The Networked Carbon Markets initiative
Partners & Strategy Workshop

Combined presentation slides:

The Mitigation Action Assessment Protocol *(Miguel Rescalvo, World Bank Group)*

Potential application for the NCM Framework in China *(Xi Liang, University of Edinburgh)*

Domestic Carbon Markets Linking ‘PAT’ & ‘REC’ in the Indian Context *(Karan Mangotra, TERI)*

Using Mitigation Values to Guide the Design of Trading Rules *(Cyril Cassisa and Sylvain Cail, ENERDATA)*

International Carbon Asset Reserve *(Luca Taschini, Grantham Research Institute, LSE and Jurg Fuessler, INFRAS)*

COP21, Carbon Pricing and “Climate Clubs” *(Michael Grubb, UCL)*

Mitigation Value to Enable International Linkage of Domestic Programs *(Johannes Heister, World Bank Group)*

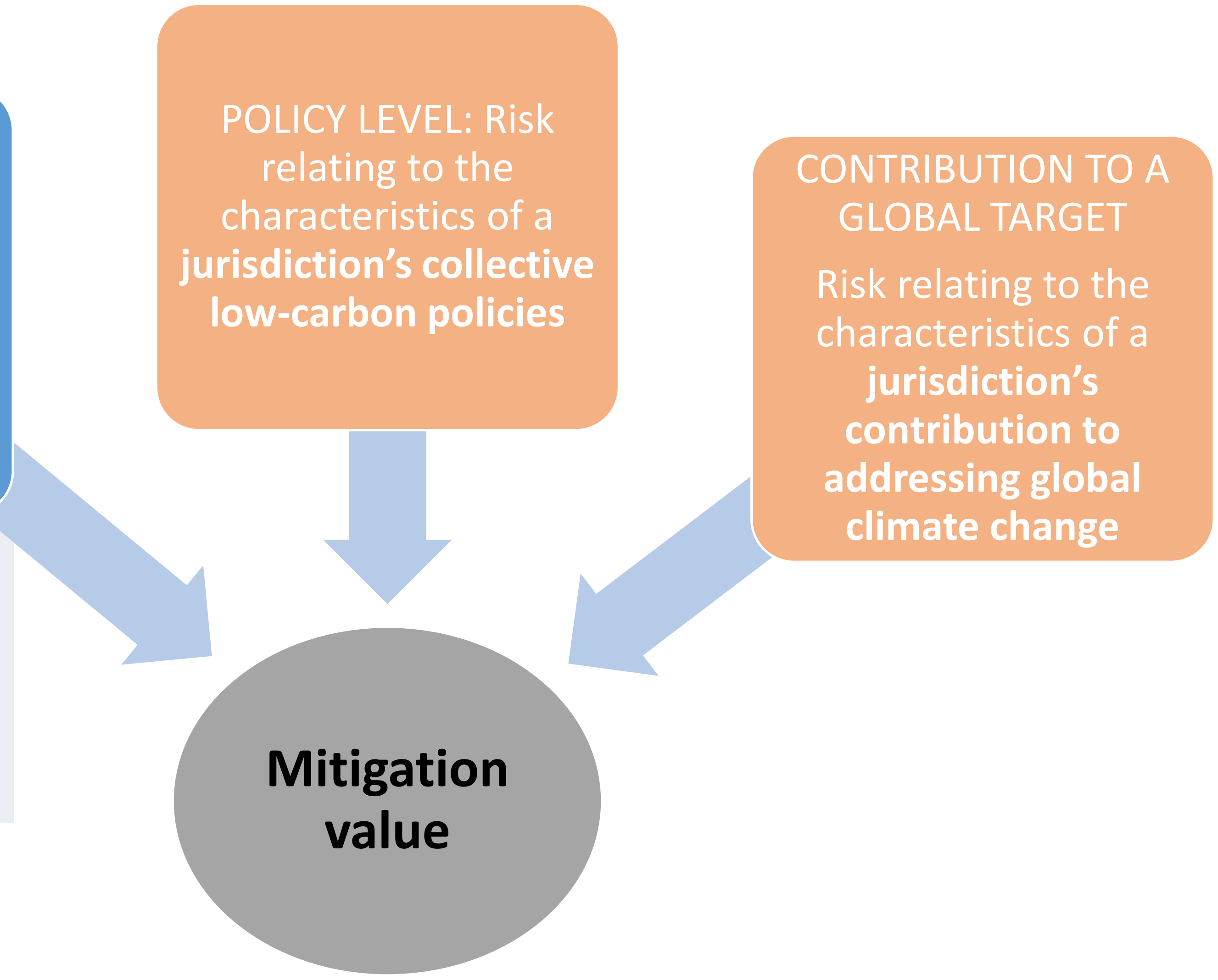
MITIGATION ACTION ASSESSMENT PROTOCOL
(MAAP)

World Bank Networked Carbon Markets Initiative

Miguel Rescalvo

Cologne. May 28 2016

Mitigation Value Assessment



Mitigation Action Assessment Protocol
- **Developed by DNV GL**
- **Expert Reviewed by IISD and New Climate Institute.**

Development Process

Stakeholders engagement

- Carbon Expo May 2013
- Latin America Carbon Forum (Rio de Janeiro), FICCI (New Delhi), Asian Carbon Forum (Bangkok) – Fall 2013
- GHG verifiers. Thailand Feb 2016

Working group - Globally Networked Carbon Markets

- WB Internal Meeting – June 2013
- Paris Working Group meeting 1 – Sept. 2013
- Webinar Update – Dec. 2013
- Paris Working Group meeting 2-February 2014

Peer review

- Comments invited from the Working Group, selected individuals and organizations
- Technical peer reviewrs

  2014 - (IdeaCarbon, C2B2)

  2015- IISD, New Climate Institute

Testing and Pilots

- NAMAs- Ecuador, Peru

  Low Carbon City Programs Phitsanulok and Pakkret, Thailand.

Goals and MAAP Structure

Key indicators weighting average

Higher weight will assign a larger impact

Module area weighting

relative importance of each risk area within a module

Module's assessment result

Key Indicators score

- Score range for each level of development
  - Default
  - Override score
- Level of confidence

MAAP- Assessment Modules and Areas

Emissions Integrity

Mitigation Action Program

- Definition & Scope
- Objectives & Targets
- Planning
- Roles, Responsibilities & Authorities
- Barriers
- Emissions reduction from Intervention
- Monitoring and Reporting

Mitigation Action Mngt Entity

- Management Framework
- Financial and Investment Capacity Framework
- Climate Change Programs Management

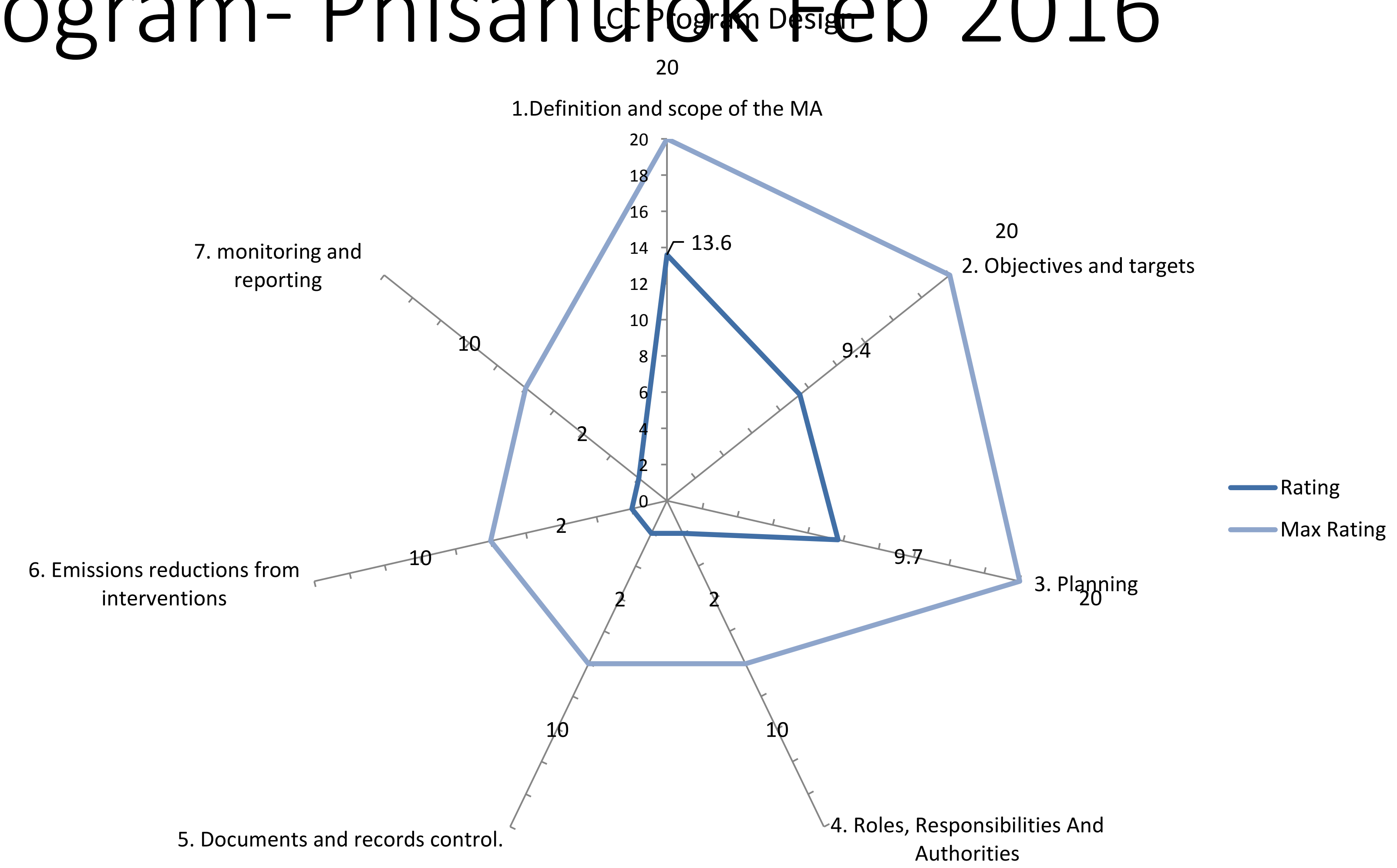
Investment Environment

- Economic and political environment
- Climate Change Capacity

Development Benefits

- Sustainable Dev. Objectives & Targets
- Planning & Participation
- Monitoring of Sust. Dev.

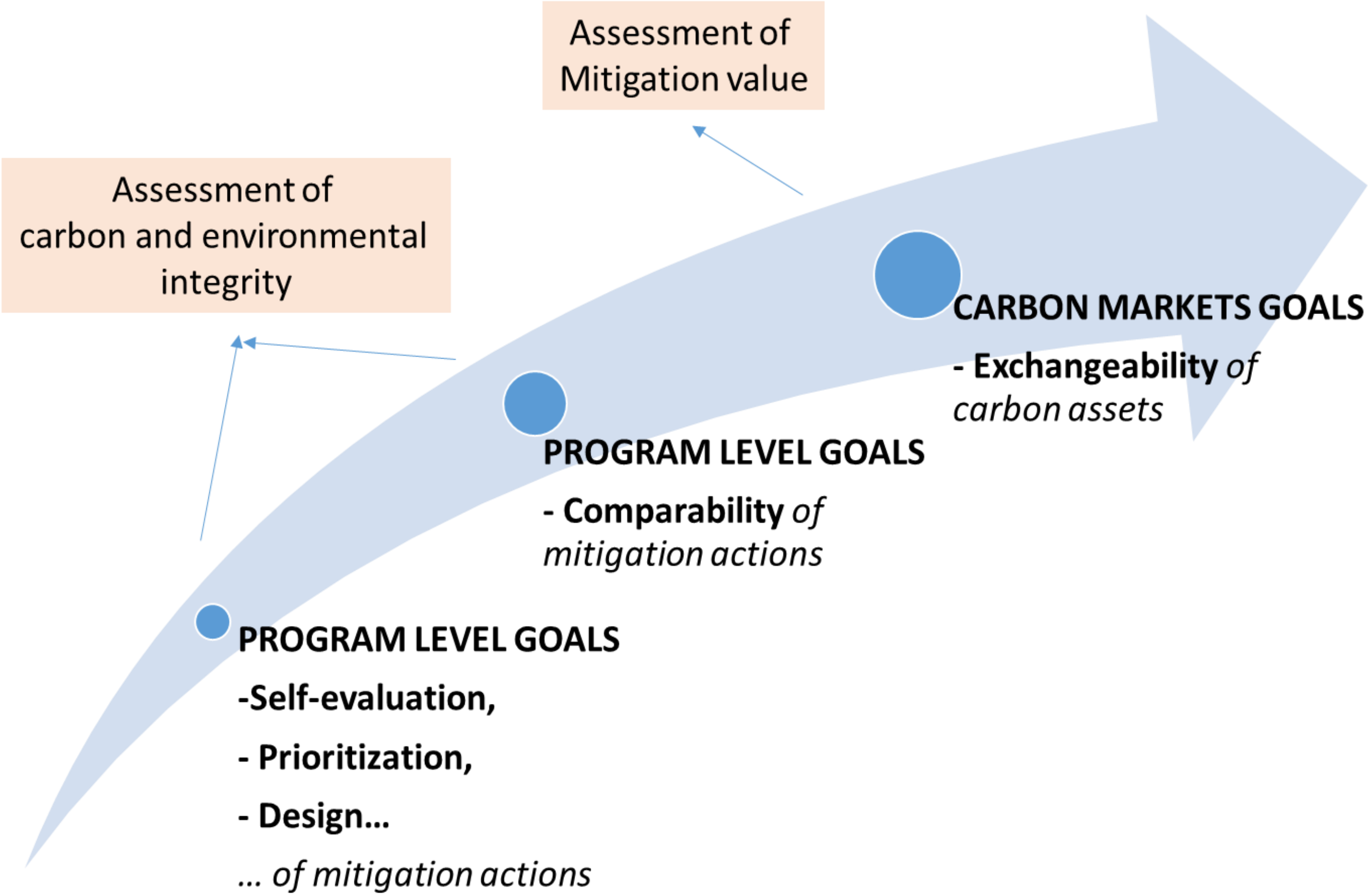
LCC Program- Phisanulok Feb 2016



LCC Program- Phitsanulok Feb 2016

Module	Impact Area		Weighted	rating	Weighted Rating	Max Rating	Module Rating
LCC Program Design	PM1	1.Definition and scope of the MA	20%	68	13.6	20	40.7
	PM2	2. Objectives and targets	20%	47	9.4	20	
	PM3	3. Planning	20%	48.5	9.7	20	
	PM4	4. Roles, Responsibilities And Authorities	10%	20	2	10	
	PM5	5. Documents and records control.	10%	20	2	10	
	PM6	6. Emissions reductions from interventions	10%	20	2	10	
	PM7	7. monitoring and reporting	10%	20	2	10	
LCC Program Management Entity LCC Committee	EG1	1. Management Framework	50%	47	23.5	50	40.1
	EG2	2.Finance and investment	20%	35	7	20	
	EG3	3. Climate change programs management	30%	32	9.6	30	
Sustainable Development Contribution	BD1	1. Development	40%	47	18.8	40	42.8
	BD2	2. Planning and participation	30%	59	17.7	30	
	BD3	3. Monitoring of development benefits.	30%	21	6.3	30	

Evolution and Benefits of the MAAP



Pilots
Application of program-level assessment

- Peru MRP elaboration: selection of 3 NAMAs for development of crediting instrument:
  - Shortlisting of mitigation actions for ex ante assessment.
  - Customization of Mitigation Action Assessment Framework.
  - Assessment of 10 prioritized mitigation actions.

- Thailand LCC programs Assessment
  - Thailand PMR proposal – LCC Fund
  - Assessment of LCC Phitsanulok and Pakkret

MAAP Pilots and Development

- Lessons learned
  - Crediting readiness
  - Availability of data for quantitative assessments
  - Jurisdiction level- it needs to assess policy level
  - MAAP implementation / databases / benchmarking
- Ongoing Pilots: Chile, Jordan, (Thailand)
- Capacity building:
  - Assessor Guidelines
  - Practical Guidance Document
- Support
  - Design level MAAP Tool
  - Deployment strategy

MAAP Deployment Strategy Proposed Activities

- Online MAAP Tool
  - Self assessment / benchmarking

- MAAP Tool – Assessments Database
  - Goal- position MAAP Tool as a reference for MA
  - Partner with recognized institution/s to build a database of assessed MA
  - Three tier approach:
    - Unsolicited assessment – self assessment - external

Conclusions

- MAAP serves at this stage two purposes
  - Self evaluation
  - MAAPs as the basis for programs development- eg. LCC
  - Assessment tool for governments, development banks

- Benchmarking
  - Need for databases, online tools, etc.

- The beauty of Assessments is in the numbers
  - MAAPs use needs to be expanded

Potential Applications for the Networked Carbon Market (NCM) Framework in China

Xi LIANG, Maosheng DUAN, Tim YEO, Xiaohu XU, Jiuhong QI

28/May/2016

Presentation at the Cologne

Content

Overview of China's Carbon Markets

Apply NCM Framework for Domestic Linkage

Apply NCM Framework to Improve Linkage Compatibility

Progress in NCM (China) Scoping Study

- **Timeline of ETS developing in China**

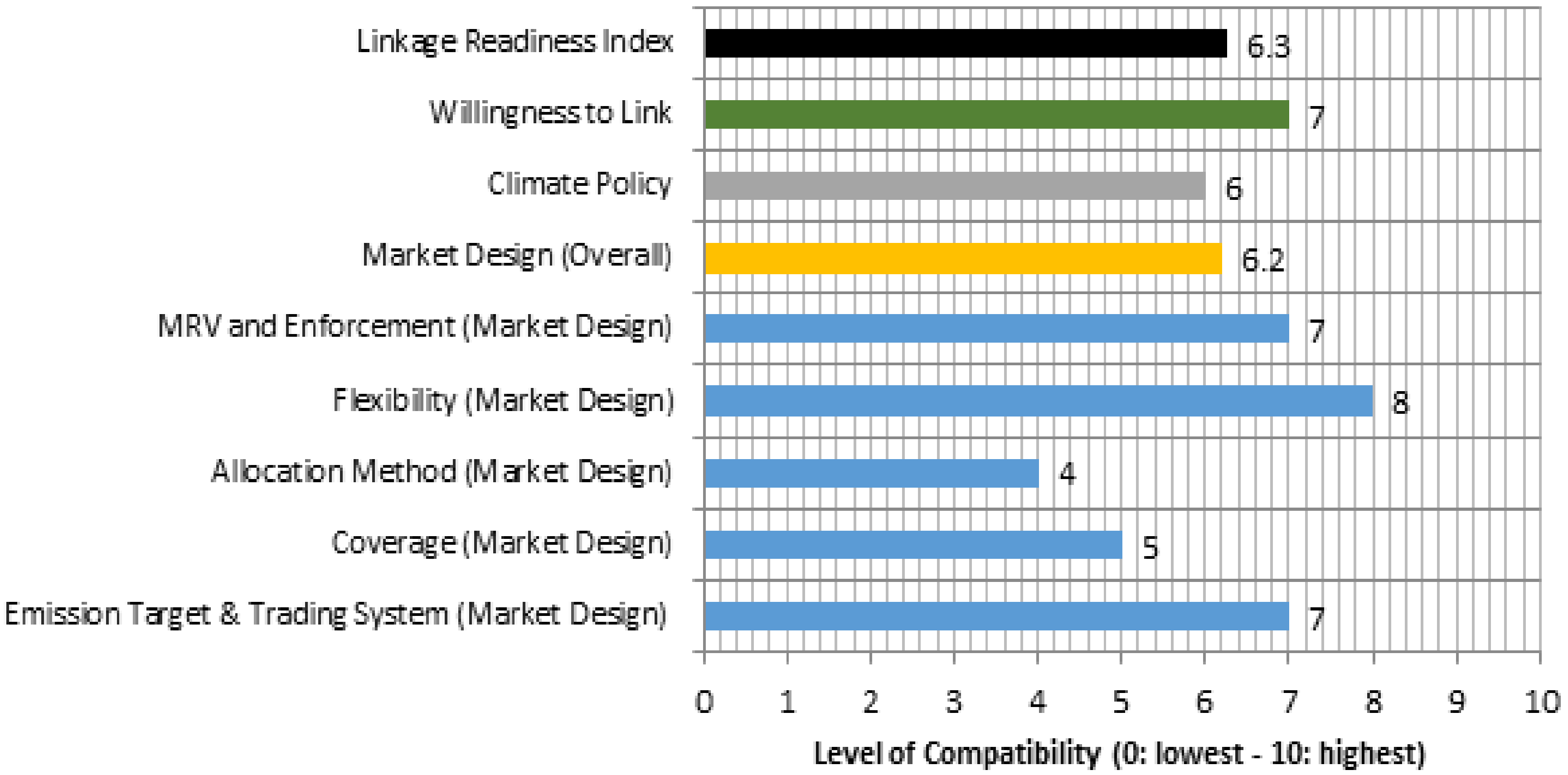
Pilot ETS in 7 regions		National ETS		National ETS Phase II
2011	→	**2017 - 2020**	→	**Post-2020**

2016 Work Plan for National ETS Development Released by NDRC in Jan 2016

- Provincial DRC submit the list of companies involved in the national ETS (the threshold is 10,000 tonne metric coal energy consumption or equivalent per year)
- Corporate audit, third party verify, government report to NDRC (year 2013, 2014, 2015 data)
- Train and select third party verification institutes and staff
- Strengthen capacity building

Findings from an early study from EU-Guangdong ETS Linkage Research Project

The study found the current linkage readiness index between the EU ETS and the GD ETS scored **6.3 out of 10**



Planned Scoping Study on 'Networking' in China

BACKGROUND OF CARBON MARKETS IN CHINA

<u>7 Pilot ETSs (2013-2015/6)</u>

Varying levels of economic development in participating regions

Local governments given significant flexibility in designing pilot ETSs

Resulted in ETSs with fairly heterogeneous structures

<u>National ETS Phase 1 (2017-2020)</u>

The first phase will focus on refining the national carbon market framework and convince Chinese stakeholders consider apply NCM framework for ETS linking in the national ETS design.

<u>National ETS Phase 2 (post-2020)</u>

The second phase would start to explore pilot regional or sectoral international linkage and implement concepts networked carbon market opportunities

NCM ACTIVITIES

- A scoping study in China will be led by Tsinghua University, University of Edinburgh, and the China Beijing Environment Exchange (CBEEX) to explore opportunities for the NCM Initiative to support China's international linkage efforts
- The study will conduct stakeholder outreach to explore opportunities for the NCM Initiative to support China's international linking efforts and identify potential for conducting regional pilots

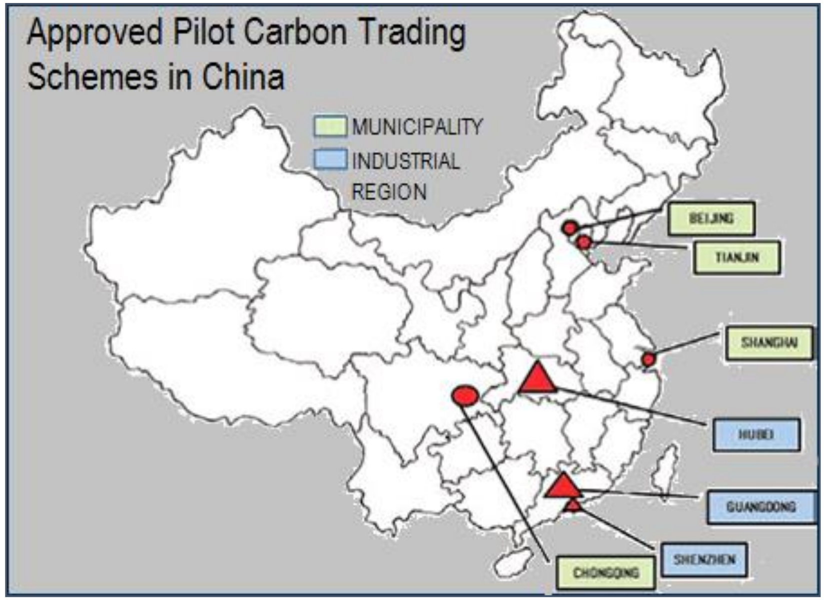


Image source: SEI (2012)

Work Plan about the Scoping Study on 'Networking' in China (to be completed by 30 Sep 2016)

- **Stakeholder Consultation**
- **Research Paper**

  Section 1: Conceptual review - risks and opportunities of ETS linkages in China and options for applying the NCM initiative to support linking efforts

  Section 2: Recommendations for developing international linkage opportunities in China
- **Apply NCM Framework to Improve Linkage Compatibility**
- **The 2nd China's market international linkage workshop**

Plan to host the 2nd China's Carbon Market International Linkage Workshop in Beijing on 1 or 2 Sep 2016

The 1st China's Carbon Market International Linkage Workshop held in Beijing on 8/Jul/2015 (Right)

Draft Questionnaire Finalized by 30 May 2016

- **Stakeholder Consultation**
- **Research Paper**

  Section 1: Conceptual review - risks and opportunities of ETS linkages in China and options for applying the NCM initiative to support linking efforts (incl. stakeholder perception, an impact assessment, develop a CGE model analysis for EU-China linkage simulation)

  Section 2: Recommendations for developing international linkage opportunities in China (a staged approach to apply linkage, motivate industry interest, apply NCM Mitigation Value in domestic market linakge, other innovative approach)

- **Apply NCM Framework to Improve Linkage Compatibility**
- **The 2nd China's market international linkage workshop**

What is your perceived most effective approach for merging the existing allowance in the seven pilot carbon markets into the national carbon market?

A. Adopt a fixed percentage conversion rate to convert existing allowance to national allowance

B. Adopt a mitigation value methodology to calculate a conversion rate (i.e. estimate hot air effect) for each pilot market

C. Adopt a mitigation value methodology to calculate a conversion rate (i.e. estimate hot air effect) for each compliance company

D. Only allow companies to convert a part of their allowance, if these allowances were generated from qualified low-carbon abatement investment or adopt innovative low carbon technologies.

E． Unsure about the conversion rate

F. Instead of conversion of existing allowance to national allowance, the pilot carbon markets would exist and continue to use the existing allowance

How do you perceive the impact of an ETS linkage pilot on China's domestic energy and climate policy in terms of certainty and flexibility?

A. It provides more certainty and enhance flexibility
B. It provides less certainty but enhance flexibility
C. It provides less certainty and reduce flexibility
D. It provides more certainty but reduce flexibility
E. Unsure

Whether it is necessary for China to carry out international carbon market linkage, and when it is possible?

A. Not necessary at the moment and future
B. Necessary, at the pilot stage
C. Necessary, at Phase I of national market(2017-2020)
D. Necessary, at Phase II of national market(after 2020)

How do you perceive the impact of an ETS linkage pilot on China’s domestic energy and climate policy in terms of certainty and flexibility?

A. It provides more certainty and enhance flexibility
B. It provides less certainty but enhance flexibility
C. It provides less certainty and reduce flexibility
D. It provides more certainty but reduce flexibility
E. Unsure

What is your perception about changing Market Design in the future of China's National ETS to Improve the Compatibility of ETS and achieve Linkage Readiness status?

8A. Improve allocation method compatibility

1	2	3	4	5
[ ]	[ ]	[ ]	[ ]	[ ]

Strongly disagree strongly agree

8B. Avoid double accounting

8C. Regulation and financial support related to MRV

8D. Improve market transparency

8E. Classify emission allowance as financial products

8F Enhance legal and regulatory framework and provide flexible provision

To what extend do you agree with the following statement:
(Tick from 1 to 5 scale, where 1 means ‘strongly disagree’ while 5 means ‘strongly agree’.)

9A. Integrating the Chinese carbon trading market into the international trading system could help reduce the adverse impact on carbon price from the interactions of other national carbon reduction incentive mechanisms.

9B. If an unexpected national carbon tax is suddenly announced for immediate implementation across all major industry sectors (power, cement, refinery, etc.), what do you think will be the most likely immediate impact on the carbon price in these pilot carbon markets?
(Tick from 1 to 5 scale, where 1 means ‘large decrease’ while 5 means ‘large increase’.)

9C. If a higher than expected short-term renewable energy target is enacted in the pilot cities (e.g. increase from 10% to 15%), what would be the most likely impact on carbon price in the pilot carbon market?
(Tick from 1 to 5 scale, where 1 means ‘large decrease’ while 5 means ‘large increase’.)

9D. If a higher than expected offset proportion of forest carbon sinks in the pilot cities (e.g. increase from 5% to 10%), what would be the most likely impact on carbon price in the pilot carbon market?

9E. Whether carbon sink credits (e.g.agricultural and forestry) could be accepted as an international general carbon offsets mechanism?

What is your perception of ‘Mitigation Value’ and its applications for China’s domestic and international linkage?

A. Likely being applied in the short-term for domestic linkage but the long-term perspective for international linkage was uncertain

B. Only likely be applied in the long-term for international linkage

C. Not likely to be applied in either short-term or long-term

D. Likely being applied in both short-term and long-term

E. Not sure

What is your perception about pilot international linkage of carbon market between 2020 and 2025?

A. Start with one sector at the national level

B. All sectors at either provincial or municipal Level

C. Pilot emission trading linkage within entities that adopt advanced abatement technologies

D. Should not pilot international linkage at all

What is your perception about the feasibility of an international 'Carbon Asset Reserve' for stabiles price in China's domestic and international carbon markets?

A. Positive
B. Neutral
C. Negative
D. Unsure

If a carbon club was established to pave the pathway towards a global carbon pricing system, do you think be a pioneer in the proposed international carbon club between 2020 to 2025?

A. China should only focus on its domestic market in this period
B. China should participate in the club but not take a pioneer role
C. China should be a pioneer in the carbon club
D. Unsure

Open Questions: Stakeholders' awareness of and recommendations to the World Bank NCM programme and opportunities and risks in making China's carbon market linkage readiness

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Acknowledgements
感谢支持

Domestic Carbon Markets Linking ‘PAT’ & ‘REC’ in the Indian Context

Karan Mangotra
Fellow
The Energy & Resources Institute

The Nature of the Climate Change Problem

- Addressing climate change concerns involves choosing higher-cost lower-CO_2 emission technologies over lower-cost, higher emission technologies

    - For some applications, especially for energy efficiency, initial cost is higher, but running (energy) costs are lower

    - For some applications, especially for renewables, the long-term cost of electricity is higher

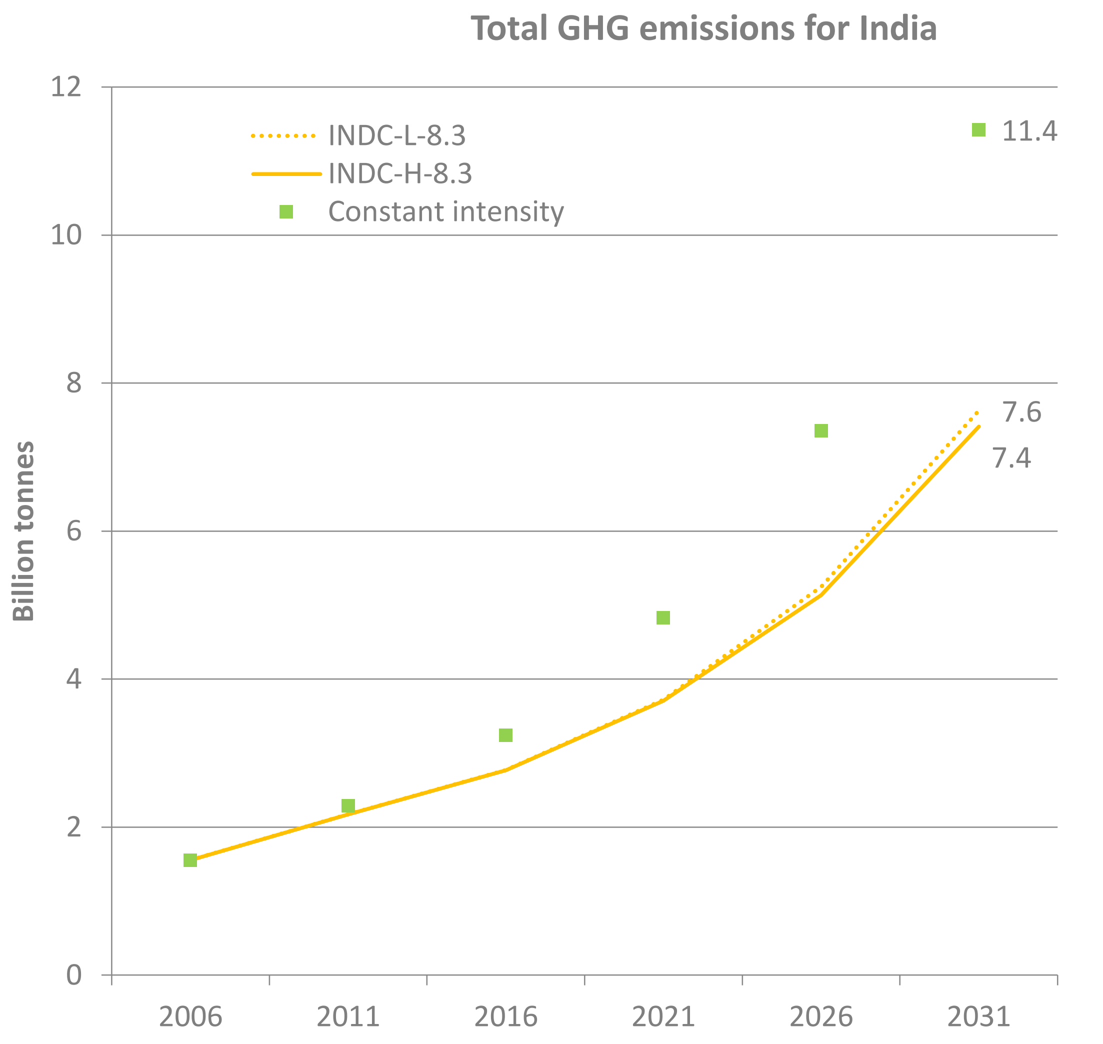
    - Technology evolution is bringing down costs and enhancing performance

- Addressing climate change is about meeting higher costs (at least in the medium term) and enabling rapid technology evolution.

Paris Agreement is a Step Ahead

- Focuses on a long term goal of limiting global temperature rise to *much less than* 2 Deg C
- All countries take action, with developed countries taking lead
- Countries pledge action and report in a transparent manner
- Mechanism to enable “ratcheting up” of ambition in subsequent pledges
- Global technological cooperation – International Solar Alliance and Mission Innovation

India: INDC targets are aggressive and ambitious



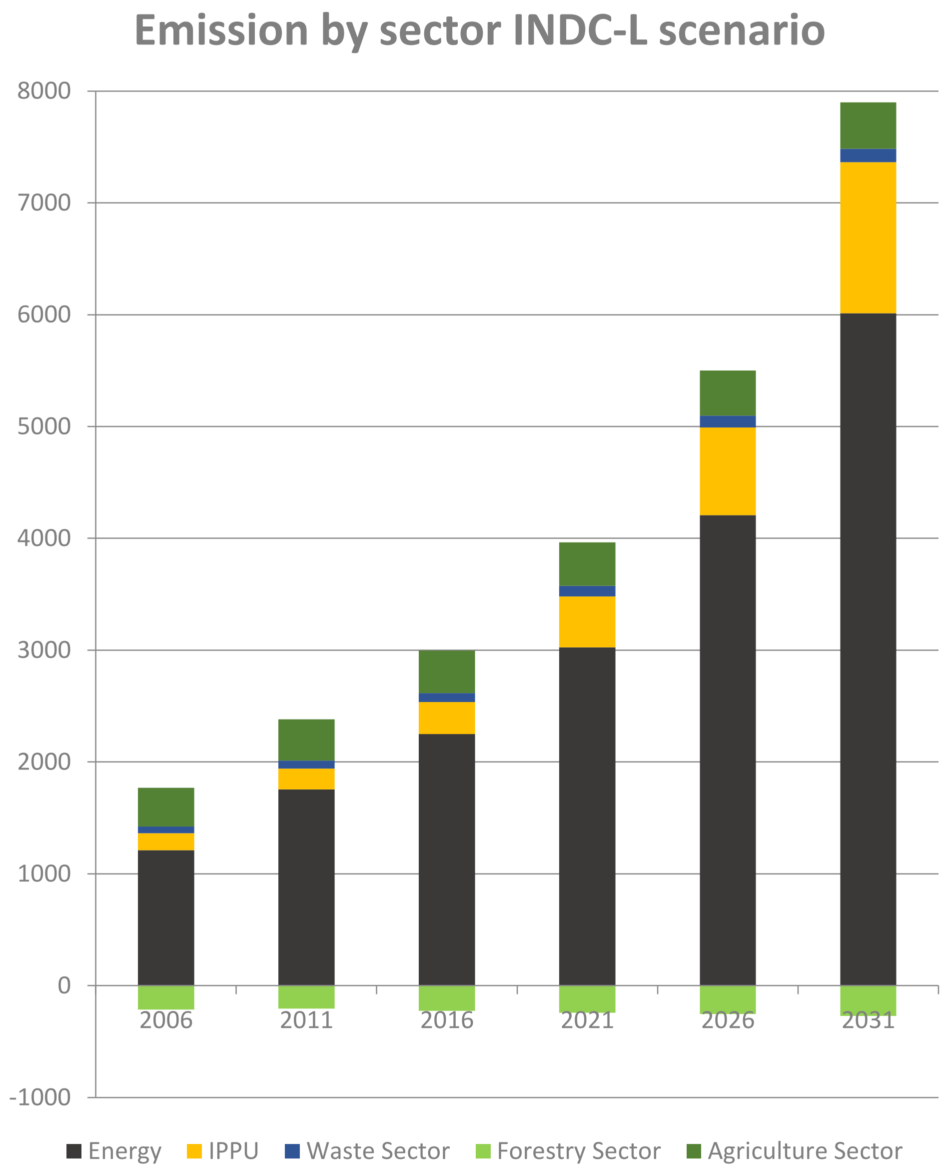
- **India's INDC** contains **two main targets**:
  - **Intensity:** INDC targets a **33%-35% decrease** in **emissions intensity of GDP** by 2030 (compared to 2005). This will be overachieved under current policies.
  - **Non-fossil:** INDC targets **40% non-fossil power generation** capacity target by 2030. This target is in line with current policies.
- **Total emissions** (excl. LULUCF) under current policies will **more than double** from 2010 reaching ~5.4 $GtCO_2e$ in 2030
  - **~80%** of this growth is through **energy-related emissions**
  - **Electricity generation** will **grow** at **6%** per year.

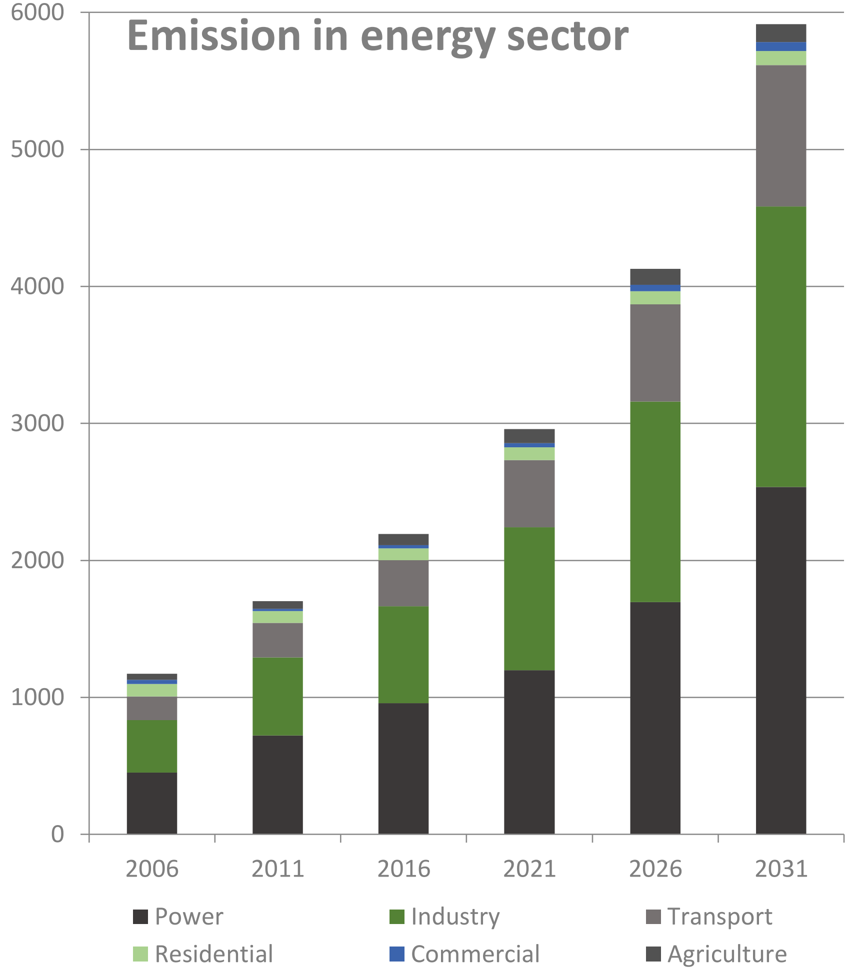
India: 8 levers are identified in the INDC, of which 6 are also quantified

Reduction levers			Included in INDC?	Specification
Energy	Non-fossil	Wind	✓	Wind: 60 GW by 2022
		Solar	✓	100 GW by 2022
		Other	✓	Biomass: 10 GW by 2022 Nuclear: 63 GW by 2032
	Energy efficiency	Buildings	✓	E.g. Energy Conservation Building Code
		Industry	✓	E.g. Perform, Achieve and Trade scheme
		Transport	✓	E.g. Vehicle fuel efficiency standard
	Fuel shifts	Coal to gas	✗	Not mentioned in the INDC
		Transport (NG/ biofuels)	✓	20% blending of biofuels
Non energy		Specification	✗	Not mentioned in the INDC
Other	Non-core energy	Methane	✗	Non-CO2 emissions are not mentioned specifically in the INDC. However, various measures related to reducing emissions from waste are included.
		Nitrogen oxide	✗	
		Other	✗	
	LULUCF[1]	Aforestation	✓	Additional (cumulative) carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.
		Reforestation	✗	

1 LULUCF: Land Use, Land Use Change and Forestry

Sectoral Emissions Scenario





India’s Growth Imperatives

- In the 2000-2013 period
  - GDP of the Indian economy grew at 7.3% p.a.,
  - the total primary energy supply grew at 5.8% p.a.;&
  - electricity supply alone grew at 5.6% p.a.
- In the period up to 2030, the economy is expected grow to 8% to 10% due to the growth in manufacturing which would result in a greater demand for energy
- Economic growth results will double per capita income every 10 years; & per capita electricity supply will be more than 2,500 kWh per year, compared to 1010 kWh per year *(2014)*.
- GHG emissions from industry are expected to grow to 448 mtCO2 in 2020 and to 806 mtCO2 in 2030 which translates to energy savings of 9% & 16% respectively over 2005 levels

India’s MRP Components

India proposed the following Market Readiness Components

The objective is to create an effective centralized data management and registry system to capture GHG emissions data and enable implementation of MBMs which support issuance, transfer, and cancellation of credits

Components

Component 1

Creation of a national registry to which various Market Based Mechanisms (MBMs) and a national GHG inventory management systems (NIMS) can be linked

Component 2

Design framework for new MBMs activities and exploring the linkages of new and existing MBMs with registry

Component 3

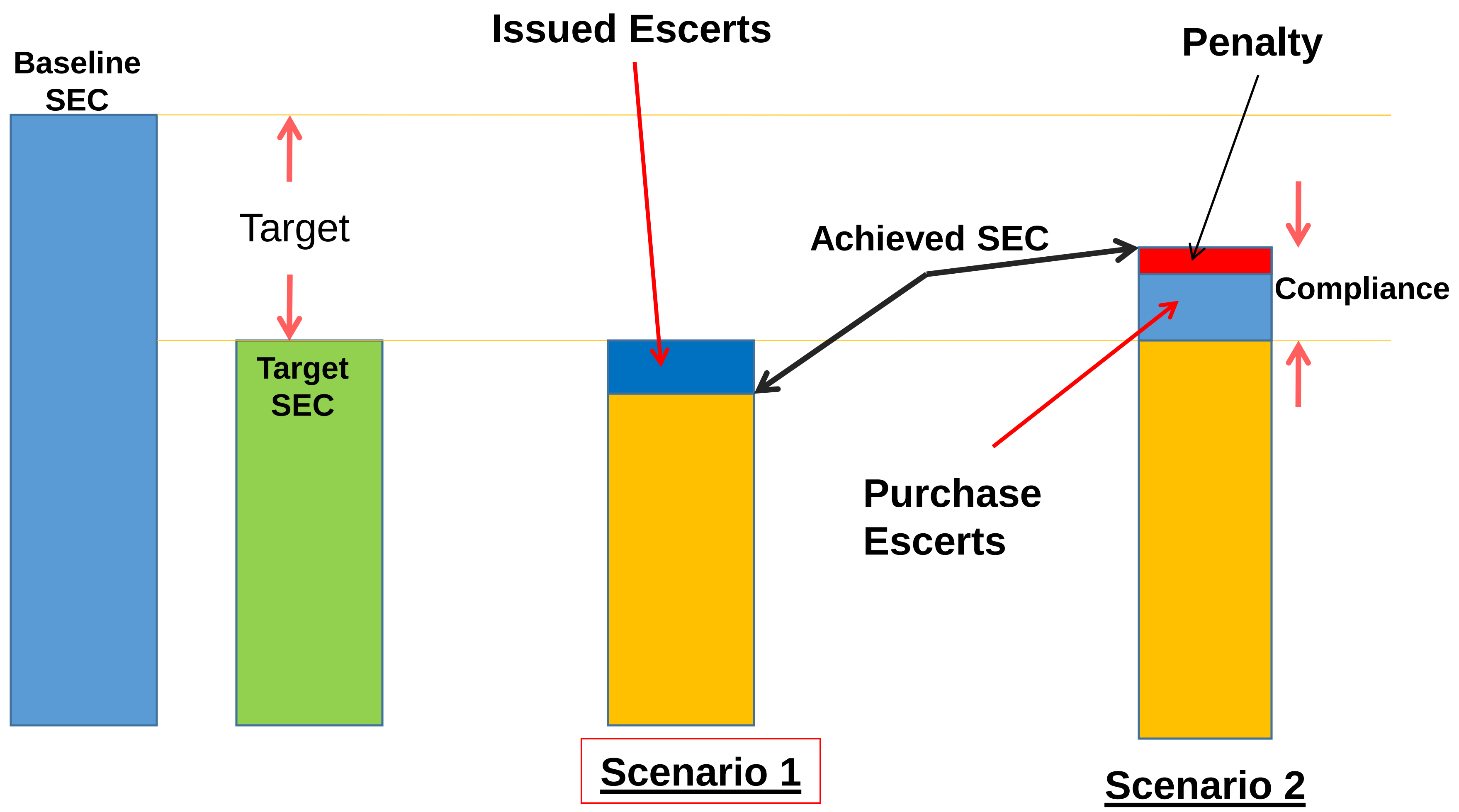
Possible linkages of the registry to a national GHG inventory management system (NIMS)

Perform Achieve and Trade

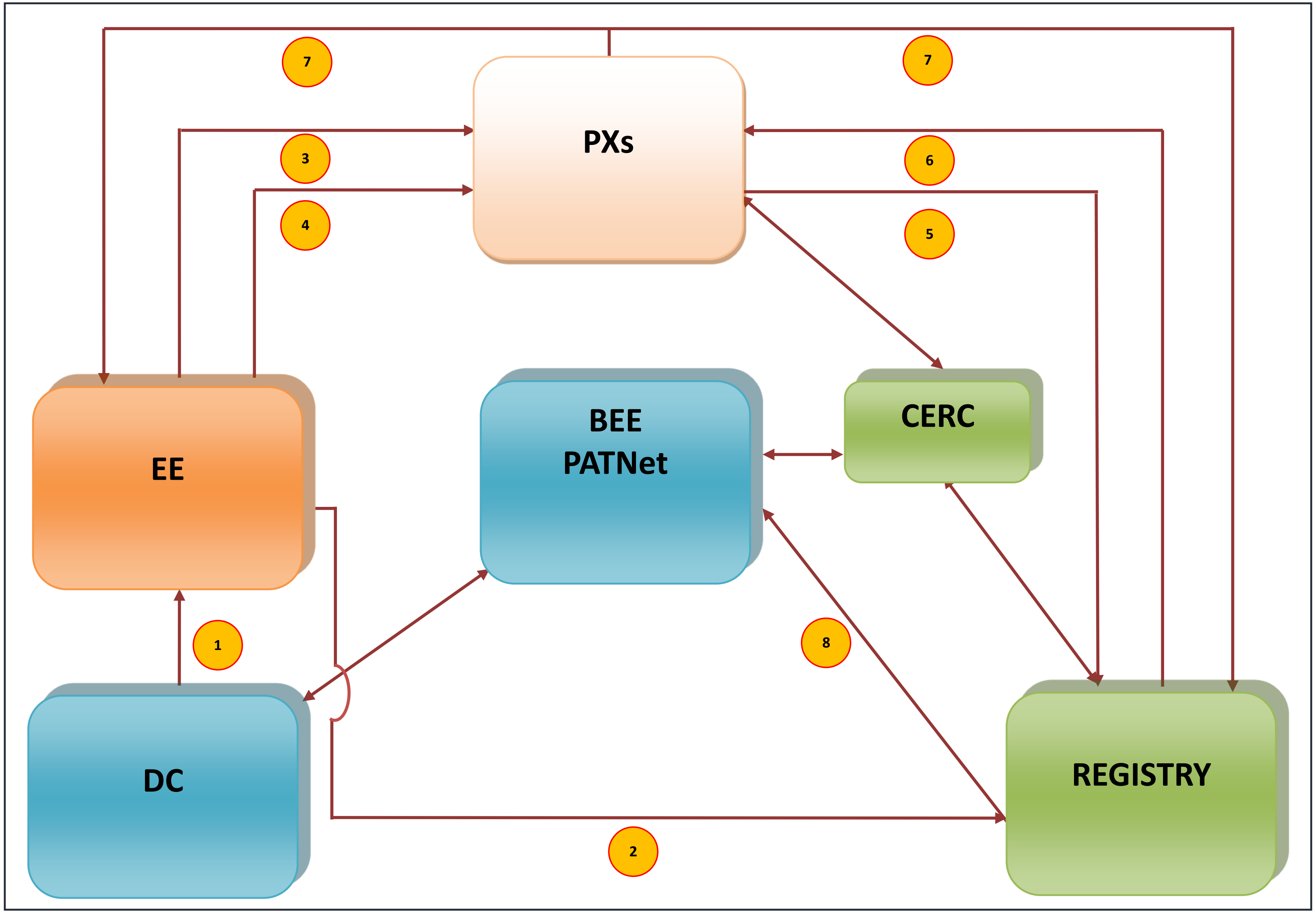
- **Specific Energy Consumption (SEC) targets mandated for 478 units in 8 energy intensive sectors**
- Energy Savings Certificates will be issued for excess savings; can be traded and used for compliance by other units
- Financial penalties for non compliance
- Baseline conditions have changed; normalization factors developed
- Widening of PAT: Inclusion of more units from new sectors
    - New sectors: Refinery, Railways and Electricity DISCOMS
    - About 175 new DCs

PAT Cycles	No. of Units	Share of total energy consumption (2009-10 Level)	Sectors covered	Energy Reduction
Cycle I (2012-13 to 2014-15)	478 DCs	36%	8	Target: 6.6 MToE Achieved: 8.4 MToE
Cycle II (2016-17 to 2018-19)	900-950 DCs	50%	11	Target: 8.86 MToE

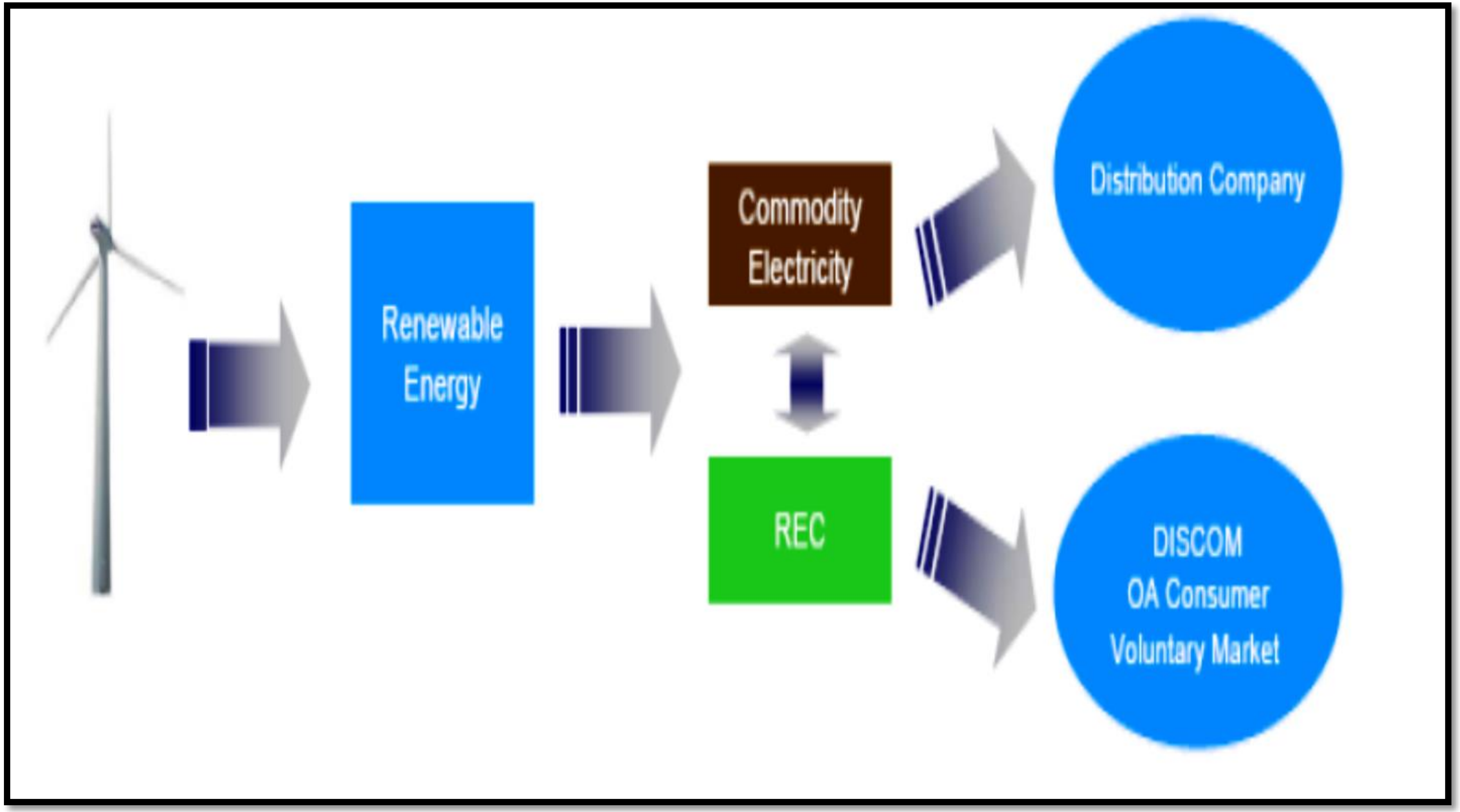
Concept of Target, Compliance, ESCerts & Penalty



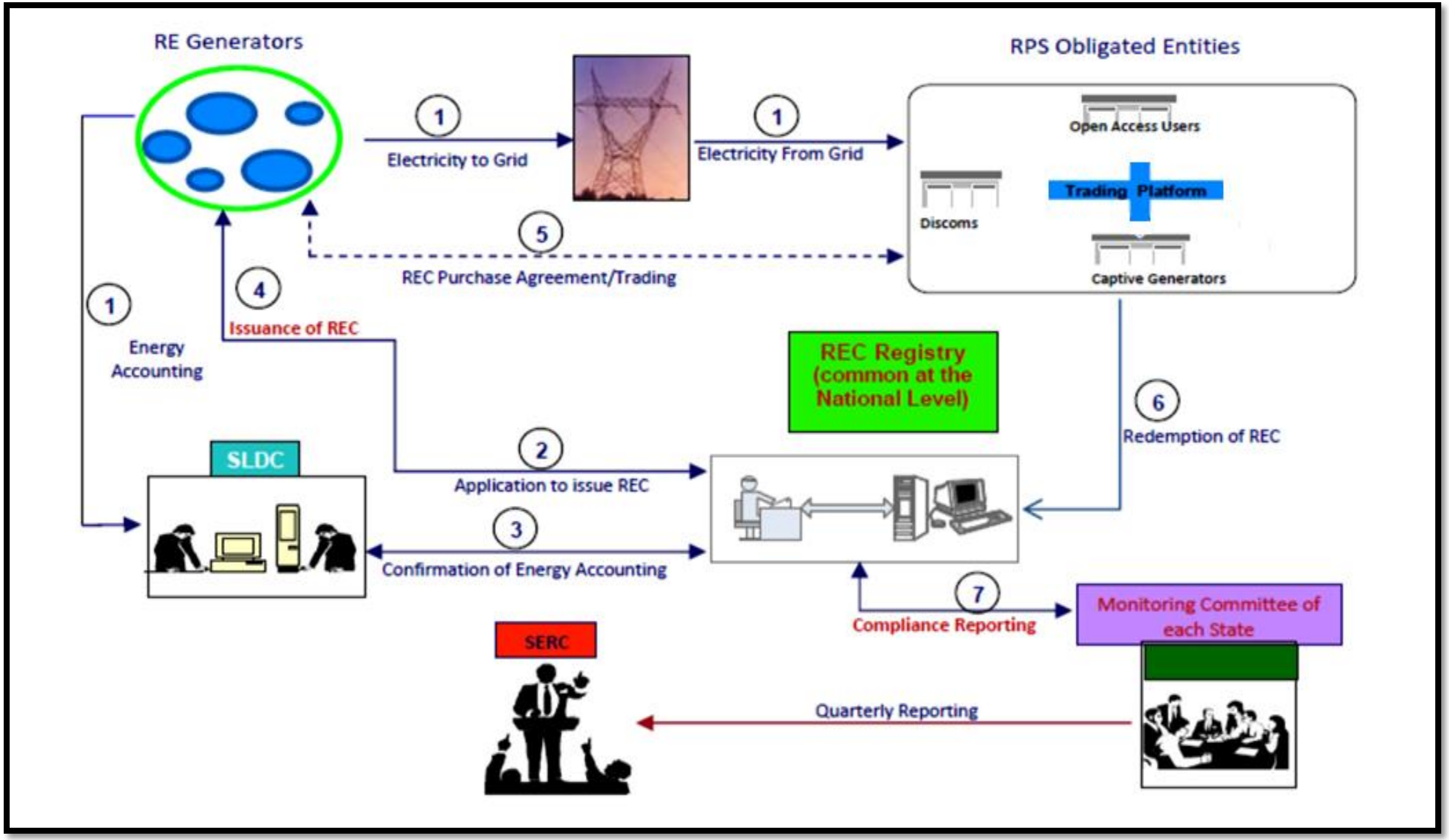
ESCerts Trading Mechanism



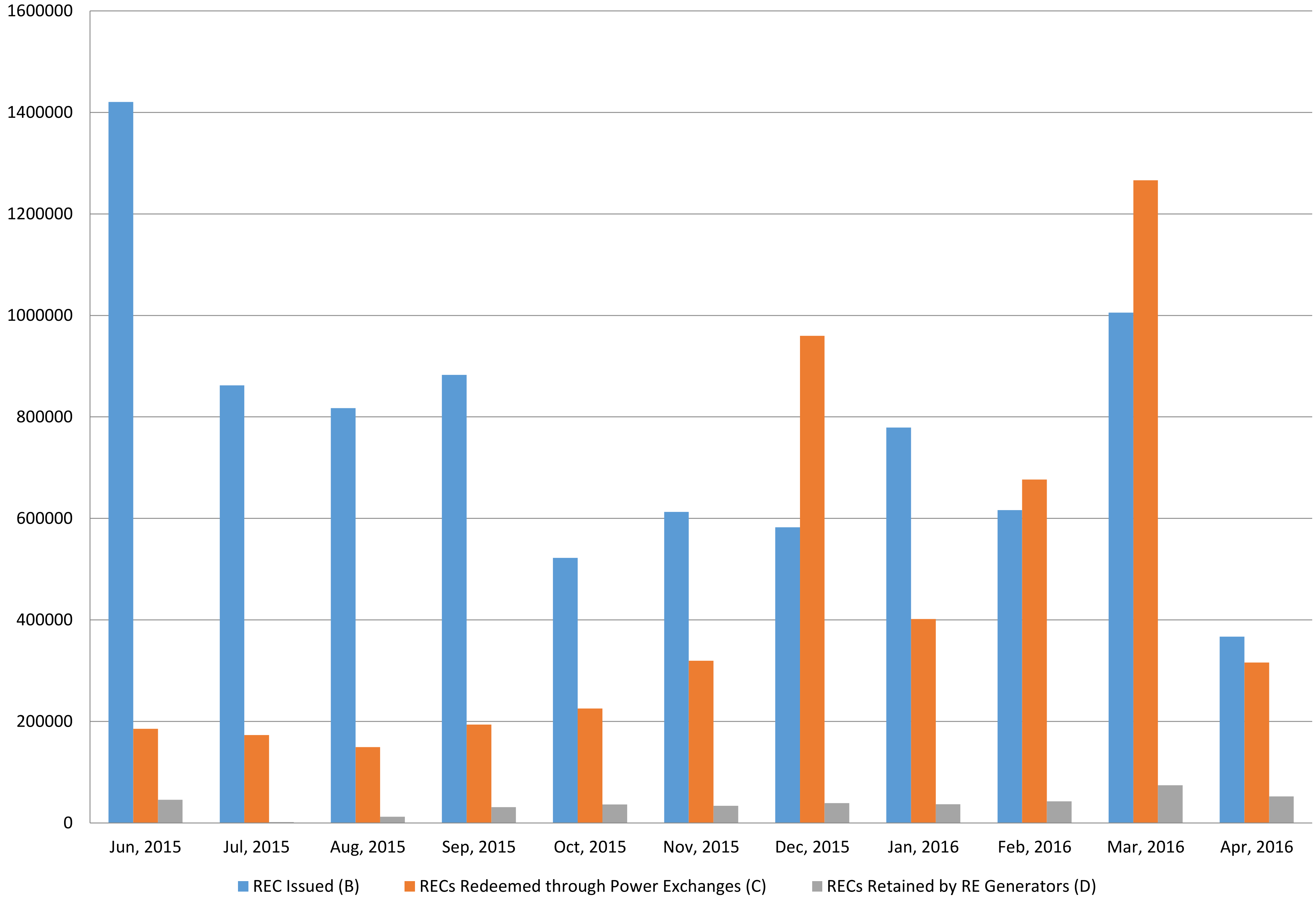
Renewable Energy Certificates



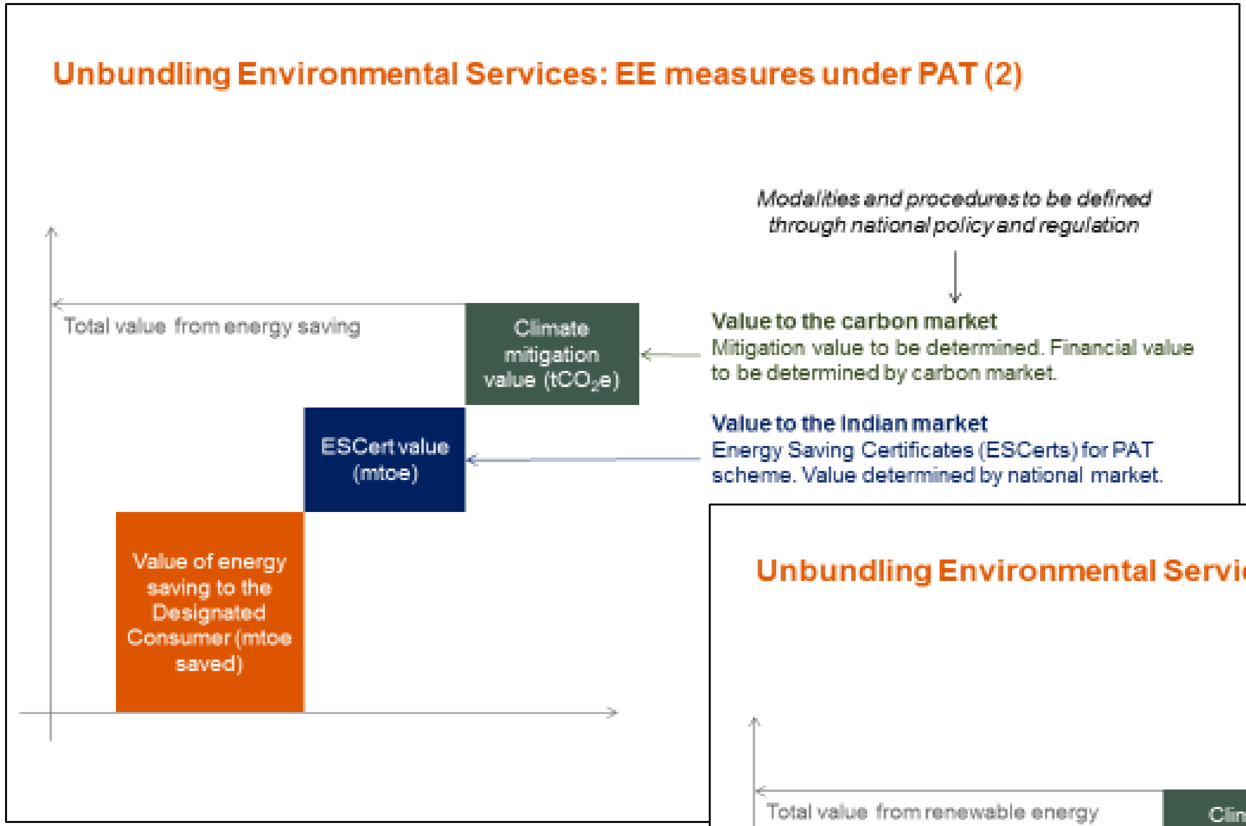
Schematic of Operational Framework for REC Mechanism

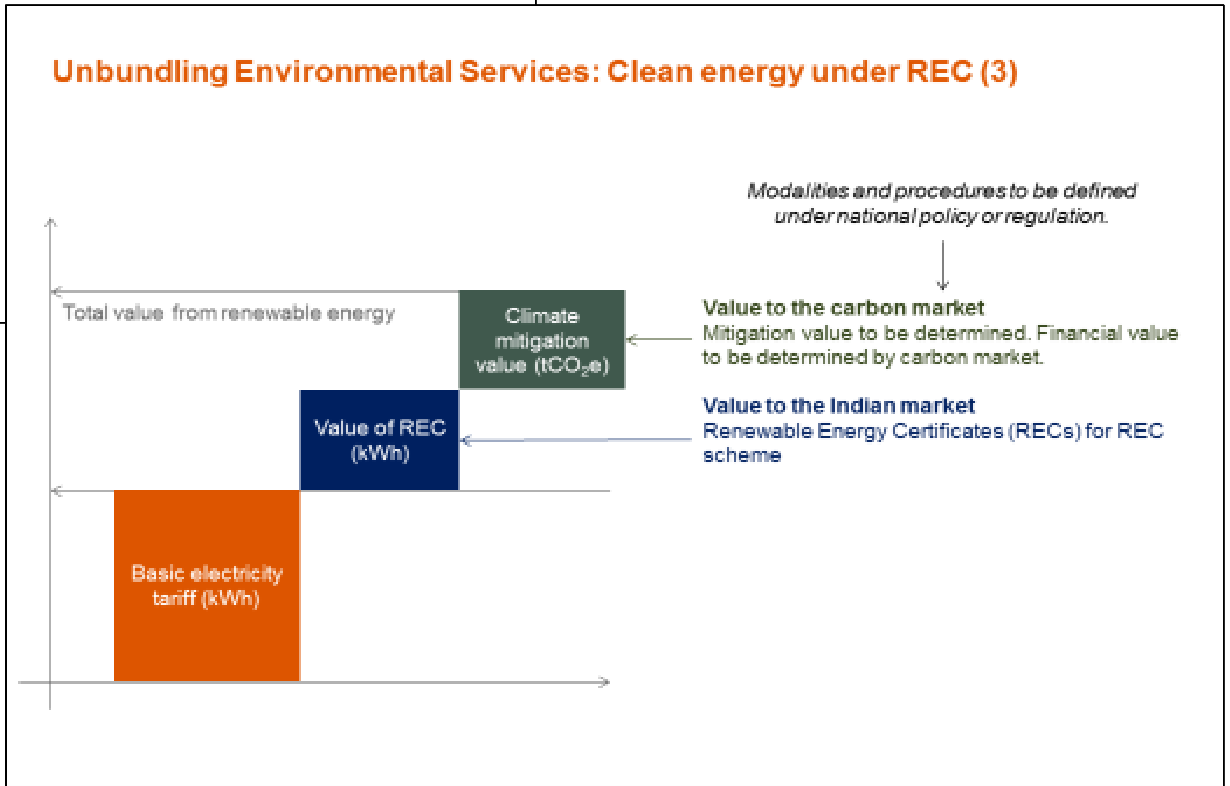


REC Market Summary



Way Forward – A common 'Green Credit Value'





Challenges to ‘linking’ the PAT & REC

- MRV
- Modalities for banking
- Stringency of targets and enforcement
- What would the mega-registry look like?
- Avoiding market failures – compliance period, prices?
- What will be the allocation methods?
- Interaction of the Green Credit Value with other global carbon pricing initiatives

Thank You

For more details contact
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Enerdata/NCMI: Project methodology

Using Mitigation Values to Guide the Design of Trading Rules

Enerdata

NCMI's Partners and Strategy Workshop, Cologne, 28 May 2016

Agenda

- Brief Background Information: Enerdata, POLES, MACCs
- Enerdata's contribution to NCMI: objective and framework
- Proposed methodology
  - Focus on marginal abatement cost curves
- Preliminary results
  - On 2 jurisdictions

Background Information

- Enerdata
- The POLES model
- Marginal Abatement Cost Curves

Enerdata: global energy intelligence company

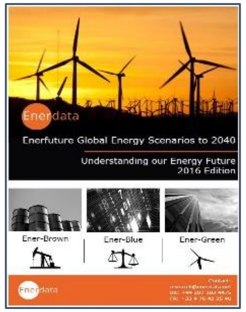
- **Independent** energy research & consulting company since 1991
- Spin-off of CNRS research center
- **Expert** in analysis and forecasting of global energy & climate issues
- **In-house** and globally recognized databases and forecasting models
- Headquartered in the Grenoble (French Alps) research cluster
- Offices in Paris, London and Singapore + network of partners worldwide
- **Global reach**: clients in Europe, Asia, Americas, Africa

Enerdata: fields of expertise

- Market Study
  - Market Assessment in developed and developing countries
  - Due diligence, feasibility studies

- Energy Efficiency & Demand
  - Analysis & Forecasting of energy demand by end use and energy efficiency
  - Policy evaluation & simulation

- Global Energy Forecasting
  - Analysis & Forecasting (drivers, supply/demand, prices)
  - Energy & Climate policy shaping
  - Power generation



The POLES model: origins and objectives

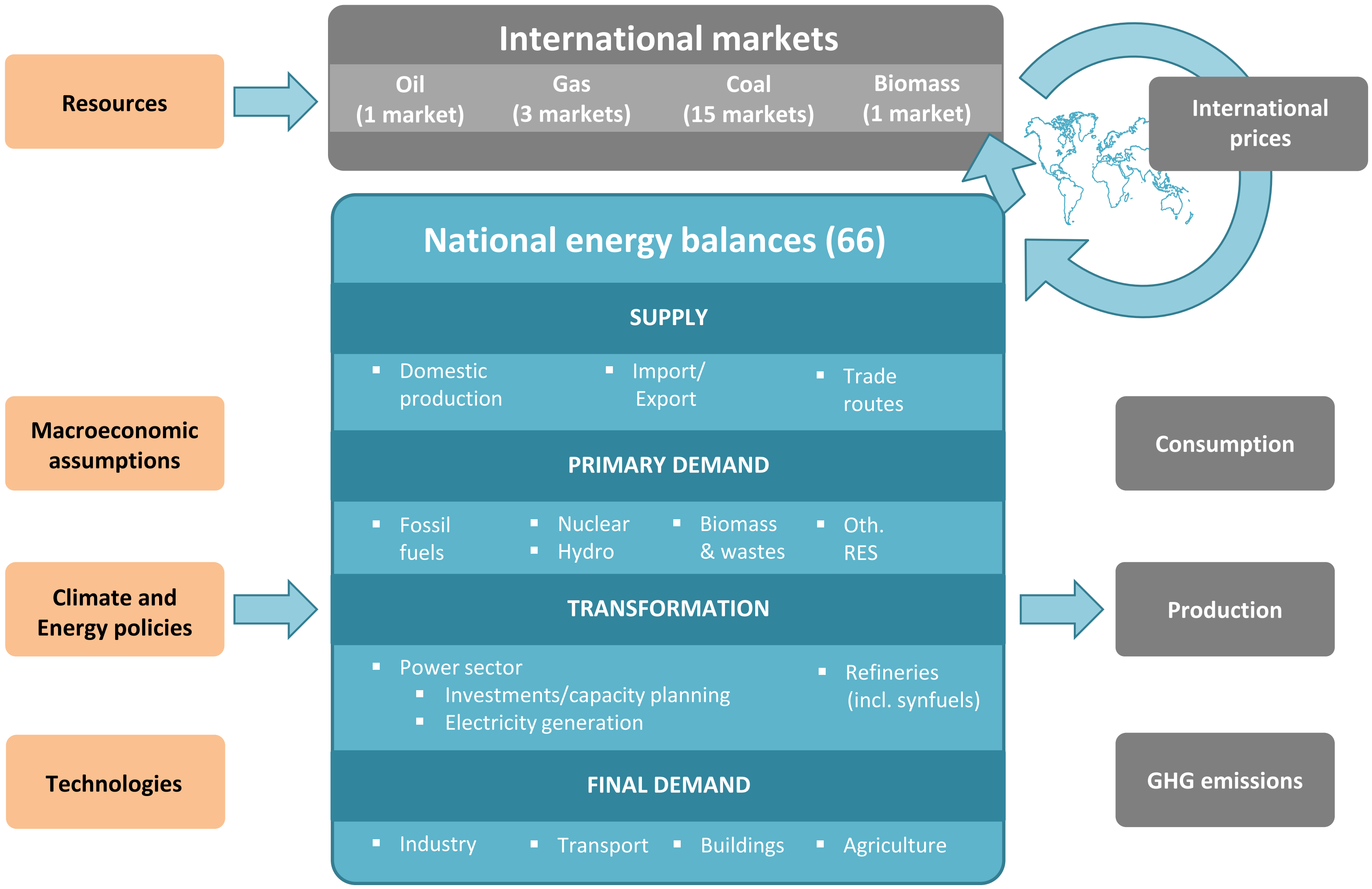
- The objective of POLES (**Prospective Outlook on Long-term Energy Systems**) is to analyze and forecast the supply & demand of energy commodities, energy prices, as well as the impact of climate change and energy policies on energy markets

- Initially developed in the early 1990s by the Institute of Energy Policies and Economics IEPE (now EDDEN-CNRS) in Grenoble, France

- Since then, POLES has been further developed by Enerdata, EDDEN, and JRC-IPTS of the European Commission

- POLES draws on practical and theoretical developments in many fields such as mathematics, economics, engineering, energy analysis, international trade, and technological change

POLES: a multi-issue energy model



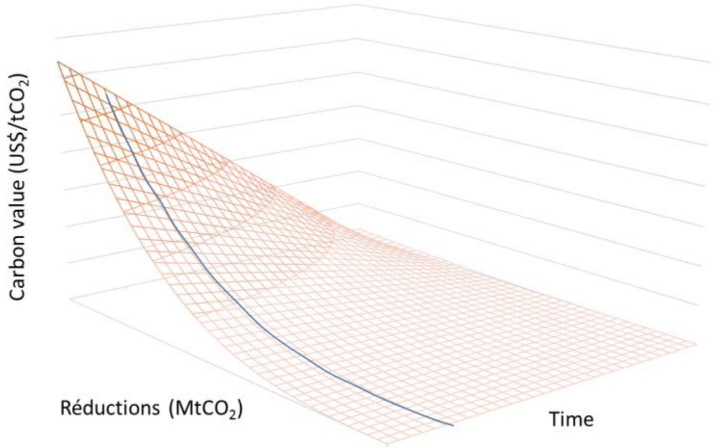
POLES geographical coverage: 66 countries & regions

Regions	Sub-regions	Countries	Country aggregates
North America		USA, Canada	
Europe	EU15	France, United Kingdom, Italy, Germany, Austria, Belgium, Luxembourg, Denmark, Finland, Ireland, Netherlands, Sweden, Spain, Greece, Portugal	
	EU25	Hungary, Poland, Czech Republic, Slovak Republic, Estonia, Latvia, Lithuania, Slovenia, Malta, Cyprus, Croatia	
	EU28	Bulgaria, Romania	Rest of Europe
		Iceland, Norway, Switzerland, Turkey	
Japan – South Pacific		Japan, Australia, New Zealand	Rest of South Pacific
CIS		Russia, Ukraine	Rest of CIS
Latin America	Central America	Mexico	Rest of Central America
	South America	Brazil, Argentina, Chile	Rest of South America
Asia	South Asia	India	Rest of South Asia
	South East Asia	China, South Korea , Indonesia, Malaysia, Thailand, Viet Nam	Rest South East Asia
Africa / Middle East	North Africa	Egypt,	Rest of North Africa x2;
	Sub-Saharan Africa	South Africa	Rest of Sub-Saharan Africa;
	Middle-East	Saudi Arabia, Iran	Gulf countries; Rest of Middle East

Marginal Abatement Cost Curves (MACCs)

- Top-down MACCs produced by the POLES model as the result of sensitivities on carbon value

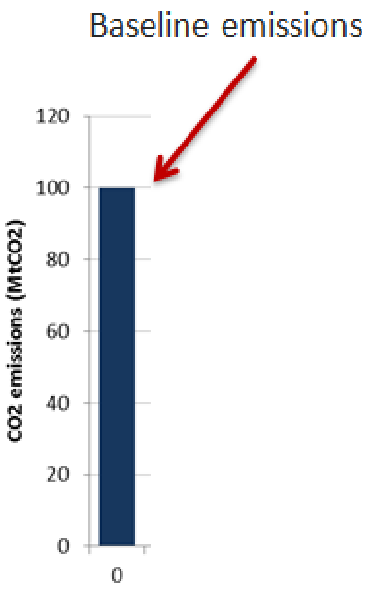
- Curves are produced by POLES for:
    - 66 countries/regions
    - 20 emitting sectors
    - 6 GHGs (from energy and industrial activities)
    - All years from 2020 to 2050



- The MACCs from POLES are based on:
    - Power sector: full technological description and load curve simulation
    - Final demand sectors: econometric demand functions (including short-term price and long-term price elasticities), incorporating explicit description of technologies in road transport and buildings

How MACCs from POLES are built

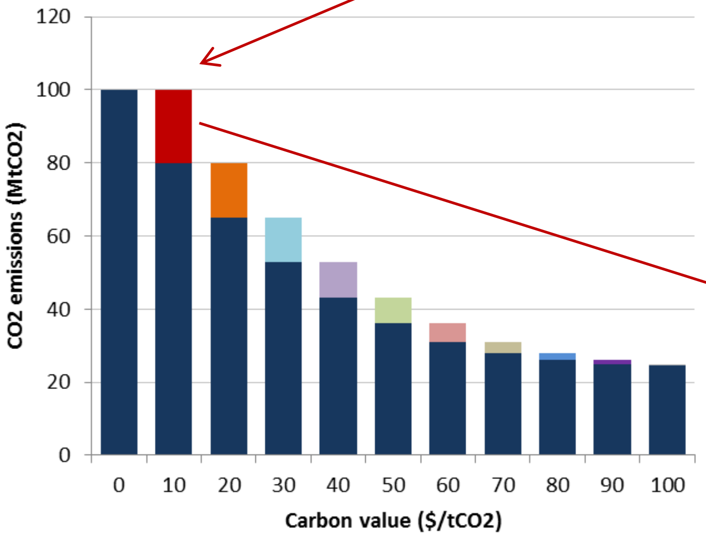
- At a given year, we simulate the impact of a given carbon taxation on the level of CO_2 (or GHG) emissions

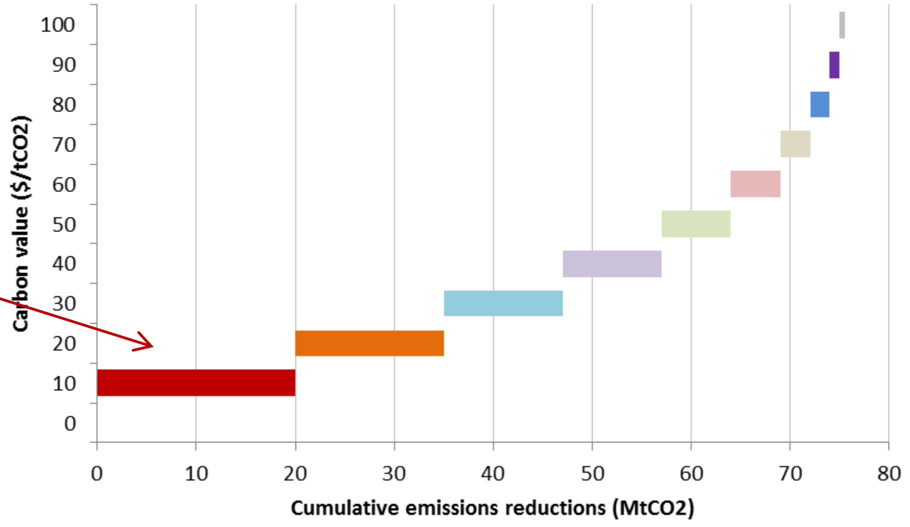


How MACCs from POLES are built

- At a given year, we simulate the impact of a given carbon taxation on the level of CO_2 (or GHG) emissions

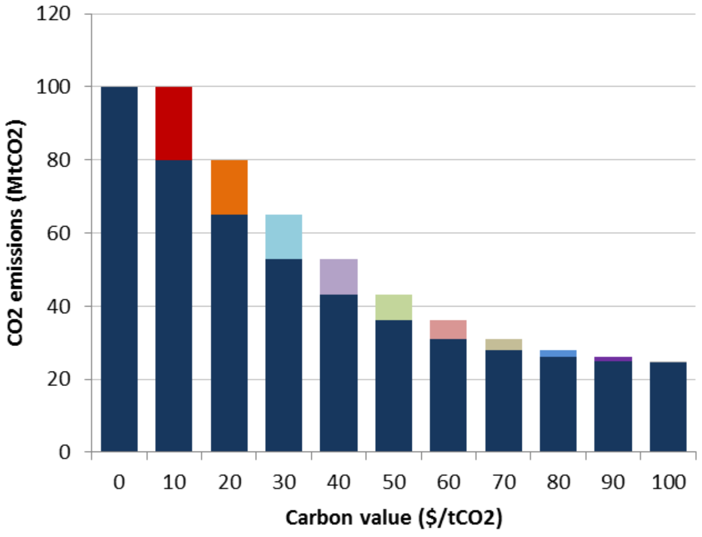
Introduction of a 10$ carbon price

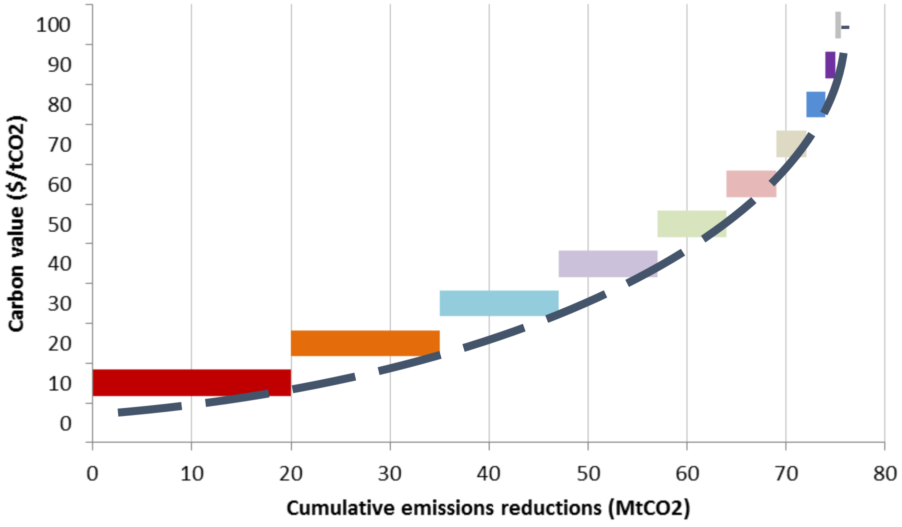




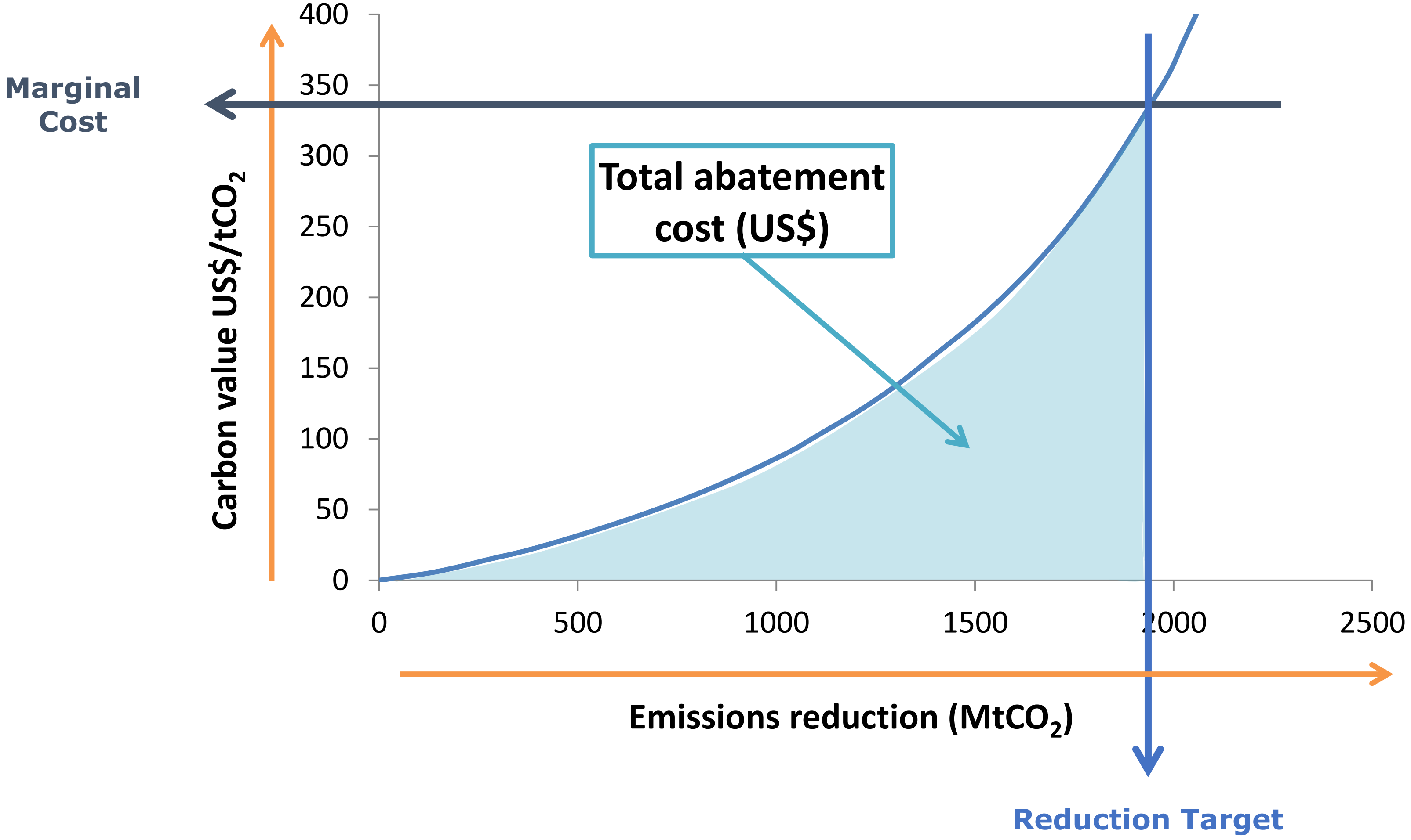
How MACCs from POLES are built

- At a given year, we simulate the impact of a given carbon taxation on the level of CO_2 (or GHG) emissions
- Using a recursive process, a complete curve is built



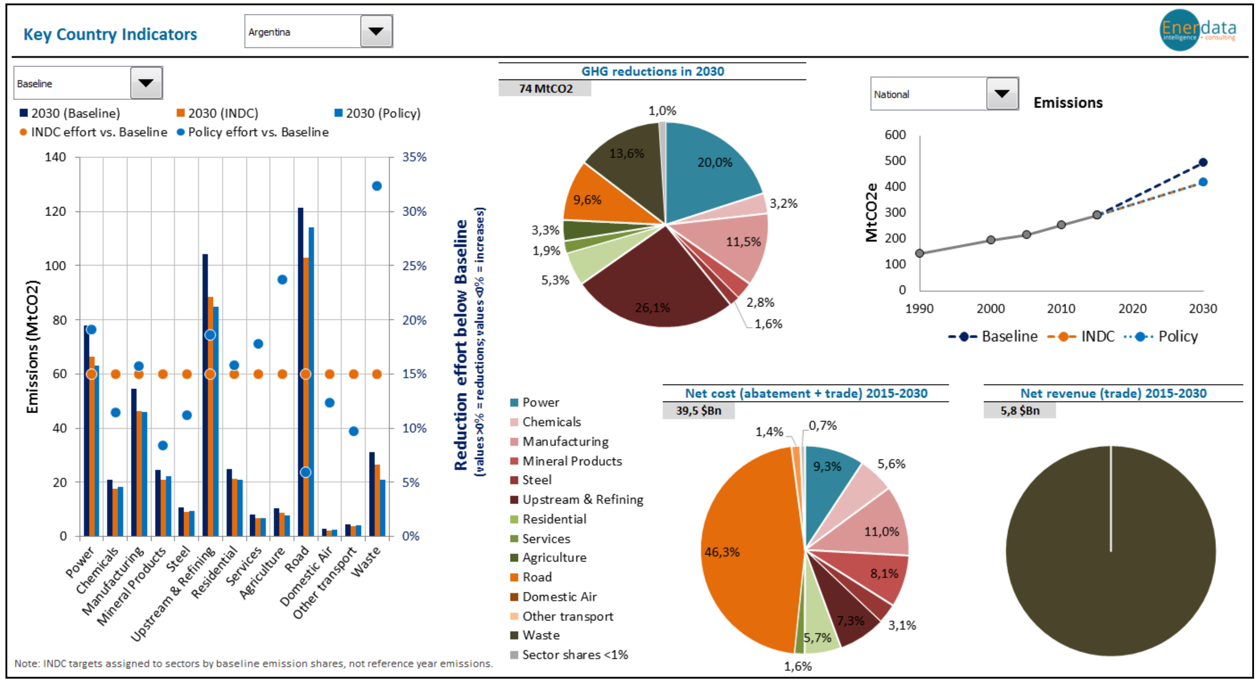


Use of MACCs: from a reduction target to a marginal cost and to an abatement cost



MACCs are the major input for the present work

- A set of coherent and interdependent MACCs for all sectors and countries considered
- Covers all GHG and emitting sectors, with the exception of LULUCF and non-CO_2 agriculture
- MACCs for the year 2030 constitute the main input data to EVALUATE



Enerdata's Contribution to NCMI: Objective and Framework

Project Objective

- Analyze impacts of various design options for Emissions Trading Schemes (ETS):
  - Domestic and International
  - Mitigation Values between jurisdictions
  - Trading limitations between jurisdictions

Project Framework

1. Case study on 3 jurisdictions: China, Mexico and South-Korea

   → Covered by EVALUATE: robust historical data and forecast

2. Target year: 2030

3. ETS sectoral coverage: Only energy-related Emissions - which sectors have targets and are allowed to trade ?

All energy-related sectors
(13 in EVALUATE)

Power
Chemicals
Manufacturing
Mineral Products
Steel
Upstream & Refining
Residential
Services
Agriculture
Road
Domestic Air
Other transport
Waste

EVALUATE sectoral description

Project Framework

1. Case study on 3 jurisdictions: China, Mexico and South-Korea

   → Covered by EVALUATE: robust historical data and forecast

2. Target year: 2030

3. ETS sectoral coverage: Only energy-related Emissions - which sectors have targets and are allowed to trade ? All EVALUATE's 13 sectors

4. What reference scenario: Country's "BaU" or "Baselines" ?
   - Baseline: Enerdata POLES forecast included in EVALUATE (i.e. where the jurisdiction will get without additional efforts – inline with WEO2013 current policy forecast):

     + quantified forecast for all energy-related variables available

     - may differ from country's own 2030 forecast (BaU)
   - BaU: Country's own 2030 forecast :

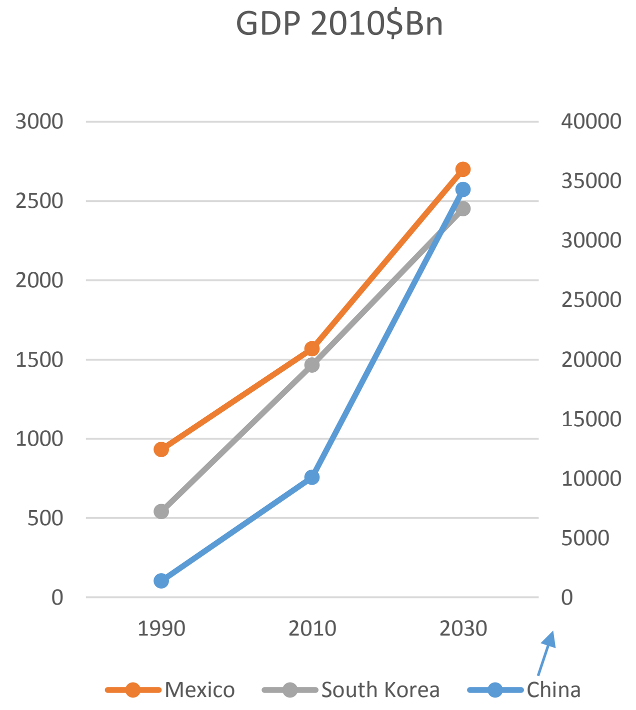
     + fit to their iNDC

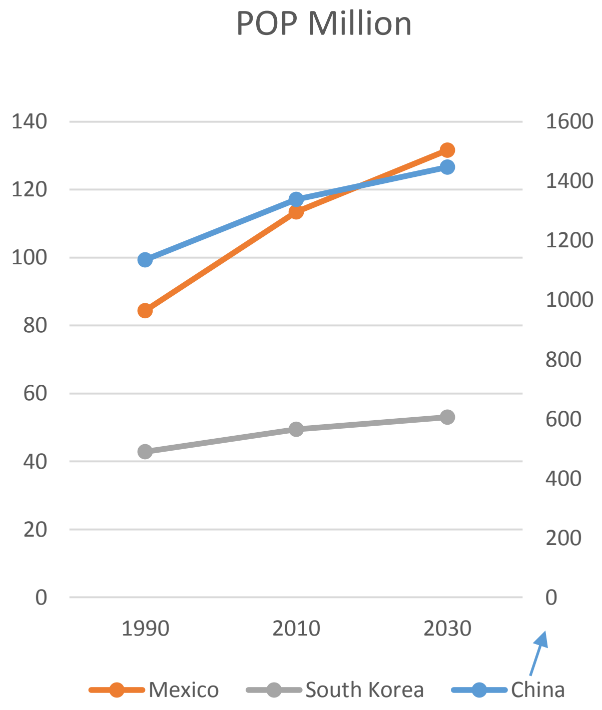
     - No information about it (only sometime 2030 BaU emissions provided)

Reference scenario = POLES "Baselines"

- EVALUATE covers only energy-related emissions
  - POLES baseline forecast considered to be BaU energy-related country's forecast
  - Reduction efforts equally distributed between energy-related emissions and others (LULUCF and non-CO_2 agriculture)

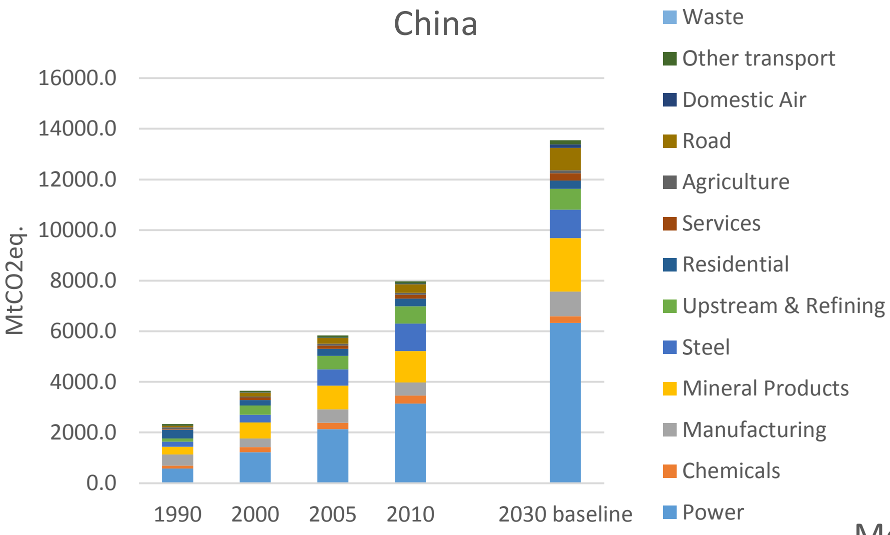
- Baseline GDP and Population

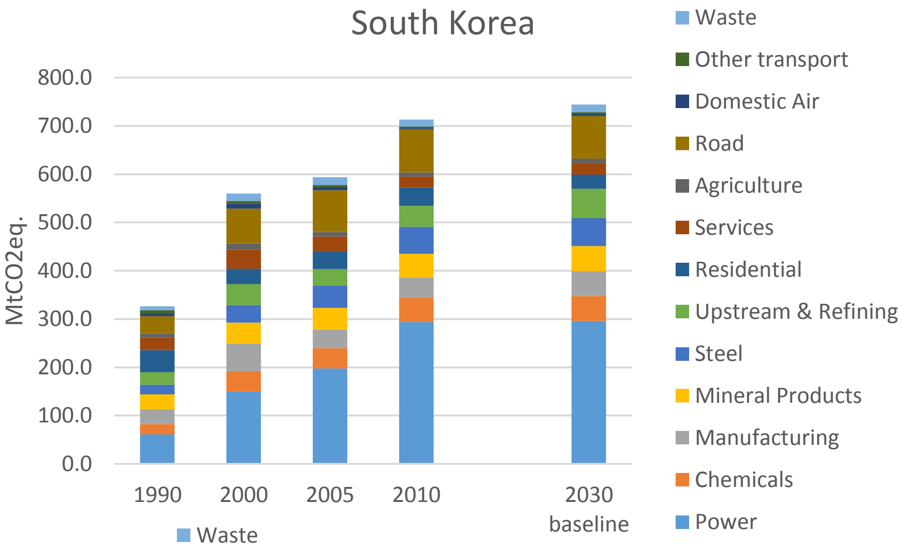


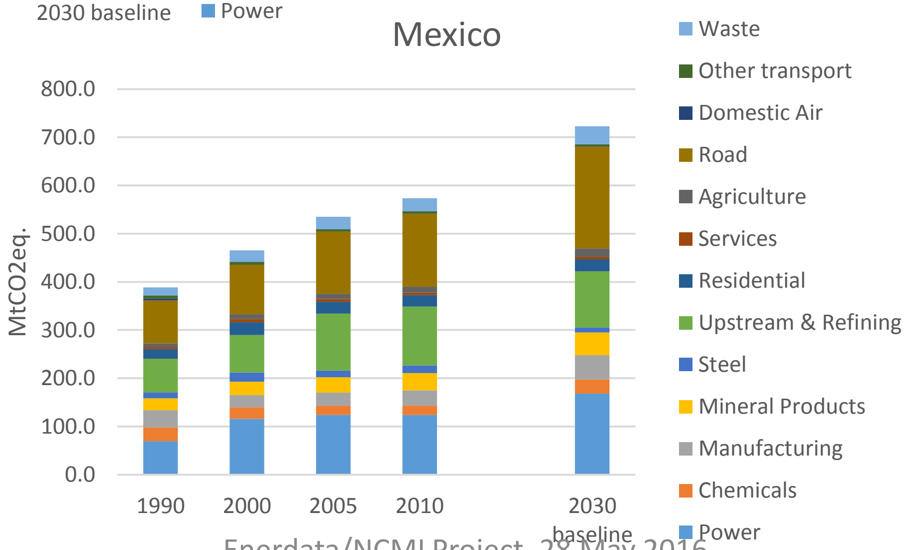


Data illustrations for selected jurisdictions

- Baseline emissions by sector in 2030







Project Framework

1. Case study on 3 jurisdictions: China, Mexico and South-Korea

   → Covered by EVALUATE: robust historical data and forecast

2. Target year: 2030

3. ETS sectoral coverage: Only energy-related Emissions - which sectors have targets and are allowed to trade ? All EVALUATE's 13 sectors

4. Country's "BaU", "Baselines" and "Reduction target":
   – Baseline: Enerdata POLES forecast included in EVALUATE (i.e. where the jurisdiction will get without additional efforts – inline with WEO2013 current policy forecast):

     + quantified forecast for all energy-related variables available

     - may differ from country's own 2030 forecast (BaU)

5. "Reduction target": iNDC target (What is the 2030 cap?)

What the iNDCs provide us

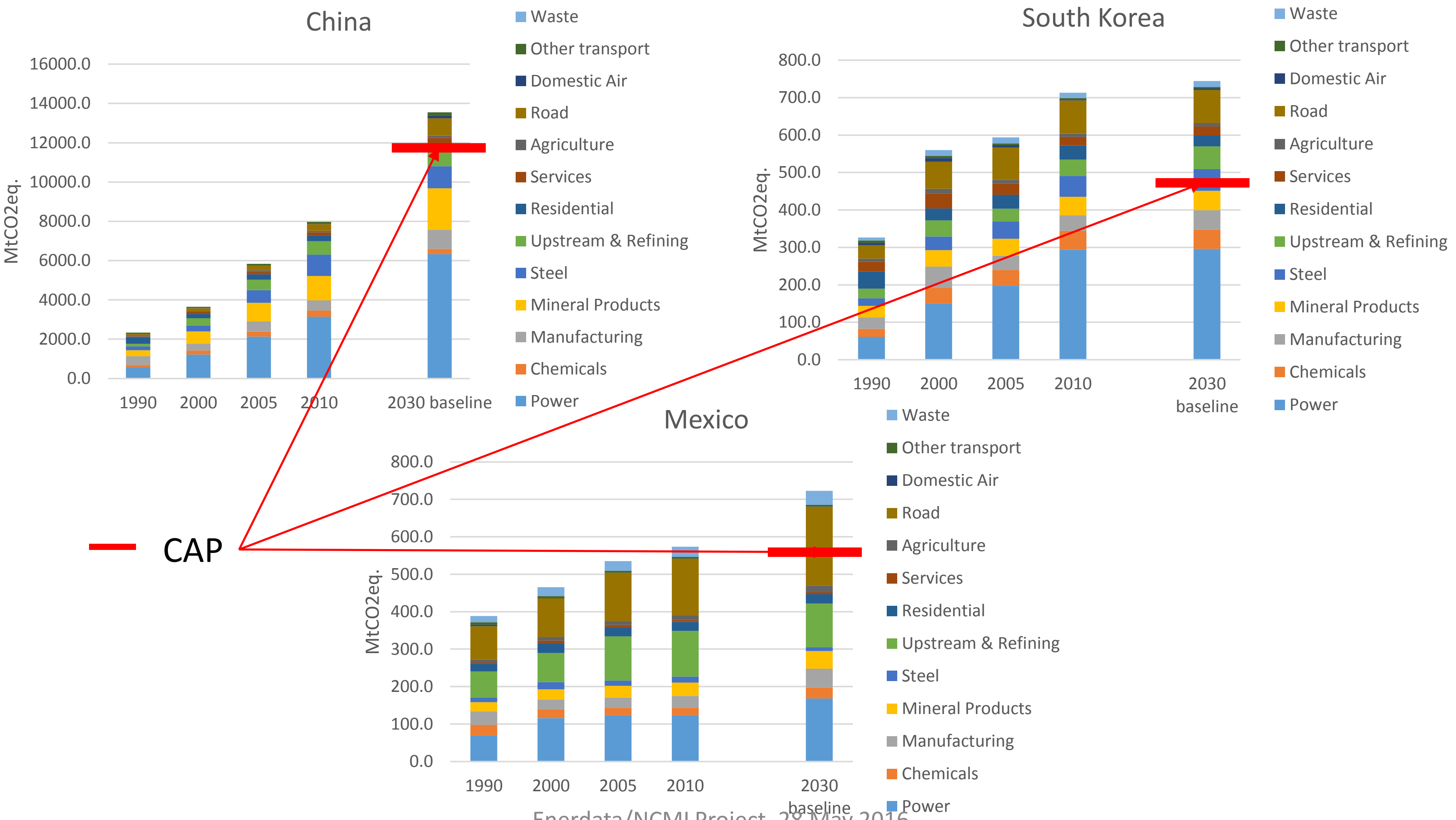
Jurisdiction / iNDCs	China	Mexico	South Korea
Type of target	% CO2/GDP	% GHG	% GHG
Base year	2005	BaU 2030 (973 MtCO2eq.)	BaU 2030 (850.6 MtCO2eq.)
Mitigation effort	60-65%	22%	37%
GHGs	CO_2	All GHGs	All GHGs
Sectors	Economy wide	Economy wide	Economy wide
Market-based mechanism	ETS (Power & Industry to be covered in national ETS)	ETS (not yet in place)	ETS (23 sub-sectors from steel, cement, petro-chemistry, refinery, power, buildings, waste and aviation sectors)

Project framework conditions: proposal

Framework	China	Mexico	South Korea
2030 baseline energy-related emissions	13,547 $MtCO_2$	723 $MtCO_2eq$	744 $MtCO_2eq$
Type of target	% CO_2/GDP	% GHG	% GHG
Base year	2005 Emissions: 5,831 $MtCO_2$ GDP: 5,942 $\$_{2010}$Bn	Baseline 2030	Baseline 2030
Mitigation effort	60-65%	22%	37%
2030 baseline GDP ($\$_{2010}$Bn)	34,291	2,698	2,451
Resulting absolute cap	13,460 $MtCO_2$ (60%) 11,778 $MtCO_2$ (65%)	564 $MtCO_2eq$	469 $MtCO_2eq$
Absolute reduction effort	87 $MtCO_2$ 1,769 $MtCO_2$	159 $MtCO_2eq$	275 $MtCO_2eq$

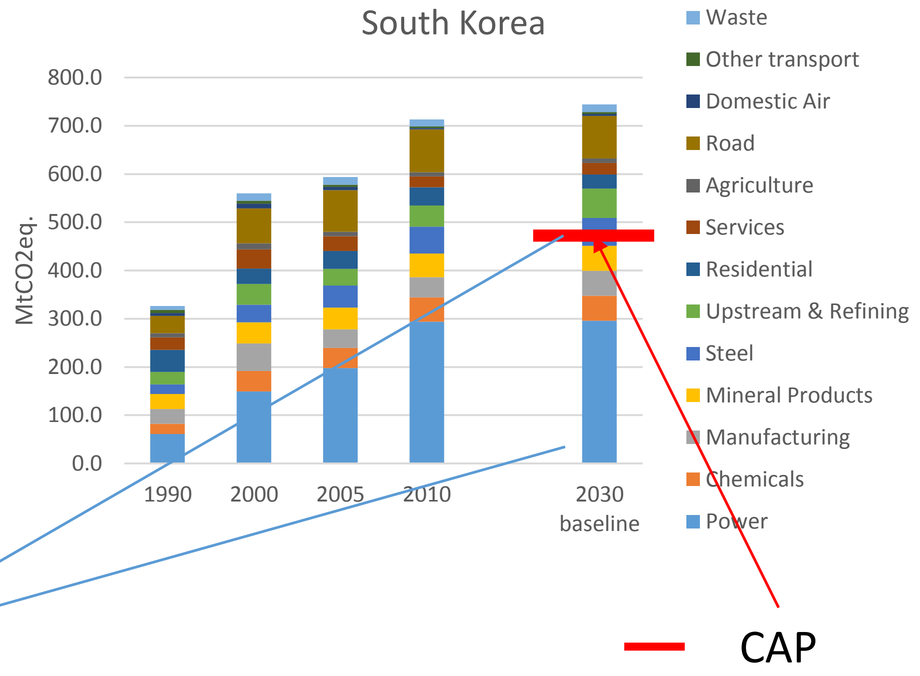
Data illustrations for selected jurisdictions

- Baseline emissions by sector with national cap in 2030



Key ETS design features in POLES

Effort : 37%
reduction compared
to baseline



Market price:

- Linearly evolving from 2015 to 2030

Total allowances:

- Auctioned (at the market price)

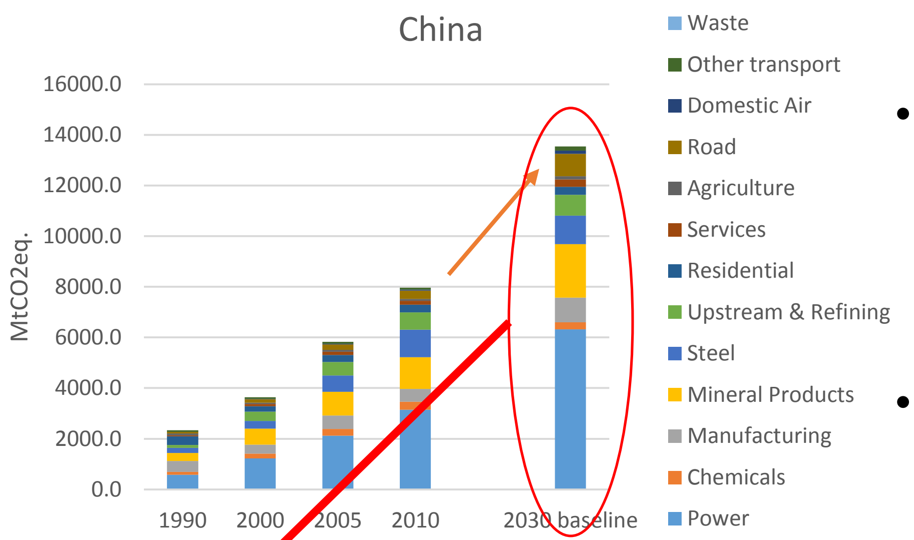
Allocation:

- Effort: Equally distributed between sectors

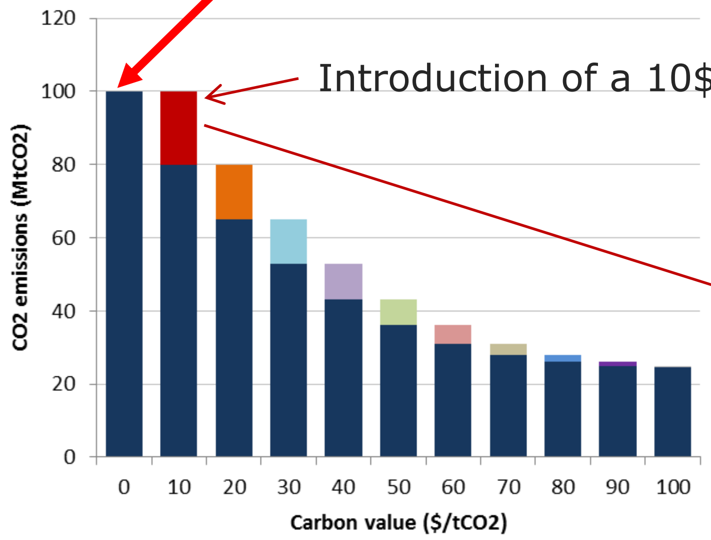
Proposed Methodology

Focus on
Marginal Abatement Cost Curves

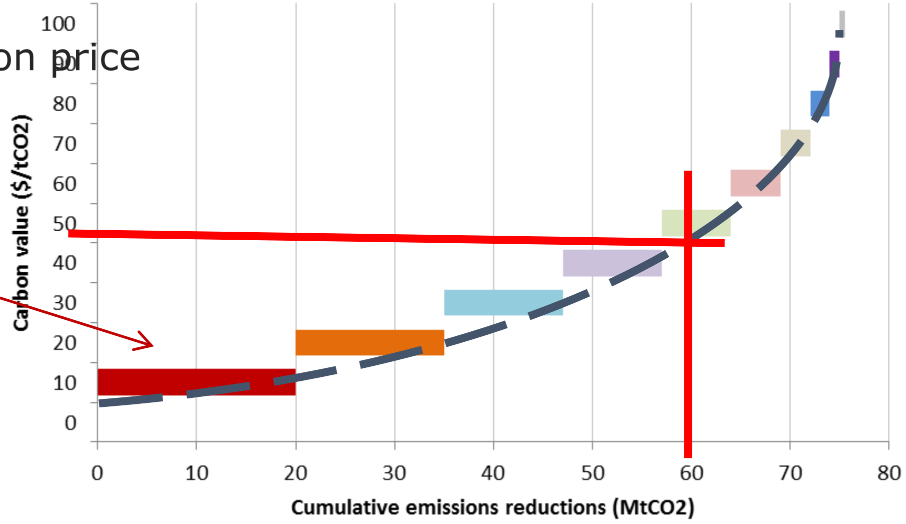
EVALUATE MACCs



- Baseline to 2030 → No effort, no carbon value
- MACCs are generated from POLES by simulating a series of scenarios introducing different carbon values (MACCs available for each sector in each jurdisdiction)
- For an emission reduction – the corresponding effort is represented by a marginal cost



Introduction of a 10$ carbon price



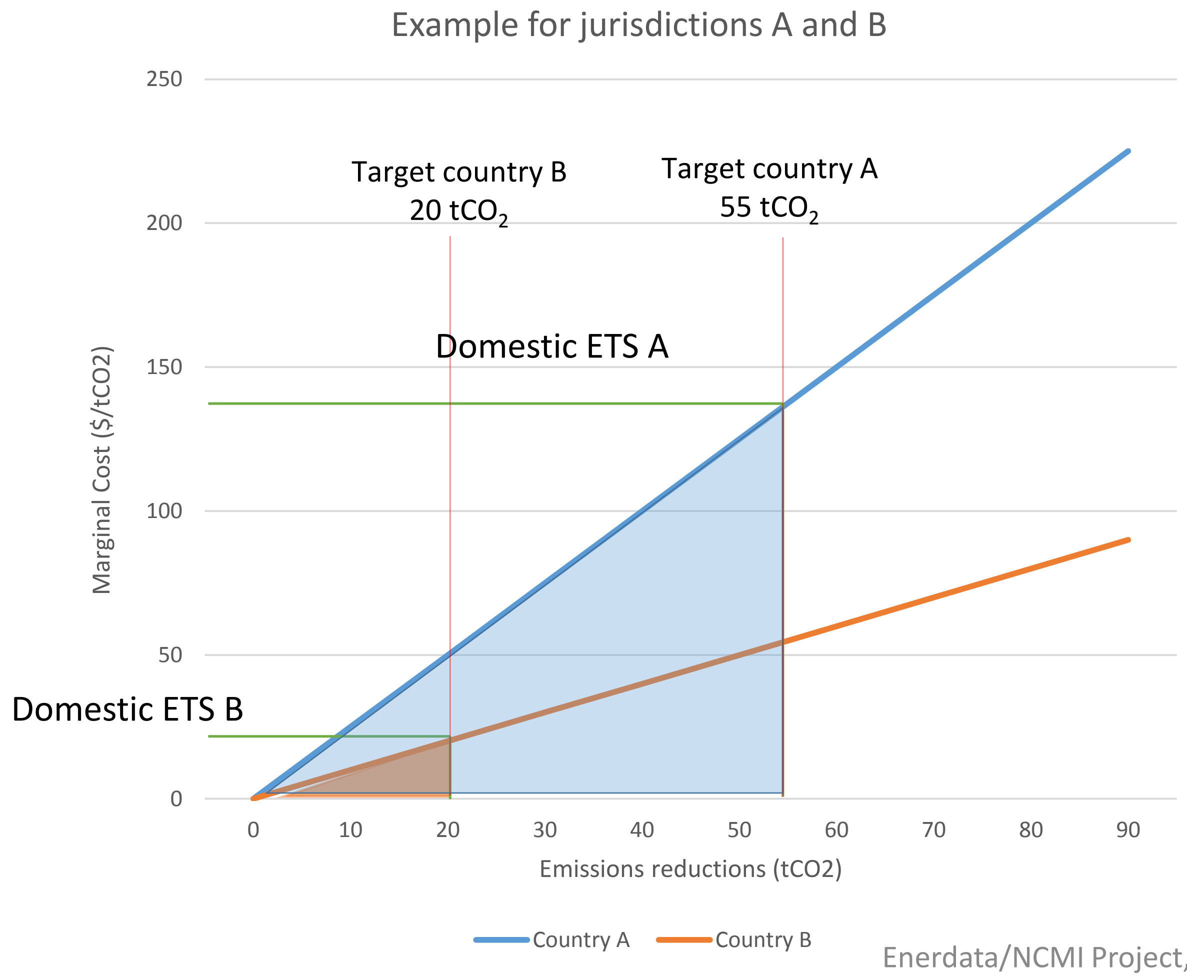
Scenario 1: Domestic ETS

<u>Total emissions reduction</u>:
75 tCO_2

<u>Carbon prices</u>:
20 and 137.5 $/tCO2

<u>Total costs</u> (2015-2030):

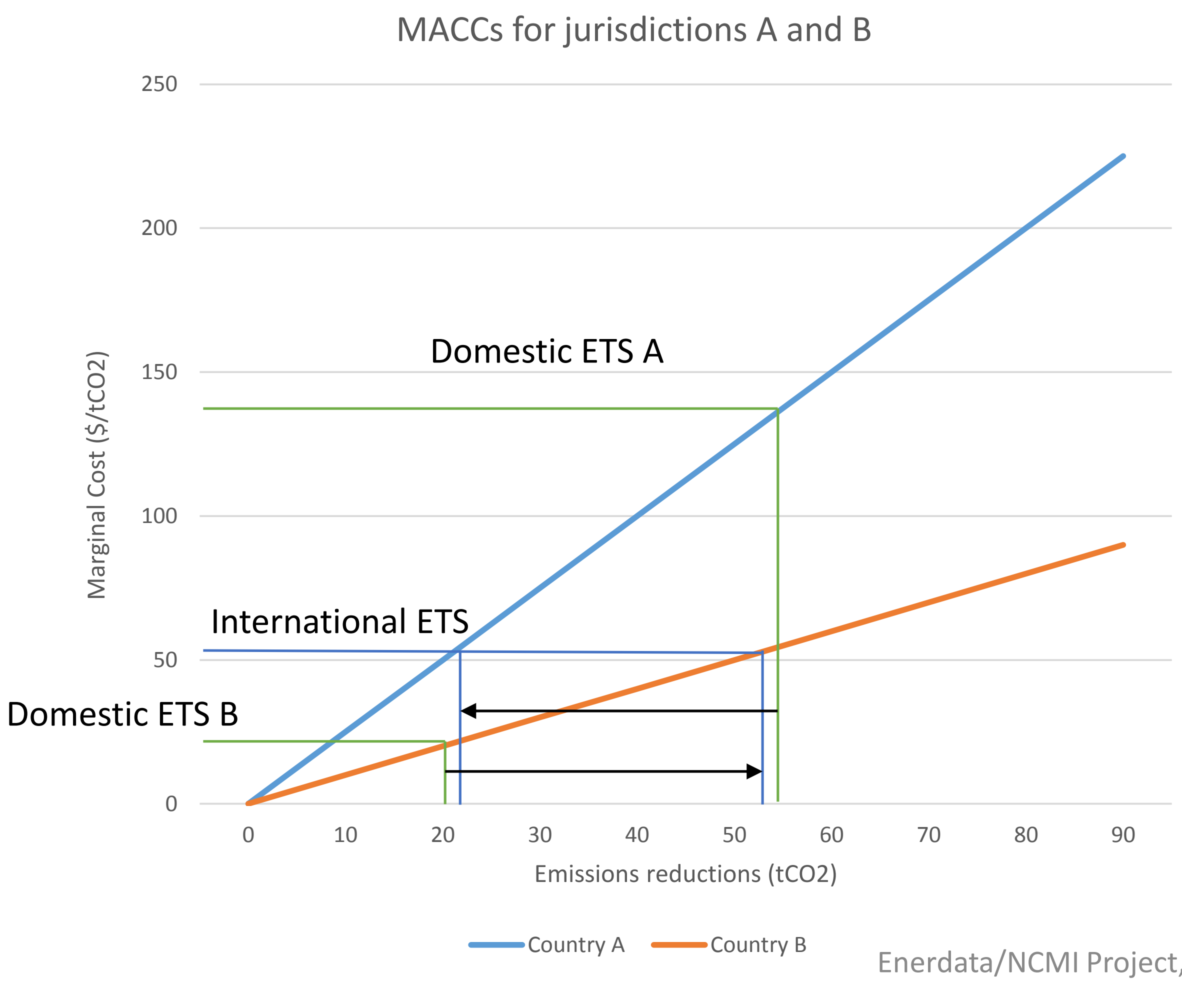
3981 $



Jurisdiction A	
Emissions reduction	55 tCO2
Total abatement cost	3781 $
Carbon price	137,5 $/tCO2

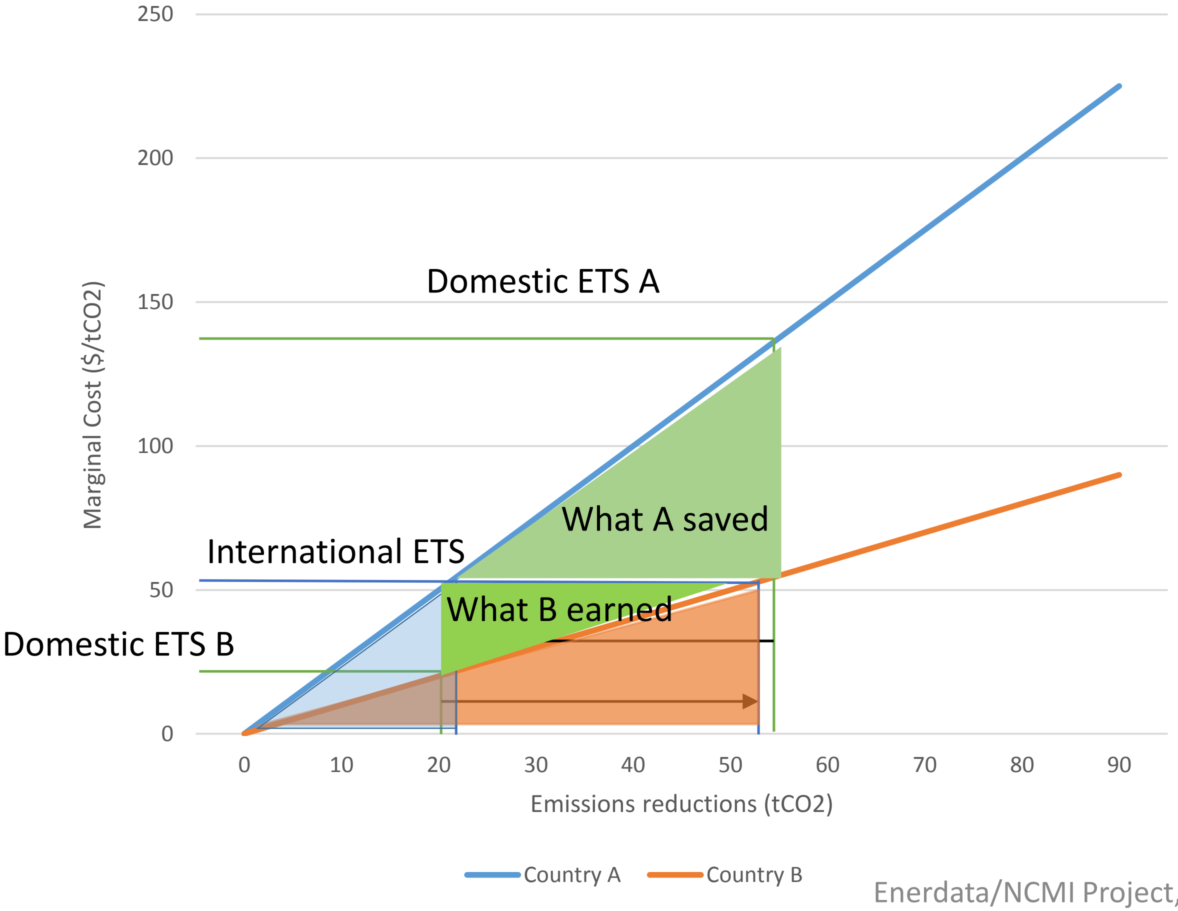
Jurisdiction B	
Emissions reduction	20 tCO2
Total abatement cost	200 $
Carbon price	20 $/tCO2

Scenario 2: Direct linking



Scenario 2: Direct linking

MV	A:1	B:1
Traded permits	33,6	- 33,6
Resulting emissions	33,6 tCO_2	- 33,6 tCO_2
Equilibrium prices	53.6 $/$tCO_2$	53.6 $/$tCO_2$



Total emissions reduction:
75 tCO_2

Carbon prices:
53.6 $/tCO2

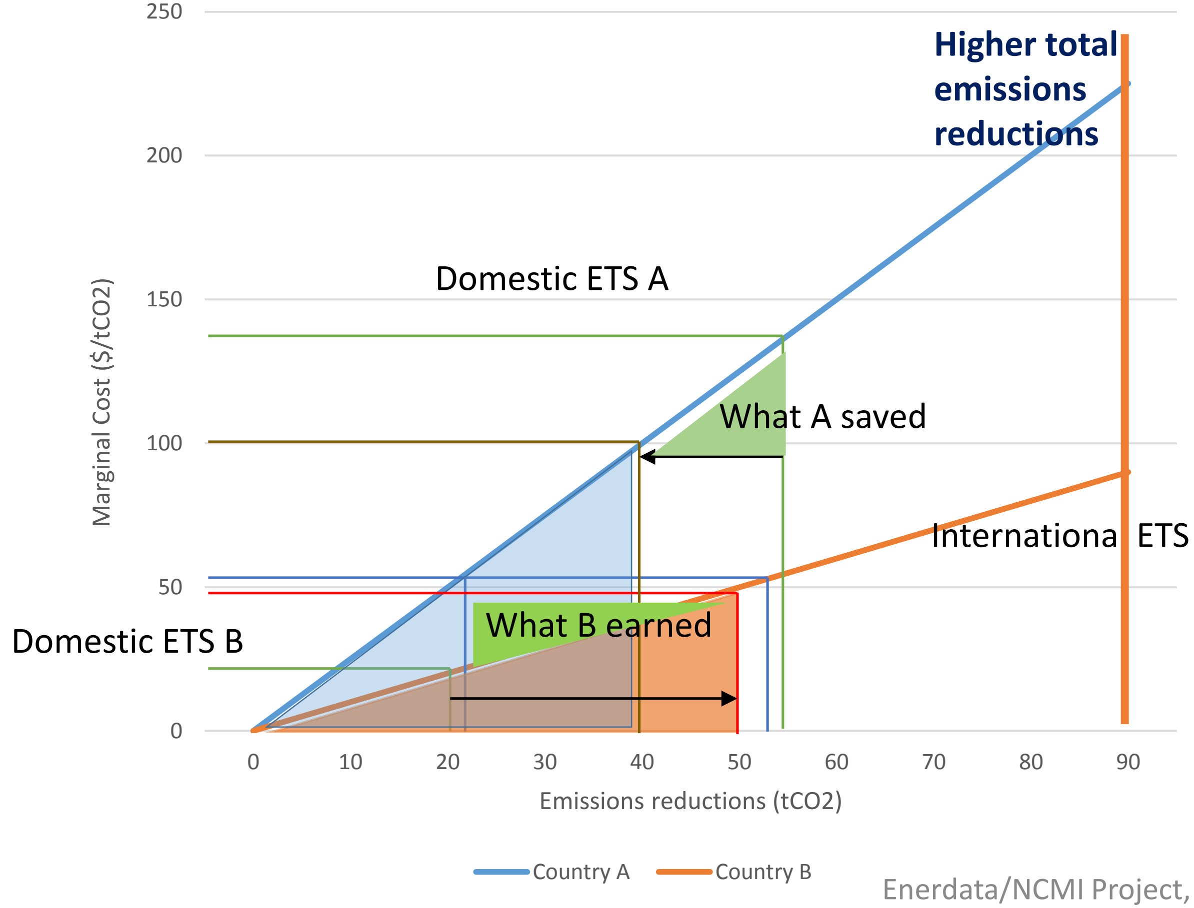
Total costs (2015-2030):
2010 $ (< 3981 $)

Jurisdiction A	
Emissions reduction	55 tCO_2
Abatement cost	3781 $
Carbon price	137,5 $/$tCO_2$
With direct linking	
Emissions reduction	21,4 tCO_2
Abatement cost	573,5 $
Trade cost	1800.96 $

Jurisdiction B	
Emissions reduction	20 tCO_2
Abatement cost	200 $
Carbon price	20 $/$tCO_2$
With direct linking	
Emissions reduction	53,6 tCO_2
Abatement cost	1436,5 $
Trade cost	-1800.96 $

Scenario 3: MV linking

MV	A:1	B:2
Traded permits	30	- 30
Resulting emissions	15 tCO_2	- 30 tCO_2
Equilibrium prices	100 $/$tCO_2$	50 $/$tCO_2$



Total emissions reduction:
90 tCO_2 (75 tCO_2)

Carbon prices:
50 – 100 (53.6 $/ tCO_2)

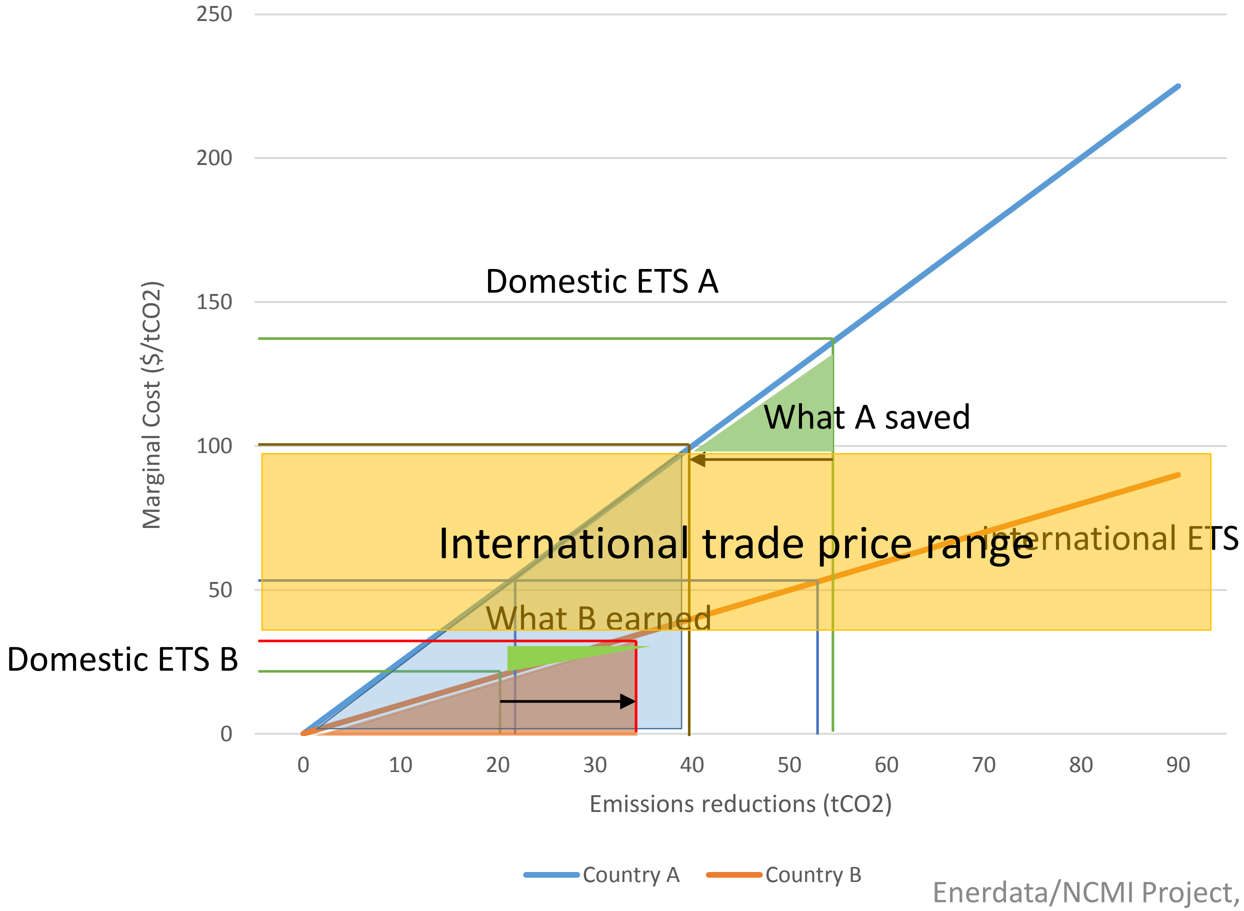
Total costs (2015-2030):
2010 $ < **3250 $** < 3981 $

A (With direct linking)	
Emissions reduction	21,4 tCO_2
Abatement cost	573,5 $
Trade cost	1800.96 $
With MV 1	
Emissions reduction	40 tCO_2
Abatement cost	2000 $
Trade cost	1500 $

B (With direct linking)	
Emissions reduction	53,6 tCO_2
Abatement cost	1436,5 $
Trade cost	-1800.96 $
With MV 2	
Emissions reduction	50 tCO_2
Abatement cost	1250 $
Trade cost	-1500 $

Scenario 4: Trade cap linking (15 tCO_2)

MV	A:1	B:1
Traded permits	15	- 15
Resulting emissions	15 tCO_2	- 15 tCO_2
Equilibrium prices	100 $/$tCO_2$	35 $/$tCO_2$



Total emissions reduction:
75 tCO_2

Carbon prices:
35 – 100 $/ tCO_2

Total costs (2015-2030):
2010 $ < 2612$< **3250$** < 3981$

A (With direct linking)	
Emissions reduction	21,4 tCO_2
Abatement cost	573,5 $
Trade cost	1800.96 $
With MV 1 trade cap 15	
Emissions reduction	40 tCO_2
Abatement cost	2000 $
Trade cost	525 ~ 1500 $

B (With direct linking)	
Emissions reduction	53,6 tCO_2
Abatement cost	1436,5 $
Trade cost	-1800.96 $
With MV1 trade cap 15	
Emissions reduction	35 tCO_2
Abatement cost	612,5 $
Trade cost	-525~ -1500 $

Preliminary results

On 2 Jurisdictions

Key indicators	Scenario 1 No link	Scenario 2 Direct link	Scenario 3 MV link	Scenario 4 Trade Cap
Global results				
Global emissions reductions ($MtCO_2$)	2045	2045	2172	2045
Global total cost ($Bn)	497	337.5	393.6	348.5
CHINA		MV 1 - No cap	MV 1 - No cap	cap: 127.7
Emissions reduction ($MtCO_2$)	1769	1955.6	2024.7	1897
Traded emissions ($MtCO_2$)		-186.3	-255.4	-127.7
Marginal Abatement Cost ($\$/tCO_2$)	42	47	49	45
Net trade Balance ($Bn)		-65.6	-93.6	(-43.4~-93.6)
Abatement Cost ($Bn)	262,5	324.4	349.2	304.2
Total Cost (abat + Trade) ($Bn)	262,5	258.8	255.7	(260.8~210.6)
SOUTH KOREA		MV 1 - No cap	MV 2 - No cap	cap: 127.7
Emissions reduction ($MtCO_2$)	275	89.1	147.7	147.7
Traded emissions ($MtCO_2$)		186.3	127.7	127.7
Marginal Abatement Cost ($\$/tCO_2$)	327	47	98	98
Net trade Balance ($Bn)		65,6	93,6	(43.4~93.6)
Abatement Cost ($Bn)	234,8	13.1	44.3	44.3
Total Cost (abat + Trade) ($Bn)	234,8	78.7	137.9	(87.7 ~137.9)
Additional reductions ($MtCO_2$)			127.7	

Summary and further works

Summary:

- Defined the approach methodology for:
  - Mitigation values
  - Trade offset limitation
- Test impacts on 2 jurisdictions

Further works:

- Simulate scenarios for 3 jurisdictions
- Analyse results of Mitigation Values for different rule options

Contact:

Global Energy Forecasting

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About Enerdata:

Enerdata is an energy intelligence and consulting company established in 1991.
Our experts will help you tackle key energy and climate issues and make sound strategic and business decisions.
We provide research, solutions, consulting and training to key energy players worldwide.

www.enerdata.net

Enerdata

Thank you for your attention!

Annex

Preliminary results

on 3 jurisdictions for scenarios 1 and 2

Scenario 1: Domestic ETS

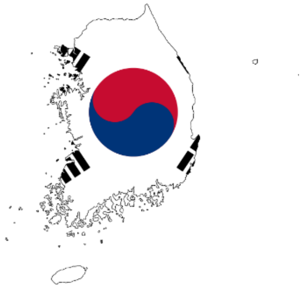
Total emissions reduction:
2204 $MtCO_2$

Carbon prices:
From 42 to 327 $/tCO2

Total costs (2015-2030):

586 $Bn

South Korea	
Emissions reduction	275 MtCO2
Total abatement cost	234,8 $Bn
Carbon price	327 $/tCO2



Mexico	
Emissions reduction	159 MtCO2
Total abatement cost	89 $Bn
Carbon price	185 $/tCO2

China	
Emissions reduction	1769 MtCO2
Total abatement cost	262,5 $Bn
Carbon price	42 $/tCO2

Emissions reduction are in $MtCO_2$ compared to 2030 baseline
Total abatement costs are cumulative between 2015-2030

Scenario 2: Direct linking ETS

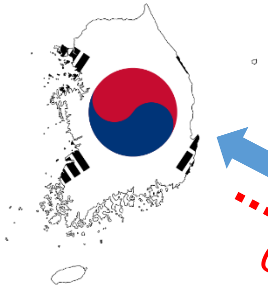
<u>Total emissions reduction</u>:
2204 $MtCO_2$

<u>Carbon prices</u>:
From 49 $/tCO2

<u>Total costs</u> (2015-2030):

380 $Bn

South Korea	
Emissions reduction	92.5 MtCO2
Net trade Balance	67.8 $Bn
Abatement Cost	14.3 $Bn
Total Cost	82.1 $Bn



182.9 $MtCO_2$

67.8 $Bn

92.2 $MtCO_2$

34.2 $Bn

Mexico	
Emissions reduction	66.8 MtCO2
Net trade Balance	34.2 $Bn
Abatement Cost	9 $Bn
Total Cost	43.2 $Bn

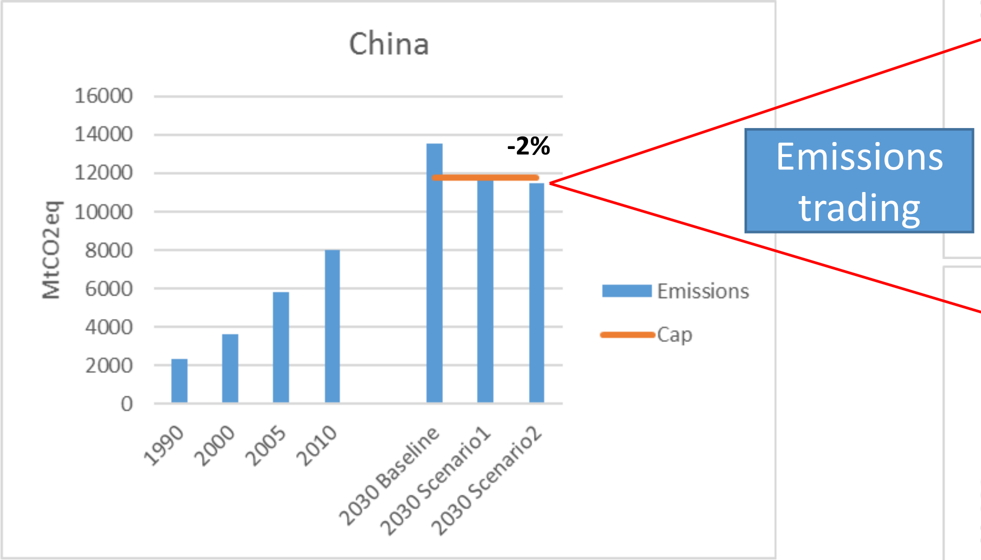
China	
Emissions reduction	2044 MtCO2
Net trade Balance	-102 $Bn
Abatement Cost	356.5 $Bn
Total Cost	254.5 $Bn

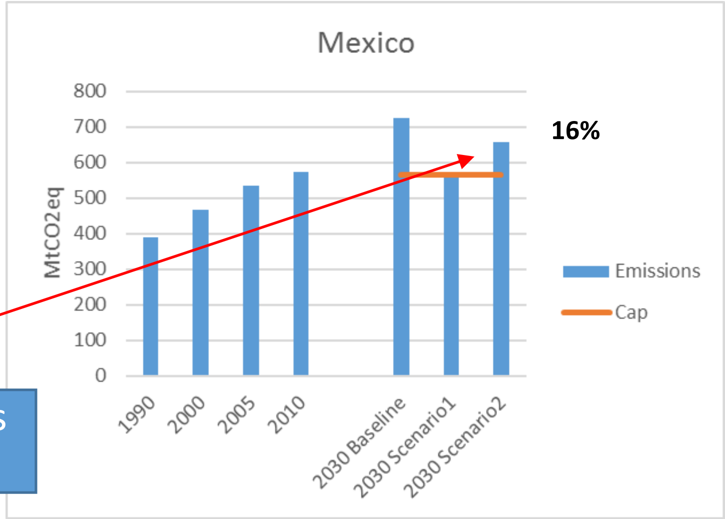
Emissions reduction are in $MtCO_2$ compared to 2030 baseline
Total abatement costs are cumulative between 2015-2030

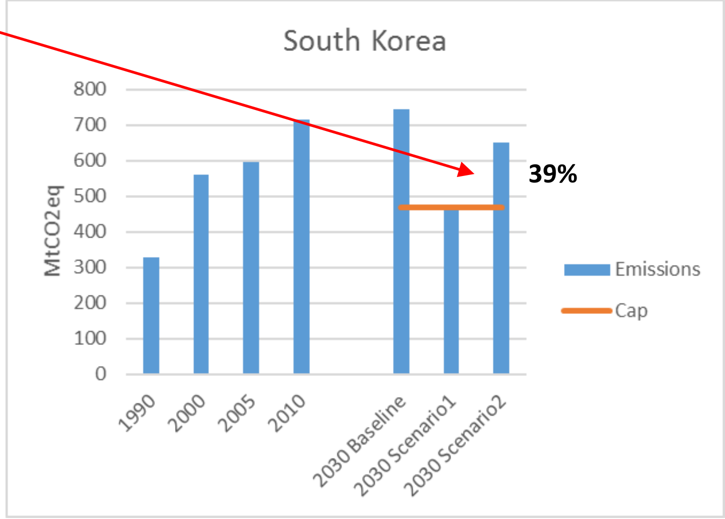
Direct linking effect

	Additional effort to Cap
China	16 %
Mexico	-58 %
South Korea	-66 %

Scenario 1 : The three countries respect exactly their cap.



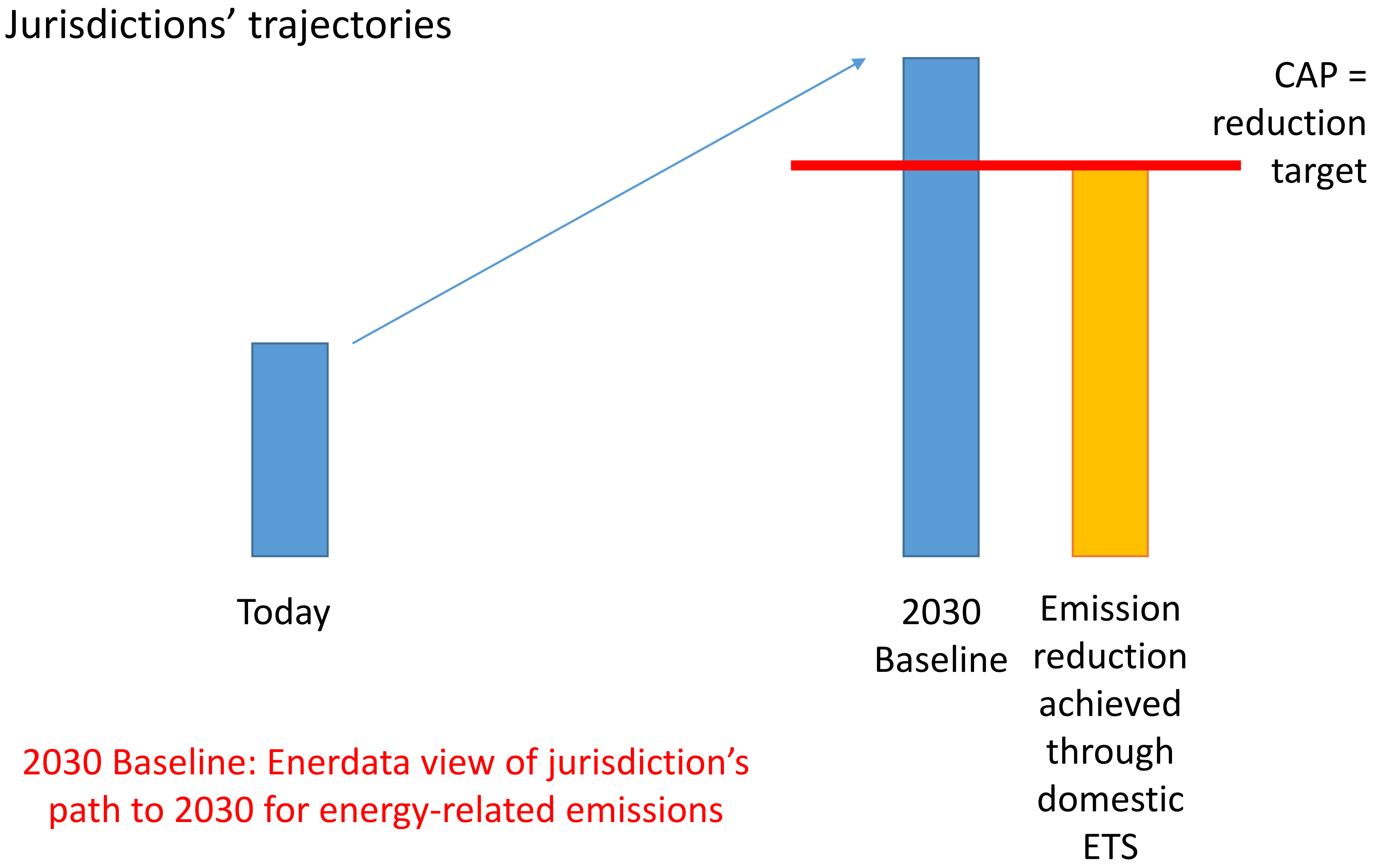




Scenario 2 : China reduces more; Mexico and South Korea reduce less.

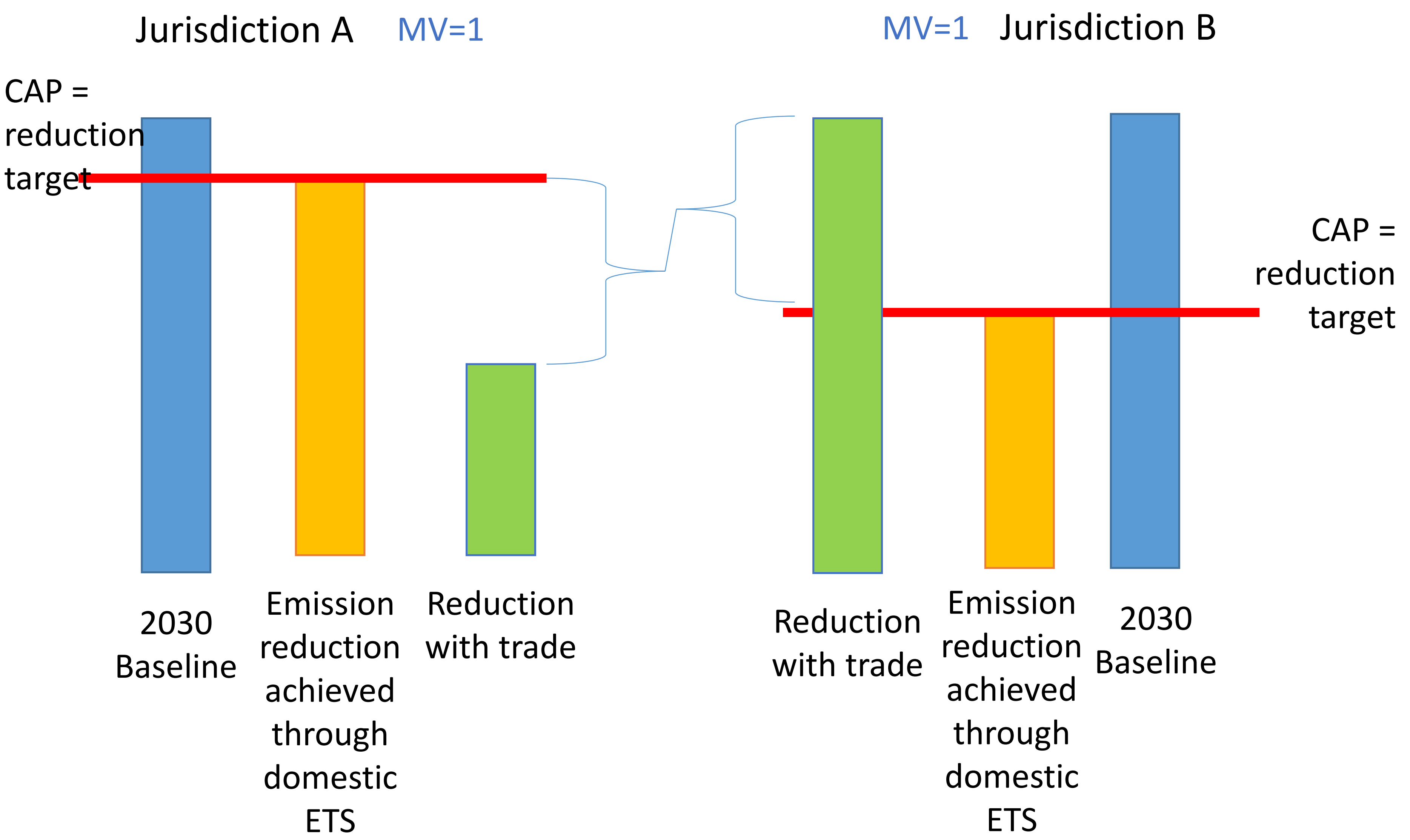
Focus on Emissions

Domestic ETS

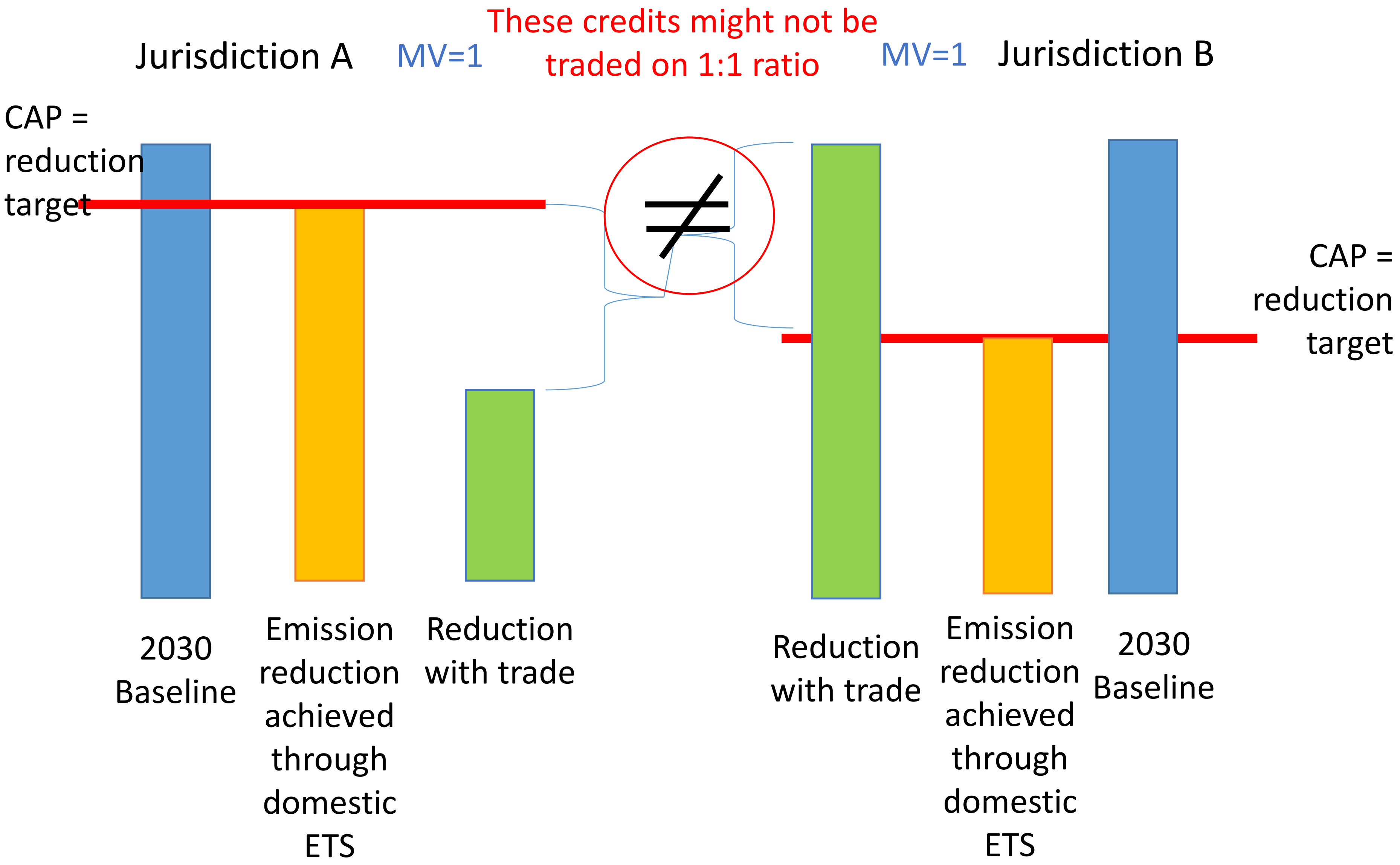


2030 Baseline: Enerdata view of jurisdiction's path to 2030 for energy-related emissions

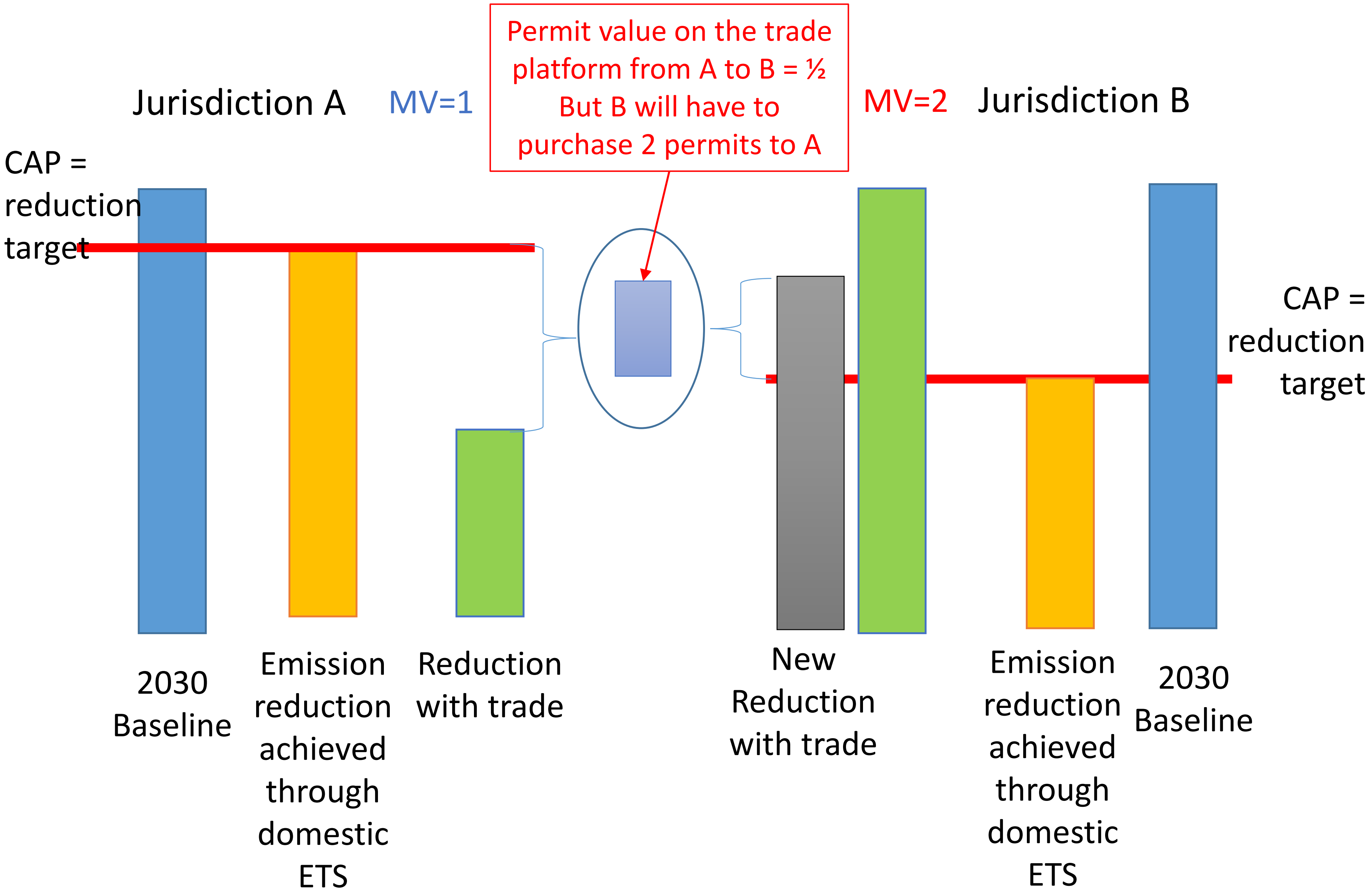
Direct linking methodology: International ETS (1:1)



Role of mitigation values: focus on environmental integrity



With mitigation value



Juerg Fuessler (INFRAS), Luca Taschini (LSE)

International Carbon Asset Reserve (ICAR)

The NCM initiative Partners & Strategy Workshop, Cologne, 28 May 2016

Linking and the role of ICAR

- The form of a link between two jurisdictions will lie along a spectrum that ranges from full link to restricted link.

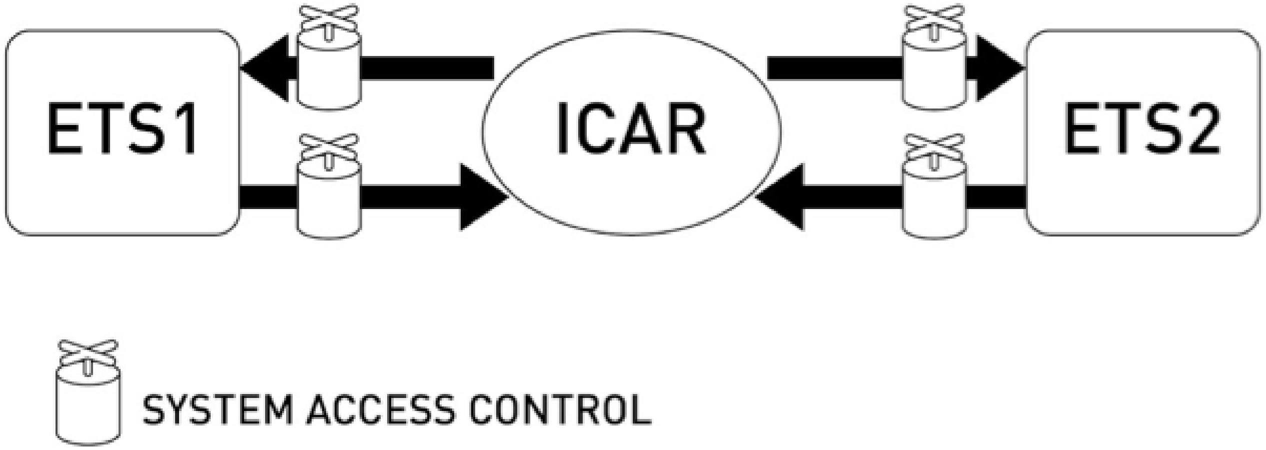
- Full linking requires a high degree of consistency between programs:
  - alignment of technical requirements (e.g. monitoring, reporting and verification (MRV) and tracking systems)
  - alignment of design features (e.g. level of ambition, mode of allocation, inter-temporal flexibility, price management rules)
- Rather than seeking to align systems, ‘networking’ is about recognizing differences in the programs and placing a value on these differences.

Three ICAR prototypes for discussion

Element	**1 «Platform»**	**2 «Central hub»**	**3 «Gateway»**
Approach	De-centralized	Centralized	«Facilitator»
ICAR Service	Platform for trading	Marketmaker and risk mitigator	Gateway for transfer of offsets Insurance services
Units	Local Units	International Units	International Units
Reserve	No	Yes	Yes

ICAR «Platform»: Description

- Decentralised trading platform (a marketplace) where to buy and sell allowances originating from multiple ETSs.
- Control timing, type and volume of export/import.
- Quality restrictions by independently deciding on CV.

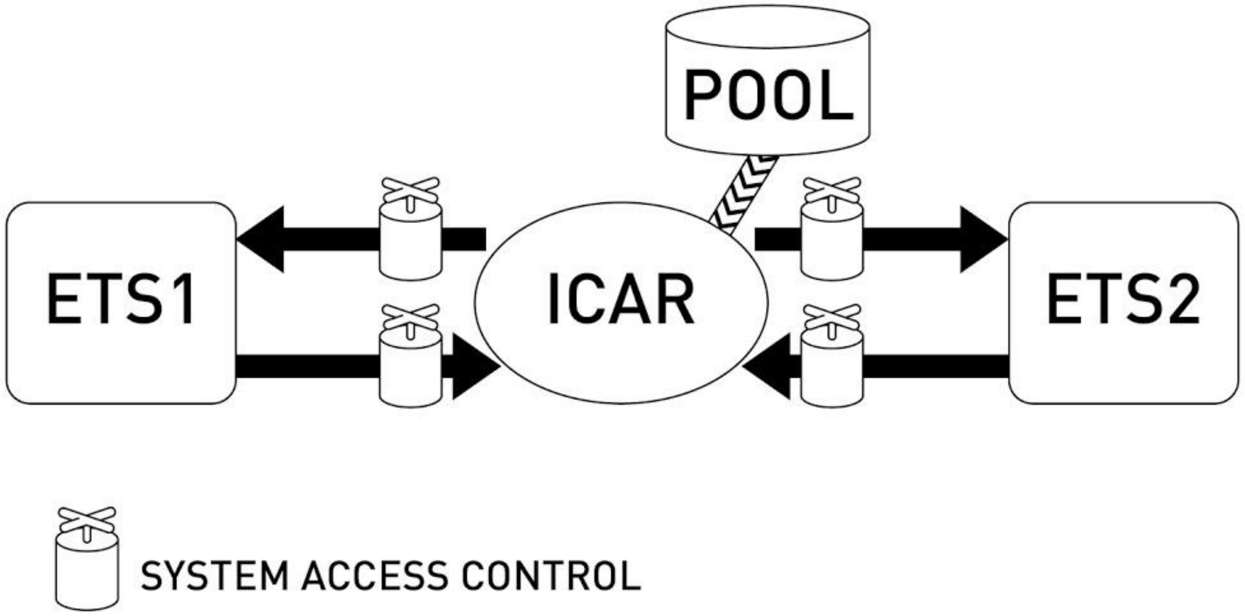


ICAR «Platform»: How it operates

- Each jurisdiction individually determine the CV they'd like to attribute to a non-domestic allowance.
- ICAR aggregates information to aid with the matching process (pool of compliance compatible allowances).
- A non-domestic allowance can have different CVs (allowance price spreads within ICAR Platform).
- Units in the system:
  - local units are directly transferred from one ETS to another
  - Independent jurisdictions' assessment will be reflected in price spreads

ICAR «Central hub»: Description

- Provide a platform for centralized trading of International Units among member jurisdictions.
- Tool for mitigating carbon risk via a centralized intermediation service (import risk) and via the provision of allowance buy and sell services (price risk).

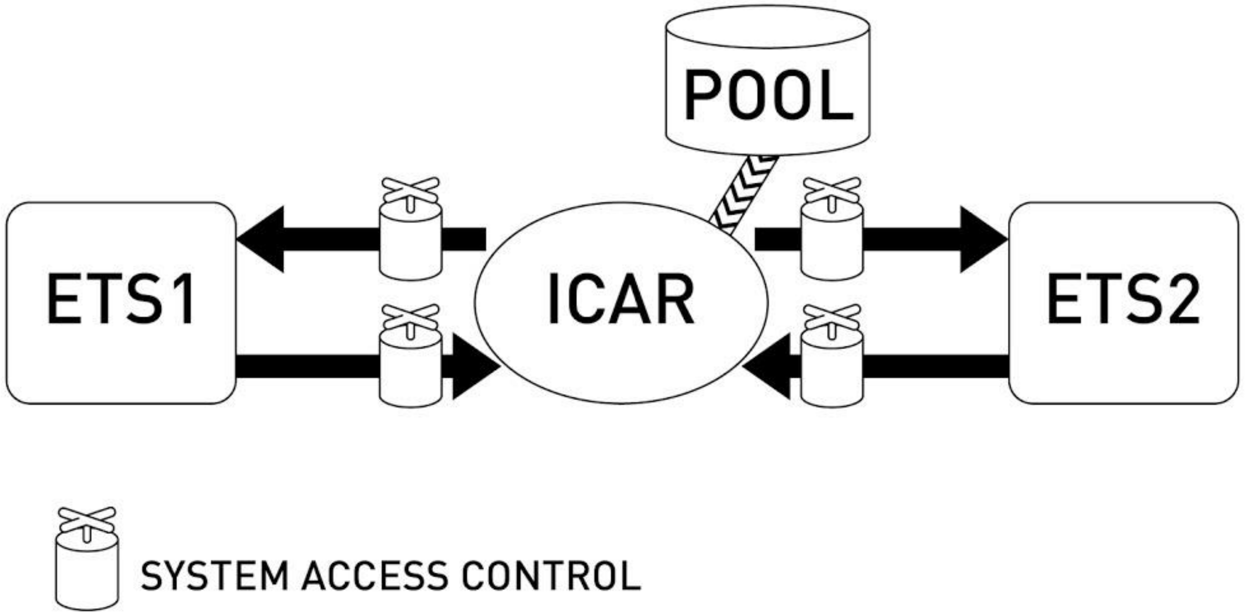


ICAR «Central hub»: International units

- Creation of a pool of internationally-fungible allowances (IU)
- Allowances are chosen on the basis of their relative MVs.
- Allowances are attributed weights which need to add up to 1 to create an IU.
- Restricted trading: IUs are issued directly to a jurisdiction and are only used to meet domestic compliance obligations
- Unrestricted trading: IUs can also be openly traded within the domestic market, this will create a secondary IU market so that IUs are traded alongside domestic allowances.

ICAR «Central hub»: How it operates

- Recourse to the Central Hub's services is rule-based (i.e. driven by triggers) – thus predictable.
- The trigger for what constitutes a contingency is pre-agreed with each jurisdiction and requires the approval of all participating jurisdictions.



Example ICAR Central Hub
ETS China – ETS South Korea

Assumptions:

- National domestic ETSs in both China and S. Korea and members
- S. Korea ETS has local price ceiling in place with limited buffer

- Functioning of ICAR Central Hub in the S. Korea ETS:
  - Risk of import of non-domestic units (ICAR pool takes the hit)
  - Domestic price risk

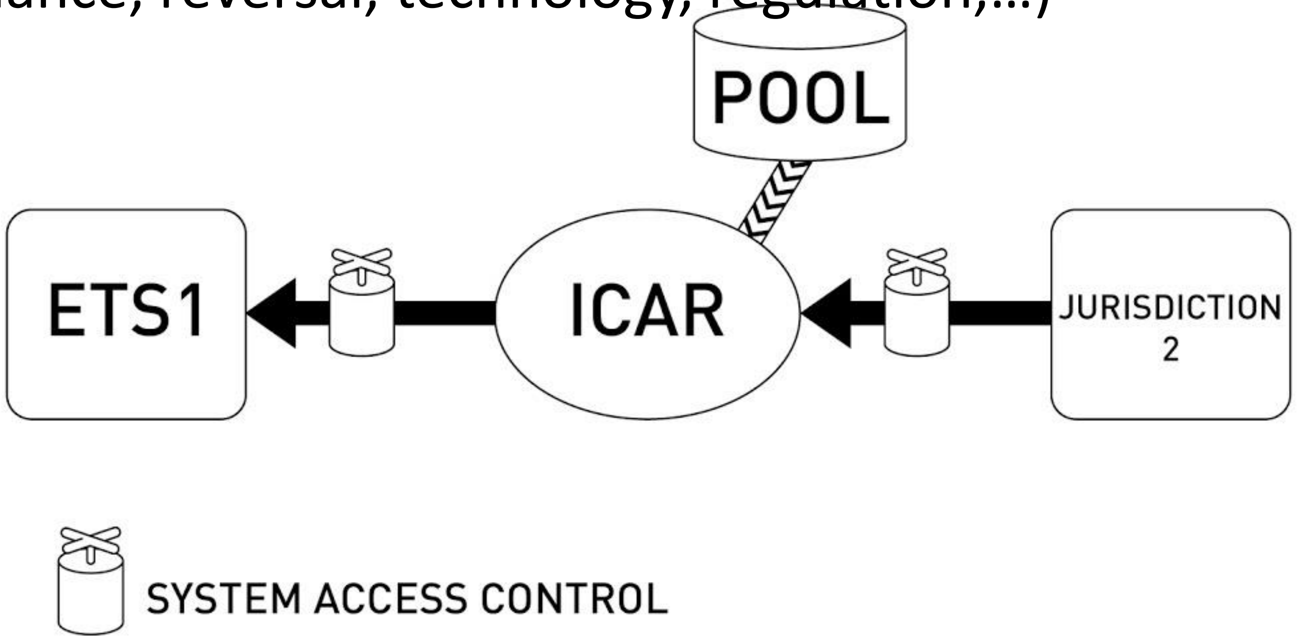
- upward pressure on prices
- domestic buffer is depleted

$\xrightarrow{\text{trigger}}$

ICAR Central Hub
replenishes local S. Korean buffer

ICAR «Gateway and insurance»

- «Facilitator» for one-way transfer of International Units (IU)
- Pool of units/fund for risk mitigation
- Insurance services for key mitigation action risks (issuance, reversal, technology, regulation,…)



Example ICAR Gateway
EU ETS – FiT wind and solar in Tunisia

Assumptions:

- EU ETS agrees with Tunisia on ICAR Gateway for transfer of mitigation outcomes from new renewable power plants
- Demand in EU ETS

- Functioning of ICAR Gateway to facilitate transfer:
  - Buy side: Gateway pays guaranteed feed-in-tariff (FiT) for wind and solar power
  - Gateway converts *kWh generated* into *tonnes of non-emitted CO2*
  - Sell side: Gateway sells guaranteed volumes of IU to EU installations
  - Gateway's pool absorbs some of the risks; the rest is distributed among e.g. governments, private sector

The evolution of networking

- We anticipates that a future international carbon market, whether through linking in the traditional sense or networking, would develop gradually (stages).
- The scope of ICAR should be seen along a continuum:

1. facilitate the exchange of different carbon units;
2. Intermediate services.

Germination

This stage is characterised by the emergence of carbon market networks that are easiest to establish.

Trading between jurisdictions is of allowances that are compliance compatible or transfer of non-ETS carbon instruments within similar jurisdictions.

ICAR Gateway provides insurances services both for buyers and sellers.

ICAR Platform and ICAR Gateway could co-exist

Growth

A necessary factor for this stage is the emergence of an universal mitigation value system, that can be used to issue international units.

To mitigate the risks associated with imported non-domestic allowances ICAR Central Hub provides mitigation tools.

All ICAR prototypes could co-exist.

Consolidation

A defining element of this stage is the mass of existing networks and linking agreements.

Foregoing benefits will induce non member jurisdictions to engage in network activities or linking arragments.

All ICAR prototypes could co-exist.

Concluding findings

- Linking is beneficial but (full linking) arrangements can be costly and may lead to some loss of control over domestic priorities
- ICAR can facilitate trade of carbon assets among heterogeneous jurisdictions
- Acting as an intermediary, ICAR can mitigate associated risks and preserve national sovereignty
- Scope of ICAR could evolve with the evolution of carbon markets

THINKING
FOR
TOMORROW

Thank you!

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Linking and ambition

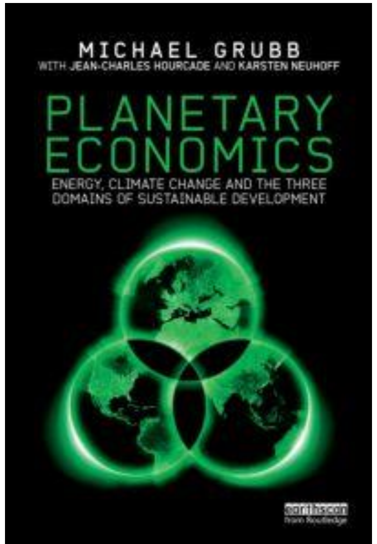
- On Ends, Means and Multilateral Cooperative Arrangements

Michael Grubb

Prof. International Energy and Climate Change Policy, UCL

Editor-in-Chief, *Climate Policy* journal

Board member, *Climate Strategies*



- What has Paris Changed?
- Carbon pricing and ‘cooperative arrangements’
- Some implications for EU ETS

Climate Strategies

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The wider significance of Paris COP21 resides in four fundamental changes

- Twenty-three years after the UNFCCC, we have a specific interpretation of 'avoiding dangerous interference' in formal UN Agreement
  - And it is a highly ambitious one, on mitigation, adaptation and finance
- We are all in this together, but with extensive and nuanced recognitions of differentiation
  - a new global balance with higher relevance of diverse developing country concerns
- An evolutionary solution
  - In time, *and space* – and potentially, in legal form
- A global social endeavour (COP Decision, sections IV and V)
  - not a UN-driven solution relying purely on nation-state implementation
  - a revolution in international governance and indeed the assumptions underpinning it
  - rooted in transparency, multi-level solutions, private sector and social pressures

A fundamental updating of the UNFCCC framework for the 21st Century

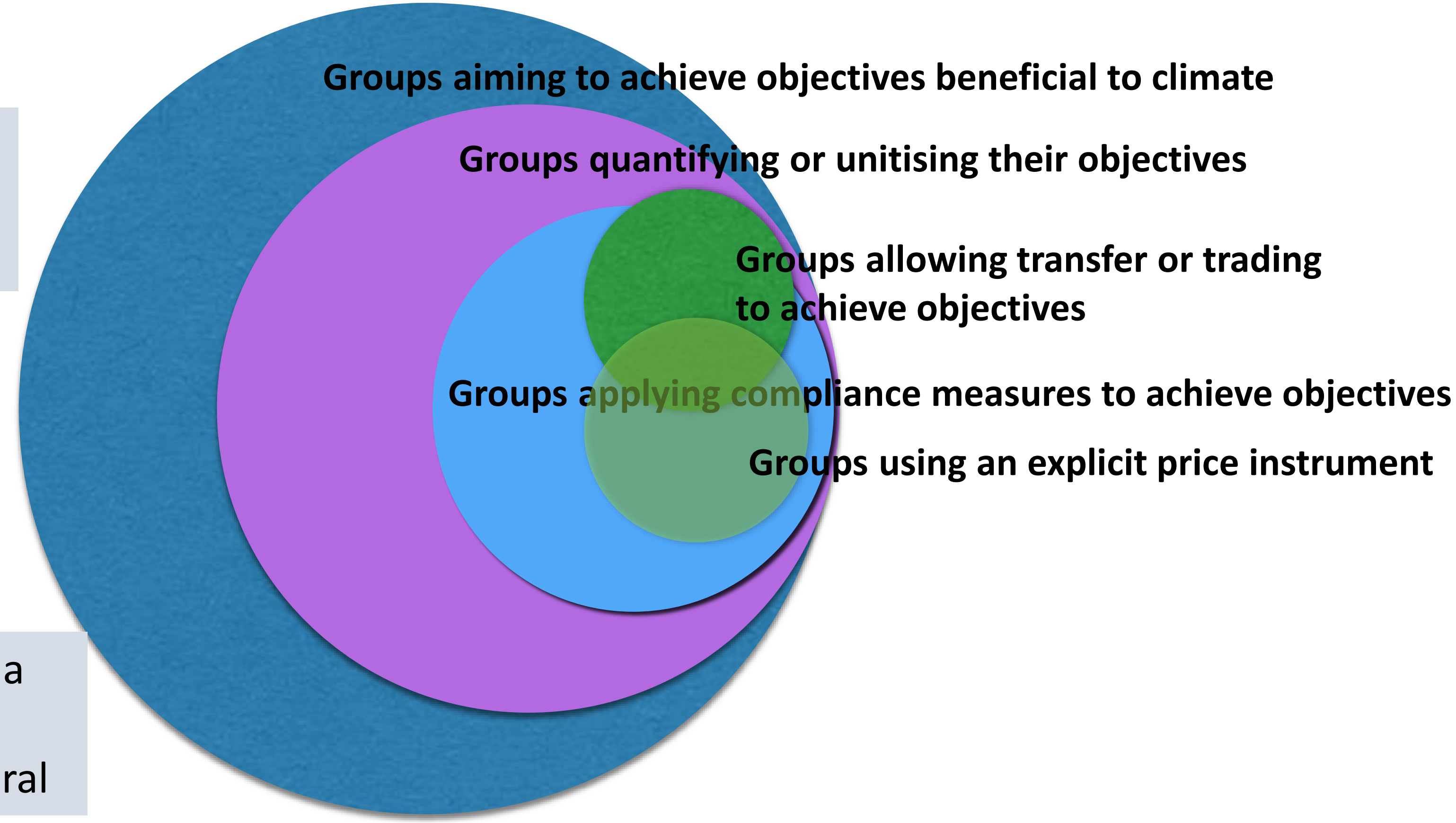
And

The 2018-2020 review in itself could provide pressure – or pretext – for strengthening NDCs, *unlikely to be universal*

Development of carbon pricing will involve co-evolution of systems along with coalition building & rules to support

- like any process of political evolution
- noting that international flexibility and pricing overlap but not synonymous

Goals and review: task for UNFCCC/NDCs



Implementation: a task for national, regional, plurilateral

'Clubs' terminology quite loaded: the core is *multilateral cooperative arrangements*

Roadmap for carbon pricing

- Deepening
- Broadening
- Converging

‘All politics is local’
Facing the realities of international carbon pricing

- Some 5000? years after inventing money, we still do not have a single global currency ..
- Some 25 years after UNFCCC and Scandinavian implementation of carbon pricing, 20 years after the US Administration advocated for global carbon markets, 10 years after the EC set explicit objective to achieve that by 2020 …
  - … c 10% of global carbon emissions covered by *any* carbon price
  - … almost all the systems differ in design, coverage, price, etc.
- Fully harmonized carbon pricing is precluded for *economic (development stage), political (sovereignty), and institutional (coordination of cycles)* reasons

The purpose of carbon pricing MCAs
(Multilateral Cooperative Arrangements) must be to
help national decision-makers, not to replace them!

(International) Roadmap for carbon pricing

International or inter-sectoral linkages

- Deepening
- Broadening
- Converging

Offsets

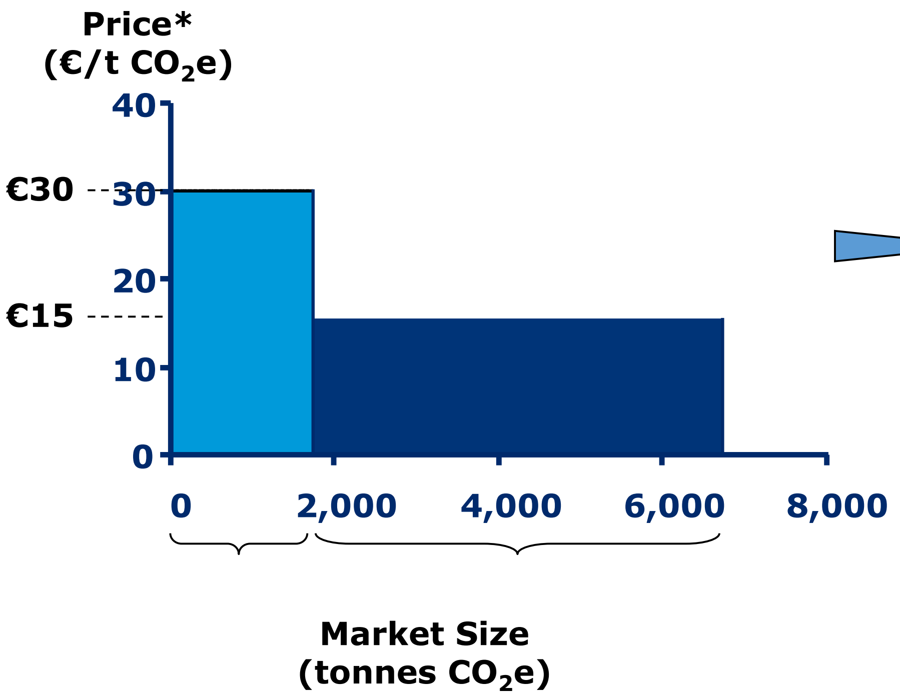
Exchange rates

Linking is potentially disruptive for both jurisdictions and entails a loss of national control

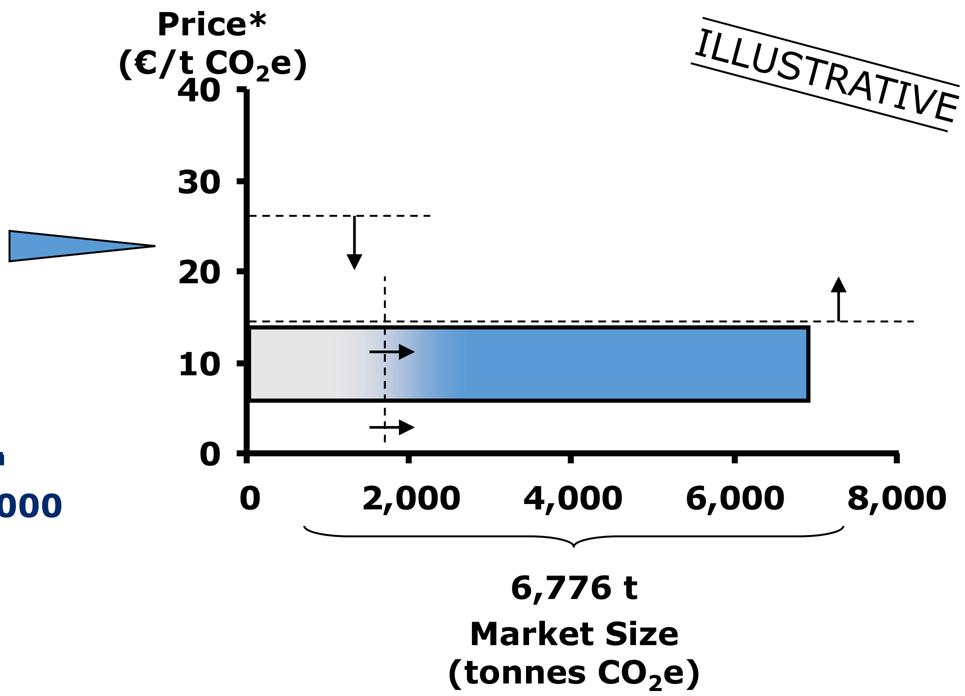
- The political issue is not efficiency, but acceptability
- Unitary linking is potential culmination of convergence, not the driver

Exchange rates are therefore crucial for managing the process

Before Bilateral Linking



After Bilateral Linking



Note: * The prices reflected are illustrative only

Source: Climate Strategies, as developed in Carbon Trust (2009)

A remark on EU ETS (Part 1)

- Carbon pricing debate in Europe become dominated by *means* (EU ETS) not *ends* (eg. role of carbon pricing in decarbonising electricity, in transformative strategies for energy intensive industries, etc – ie. meeting Paris goals)
- Ideology of the EU ETS became rooted in rapid convergence (OECD-wide full unitary linked by 2015, All Major Economies by 2020) set in global breadth (through Kyoto CDM)
  - Which would then enable deepening
  - ie. *back-to-front*
- The abject failure of this strategy on both counts has led to retreat
  - A weak system, riven by the politics i.a. of 'carbon leakage'
  - A lack of any coherent international vision
- … and a dangerous intellectual inconsistency

A remark on EU ETS (Part 2)

- The Allowance Surplus in the EU ETS is now on a scale directly comparable to the ‘Hot Air’ surplus in Russia under Kyoto CP1
  - And projections under current proposals are that this surplus could continue or even expand through the 2020s
- Linking the EU ETS to *anything* under these circumstances would be either
  - irrelevant (if others refused to buy surplus, as most refused to do under Kyoto CP1) or
  - fundamentally destructive (if they did buy – except perhaps at extremely low exchange rate to reflect the minimal mitigation value)
- Yet there remains vacuum of policy for facilitating industrial transformation in a world of unequal carbon prices (eg. through ETS Article 10b), on the grounds that …. ?

Conclusions

International or inter-sectoral linkages

- Deepening
- Broadening
- Converging

A national endeavour, with reference to ..

Offsets (domestic, and international), wider context Paris finance & development

(w.r.t. Paris Arts. 6.1, 6.4?)

Development of MCAs with rules for

Exchange rates, system management, treatment of carbon-intensive goods trade (with ref to Paris Art 6.2?)

Linking and ambition

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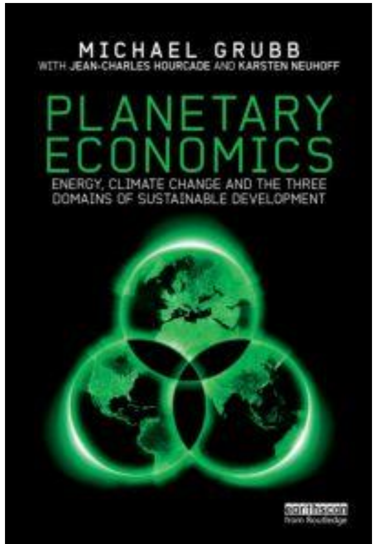

- What has Paris Changed?
- Carbon pricing and ‘cooperative arrangements’
- Some implications for EU ETS

- ANNEX

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Need to map contours of carbon pricing

which will vary between applications and economies, and evolve, eg

(a) Market / equivalent carbon prices

	Current	Expectation
Industrialised	P2 ~ D2	P3 ~ D3 Innovation & Transformation
Emerging economies	P1 ~ D1? Behaviour and learning	P2 ~ D2

(b) Institutional / 'shadow' / anchor carbon prices

	Current	Expectation
Industrialised Country public & MDBs	P2	P3
Emerging econ public & SOEs (state-owned enterprises)	P1	P2

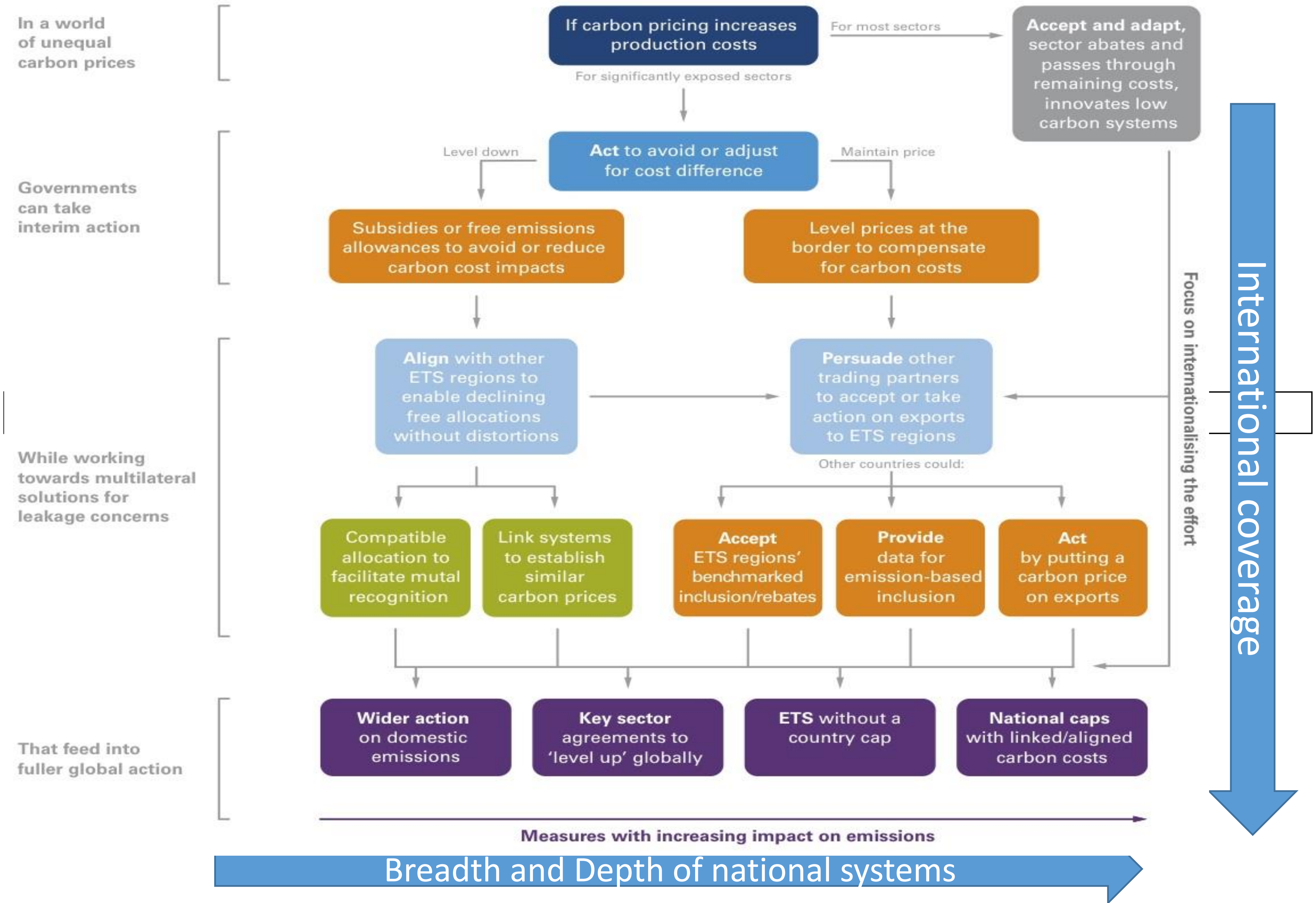
Damage/risk perspectives:

- D1. Global damage as evaluated *by a national decision-maker in emerging economy*
- D2. Global damage as evaluated at *developed economy social discount rate*
- D3. Global damage + risk-aversion or 2 deg.C threshold implied cost or inclusion of learning/pathways benefits

Carbon price equivalents:

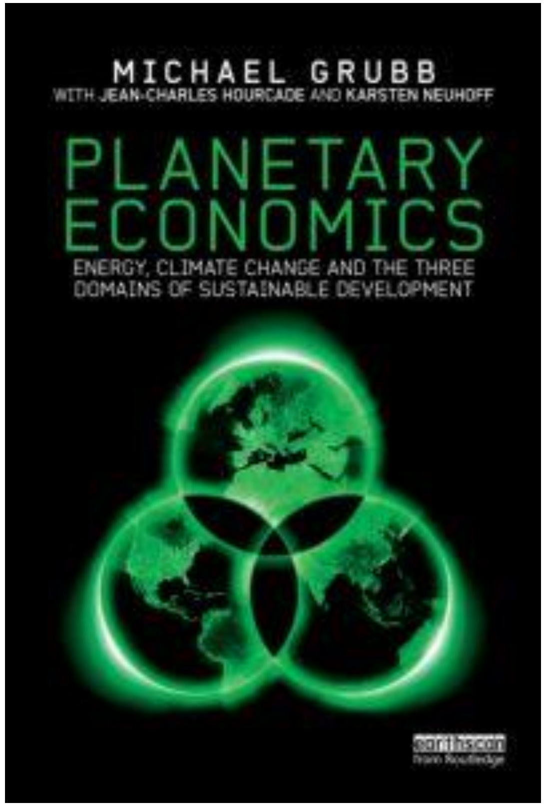
- P1. 'Entry price' to establish legal basis, attention & institutional credibility
- P2. Price to drive *substantial operational substitution and deter higher carbon lock-in*
- P3. Price to support *investment, innovation and strategic decision-making including risk management*

Purpose of carbon pricing clubs – to help jurisdictions navigate a difficult journey



Planetary Economics:

Energy, Climate Change and the Three Domains of Sustainable Development



1. **Introduction: Trapped?**
2. **The Three Domains**

Pillar 1

- **Standards and engagement *for* smarter choice**
- 3: Energy and Emissions – Technologies and Systems
- 4: Why so wasteful?
- 5: Tried and Tested – Four Decades of Energy Efficiency Policy

Pillar II

- **Markets and pricing *for* cleaner products and processes**
- 6: Pricing Pollution – of Truth and Taxes
- 7: Cap-and-trade & offsets: from idea to practice
- 8: Who's hit? Handling the distributional impacts of carbon pricing

Pillar III

- **Investment and incentives for innovation and infrastructure**
- 9: Pushing further, pulling deeper
- 10: Transforming systems
- 11: The dark matter of economic growth

12. **Conclusions: Changing Course**

Kindle: http://www.amazon.co.uk/Planetary-Economics-Sustainable-Development-sustainable-ebook/dp/B00JQFBWDO/ref=tmm_kin_swatch_0?_encoding=UTF8&sr=8-1&qid=1415625933

http://climatestrategies.org/projects/planetary-economics/
for information, Highlights summary and register of related work.

Mitigation Value to Enable International Linkage of Domestic Programs

Networked Carbon Markets Initiative

Partners & Strategy Workshop

Cologne, 28 May 2016

Johannes Heister, World Bank Group

Starting points

- In the Paris Agreement, UNFCCC Parties laid down two important cornerstones:
    1. They capped global temperature increases at 1.5^{o}C. This translates into a global carbon budget of still available GHG emissions.
    2. They directed all Parties to contribute to this goal through nationally determined contributions (NDCs).

- These decisions allow to measure the level of ambition and can server as an anchor for defining “mitigation value” (MV) :
    1. Are the aggregated NDCs consistent with the global budget? (collective objective)
    2. Is each Party’s proposed NDC a “fair” contribution relative to other Parties NDCs. (burden sharing)
    3. Will each Party’s emissions stay within its NDCs? (compliance)

- This presentation explores MVs only at the global level.

Anchors

- MVs may be anchored in the global temperature target.

  International carbon markets may operate under assumption of compliance with the global temperature target.

  → Exported units must be made compatible with the global budget (“budget compliant”).

  Anchoring MV in this way produces a system of *ex ante* “fixed” exchange rates between countries.

Operationalizing MV

Definitions:

i = countries
t = time periods

B = global emissions budget (derived from temperature goal)

(Pit) = NDCs, planned emissions of countries i in periods t
(pit)=(Pit)/B = claimed shares of global emissions budget

(bit)=(Bit)/B = goal compliant shares of emission budget

= "fair" distribution matrix, sum of (bit) = 1

Discount Factors and Exchange Rates

- Discount factor: (dit) = (bit)/(pit) = (Bit/Pit)

  Determines the mitigation value of each emitted unit in relation to the global temperature goal. E.g. a country emitting twice its budget share has a discount factor of 0.5.

- Exchange rate: (dit)/djt)

  Determines the ambition of two countries relative to each other as expressed in their NDCs. The global budget is used to measure ambition. The exchange rate is not budget compliant, it only preserves the recipient country's ambition level.

Example: Discount Factor

Blue-shaded values are assumed, red-shaded values are calculated):

B =	100

		t=1	t=2
(Pit)=	i=1	74	53
	i=2	150	200

		t=1	t=2
(bit)=		0.25	0.25
		0.25	0.25

Discount factors for two countries and two periods

		t=1	t=2
(dit) =	i	0.3333	0.5000
	j	0.1667	0.1250

For every 3 units emitted by country i in period 1, two units are not “goal compliant”. In the first period:

→ Units exported by country i must be discounted down to 1/3.

→ Country i is twice as ambitious as country j.

Example: Exchange Rate

Exchange rates for two countries and two periods:

		t=1	t=2
(dit/djt)	=	2.0000	4.0000
(djt/dit)	=	0.5000	0.2500

→ For each unit imported from country i, country j can issue 2 of its own units.
→ To preserve it level of ambition, country i can only issue 0.5 of its own units for each unit imported from country j.

These trades can be implemented through an international registry, which adjusts incoming and outgoing units by applying the respective discount factors.

Ex ante vs. ex post

Discount factors and exchange rates based on NDCs can be calculated ex ante.

But actual emissions at the end of each period $(Ait)^p$ can exceed planned (NDC) emissions.

	t=1	t=2
(Pit)=	74	53
	150	200

	t=1	t=1
$(Ait)^p$ =	80	90
	160	160

The calculation of discount factors and exchange rates would need to be done ex post.

	t=1	t=2
$(dit)^a$ =	0.3333	0.5000
	0.1667	0.1250

		t=1	t=1
$(dit)^p$=(B*bit)/$(Ait)^p$		0.3125	0.2778
		0.1563	0.1563

	t=1	t=2
$(dit/djt)^a$	2.0000	4.0000
$(djt/dit)^a$	0.5000	0.2500

	t=1	t=1
$(dit/djt)^p$	2.000	1.778
$(djt/dit)^p$	0.500	0.563

Criteria to determine fair shares

- General consensus on criteria to determine fair share:
  - **Emissions responsibility** (e.g. historical, current, or projected future emissions per capita or total emissions)
  - **Economic capacity and development indicators** (e.g. GDP per capita, indicators related to health, energy access, etc.)
  - **Relative costs of action and mitigation potential**
  - **Vulnerability and capacity to adapt** to physical and social impacts of climate change
  - **Benefits of action**
- Criteria weights determines fair share:
  - E.g. Civil Society Review: 50/50 weights for

    (1) historical responsibility (cumulative emissions) and

    (2) capacity to take on the climate challenge.

Constructing the distribution matrix (bit)

The distribution matrix (bit) above was assumed for 2 countries. Using a set of fairness criteria, a distribution matrix can be constructed. Example for period t=1:

Criteria	Formula (t=1)	Weights
Grand fathering: actual emissions A	(Ai)/A	0.4
Per capita sharing: population N	[(B/N)*Ni]/B = (Ni)/N	0.4
Responsibility: historic emissions H	(H-Hi)/H = 1 - (Hi)/H (normalized)	0.1
Ability to pay: (GDP/capita) G	(G-Gi)/G = 1 - Gi/G (normalized)	0.1
Mitigation cost (per unit, first 50%): M	Mi50/M50	0.0

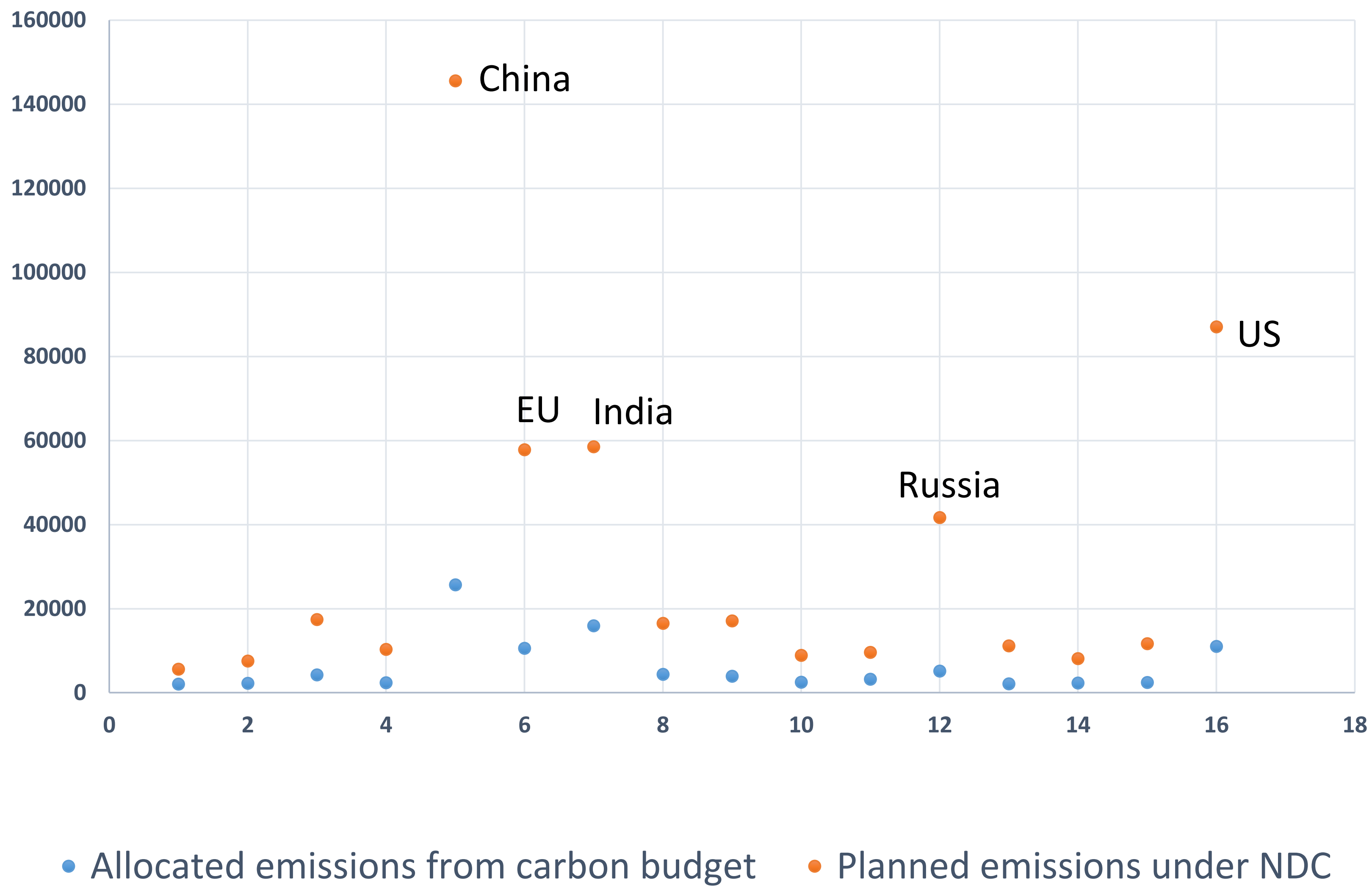
Calculating elements of (bit)

Country	Annual CO2 (ex LUCF)	Ai1/A1	Historic CO2 (ex LUCF)	1-Hi1/H1	Population	Ni1/N1	GDP per capita at PPP	1-Gi1/G1
Year	2012		1860-2012		2014		2014	
Unit	MtCO2		MtCO2	normalized	people		2014 US$bn	normalized
Argentina	338	0.0098	6844	0.0663	42980026	0.0092	21568	0.0635
Australia	648	0.0187	14880	0.0658	23470118	0.0050	46868	0.0597
Brazil	1013	0.0293	11775	0.0660	206077898	0.0443	14912	0.0644
Canada	714	0.0206	28317	0.0651	35543658	0.0076	44424	0.0601
China	10975	0.3173	150109	0.0581	1364270000	0.2930	12924	0.0647
European Union	4399	0.1272	329072	0.0479	507962837	0.1091	36440	0.0612
India	3014	0.0871	37976	0.0645	1295291543	0.2782	5618	0.0658
Indonesia	761	0.0220	9554	0.0661	254454778	0.0546	10037	0.0652
Japan	1345	0.0389	51005	0.0638	127131800	0.0273	37662	0.0611
Korea, Rep. (Sou	693	0.0200	13226	0.0659	50423955	0.0108	35499	0.0614
Mexico	724	0.0209	14983	0.0658	125385833	0.0269	17091	0.0641
Russian Federat	2322	0.0671	102709	0.0608	143819569	0.0309	24746	0.0630
Saudi Arabia	527	0.0152	8698	0.0662	30886545	0.0066	53486	0.0587
South Africa	463	0.0134	14865	0.0658	54001953	0.0116	12648	0.0648
Turkey	420	0.0121	7289	0.0663	75932348	0.0163	19912	0.0637
United States	6235	0.1803	366421	0.0457	318857056	0.0685	54620	0.0585
Sum	34590	1	1167723	1	4656489917	1	448456	1
Weight		0.4		0.1		0.4		0.1

From budget shares to discount factors

Carbon budget B= 100000						
Country	Distribution	Allocated emissions from carbon budget	Planned emissions under NDC	Ex ante discount factors	Observed emissions in the future	Ex post discount factors
	bit	bit*B	Pit	dit	Ait	dit (ex post)
Argentina	0.0206	2057	5550	0.3707	6000	0.3429
Australia	0.0221	2206	7500	0.2942	7600	0.2903
Brazil	0.0425	4246	17400	0.2440	17500	0.2426
Canada	0.0238	2382	10275	0.2318	11000	0.2166
China	0.2564	25640	145500	0.1762	150000	0.1709
European Union (28	0.1054	10542	57750	0.1825	58000	0.1818
India	0.1592	15915	58500	0.2721	59000	0.2697
Indonesia	0.0438	4379	16500	0.2654	17000	0.2576
Japan	0.0390	3895	17063	0.2283	17500	0.2226
Korea, Rep. (South)	0.0251	2508	8850	0.2834	9000	0.2787
Mexico	0.0321	3214	9563	0.3361	10000	0.3214
Russian Federation	0.0516	5159	41625	0.1239	42000	0.1228
Saudi Arabia	0.0212	2124	11100	0.1913	12000	0.1770
South Africa	0.0230	2305	8100	0.2846	9000	0.2561
Turkey	0.0244	2437	11625	0.2096	12000	0.2031
United States	0.1099	10992	87000	0.1263	110000	0.0999
Sum	1	100000	513900		547600	

Allocated and Planned Emissions



Exchange rates (ex ante)

	Trading partner i.e. imports are from country															
Importing Cou	Argentir	Australi:	Brazil	Canada	China	EU (28)	India	Indonesia	Japan	Korea, Re	Mexico	Russian F	Saudi Ar	South Af	Turkey	US
Argentina	1.0000	0.7118	0.4137	0.5303	0.1399	0.1761	0.2919	0.4571	0.3776	0.6385	0.6686	0.1660	0.4802	0.7066	0.5046	0.1044
Australia	1.4049	1.0000	0.5812	0.7450	0.1965	0.2474	0.4100	0.6422	0.5304	0.8971	0.9393	0.2332	0.6747	0.9926	0.7088	0.1467
Brazil	2.4173	1.7206	1.0000	1.2819	0.3382	0.4257	0.7055	1.1049	0.9127	1.5435	1.6162	0.4012	1.1608	1.7080	1.2197	0.2525
Canada	1.8858	1.3423	0.7801	1.0000	0.2638	0.3321	0.5504	0.8620	0.7120	1.2041	1.2608	0.3130	0.9056	1.3324	0.9515	0.1970
China	7.1484	5.0883	2.9572	3.7907	1.0000	1.2588	2.0864	3.2675	2.6989	4.5645	4.7795	1.1866	3.4328	5.0508	3.6068	0.7466
European Unic	5.6786	4.0420	2.3492	3.0113	0.7944	1.0000	1.6574	2.5957	2.1440	3.6259	3.7967	0.9426	2.7270	4.0122	2.8652	0.5931
India	3.4262	2.4388	1.4174	1.8169	0.4793	0.6034	1.0000	1.5661	1.2936	2.1877	2.2908	0.5687	1.6453	2.4208	1.7287	0.3579
Indonesia	2.1877	1.5572	0.9050	1.1601	0.3060	0.3853	0.6385	1.0000	0.8260	1.3969	1.4627	0.3631	1.0506	1.5457	1.1038	0.2285
Japan	2.6486	1.8853	1.0957	1.4045	0.3705	0.4664	0.7730	1.2107	1.0000	1.6912	1.7709	0.4396	1.2719	1.8714	1.3364	0.2766
Korea, Rep. (Sc	1.5661	1.1147	0.6479	0.8305	0.2191	0.2758	0.4571	0.7159	0.5913	1.0000	1.0471	0.2600	0.7521	1.1065	0.7902	0.1636
Mexico	1.4957	1.0646	0.6187	0.7931	0.2092	0.2634	0.4365	0.6837	0.5647	0.9550	1.0000	0.2483	0.7182	1.0568	0.7546	0.1562
Russian Federa	6.0246	4.2883	2.4923	3.1947	0.8428	1.0609	1.7584	2.7538	2.2746	3.8468	4.0280	1.0000	2.8931	4.2567	3.0397	0.6292
Saudi Arabia	2.0824	1.4822	0.8615	1.1043	0.2913	0.3667	0.6078	0.9519	0.7862	1.3297	1.3923	0.3456	1.0000	1.4713	1.0507	0.2175
South Africa	1.4153	1.0074	0.5855	0.7505	0.1980	0.2492	0.4131	0.6469	0.5344	0.9037	0.9463	0.2349	0.6797	1.0000	0.7141	0.1478
Turkey	1.9819	1.4107	0.8199	1.0510	0.2773	0.3490	0.5785	0.9059	0.7483	1.2655	1.3251	0.3290	0.9518	1.4003	1.0000	0.2070
United States	9.5744	6.8151	3.9608	5.0772	1.3394	1.6861	2.7945	4.3764	3.6149	6.1135	6.4015	1.5892	4.5978	6.7649	4.8309	1.0000

Operating the system

- The calculation system and ex ante discount factors are made known.
- Ex post discount factors are calculated and applied when units are accepted for compliance.
- Market participants will anticipate in their trading decisions later corrections to discount factors.
- With better information and projections, ex ante and ex post discount factors (and exchange rates) will converge.

Conclusions

- A relatively simple system to determine mitigation values seems possible.
- Normative issues (fairness of distribution matrix) and data challenges (MRV system) must be resolved.
- A matrix of discount factors can be calculated. It describes mitigation values of the units by country and time period.
- Applying the discount matrix to traded volumes makes internationally traded emission quantities consistent with the global target.
- A matrix of bilateral exchange rates can be calculated. It describes *relative* ambition for pairs of countries.
- These exchange rates can be used to raise or lower imported units to the ambition level of the importing country.
- If discount factors and mitigation values are calculated ex post for compliance, market participants will factor this information into their operations.