



Workshop - “The Science of Climate Change & Climate Change Vulnerability & Adaptation”

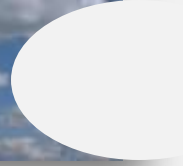
Introduction to Climate Change Mitigation

Climate Studies Group Mona (CSGM)- University of the West Indies.

Institute of Meteorology of Cuba (INSMET).

Presented by David Barrett – ENBAR Consulting (MSc., MPhil.).

1. Key Definitions.
2. Mitigation Potentials.
3. Emissions Trading.
4. Mitigation Options.



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KEY DEFINITIONS.



Key Definitions

Climate Change:

A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

(UNFCCC Article 1.)

Vulnerability:

The degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change (variability and extremes).

Vulnerability is a function of;

- *Character of CC*
- *Magnitude of CC*
- *Rate of CC & climate variation.*
- *Sensitivity of environment.*
- *Adaptive capacity of the environment.*

Adaptation:

Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected *climate change effects*.

◆ *Types of Adaptation Efforts:*

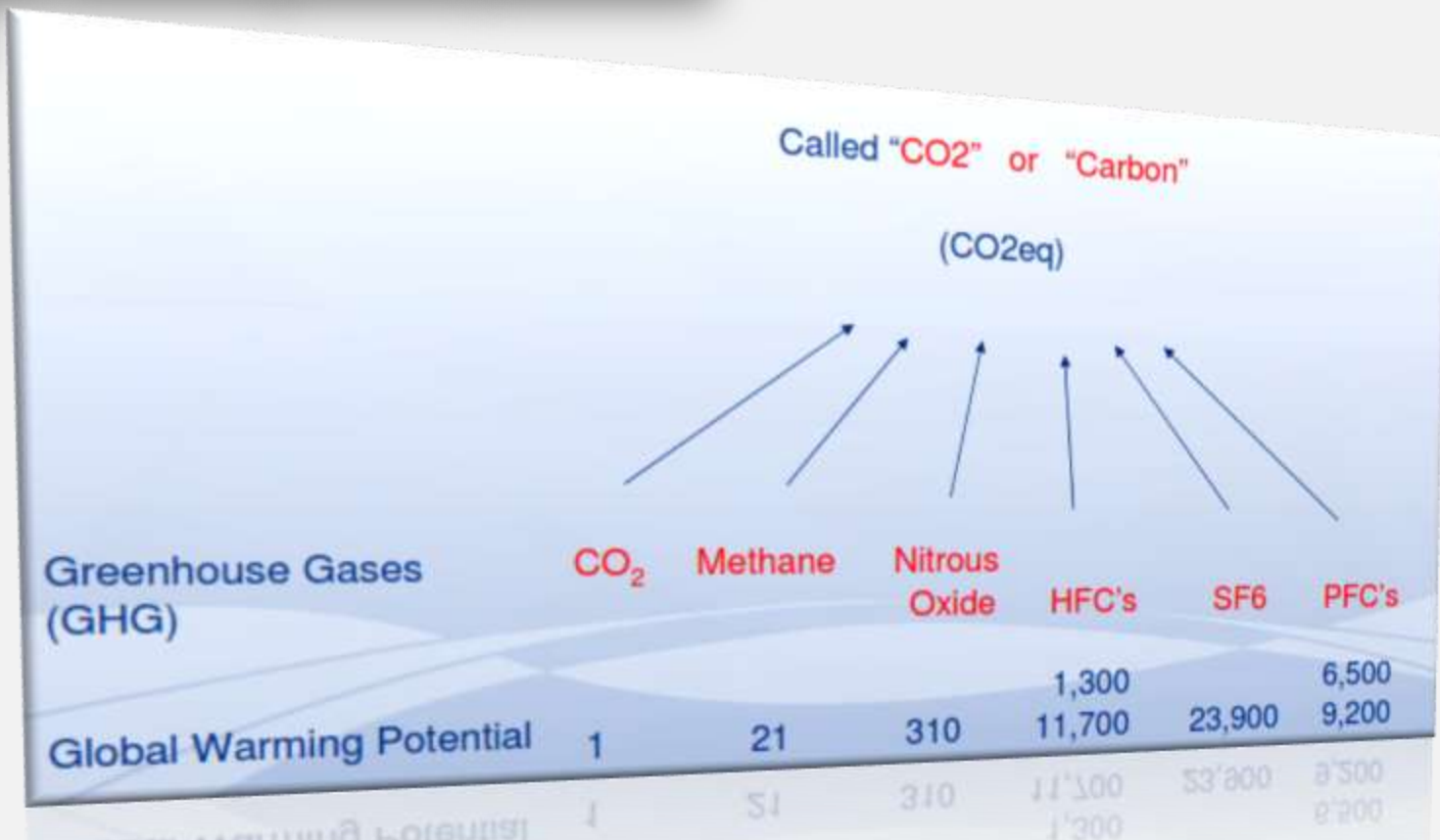
- *Anticipatory and reactive.*
- *Private and public.*
- *Autonomous and planned.*

Mitigation:

A human intervention to reduce the sources or enhance the sinks of greenhouse gases.

(Glossary - IPCC Working Group I: The Scientific Basis)

6 Kyoto Protocol GHGs



- ➔ CO₂ equivalent: The combined impact GHG's expressed in tonnes CO₂.
- ➔ A tonne of carbon/ton CO₂ can be an index for reduction or emission allowance.

PROCESS RELATED EMISSIONS ¹

PROCESS		EMISSION					
		CO ₂	CH ₄	N ₂ O	PFC	SF ₆	HFC
Mineral Products	Cement Production						
	Lime Production						
	Limestone Use ²						
	Soda Ash Production and Use						
	Fletton Brick Manufacture ³						
Chemical Industry	Ammonia						
	Nitric Acid						
	Adpic Acid						
	Urea						
	Carbides						
	Caprolactam						
	Petrochemicals						
Metal Production	Iron, Steel and Ferroalloys						
	Aluminium						
	Magnesium						
	Other Metals						
Energy Industry	Coal mining						
	Solid fuel transformation						
	Oil production						
	Gas production and distribution						
	Venting and flaring from oil/gas production						
Other	Production of Halocarbons						
	Use of Halocarbons and SF ₆						
	Organic waste management						



◆ Adaptation:

- Near term results.
- Focused action on adjustments of the recipient (physical and natural environment and biota) to reduce vulnerability and increase resilience to CC.
- No action taken towards influencing climate systems.
- Anticipatory or reactive/reactive.
- Risk reduction strategies.
- Planning for long timelines.
- Generally developing countries will be impacted more and will need to implement greater adaptation.
- Policies and strategies vary by region, social groups, etc.

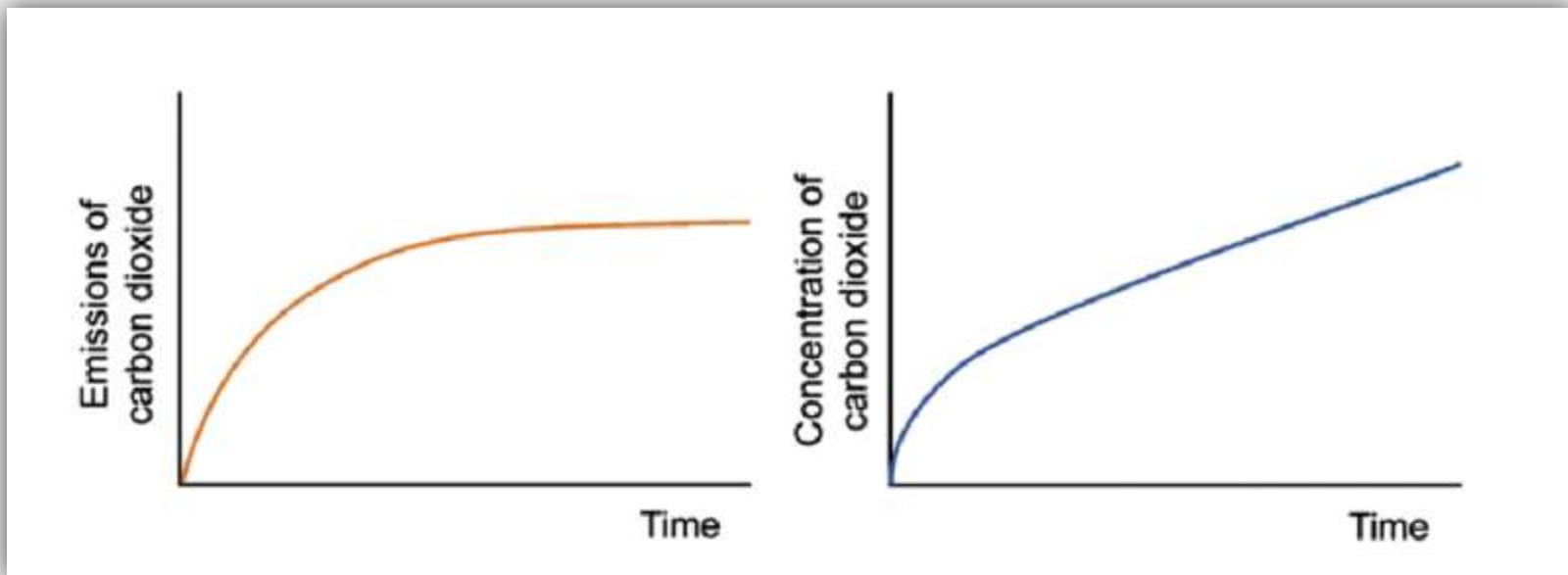


◆ Mitigation:

- Premised on the “precautionary principle”.
- Preventative (proactive) or reactionary strategies to more dangerous anthropogenic interference of the climate systems.
- May have defined timelines.
- Developing, developed and industrial nations will have the greater influence on climate systems. Will need to implement elevated mitigation efforts.
- Targets **the stabilization of GHG emissions** but does not reduce the amount of GHG in the atmosphere nor reverse existing effects of climate warming.

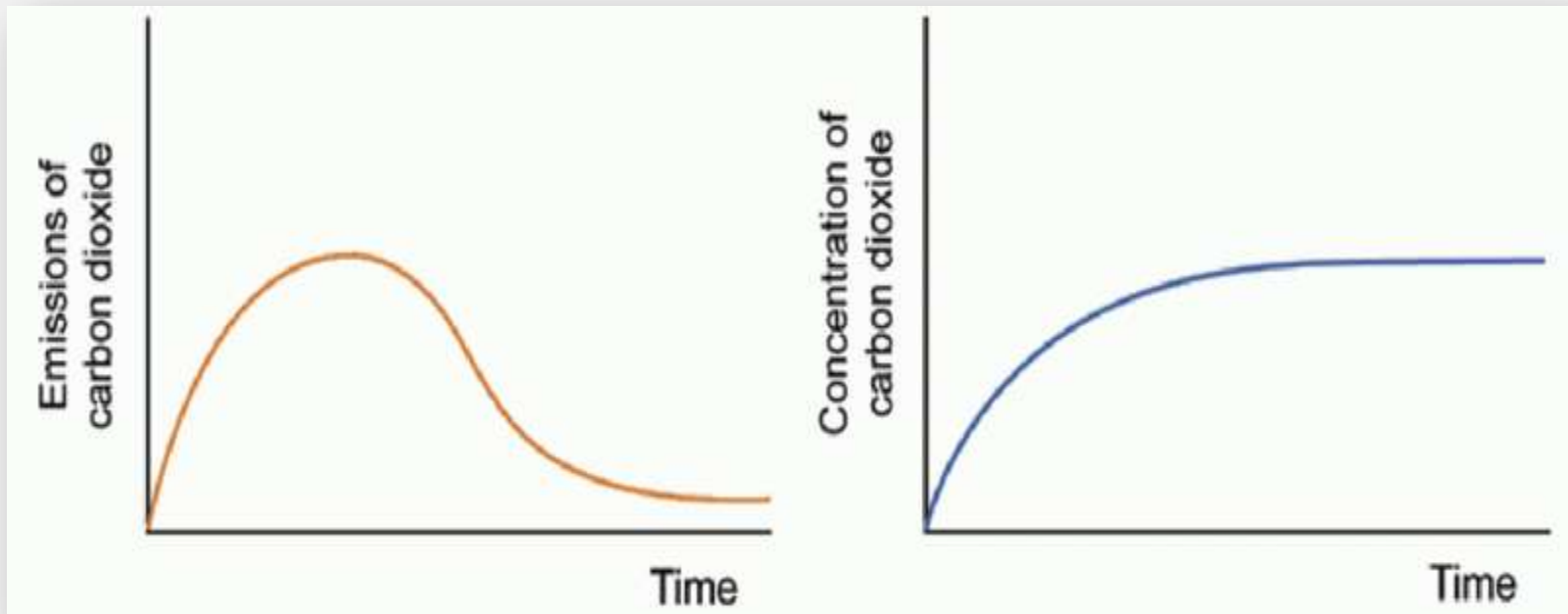
Adaptation Vs. Mitigation

- ◆ Stabilizing CO₂ emissions at their present level would not stabilize its concentration in the atmosphere (*Contribution of Working Group I, 4th Assessment Report*).



Adaptation Vs. Mitigation

- ◆ Stabilizing the atmospheric concentration of CO₂ at a constant level would require emissions to be effectively eliminated (*Contribution of Working Group I, 4th Assessment Report*).





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MITIGATION POTENTIALS.



Mitigation Potentials:

Extent of the desired mitigation which could futuristically be achieved over time.

1. Market Potential (*assessment of potentials under forecast market conditions*):
 - Mitigation potential based on private costs and private discount rates (private investor and consumer driven).
 - Potential based on facilitating policies and measures currently in place (state driven).
 - Barriers to actual uptake (market/other driven).

2. Economic Potential (*assessment of potential based on social cost/benefit factors*)

- Mitigation potential which considers/includes social costs, social benefits and social discount rates.
- Assumes that market efficiency is improved by policies and measures and the removal of barriers.
- Social discount rates are lower than private investor discount rates.
- Studies of market potential can be used to inform policy makers.
- Assessed economic potential - generally greater than market potential.

3. Technical Potential: (assessment of the extent to which possible GHG reduction or improved EE can be achieved using technology).

- Mitigation using a demonstrated technology or practice.
- Not defined by cost for the technology application.
- Economic considerations may be applied to allow for actual use.



Mitigation Potentials

- ◆ Cost/benefit decisions should consider optimal outcomes of mitigation.
- ◆ “Biggest bang for the buck” – identify greatest impacts.
- ◆ Define the scope of the mitigation efforts.

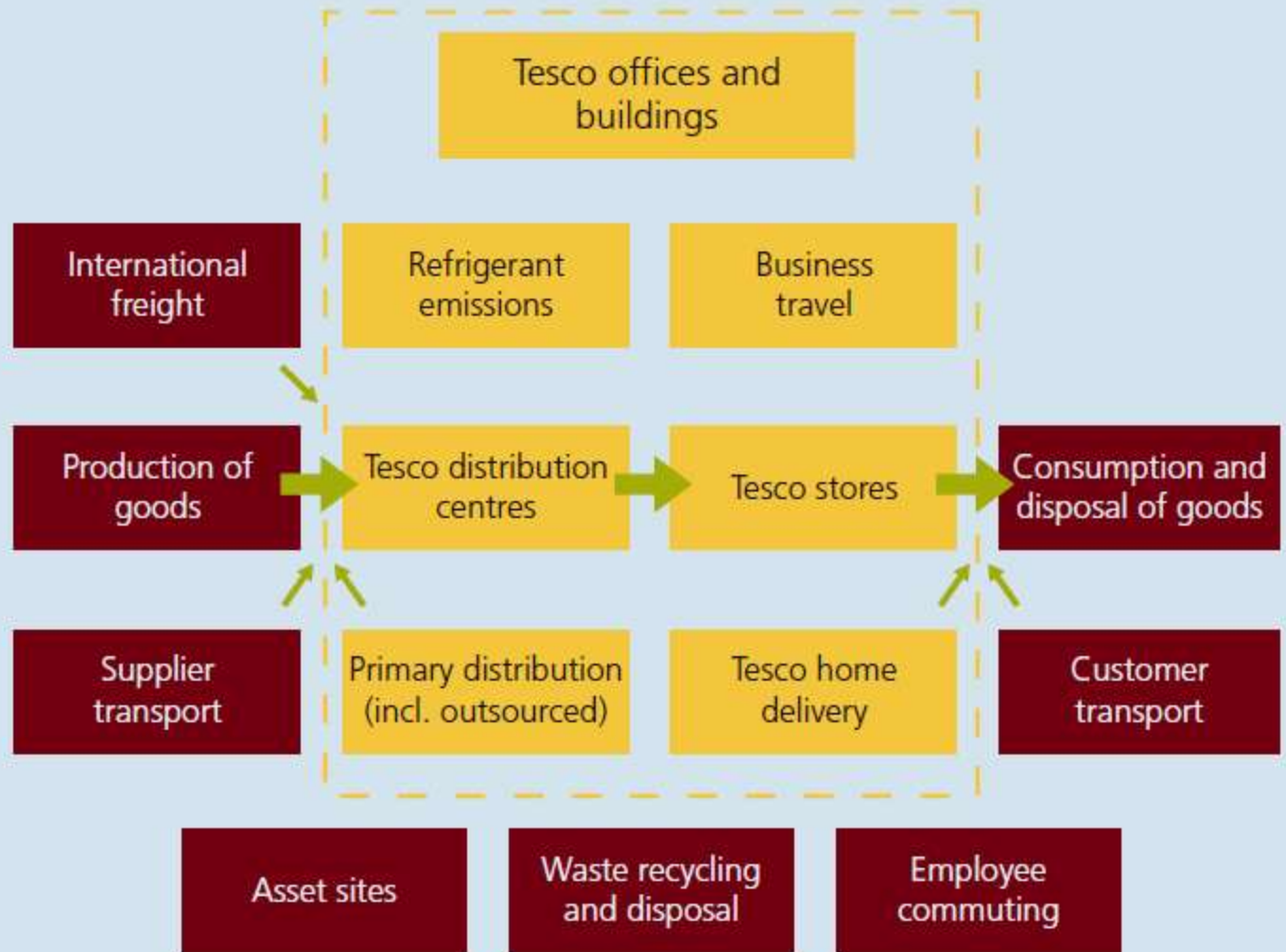
Main Types Of Emissions Sources Under Each Scope:

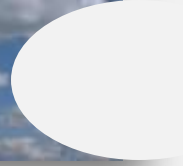
SCOPE 1: DIRECT FUELS COMBUSTION	SCOPE 2: ENERGY INDIRECT	SCOPE 3: OTHER INDIRECT (Discretionary)
Fuel Combustion (E.G. Boilers, furnaces or turbines).	Consumption of purchased electricity, heat, steam and cooling.	Purchased materials and fuels (E.G. Extraction, processing and production).
Owned transport (E.G. Trucks, trains, ships, airplanes, cars).		Transport-related activities* (E.G. Commuting, business travel, distribution).
Process emissions (E.G. Cement, aluminum, Waste processing).		Waste disposal (E.G. Waste, recycling).
Fugitive emissions (E.G. Air conditioning and Refrigeration leaks, methane leaks from pipelines).		Leased assets, franchising and outsourcing.
		Sold goods and services (E.G. Use of Goods and services).

(Source Defra – Department of Environment Food and Rural Affairs, UK)



Boundary for direct carbon footprint





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EMISSIONS TRADING.



◆ Elements of Recognized Mitigation Initiatives:

- Defined objective.
- Defined baseline or base case.
- Measurement system for deviations from baseline/base case.
- Reporting system.
- Verification system.



➤ **Nationally Appropriate Mitigation Actions (NAMA):**

- Bali Action Plan (CP.13, 2007).

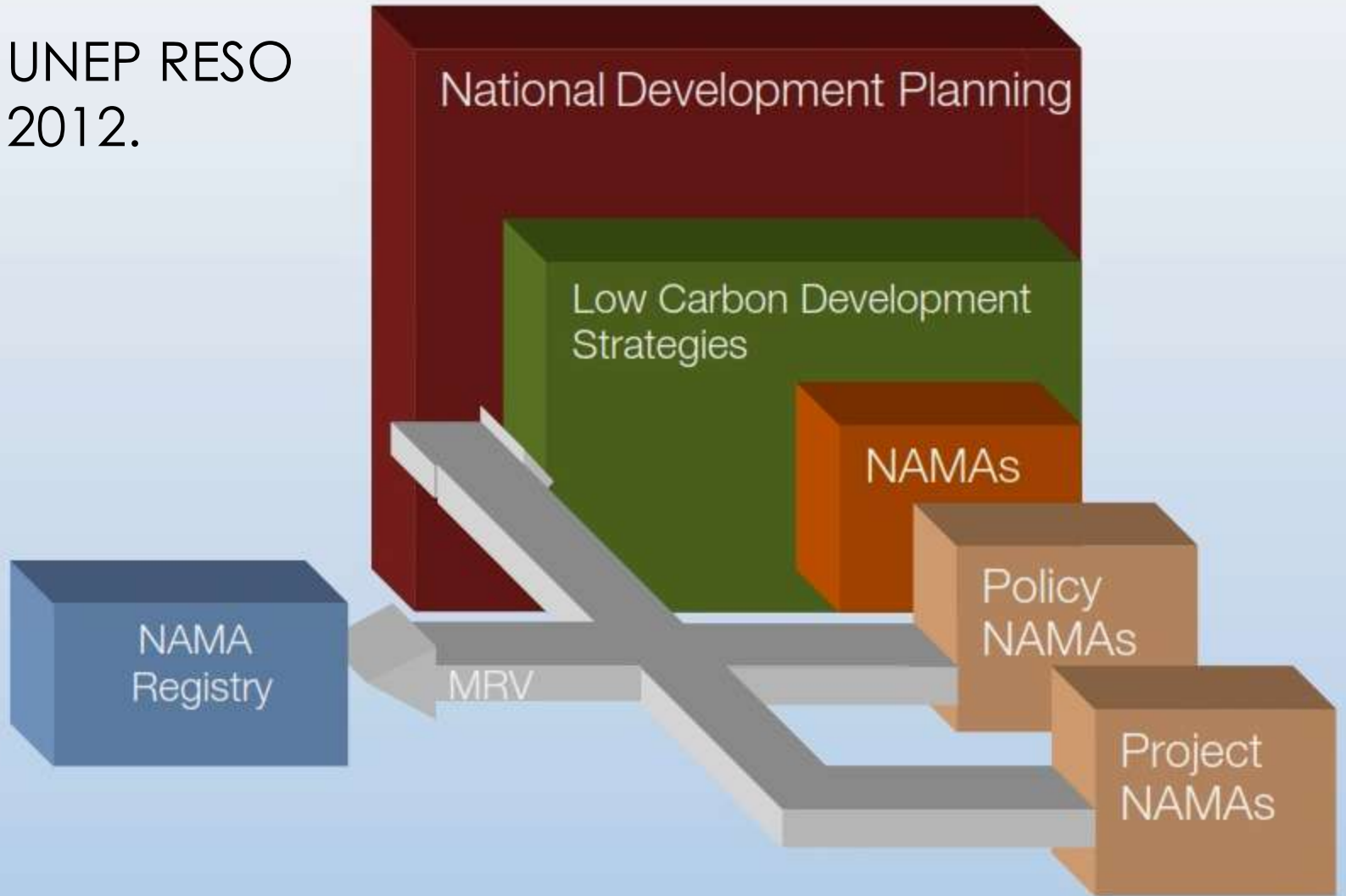
 - For Developing Country (DC) parties towards sustainable development, supported and enabled by technology, financing and capacity-building.
1. Unilateral NAMAs – autonomous actions taken by DCs to reduce domestic GHGs (domestically funded and unilaterally implemented).

 2. Supported NAMAs – actions undertaken with financial, technological and/or capacity building support from developed countries.

 3. Credit-Generating NAMAs – actions that produce credits for sale in the global carbon market. (New Market Mechanism).

Low Carbon Development Strategies

UNEP RESO
2012.



- Carbon trading is a financial incentive driven mechanism to facilitate mitigation;
 - Locally
 - Bilaterally.
 - Regionally.
- Defined market mechanism and agreed price for carbon credit (commodity) or GHG project development.
- Mitigation initiative must be measured against a baseline, reported and verified (1st, 2nd, 3rd party).

Emissions Trading Markets/Initiatives

Australian Clean Energy Act 2011 and National Greenhouse and Energy Reporting Act (Australian Territories)

Clean Development Mechanism (All Non-Annex 1 countries).

1990 Clean Air Act (Acid Rain Programme) (US States)

European Union Emission Trading Scheme (EU ETS) (EC Member States).

California Climate AB32 (California State)

South Korean Emission Trading Scheme (Korean ETS) (South Korea)

Western Climate Initiative (WCI) (7 US States; 4 Canadian States).

Regional Greenhouse Gas Initiative (RGGI) (10 US States)

New Zealand Emission Trading Scheme (NZ ETS) (National).

Mid-Western Greenhouse Gas Reduction Accord (MWGGRA) (6 US States).

Emission Trading



National/International/ industry emission standards & agreements.



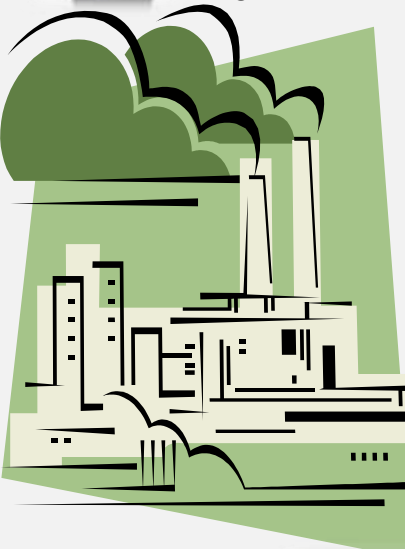
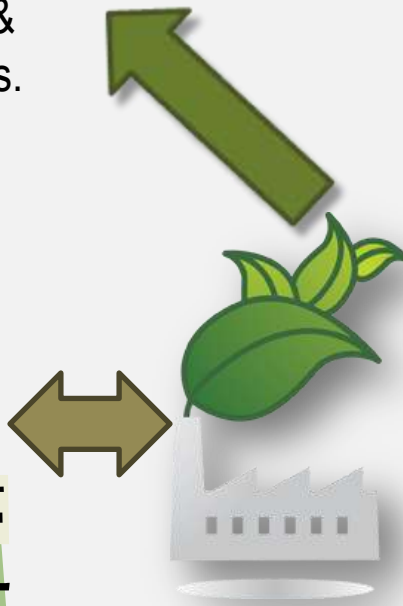
Verified Carbon Credits



GHG Reduction/ Sequestration



Emission obligations met.



Fines, fees, licenses, other.

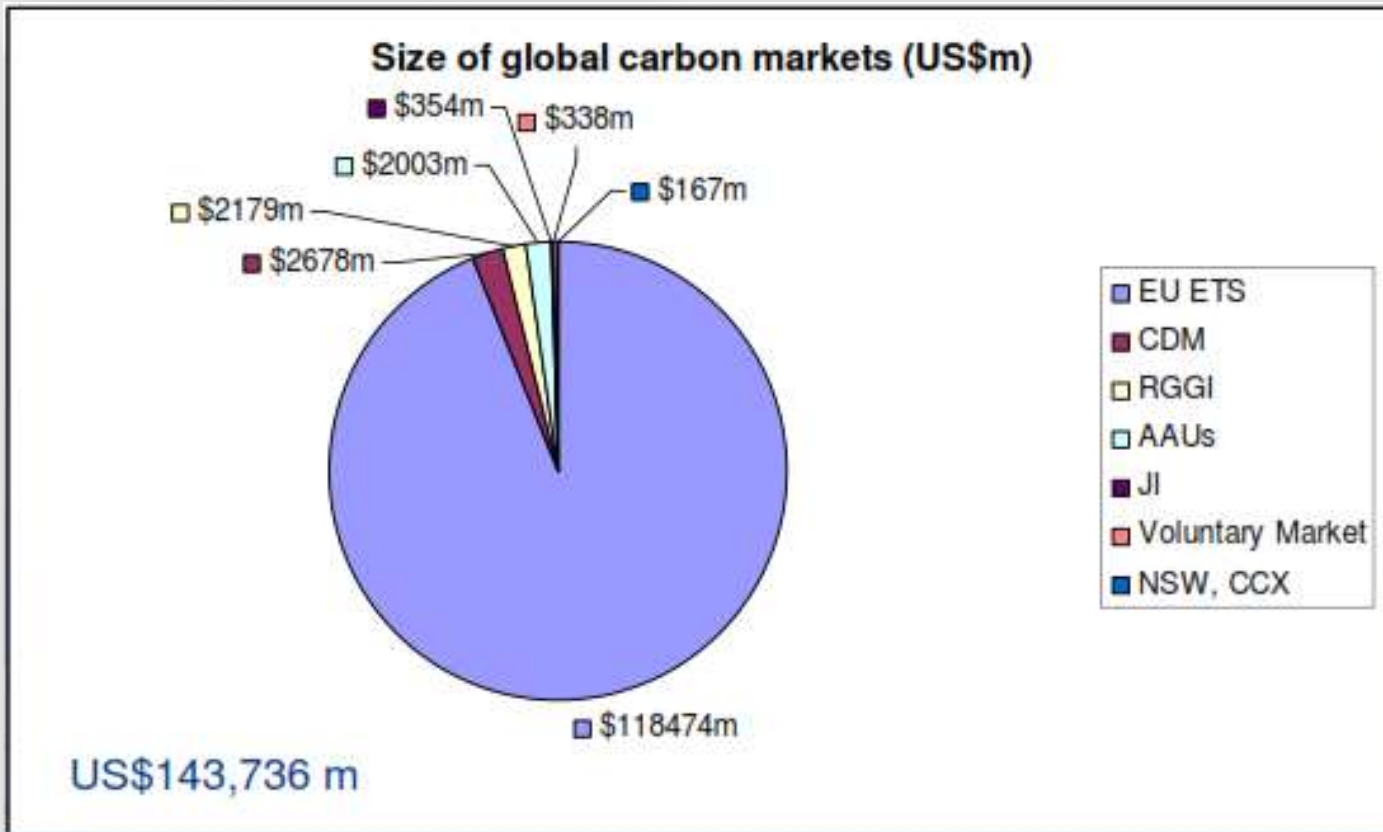


Market Mechanism



Projects, SD goals and income.

Global Emission Trade Market



- EU ETS: 82% Market share
- Primary CDM: 2% Market share
- Voluntary schemes: < 1%

(Source: World Bank – State and Trends of the Carbon Market, 2010).
Introduction to Climate Change Mitigation



Monitoring, Reporting & Verification

MRV Elements for EU ETS and CDM.

MRV Elements	Types of Systems and Options	CDM Framework.
Scope	<ul style="list-style-type: none"> •CO2 emissions. •N2O Emissions (1/1/2013). •Specified Installations. 	<ul style="list-style-type: none"> •Kyoto Protocol Gases.
Programme Oversight.	<ul style="list-style-type: none"> •EU Commission with National Government Transition into Local Legislation. 	<ul style="list-style-type: none"> •COP/MOP. •CDM EB.
Appeals	<ul style="list-style-type: none"> •European Court. •National Court. 	<ul style="list-style-type: none"> •CDM EB.
Issuance and Compliance Body.	<ul style="list-style-type: none"> •Competent Authority. 	<ul style="list-style-type: none"> •CDM EB.
Standards.	<ul style="list-style-type: none"> •EU Directive. •Installation Specific Monitoring Plan. 	<ul style="list-style-type: none"> •CDM Modalities & Procedures. •Project Activity Specific Approved Methodology.



Monitoring, Reporting & Verification

MRV Elements for EU ETS and CDM (Cont'd).

MRV Elements	Types of Systems and Options	CDM Framework.
Verification (Control Entity and Qualifications).	•Third Party Entities.	•Designated Operating Entity.
Monitoring & Reporting.	•Individual Installations.	•Project Proponent Implementation the Project Activity.
MRV Reporting At National Level.	•National Registries.	•Non/CDM Registry.



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MITIGATION OPTIONS (Technologies And Strategies).



- Reducing demand for GHG emission intensive goods and services.
- Increased (energy) efficiency.
- Development and increased use of low-C technologies.
- Reduced FF emissions (efficiency, reduction or sinks).
- Policy and legislation (national, regional and international).

Mitigation Legislation

TRADING SCHEMES	STANDARDS	SCOPE	JURISDICTION	FRAMEWORK
Australian Clean Energy Act 2011 and National Green House and Energy Reporting Act.	National Green house and Energy Reporting (Measurement) Determination 2008 and Associated NGER Technical Guidelines.	Reduction of 6 GHG Emitted from the Stationary Energy, Industrial Processing, Resources and Waste Sectors.	All States and Territories in Australia Including External Territories and Australia's Exclusive Economic Zone.	Commonwealth Law.
1990 Clean Air Act 9 Acid Rain Programme).	Actual Measured Emission Levels.	SO ₂ and NO _x Emissions ..	Federal Government USA (All States of USA).	Federal Law.
California Climate AB32.	Reporting Protocols.	Reduction of 6 GHG .	State of California.	State Law.

Mitigation Legislation

TRADING SCHEMES	STANDARDS	SCOPE	JURISDICTION	FRAMEWORK
Clean Development Mechanism	Project Activity Specific Methodology.	Reduction of 6 GHGs Contribution to Sustainable Development.	All non-Annex 1 Countries that Ratified the Kyoto protocol.	International Treaty.
European Union Emission Trading Scheme (EU ETS).	Installation Specific Monitoring Protocol.	Reduction of CO ₂ Emissions of a Defined Number of Sectors and Sizes of Installations (As of 2013, Scope is Extended to Include also N ₂ O).	All Member States of the European Community.	EU Directive Operationalized into National Legislation.

Mitigation Legislation

TRADING SCHEMES	STANDARDS	SCOPE	JURISDICTION	FRAMEWORK
South Korean Emission Trading Scheme (Korean ETS).	CDM Methodologies & Local Developed Technology Methodologies.	Reduction of 6 GHGs.	South Korea.	National Legislation.
Western Climate Initiative (WCI)	Reporting Protocols.	Reduction of 6 GHGs.	7 States of the USA and 4 States of Canada.	State Law.

- GHG refer to the Kyoto Protocol Gases.
- Source – UNEP RISO Center 2012.



- Energy efficiency and conservation.
- Solar – Thermal, photovoltaic and lighting.
- Wind.
- Hydropower.
- Geothermal.
- Biomass (forestation, fuelwood, fuel cane, cellulosic).
- Biofuels –Ethanol and Biodiesel (3rd and 4th generation – micro algae, synthetic genomics).
- Waste to Energy.
- Blue/Ocean Energy (wave, tidal, current, wind).
- Ocean Thermal Energy Conversion (OTEC).
- Nuclear power.



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David Barrett, ENBAR Consulting

+876 946 2662 (t)

+876 946 2659 (f)

+876 342 9996 (m)

+876 366 2454 (m)

dbarrett2@gmail.com