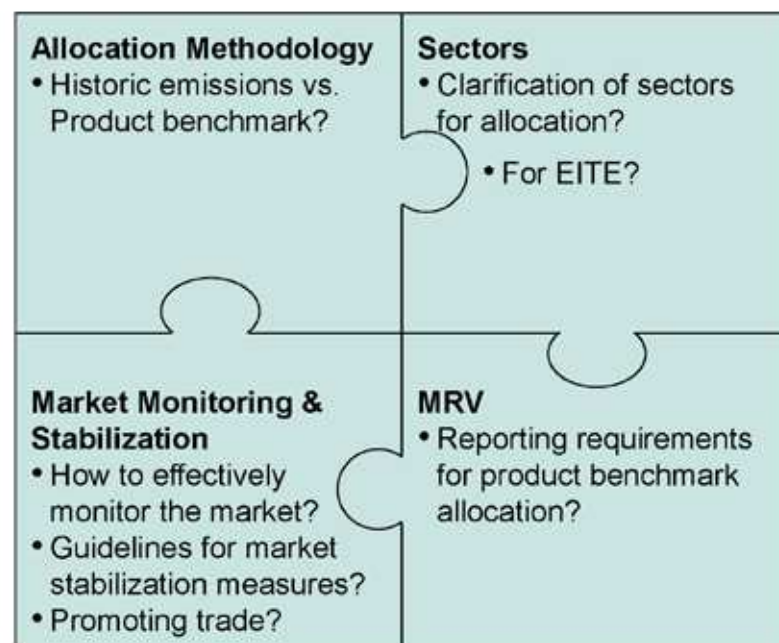


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Thank You

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Key Challenges



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Session 2

ETS Design: Introductory Phase

2-3 ETS Market Design in China
.....
Maosheng Duan, *Professor & Deputy Director*
Institute of Energy, Environment and Economy, Tsinghua University, China

SESSION 2. ETS Design: Introductory Phase

ETS Market Design in China



Maosheng Duan

Professor & Deputy Director

Institute of Energy, Environment and Economy, Tsinghua University, China

DUAN Maosheng has been working on issues related to carbon market since 2000, as researcher, negotiator and key advisor to the Chinese Government. He is now advising both the Chinese Government and several China’s provincial governments on the design of their emissions trading systems. He is currently coordinating several projects in this area, including Design of China’s National ETS Registry and Proposal by China to the Partnership on Market Readiness on Establishing China’s National ETS. He has been a member of the Clean Development Mechanism Executive Board since 2010 and served as chair of the board in 2012. He has a background of engineering, economics and energy.

International Modeling Conference
July 12, 2013 Seoul, Korea

DEVELOPMENT OF PILOT EMISSIONS TRADING SYSTEMS IN CHINA

Duan Maosheng
Tsinghua University, Beijing

CONTENTS

1. Context of Developing ETS
2. Development of ETS in Pilot Regions
3. Development of ETS at the National Level
4. Support for ETS Development
5. Challenges

WHY CHINA NEEDS ETS?

- policy tradition and tough lessons learned
- addressing climate change considered as a major strategy
 - Outline of the Twelfth Five-Year Plan for National Economic and Social Development (the 12th Five-Year Plan) (2011.3)
 - Work Plan for Greenhouse Gas Emission Control during the 12th Five-Year Plan Period (2011.12)
- clear GHG emissions control target
 - 2005-2020, CO2 intensity of GDP reduction by 40~45%
 - 2011-2015, CO2 intensity of GDP reduction by 17%
 - by 2015, total energy consumption no more than 4 billion tce

3

OVERVIEW OF PILOT ETS DEVELOPMENT

- Beijing: 2012.3, official inception meeting, *Work Programme on Pilot ETS* by Municipal Government
- Shanghai: 2012.8, Municipal Government Notice
- Guangdong: 2012.9, Provincial Government Notice
- Shenzhen: 2012.10, *Provision on Carbon Emissions Management* by Standing Committee of Municipal People's Congress; 2013.6.18, inception of pilot ETS
- Tianjin, 2013.2, Municipal Government Notice
- Hubei: 2013.2, Provincial Government Notice
- Chongqing: programme under development

5

DEVELOPMENT OF ETS IN PILOT REGIONS

- transformation of policy approaches
- *Notice on Implementing Carbon Emissions Trading in Pilot Regions* by National Development and Reform Commission (NDRC) (2011.10)
- pilot regions:
 - 4 municipalities: Beijing, Tianjin, Shanghai, Chongqing
 - 2 provinces: Hubei, Guangdong
 - Special economic zone: Shenzhen City

4

OVERVIEW OF PILOT ETS DEVELOPMENT

- Inclusion criteria
 - ✓ Annual energy consumption: 5,000-60,000 tce
 - ✓ Annual emissions: 5,000-20,000 tCO₂
- Coverage
 - ✓ 100-800/region, >2500 in total
 - ✓ Direct and indirect emissions
 - ✓ 40-60% of total emissions in each pilot area
- Diversified allocation approaches
- Offset
- Market intervention

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SHANGHAI PILOT ETS AS AN EXAMPLE

- Coverage
 - ✓ Production industries: iron and steel, petrochemical, chemical, non-ferrous, electricity, building materials, textile, paper, Rubber, Fiber
 - ✓ Service industries: Airlines, ports, airports, railways, commercial, hotels, financial, ...
- Scope (entity)
 - ✓ P: 20,000 tCO₂ (direct + indirect emissions)
 - ✓ S: 10,000 tCO₂ (direct + indirect emissions)
- Reporting obligation: 10,000 tCO₂ during '12-15

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SHANGHAI PILOT ETS AS AN EXAMPLE

- Third party verifier: contracting relations
- Regulation, including stabilization, of market
- Leading Group on Pilot ETS with office in municipal DRC, expert group
- Compliance rules
- Stakeholder consultations, most bilateral

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SHANGHAI PILOT ETS AS AN EXAMPLE

- Pilot Period: 2013-2015
- Participants: covered entities + ...
- Allocation
 - ✓ Grandfathering (2009-2011) + benchmarking (limited sectors)
 - ✓ Auctioning in the future
- Registry and trading platform

8

KEY CHALLENGES IN THE PILOT REGIONS

- Coordination among different policies and authorities
- Data: availability and quality, energy vs. emissions
- Allocation: scarcity of allowances
- Direct vs. indirect emissions
- Heavily regulated sectors
- Compliance rules: limitations on the local governments and legislation
- Capacity needs
- Time pressure
- Financial support
- Harmonization or not
-

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DEVELOPMENT OF ETS AT THE NATIONAL LEVEL

- Linking of pilot ETSSs
- Pilot time and coverage
- Capacity building
- National ETS
 - ✓ Registry
 - ✓ MR methodology
 - ✓ System design
- Support from various sources

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PMR SUPPORT FOR CHINA'S ETS

- Allowance allocation
 - National level allocation vs. provincial level allocation
 - Grandfathering, updating, benchmarking, vs. auctioning
- MRV: sector-specific guidelines
- Registry: one central registry vs. provincial registries
- Compliance rules: options and enforceability
- Price containment mechanisms
- Offset mechanism and linking
- Market oversight: scope and authorities
- Participants and Trading Products
- Special Issues Related to the Participation of Central Government Managed State-Owned Enterprises in China ETS

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PMR SUPPORT FOR CHINA'S ETS

- Geographical vs. Sectoral Coverage
- Data
- Management system
- Legal framework
- Scope
 - gases
 - installations vs. enterprises
 - coverage criteria
- Cap setting
 - top-down vs. bottom-up
 - absolute vs. intensity
 - coordination with other policies
 - new-entrants

12

PMR SUPPORT FOR CHINA'S ETS

- Participation of the Power Sector in China ETS
- Enhance coordination among relevant ministries at the Central Government Level
- Strengthen dialogue with Local Governments and Key Stakeholders
- Outreach to experts as well as the general public

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CHALLENGES

- Data: availability, quality and sharing
- Compliance regime
- Institutional capacity
- Institutional coordination
- Technical expertise

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THANKS FOR YOUR ATTENTION

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PANEL DISCUSSION

Friday, July 12 16:40 – 17:10

GHG Mitigation Potential of Power Generation Sector
in Non-Annex I Countries

Chair

Amad Rafdi Endut

Fellow

Institute of Strategic International Studies (ISIS Malaysia)

PANEL DISCUSSION

GHG Mitigation Potential of Power Generation Sector in Non-Annex I Countries



Amad Rafdi Endut / *Chair*

Fellow

Institute of Strategic International Studies (ISIS Malaysia)

Ahmad Rafdi Endut is a member of International Society of Ecological Economics and Malaysia Economics Association. As an environmental consultant, he provided consultation for Malaysia Natural Resource Ministry on 20% Carbon Intensity Reduction Roadmap, as well as on Low Carbon Economics Pathway of Malaysia and NAMAs. Mr. Endut is also a consultant for MNRE on Technology Need Assessment for Malaysia, and a member of Subsidy Rationalization for Members of Malaysia NKEA Project Team.

SPECIAL C2GMF SESSION

Country Case Studies in Power Generation Sector

Friday, July 12 15:25 – 16:40

- 3-1

Bangladesh Case Study

- Utilization of Renewable Energy for Rural Population: Experiences of Bangladesh

MD. Ziaul Haque, *Deputy Director (Technical)*
Department of Environment (DOE), Ministry of Environment and Forests, Bangladesh
- 3-2

Ghana Case Study

- Emissions and Scenario Projections from the Power Generation Sector of Ghana

Lawrence Kotoe, *Programme Officer*
Environmental Protection Agency (EPA), Ghana
- 3-3

Vietnam Case Study

- GHG Inventory Emissions Scenario and Policy Analysis in the Power Generation Sector of Vietnam

Huyen Nguyen Thi Thu, *Manager of Environmental Department*
Institute of Energy, Ministry of Industry and Trade, Vietnam

SPECIAL
C2GMF SESSION

Country Case Studies in Power Generation Sector

3-1

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MD. Ziaul Haque, *Deputy Director (Technical)*
Department of Environment (DOE), Ministry of Environment and Forests,
Bangladesh

SPECIAL C2GMF SESSION.
Country Case Studies in Power Generation Sector

Bangladesh Case Study :
Utilization of Renewable Energy for Rural Population - Experiences of Bangladesh



MD. Ziaul Haque

Deputy Director (Technical)

Department of Environment (DOE), Ministry of Environment and Forests, Bangladesh

Md. Ziaul Haque has been working in the Department of Environment (DOE) since 1996 under several Sections, e.g. international conventions, research, planning, law, enforcement, etc.

Mr. Haque has been involved in formulation, revision and amendment of national policies/ strategies/ action plan/ act/ rules/ guidelines on environmental protection and management;

Mr. Haque has been involved in the climate change cell of the department since 2005, and involved in climate change activities at national and international level;

Mr. Haque actively participated in the preparation of Second National Communication on climate change (In particular GHG Inventory and Mitigation), National Adaptation Program of Action (NAPA), Bangladesh climate change strategy and action plan, etc. He has also been actively engaging in the initiative of establishing a sustainable GHG Inventory Management System in the DOE.

Mr. Haque has been participating in international climate change (UNFCCC) negotiations (Conference of Parties & Inter-sessional Meetings) as one of the core members of the Bangladesh delegation since 2005.

Utilization of Renewable Energy for Rural Population: Experiences of Bangladesh

MD Ziaul Haque
Department of Environment
Ministry of Environment and Forests, Bangladesh
International Modeling Conference
Seoul, 12 July 2013

Bangladesh: A south Asian country



Policies and Regulations around Low Carbon Development

- Bangladesh Climate Change Strategy and Action Plan 2009
- Bangladesh Environment Policy 1992 and Draft Update 2013
- Bangladesh Energy Policy 1996 and Draft Update 2012
- Bangladesh Renewable Energy Policy 2008
- **Vision:** From renewable sources, 5% (800MW) of the total power demand be met by 2015 and 10% by 2020
- Bangladesh Energy Regulatory Commission (BERC) Act 2003

Contd.

- Remote Area Power Supply Systems Fund (RAPSS Fund)
Objective: -to support access to rural power supplies, -to make tariff more affordable, and -to help “buy down” the capital investment
- Bangladesh Climate Change Trust Fund (BCCTF) with Government’s own resources (\$350 million)
- Bangladesh Climate Change Resilience Fund (BCCRF) with the support of development partners (\$190 million)

Contd.

- Sustainable and Renewable Energy Development Authority (SREDA) Act 2012
- Draft Energy Efficiency and Conservation Rules 2013
- Draft Interim Action Plan for Improvement of Energy Efficiency & Conservation 2012
- Bangladesh Environment Conservation Act 1995 and Rules 1997 with Subsequent Amendments

Bangladesh Climate Change Strategy and Action Plan (BCCSAP 2009)

SIX THEMATIC AREAS

1. Food security, social protection and health
2. Comprehensive disaster management
3. Infrastructure
4. Research & knowledge management
5. **Mitigation & low carbon development**
6. Capacity building & institutional strengthening

****44 thematic programmes and 133 major activities**




Case Study: Renewable Energy Development and Energy Conservation in Rural Areas by Grameen Shakti

- Solar Home Systems (SHSs)
- Improved Cook Stoves (ICSs)
- Biogas Plant

Dissemination of Solar PV Technology in Rural Communities


- Grameen Shakti (GS) established by Nobel Laureate Professor Muhammad Yunus in 1996 is considered one of the pioneer renewable companies in the world that could successfully promote renewable energy technologies in the rural areas of a third world country.
- GS has reached its first landmark of **one million Solar Home Systems (SHS)** installed in the rural areas of the country on November 30, 2012.



GRAMEEN SHAKTI

Sharing a Great News with You!


One Million
Solar Home System Reached.



From : Professor Muhammad Yunus
Chairman, Grameen Shakti

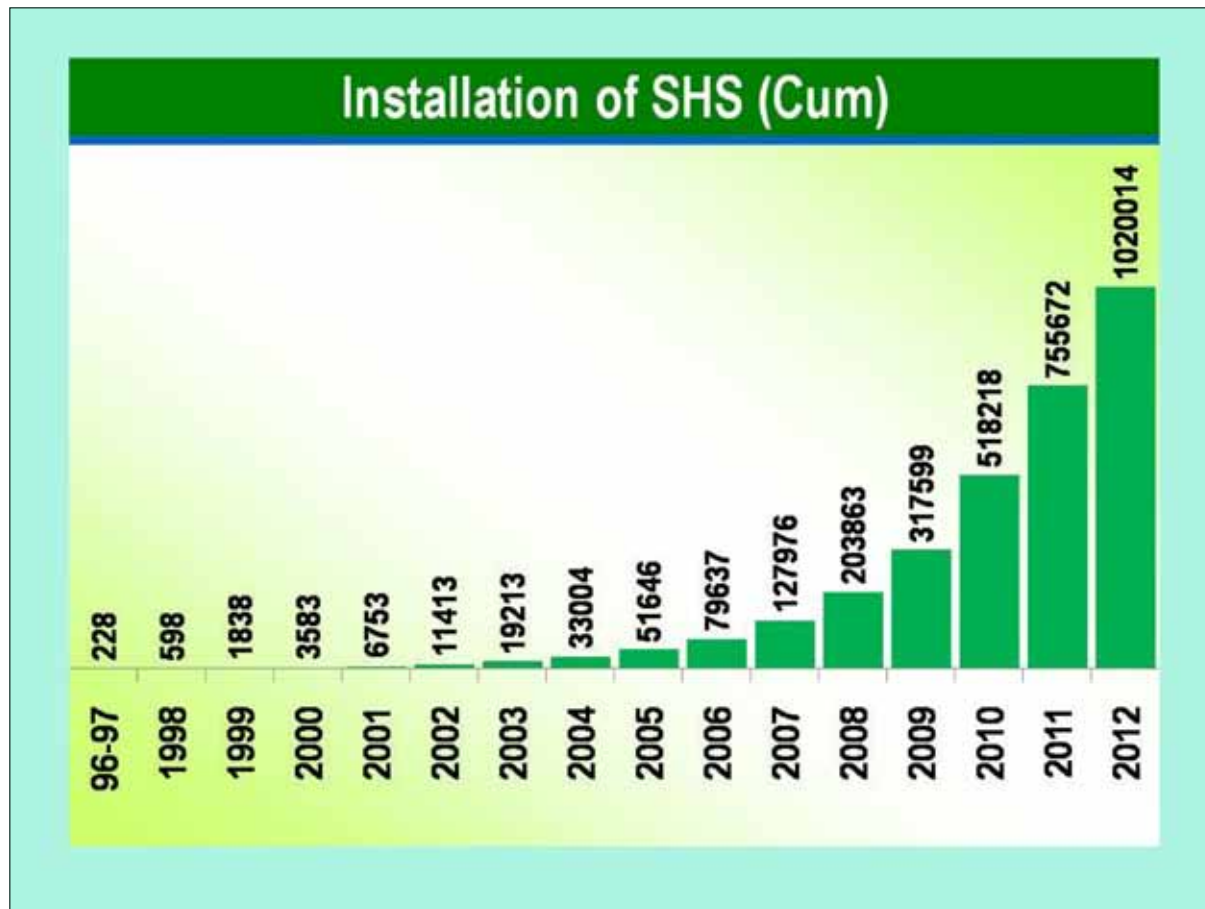
Grameen Shakti Has Just Reached One Million homes in rural Bangladesh with Solar Power. It took 16 years to reach this magic number. It installs more than 1,000 Solar Home Systems per day. It will reach second million homes in the next four years. Its 12,000 dedicated staff have done a wonderful job. Bangladesh is proud of them. Thanks to you for your friendship and support to our work.

Power to the People!



Contd.

- The expansion of the **SHSs** program of **GS** has been backed by the loans and subsidies provided by a Government Institution, **Infrastructure Development Company Ltd. (IDCOL)**, created with the financial support of the World Bank and other bilateral and multilateral funding agencies.
- Under **IDCOL's** renewable energy program, more than **two million SHSs** (capacity around **100MW**) have already been installed in the remote areas of the country by various partner organizations.



Local people buying Solar Panel

Key Features

- GS replaces millions of litres of kerosene by the one million SHSs and reduces CO2 emission substantially. On an average, GS installs over a thousand SHSs per day, working with workforce of 12,000 young people.
- GS is expecting to witness the signpost of the next million by 2016.
- GS SHSs are highly decentralized and particularly targeted for remote areas having no access to conventional electricity and little chance of getting connected to the national grid within 5 to 10 years.

Contd.

- Very Successful Two Applications of SHSs-
 - ✓ Micro-utility model and
 - ✓ SHS powered Polli-phone
- Soft Credit through Installments- Making SHSs Affordable
 - ✓ The user pays 15% of the total price as down payment. The remaining 85% of the total cost to be repaid within 36 months with 6% (flat rate) service charges.

Contd.

- ✓ The customer pays 25% of the total price as down payment. The remaining 75% of the cost to be repaid within 24 months with 4% (flat rate) service charge.
- ✓ Micro-utility : The customer pays 10% of the total price as down payment. The remaining 90% of the loan amount to be repaid by 42 cheques. No service charge.
- Community Involvement and Social Acceptance

Contd.

- Effective After Sales Service
 - ✓ Free monthly checkups during payments of installment.
 - ✓ Post warranty service through annual maintenance contact with GS for SHSs.
 - ✓ Inclusive warranty system plus a buy back system under which a buyer may return his system to GS when his area gets connected to the grid.
 - ✓ Training of users and technicians.

Contd.

- Blending Technology with Market Forces
 - ✓ Product diversification such as introducing LED, small SHS, DC-DC converters, safety devices for black/white TVs, etc.
 - ✓ Focus on Income generation such as micro-utility model, SHS powered mobile phones
 - ✓ Collaboration with International manufacturers to produce CFL, LED locally, design more efficient solar systems at lower costs

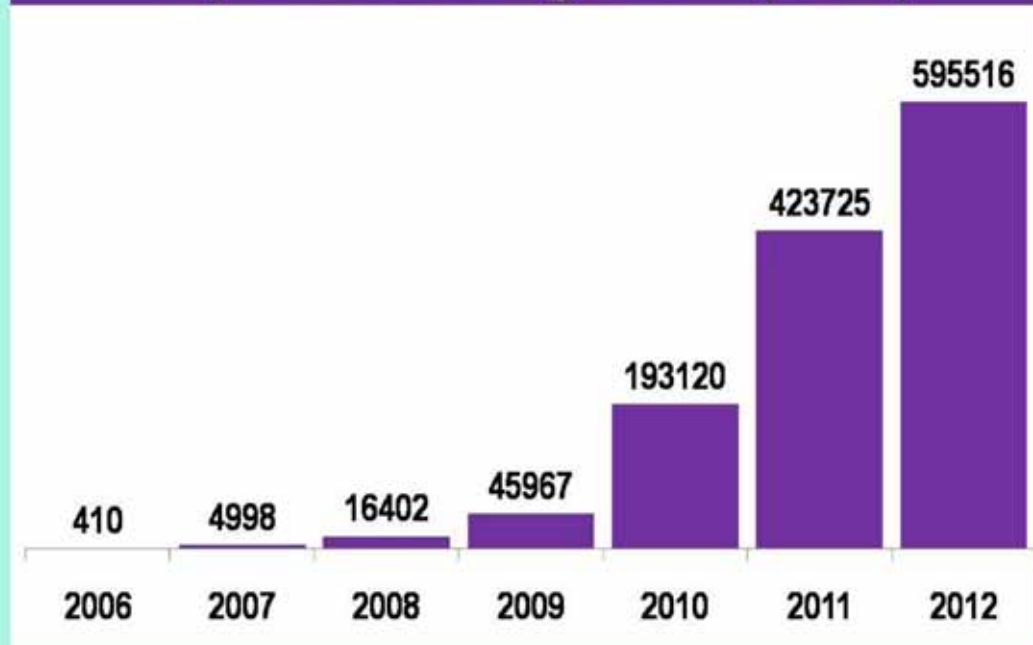
Improved Cook Stoves (ICSs)

- As of December 2012, GS has installed 595,516 ICSs in rural areas with more than 14,000 ICSs installed per month.

Features:

- ✓ 50% less fuel cost
- ✓ Women protected from in-door air pollution
- ✓ no blackening, no heat from stove
- ✓ Very cost effective for large establishment such as hostels, restaurants etc.

Improved Cooking Stoves (Cum.)



Contd.

- GS has set up 10 manufacturing units in rural settings for constructing ICS accessories such as metal grates and chimneys.
- These manufacturing units are run by entrepreneurs with the financial and technical assistance from GS.



Improved Biomass Cook Stove

Biogas Plant

- GS has been successful in promoting and constructing both domestic and larger sizes biogas plants to rural villagers.
- GS has proved that Biogas technology be used to implement a sustainable waste management program suitable for rural areas, as wastes of all sorts are transformed into biogas or slurry.
- GS has developed an integrated and sustainable model for expanding biogas program. Such as:
 - ✓ A financial mechanism based on credit, which makes biogas plants affordable to the villagers

Contd.

- The buyer pays 25% of the total cost as down payment. The remaining 75% of the cost be repaid through 24 monthly installments with 8% service charge (flat rate) within 2 years.
- The buyer can construct his plant with his own funds under the supervision of GS engineers.
- Free after sales service including monthly visits by GS engineers for two to three years.
- Option for signing annual maintenance agreement with a small fee during post warranty period.

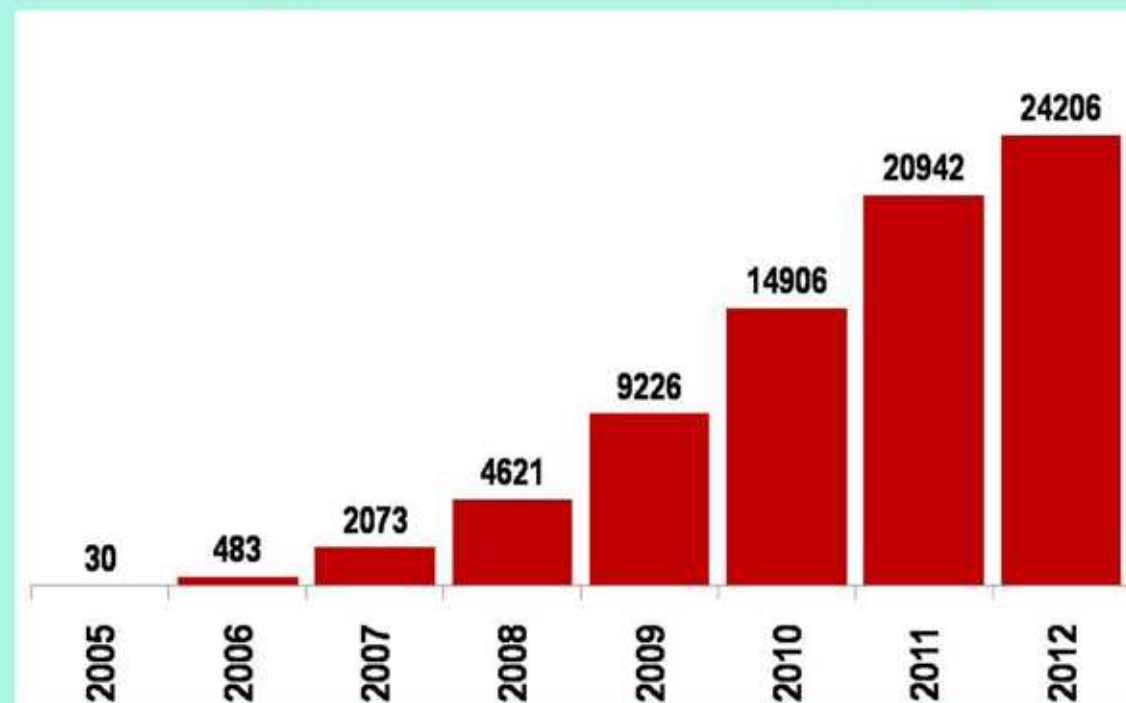


Biogas
Digester



Biogas can
Replace LPG

Biogas Plant Construction (Cum.)



Biogas can Replace NRB (Non Renewable Biomass)



SPECIAL
C2GMF SESSION

Country Case Studies in Power Generation Sector

3-2

Ghana Case Study

- Emissions and Scenario Projections from the Power Generation Sector of Ghana

.....

Lawrence Kotoe, *Programme Officer*

Environmental Protection Agency (EPA), Ghana

SPECIAL C2GMF SESSION.

Country Case Studies in Power Generation Sector

Ghana Case Study :

Emissions and Scenario Projections from the Power Generation Sector of Ghana



Lawrence Kotoe

Programme Officer

Environmental Protection Agency (EPA), Ghana

2011.04 – present	Programme Officer, Oil and Gas Department Environmental Protection Agency
2006.07 – 2011.03	Assistant Programme Officer Environmental Assessment and Audit Department Environmental Protection Agency
2009.11 – 2010.05	Environmental Assessment Capacity Enhancement Activities Industry Technical Committee on Communication Masts and Towers: Represented the Agency (EPA) as a stakeholder at an Industry Technical Committee spearheaded by the National Communication Authority (NCA) to put together guidelines for the deployment of Communication Masts in Ghana.
2009.08 – 2010.08	Provided introductory seminar on EIA for practicing architects and surveyors at the Architects Council as part of their professional practice examination.

GHG Emissions and Scenario projections from the Power Generation Sector of Ghana

Presentation

By

Lawrence Kotoe

The specific areas of interest for this exercise are to:

- Ghana's power sector
- Energy supply chain in Ghana
- Historical trends of GHG emissions for the energy sector in Ghana
- Estimate the GHG emissions from the power generating sector
- Mitigation scenarios for the power generating sector

The Power Sector

Power generation

- Volta River Authority (VRA)
- Bui Power Authority (BPA)
- Independent Power Producers (IPP)

Transmission

- Ghana Grid Company (GRIDCo)

Distribution

- Electricity Company of Ghana (ECG) – Southern Ghana
- Northern Electricity Department (NED) - Northern Ghana

Electricity Demand

Population and Housing Census (PHC, 2010)

- Ghana's population - 24,658,823

Electricity consuming sectors

- Residential
- Non-residential
- Industrial
- Street lighting

Source of Power

Hydro (VRA)

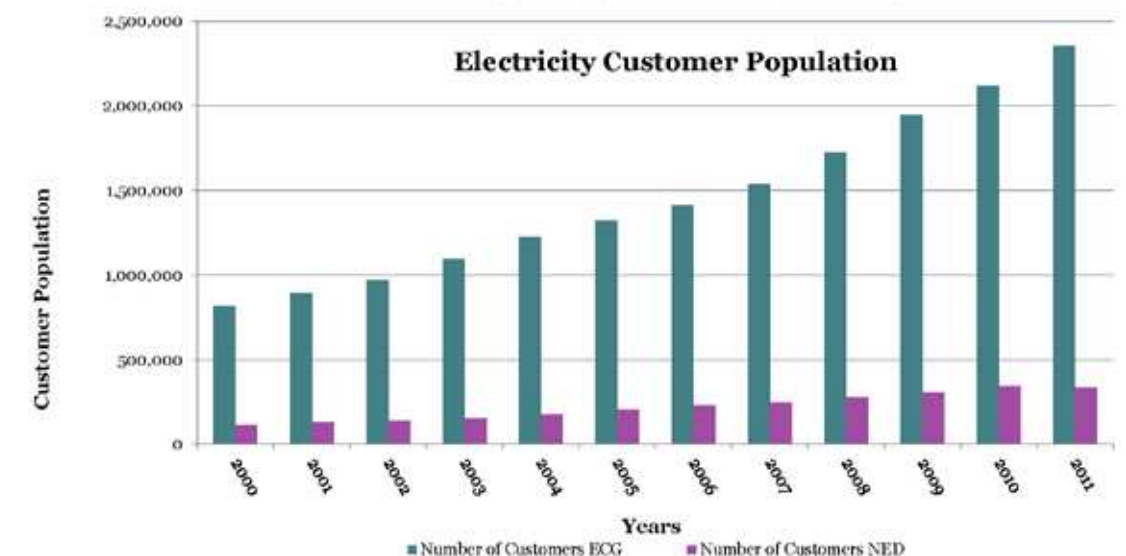
- Akomsombo
- Kpong
- Bui
- Installed Capacity of Hydro (2013) - 1,313 MW

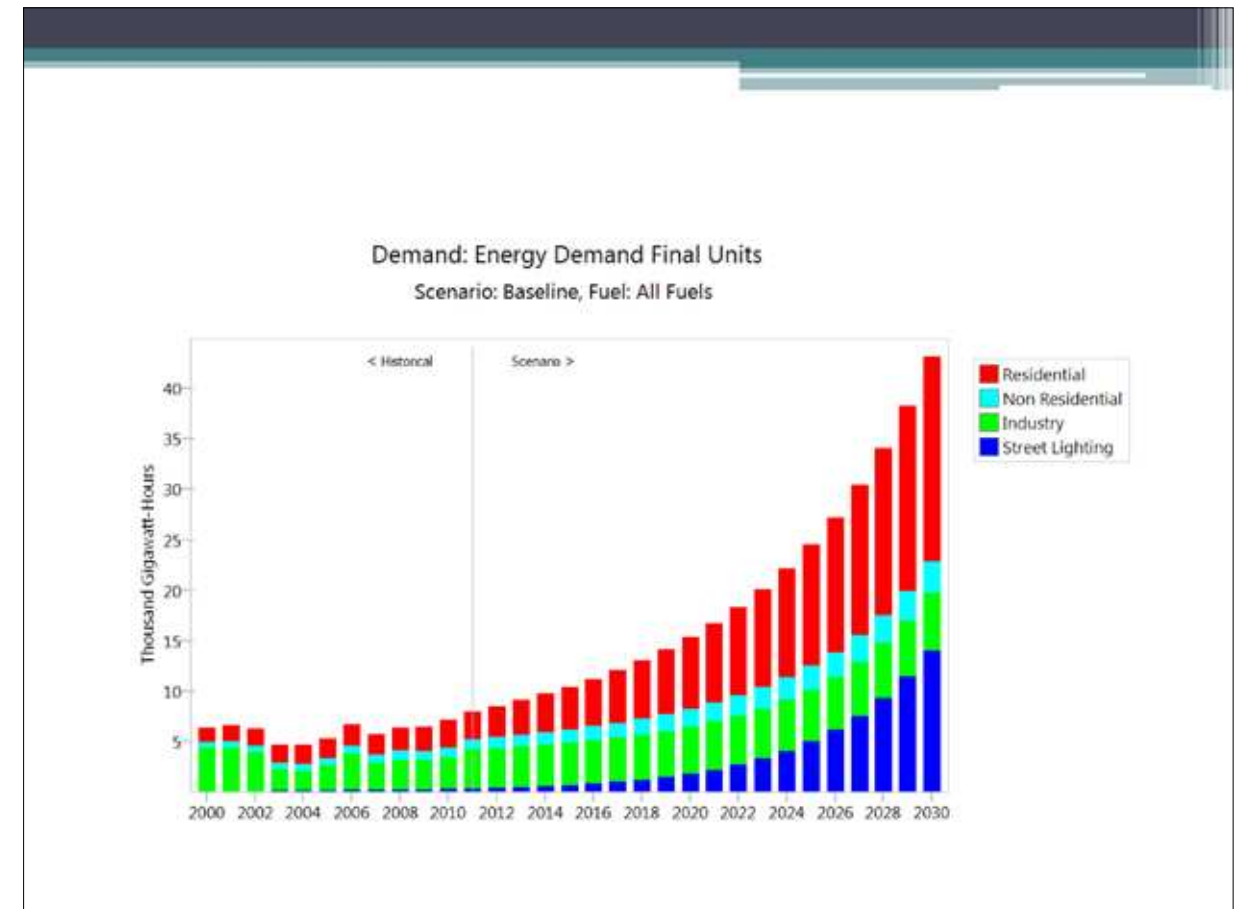
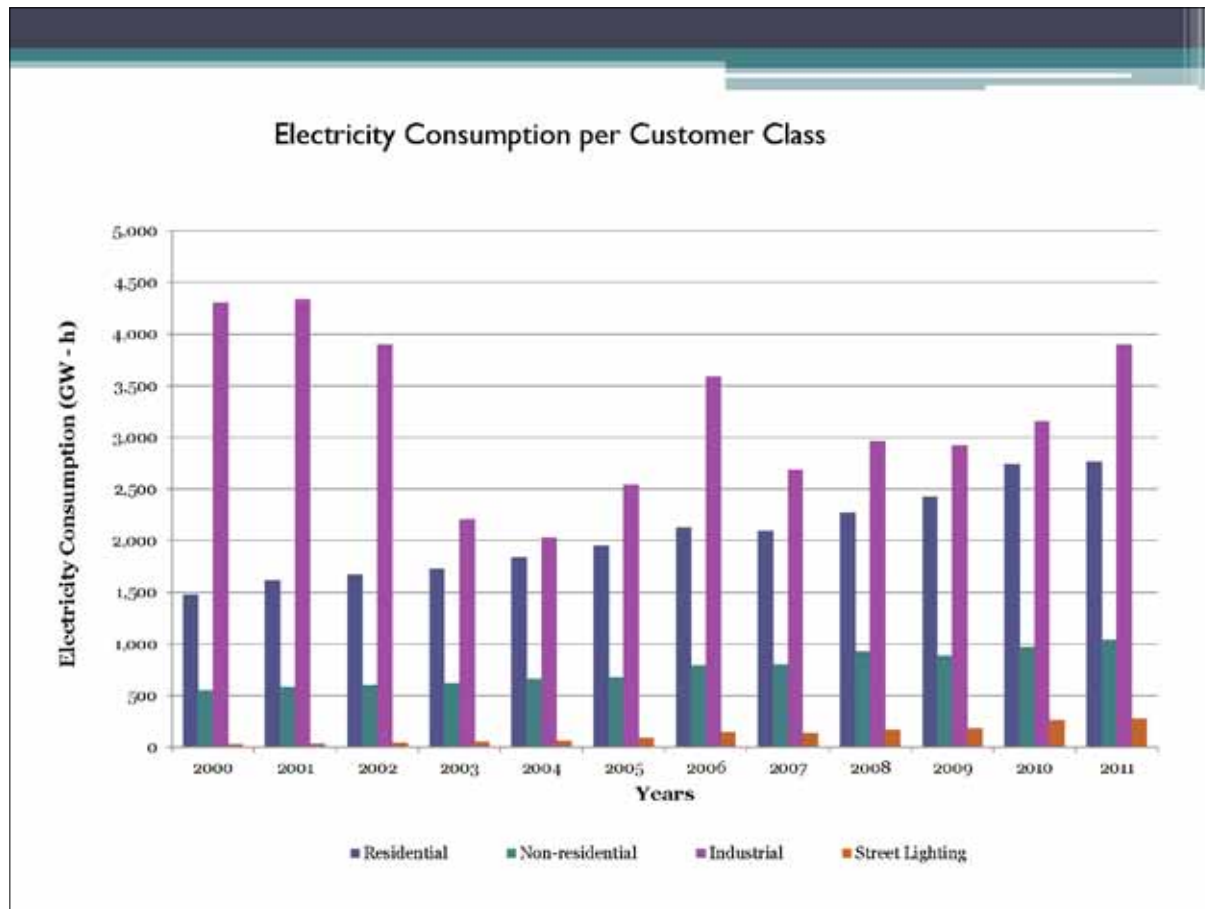
Thermal Plants

- Volta River
- Independent Power Producers (IPP)
- Installed Capacity of Thermal (2013) - 990 MW

In 2011, the customer population;

- Electricity Company of Ghana (ECG) - 2,353,765
- Northern Electricity Department (NED) - 335,633



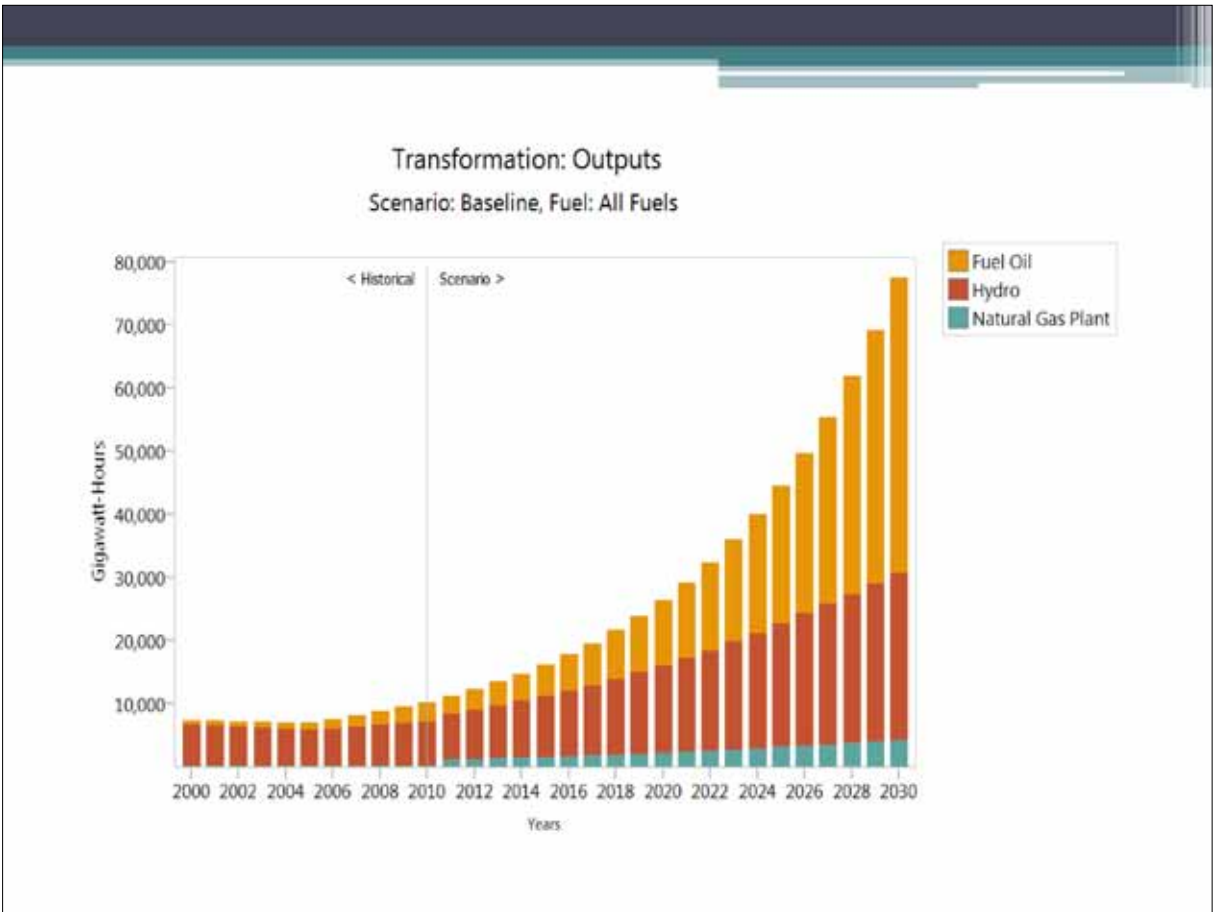
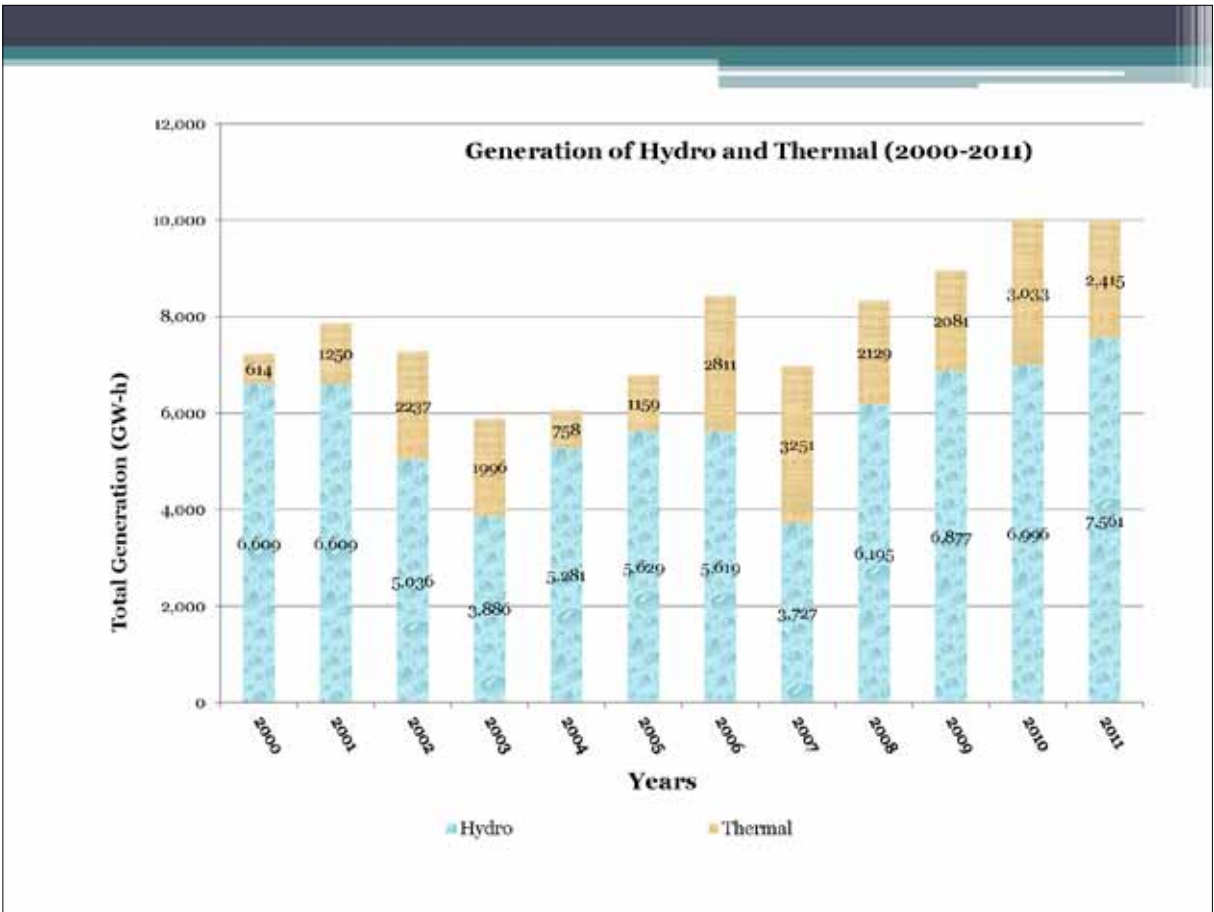
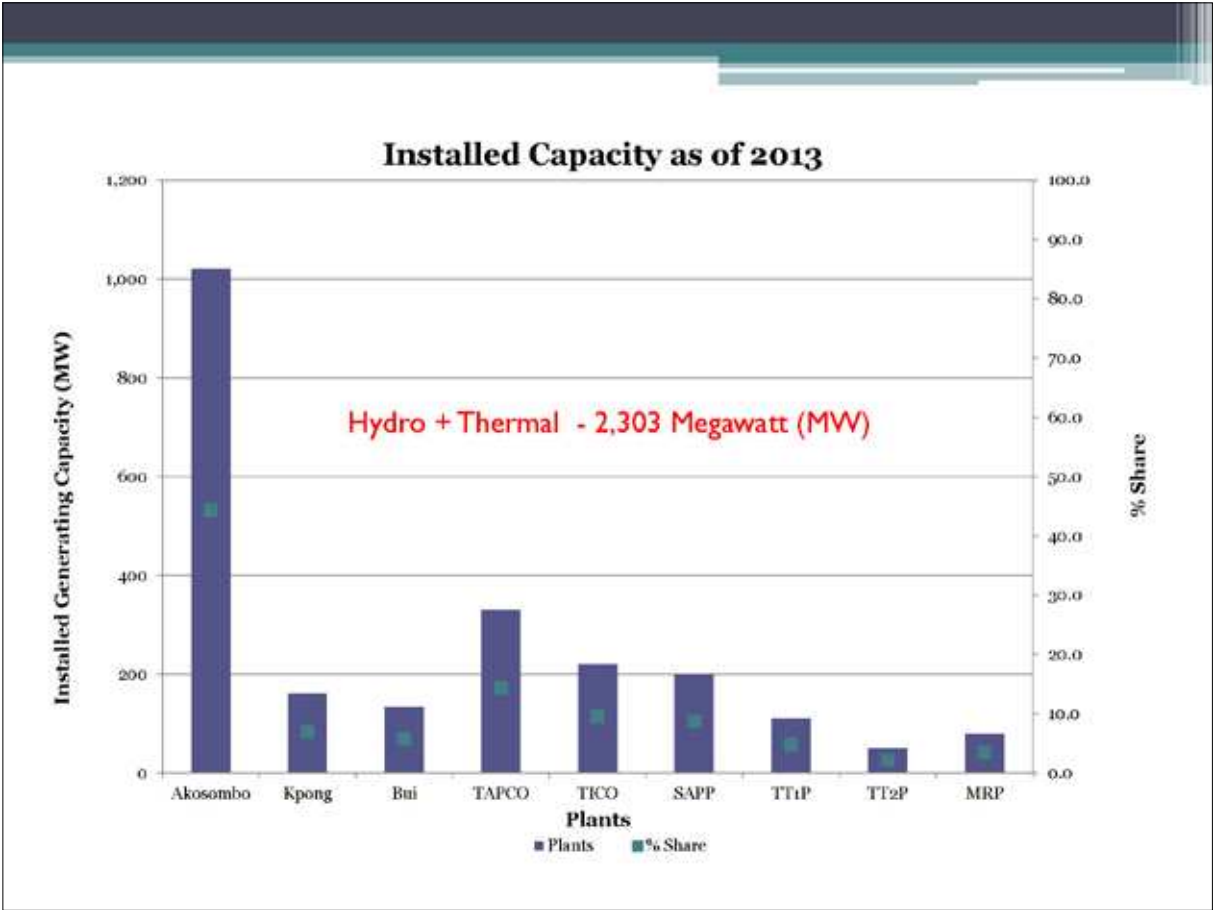


Demand Projection

- The total energy demand for the base year (2000) was estimated around 7,200 Gigawatt-hours of electricity from the four demand sectors.
- These demand sectors are also projected under 'Business as Usual' to increase about 2,140 Gigawatt-hours of electricity per year.

Supply Projection

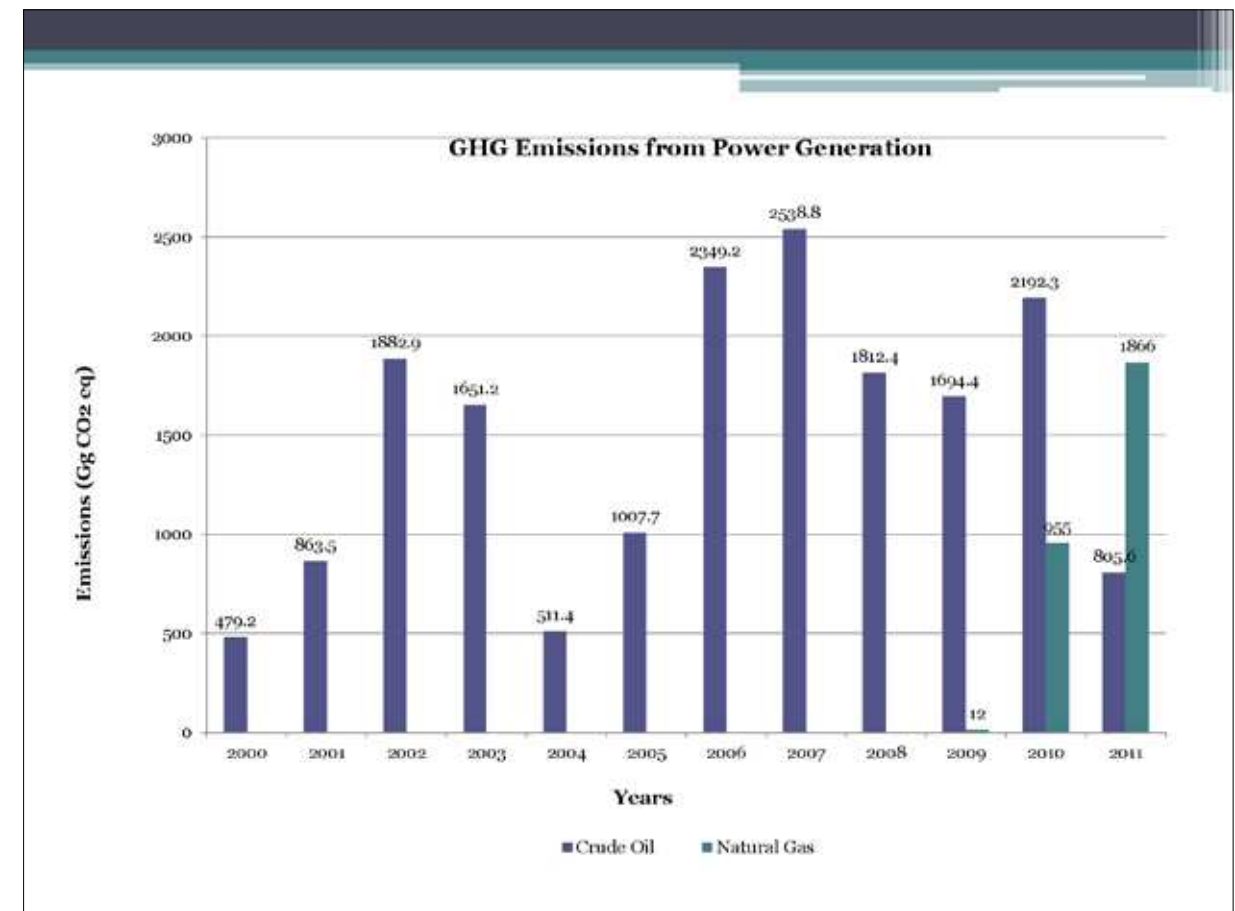
- The generation patterns are likely to change from the predominant dependence on hydro to thermal by 2018 under baseline conditions.
- This scenario would increase the country's GHG emissions and intensities over the period.



Historical GHG Emissions

Energy Sector

- In 2000, the energy sector contributed 41% of the total GHG emissions
- Total greenhouse gas emissions from the energy sector amounted to 5.9MtCO₂eq in 2000
- The energy sector emissions increased from 3.3MtCO₂eq in 1990 to 9.2MtCO₂eq, representing a total increase of 183% between 1990 and 2006



Power Generation Sector

- GHG emissions from the Power generation sector was mainly from thermal power generation
- The thermal generation depends on LCO and NG
- In 2000, GHG emissions from the sector was estimated at 479 Gg CO₂eq and increased to 2,672 Gg CO₂eq in 2011 representing an average annual increment of 35% per year

Mitigation Scenario 1

The GHG emission reduction fuel switching approach, where all thermal power plants will use natural gas as their primary fuel instead of their original fuel.

Mitigation Scenario 2

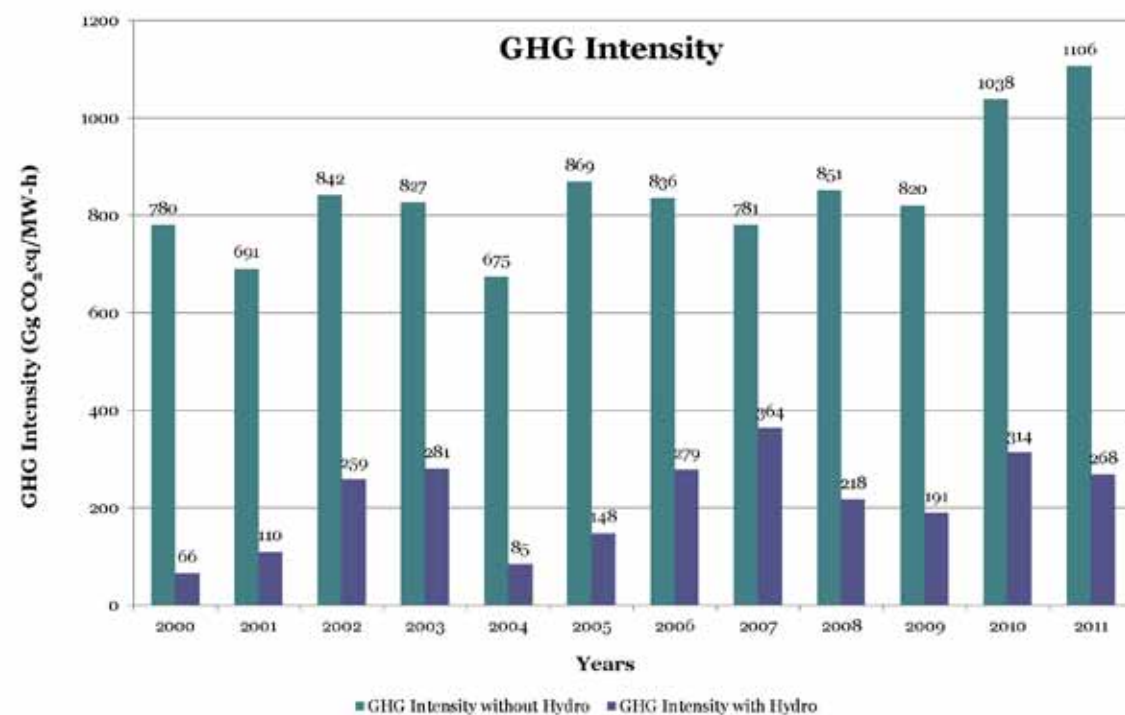
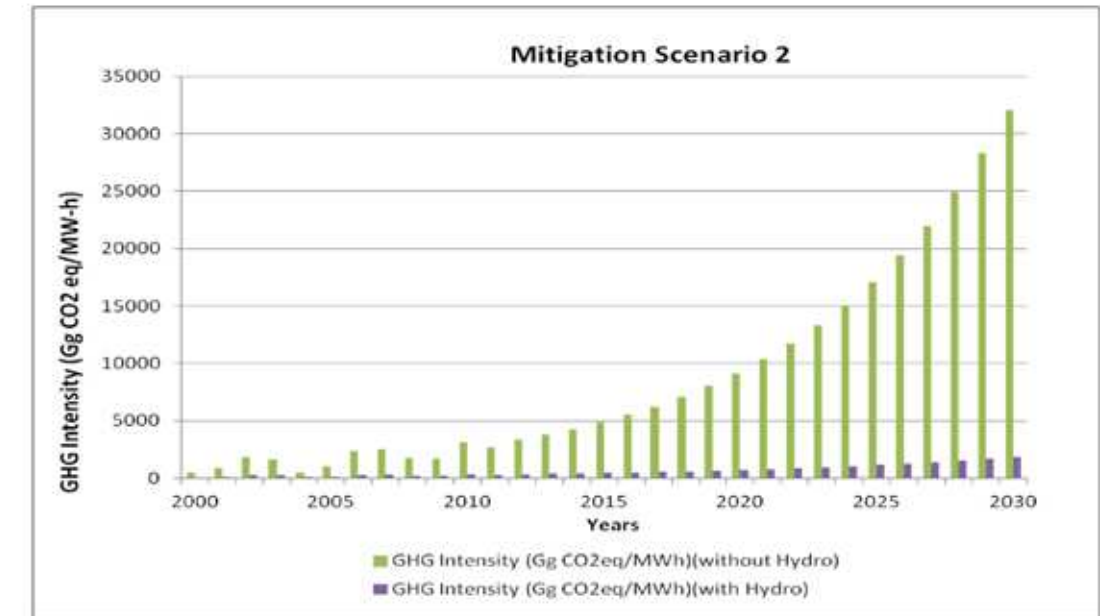
The GHG emission reduction potential in this scenario will introduce additional hydro and renewable sources such as wind into the energy supply mix.

GHG Intensity

- The definition of GHG intensity is the ratio of GHG emissions to the total electricity generation as an indication of the contribution of electricity generation to GHG emissions.
- An overall reduction in GHG intensity (including hydro) by 16% at the end of 2011.

Emission Reduction Potential

GHG intensity in the thermal power generating sector show high GHG intensity compared to natural gas generating plants between 2009 and 2011.



- GHG intensity for crude oil thermal generating plants was in the range from 591 to 875 Gg CO₂eq/kWh.
- The range for natural gas generating plants was 229-231 Gg CO₂eq/kWh between 2009 and 2011.
- Further reduction potential of GHG intensity can be achieved within the electricity generating sector through the adoption of more hydro and other renewable sources

Recommendations (Based on country circumstance)

- Introduction of additional hydro and renewable sources such as wind and solar into the energy supply mix.
- Reduction in Transmission and Distribution Losses from the current 31.2% in 2011 to about 9% in 2030.
- This scenario looks at the demand sectors through the adoption of end-use energy efficiency especially in the residential sector

Thank you

Relevant Policy Implications for Mitigation Strategies derived from the Modeling Analysis

- The country has the potential to reduce its GHG emissions from the power generation sector through the adoption of appropriate mitigation measures.
- These results demonstrate that there are great opportunities for GHG emission reduction in the electricity generation sector.
- These potentials are evaluated through four demand and supply GHG mitigation scenarios that are already captured in the country's energy policy documents.
- .

SPECIAL C2GMF SESSION

Country Case Studies in Power Generation Sector

3-3 Vietnam Case Study

- GHG Inventory Emissions Scenario and Policy Analysis in the Power Generation Sector of Vietnam

Huyen Thi Thu Nguyen, *Manager of Environmental Department*
Institute of Energy, Ministry of Industry and Trade, Vietnam

SPECIAL C2GMF SESSION.
Country Case Studies in Power Generation Sector

Vietnam Case Study:
GHG Inventory Emissions Scenario and Policy Analysis
in the Power Generation Sector of Vietnam



Huyen Thi Thu Nguyen

Manager of Environmental Department

Institute of Energy, Ministry of Industry and Trade, Vietnam

Huyen Thi Thu Nguyen has been working in the environmental field of the energy sector about 15 years and she has had deep experience in this sector. Her job is related to National Development Master Plans of: Energy, Power, Renewable Energy, Energy Conservation and Energy Efficiency, Monitoring and assessment of the Power Development Master Plan implementation process, as an Advisor to Ministry of Industry and Trade on steering measures.

Ms. Nguyen is a study group leader on strategic environmental assessment and environmental impact assessment for over 15 power projects including National Power Development Master Plans and Thermal Power, Hydropower and Nuclear Power Plant Projects;

In regard to environment and climate change, Ms. Nguyen has studied environmental technologies and equipments in power plants; scenarios of GHG emission reduction measures and estimated damage cost by GHGs from exhausted gas to integrate into the investment cost of traditional power plants aiming to promote new and renewable power energy and energy savings.

Furthermore, she is also a consultant for proposal and consulting environmental protection and pollution mitigation equipment and technologies for power plant projects such as exhausted gas, solid waste and waste-water treatment equipment, low-emission coal combustion technology, GHG emission reduction, etc through specific consulting works such as: project investment reports/FS reports, technical designs, detailed/construction drawings (for contractors), appraisal of design reports/document reports; consultancy services on bidding and supervision of project construction.

**C2GMF 6th Steering Committee Meeting & 2013 International
Modeling Conference**

**GHG Emission Inventory Scenario
and Policy Analysis - Power
Generation in Vietnam**

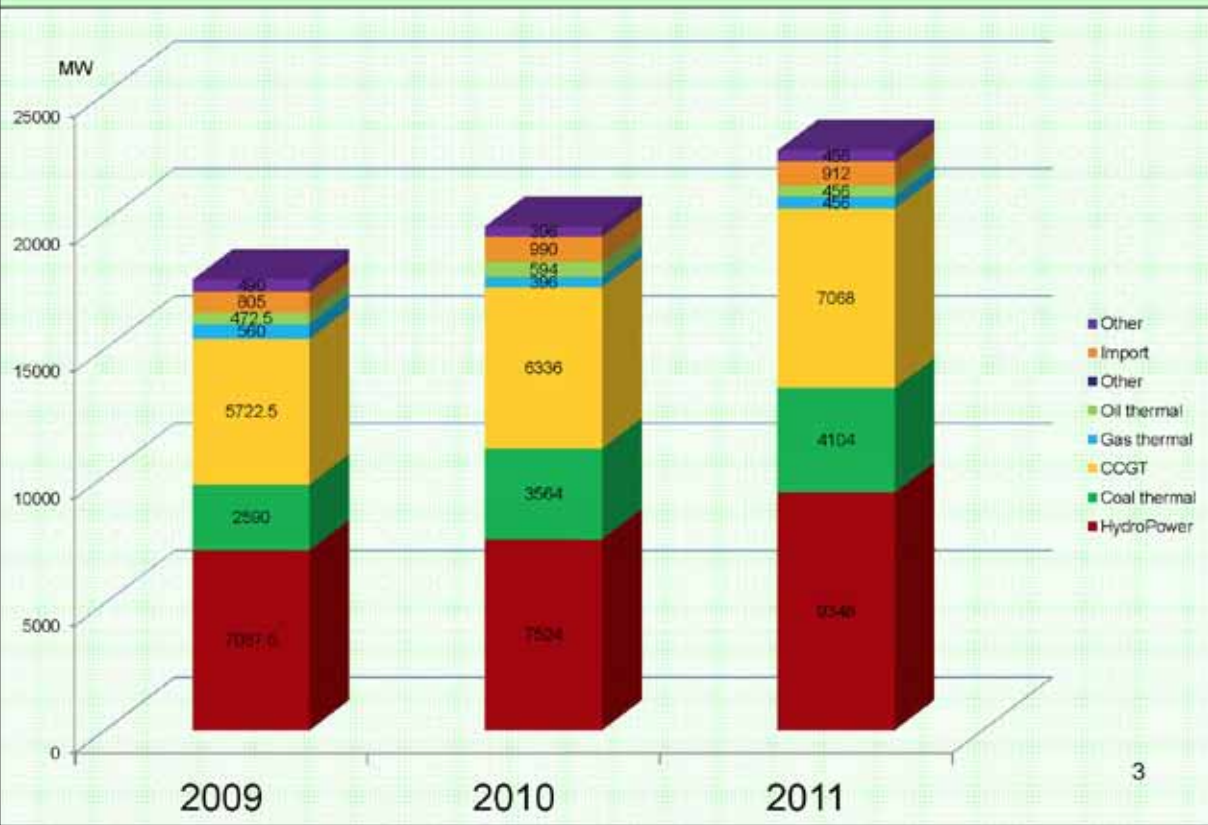
Nguyen Thi Thu Huyen - INSTITUTE OF ENERGY, MOIT

Seoul, 7/2013

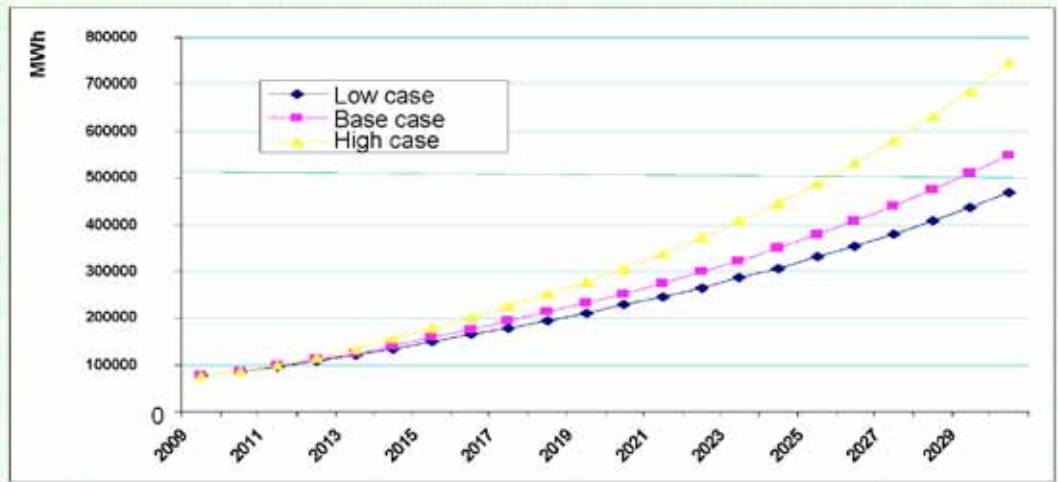
1. Current status of vietnam power network (1/2)

Year	2009	2010	2011
Installed capacity (MW)	17500	19800	22800
<i>HydroPower MW(%)</i>	<i>7088 (40.5)</i>	<i>7524 (38)</i>	<i>9348 (41)</i>
<i>Coal thermal MW (%)</i>	<i>2590 (14.8)</i>	<i>3564 (18)</i>	<i>4104 (18)</i>
<i>CCGT MW (%)</i>	<i>5723 (32.7)</i>	<i>6336 (32)</i>	<i>7068 (31)</i>
<i>Gas thermal MW (%)</i>	<i>560 (3.2)</i>	<i>396 (2)</i>	<i>456 (2)</i>
<i>Oil thermal MW (%)</i>	<i>472.5 (2.7)</i>	<i>594 (3)</i>	<i>456 (2)</i>
<i>Import MW (%)</i>	<i>805 (4.6)</i>	<i>990 (5)</i>	<i>912 (4)</i>
<i>Other MW (%)</i>	<i>490 (2.8)</i>	<i>396 (2)</i>	<i>456 (2)</i>

1. Current status of vietnam power network (2/2)

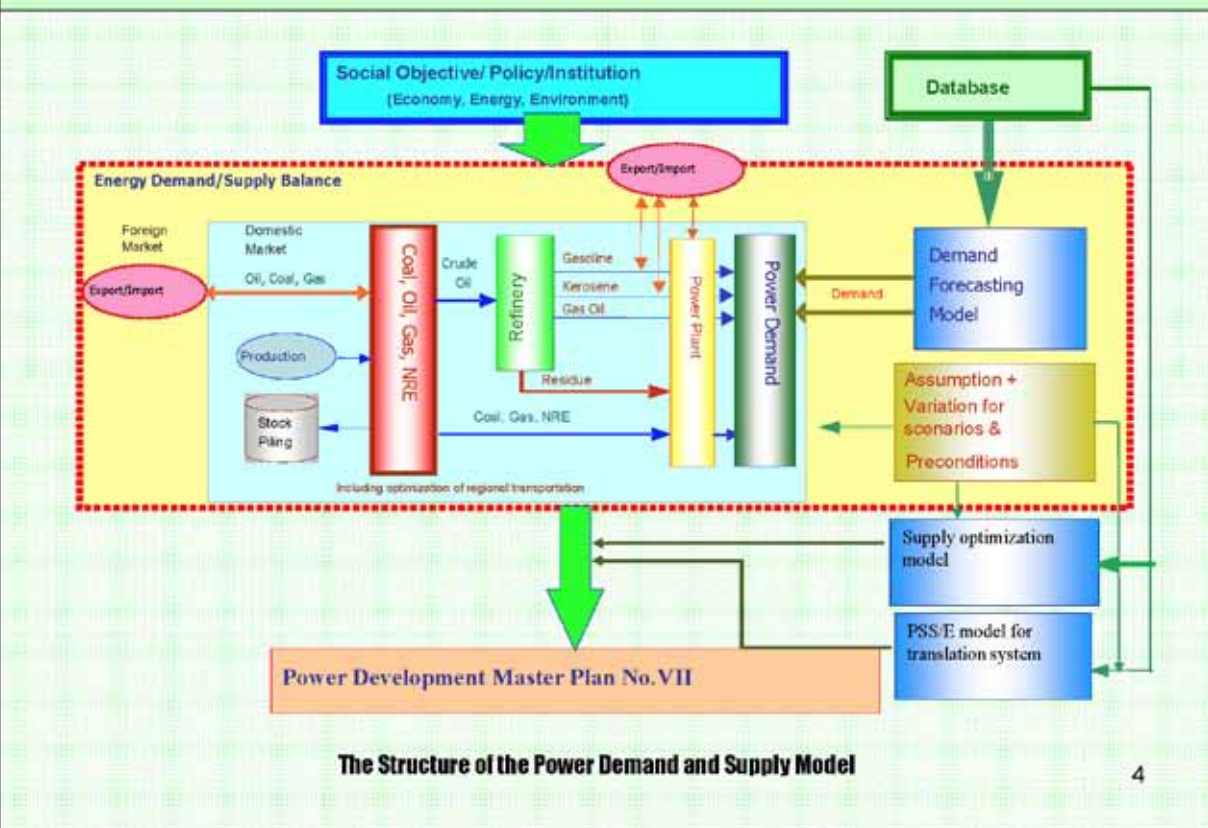


Growth Scenario of electricity demand in period 2010 - 2030



Growth rate/year	2006-2010	2011-2015	2016-2020	2021-2025	2026-2030
High case		16.3%	11.6%	9.2%	8.8%
Base case	13.5%	14.4%	11.3%	8.2%	7.8%

2. demand and supply forecast



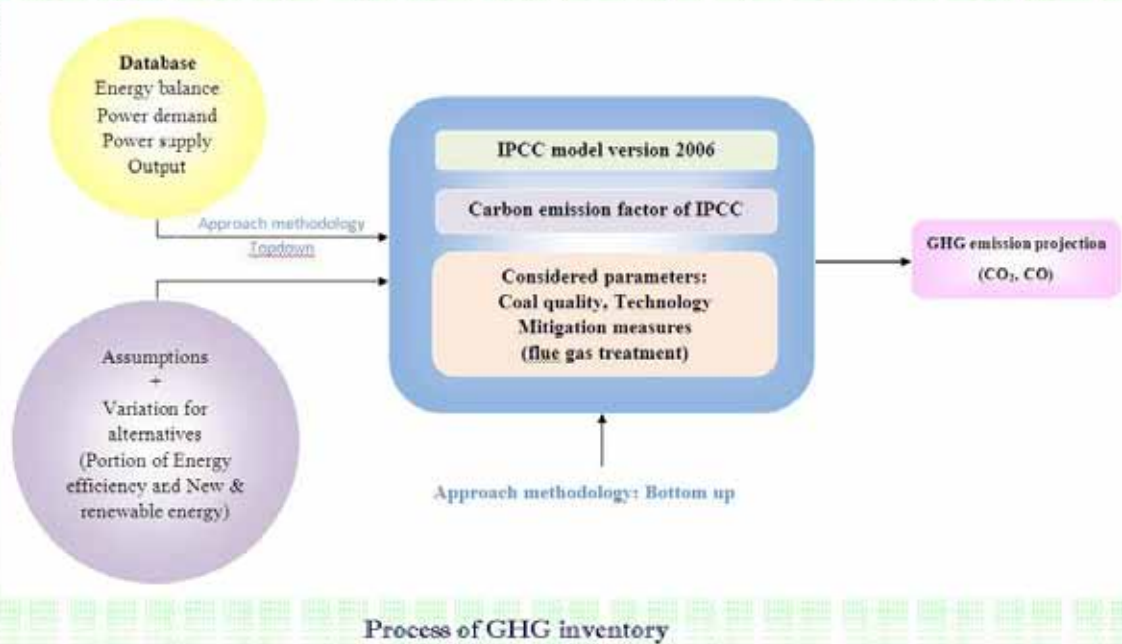
Power generation development program

Fuel mix Gen	2010	2015	2020	2025	2030
Electricity production	100.9 TWh	194.3 TWh	329.4 TWh	489.6 TWh	695.1 TWh
Pmax whole country	16,048 MW	30,803 MW	52,040 MW	77,084 MW	110,215 MW
Total installed capacity	19937 MW	43,050 MW	69,433 MW	98,010 MW	137,780 MW
Total reserve	3,889 MW	12,247 MW	17,393 MW	20,926 MW	27,565 MW
In which					
HPP&PSPP	7,726MW (38.8%)	14,351 (33.3%)	17,455 (25.1%)	19,857MW (20.3%)	21,057 (15.3%)
Oil&Gas TPPs	7,703MW (38.6%)	10,582 (24.6%)	13,625 (19.6%)	17,525MW (17.9%)	17,525 (12.7%)
Coal TPPs	3,231 MW (16.2%)	15,365 (35.7%)	32,385 (46.6%)	45,190 MW (46.1%)	77,310 (56.1%)
RE	527MW (2.6%)	1,679 (3.9%)	3,129 (4.5%)	4,829MW (5.0%)	4,829 (3.5%)
Import	750MW (3.8%)	1,073 (2.5%)	1,839 (2.6%)	4,609MW (4.7%)	6,359 (4.6%)
NPP			1,000 (1.4%)	6,000 MW (6.1%)	10,700 (7.8%)

In 2020 capacity of RE power is ~3,100MW (1900MW of SHP & 1200MW of Wind, solar, biomass ...), accounting for 4.5% of 70,115MW total installed capacity. Issue of price mechanisms for wind power is being studied and submitted to the Government.

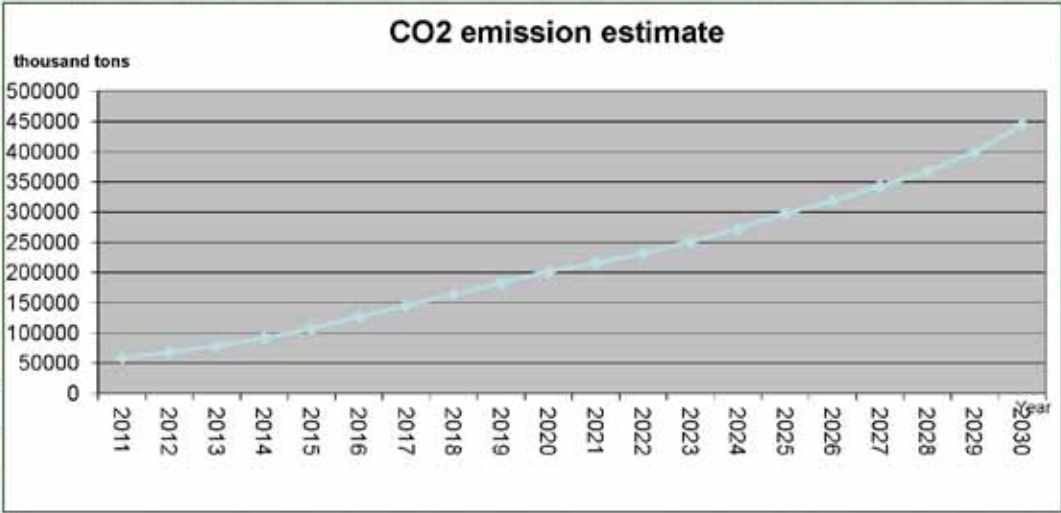
In 2025, RE power capacity is 4,800MW (~2,700MW SHP and ~2,100MW of Wind, solar, Biomass, etc...), accounting for 5% of total installed capacity.

3. GHG inventory approach



7

4. Predicted GHG emission from power sector



Year	2011	2015	2020	2025	2030
CO ₂	59463	107162	201491	297237	443802

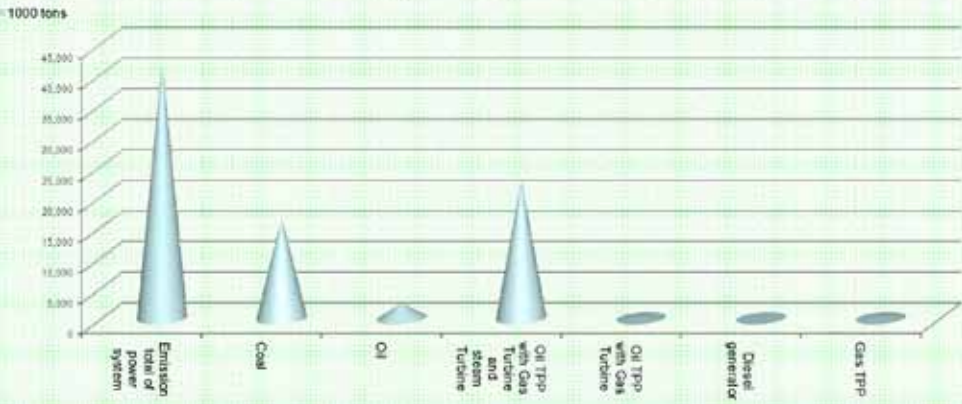
Source: SEA of PDP VII

Result of GHG inventory in 2010

Activities of power generation in 2010	Emission value (1000 tons)
Emission total of power system	42,105
Coal	16,501
Oil	2,391
Oil TPP with Gas Turbine and steam Turbine	22,686
Oil TPP with Gas Turbine	230
Diesel generator	7.2
Gas TPP	291

Source: Vietnam National Power Development Master Plan in 2011-2020 perspective to 2030, 2011, IE.

GHG emission of power generation in 2010



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2. Alternatives for power generation

Power generation scenario are suggested as alternative to consider:

- Alternative 1: For thermal power generation: increase from 4185 MW in 2011, 86,625MW in 2020 and 94,625 MW in 2030. It is expected that:
 - Existing gas turbine will be change into LNG after 2017. (LNG is imported).
 - Increase power generation sources from new and renewable energy to 8-10% comparing to 3.1% as put in basecase.
 - Increase nuclear power to 8 units comparing to 3 units in basecase.

Result: Coal demand lessen remarkably, so CO2 emission reduce respectively.

Period	2011	2015	2020	2025	2030
Coal (10 ⁶ tons)	11.2	31.9	75.8	111.9	177.5
Domestic	10.8	29.9	46.2	61.9	64.8
Import	0.38	2	29.7	50	112.7
Reduction of the coal (10 ⁶ tons)	0	0.1	1.2	4.6	10.6

Emission reduction and environmental cost reduction up to \$ 1.7 billion in 2030. This saving is long and constantly increasing and affecting direct finance in the field of power generation related to the current conditions of use renewable energy. Relative economic costs of renewable energy when compared with conventional electricity sources will change in coming decades with the development of technical, economic size and the amount of renewable energy used worldwide is increasing .

Alternative 2: Energy saving and efficiency

Increase of energy saving and efficiency to 8-10% (pursuant to The national target program on energy saving and indicators of effectiveness and The implementation of savings in electricity use).

Primary energy demand in the scenario given in the following table:

Period	2011	2015	2020	2025	2030
Coal (10 ⁶ tons)	10,9	28,2	57,9	89,6	135,1
Domestic	10,6	26,2	39,8	53,2	69,5
Import	0,34	2	18,1	36,4	65,6
Reduction of the coal (10 ⁶ tons)	0,6	3,8	19,2	26,9	56,3

As result, about 16 coal fire TPP will be withdrawn from candidate list of coal fire thermal power plants in 2030, saving 56 million tons of coal per year (65 million tons of import), **cutting down 100 million tons of CO₂ emission**, over 72 million tons of SO₂, 42 million tons of NO_x, nearly 10 million tons of dust.
→ reducing climate change, harmful effects of acid rain and reduce impacts on human health. Consequence of saving \$ 33 billion. This number is greater than the costs for mitigation and investment costs for energy efficiency.

5. Policy implications

Effects of Power sector development scenarios by the national development orientations and strategy to contribute the GHG reduction target and impact climate change mitigation of the world.

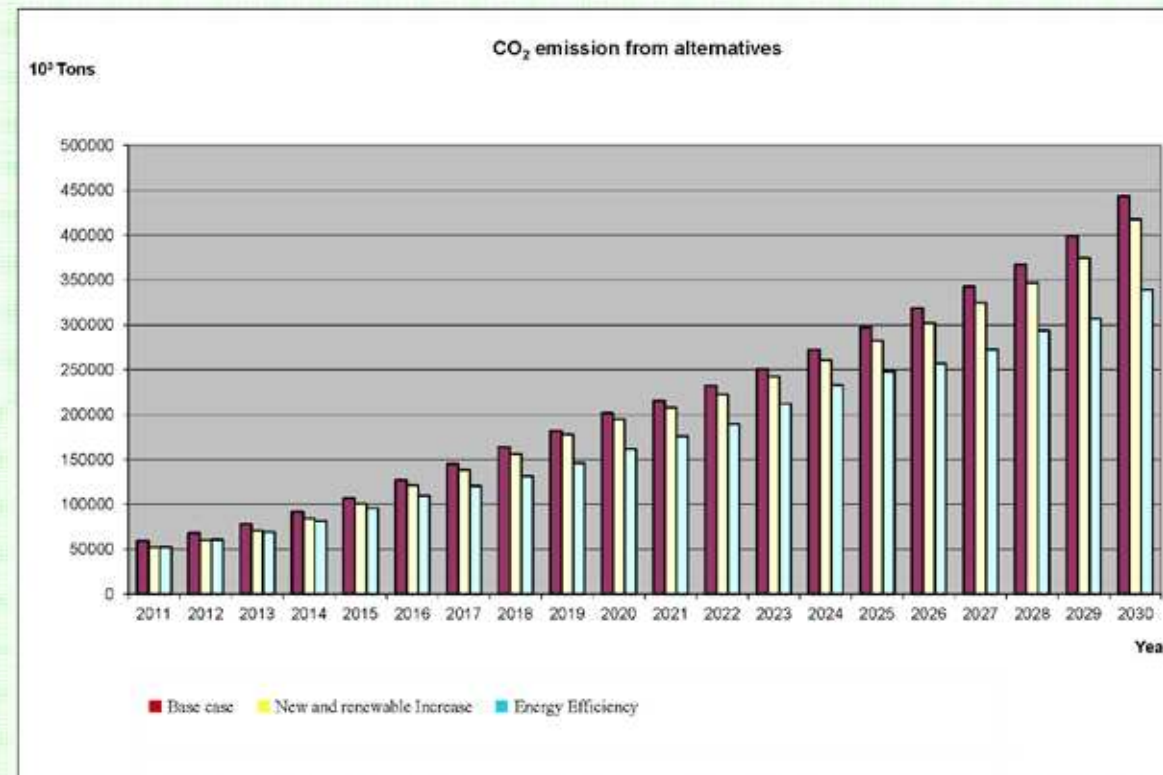
➤ The National target program to respond to climate change (2008)

The program's strategic objectives comprise of:

- Assessment on climate change impacts on sectors and regions in specific periods
- Developing feasible action plans to effectively respond to climate change in the short and long term to ensure sustainable development in Vietnam,
- Take opportunities to develop towards a low-carbon economy and to join the international community's efforts in mitigating climate change and protecting the climatic system.

➤ Regulation for price support for products of CDM projects consisting of power generation from wind, solar, geothermal, ocean energy, recovered CH₄ gas from landfills and coal mines.

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➤ National strategy on Climate change (2011)

Objectives of this strategy:

- (1) Mobilize the national capacity, carry out simultaneously adaptive solutions to climate change and mitigation GHG emission, ensure people's life and property security aiming to sustainable development target;
- (2) Strengthening people and natural systems's capacity of adapting to climate change, low carbon economic development aiming to protect and improve living standard, ensure security and national sustainable development in the context of global climate change and actively work with the international community to protect earth's climate system.

➤ Green growth strategy (2012)

- Objectives : to progress towards a low carbon economy, to secure rich natural capital resource as part of the decision made under the sustainable economic development, reduce emission and increase GHG capture capacity .

These are important and mandatory objectives that are to be achieved gradually during socio-economic development.

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➤ **Governing Emission for GHG and CER business to the international market.**

To conform to UNFCCC and the international treaties which Vietnamese signed as a member to use every opportunities to develop low carbon economy, green growth and join the international community to mitigate GHG emission, and contribute to the national sustainable development target.

Achievements

- ❖ There is an increase tremendously of power generation from renewable power source from 3.1% in time of PDP VII to over 6% now. This increase pace of renewable power source is faster expected.
- ❖ For coal-fired power source: It is expected the highest GHG emission source, has had a lot of specific actions to improve efficiency of the plants such as advanced technology use with high efficiency, burner innovation in existing coal fired power plants, coal mixture, financial incentives for Encourage cogeneration, initial study on CO2 Capture and Storage (CCS) ... Measures to decline auxiliary power of plants up to 3% auxiliary power in comparison to 10% now.
At present, Vietnam is conducting setting road map to apply GHG emission mitigation measures for coal fired thermal power plants.
- ❖ National program on energy efficiency and saving has developing broadly in many sectors such as buildings, services, applications...

***Thank you for
your attention!***