Lomonosov Moscow State University
Business School

Global Limits of Economic Growth

Lomonosov Moscow State University,
Inter-Departmental Course, 2023-2024, Spring Fall

Course Reader:

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Requirements to Pass the Course

1) At least 50% of sessions are attended (6 sessions)

2) At least 60% points for the final course test

3) Individual Project (Presentation) is done properly and delivered in time

General Scheme for Resource Limitations Analysis

Scheme for the Individual Project (1-2 students per 1 project)

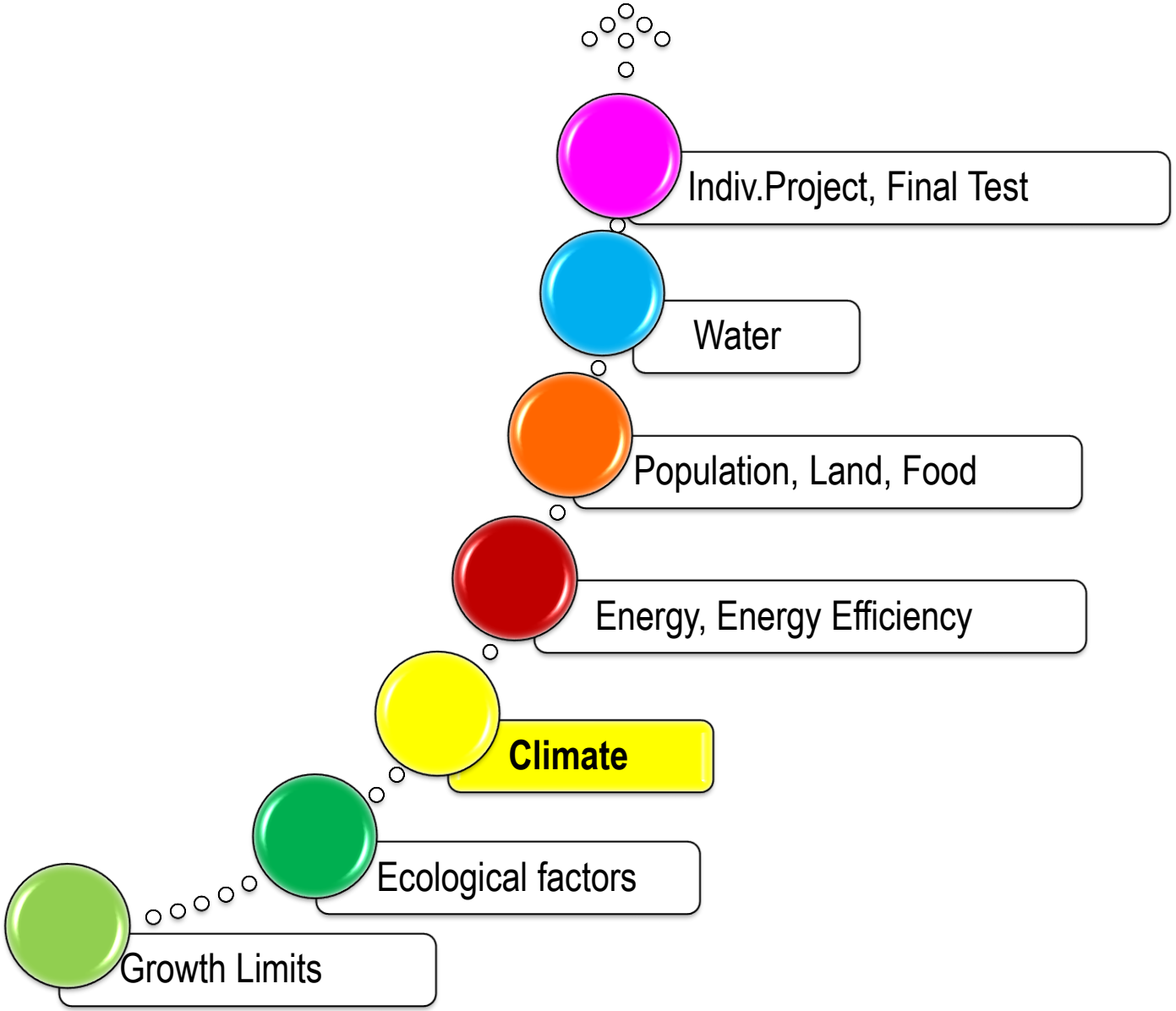
Resources	Steps of Analysis					
	Step 1	Step 2			Step 3	Step 4
	Role/ Importance	Limitations produced for			Ways used to overcome existing limitations	Suggestions how to improve these ways of coping with limitations
		World economy	National economy	Industries/ Business		
Unique Resource or Problem selected by you ***Scale: world or a country or an industry***	…	…	…	…	…	…

Learning Schedule

- Our classes will take place on Wednesdays at 15:00 for 3 months (12 weeks)
- Communication with the course reader:
  - During classes
  - Via e-mail
  - All administrative issues should be addressed via your Personal Account in the MSU Learning Management System

- Before each session you will receive Pre-Reading and Food-for-Thought Assignment through your Personal Account

Course Route



Pre-Reading and Food-for-Thought Assignment

Pre-Reading and Food-for-Thought Assignment before Session 4 (Febr., 28)

CLIMATE CHANGE THEORY

1. Familiarize yourself with the **IPCC Special Report: Global Warming of 1.5C**:
   https://www.ipcc.ch/sr15/chapter/spm/
   Think about:
   What this document is about?

INTERNATIONAL CLIMATE DOCUMENTS

1. **Paris Agreement**: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

2. Explore **UN Sustainable Development Goals** related to climate (SDG13 and SGD7):
   https://sdgs.un.org/goals

   Think about:
   How do the SDGs correlate between one another?
   How do ideas of Paris Agreement correlate with SGDs on climate?

CLIMATE CHANGE_HOW INDUSTRIES ARE ADAPTNG TO IT

Find information on **Climate strategies for companies/industries** of your interest.

Think about:
What do companies need climate strategies?
What companies are more climate sensitive?

Session 4
Global Climate Changes

28.02.2024

Aims of Session 4. *Global Climate Changes*

1. To understand and interpret correctly climate change manifestations, **and following mitigation and adaptation measures**
2. To understand **world climate policy and potential of carbon taxing**
3. To calculate gaining from **CO2 trade**
4. To develop a draft of a **climate strategy** of different industries
   - **Climate Impact on** Industry
   - Industry **Adaptation & Mitigation M**easures

Plan of Session 4

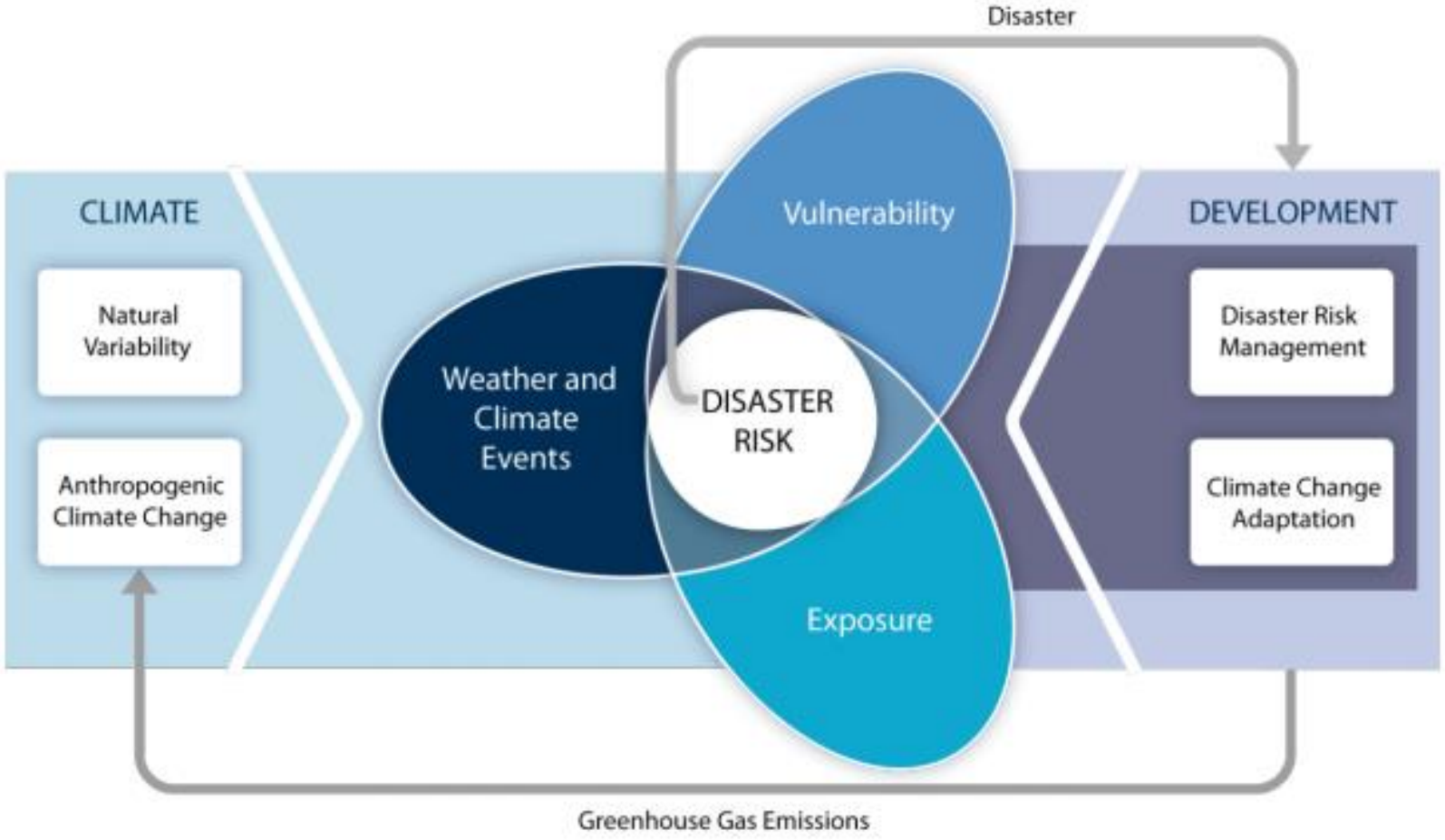
1. Climate Change Manifestations and Adaptation + Mitigation Policy as a Response
2. International Agreements on Climate Change
3. Russian Climate Doctrine
4. Carbon Markets, Kyoto Flexibility Mechanisms
5. Climate Change Impacts on Business, Companies Adaptation to Climate Change
   - Team-work on Climate Strategies for Different Companies

The IPCC Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

ipcc
INTERGOVERNMENTAL PANEL ON climate change

http://www.srex.org/, http://www.ipcc.ch/report/srex/

Increasing vulnerability, exposure, or severity and frequency of climate events increases disaster risk



*Disaster risk management and climate change adaptation can influence the degree to which **extreme events translate into impacts** and **disasters***

Managing the risks: heat waves in Europe

National & international efforts

Risk Factors

- lack of access to cooling
- age
- pre-existing health problems
- poverty and isolation
- infrastructure

France, August 2003 (over 14,000 dead)

Risk Management/ Adaptation

- cooling in public facilities
- warning systems
- social care networks
- urban green space
- changes in urban infrastructure

Projected: *likely* increase in heat wave frequency and *very likely* increase in warm days and nights across Europe

Managing the risks: hurricanes in the USA and Caribbean

National & international efforts

Risk Factors

- population growth
- increasing property value
- higher storm surge with sea level rise

Risk Management/ Adaptation

- better forecasting
- warning systems
- stricter building codes
- regional risk pooling

Projected globally: *likely* increase in average maximum wind speed and associated heavy rainfall (although not in all regions)

WEF: The Global Risks Report

The 2017 examines the five greatest priorities facing the world in 2017, their interconnections and the actions necessary to avoid their harshest fall-out.

Economic Risks

Geopolitical Risks

Technological Risks

Environmental Risks

Societal Risks

WEF: The Global Risks Report

Environmental Risks	
Extreme weather events (e.g. floods, storms, etc.)	Major property, infrastructure and/or environmental damage as well as loss of human life caused by extreme weather events
Failure of climate-change mitigation and adaptation	The failure of governments and businesses to enforce or enact effective measures to mitigate climate change, protect populations and help businesses impacted by climate change to adapt
Major biodiversity loss and ecosystem collapse (terrestrial or marine)	Irreversible consequences for the environment, resulting in severely depleted resources for humankind as well as industries
Major natural disasters (e.g. earthquake, tsunami, volcanic eruption, geomagnetic storms)	Major property, infrastructure and/or environmental damage as well as loss of human life caused by geophysical disasters such as earthquakes, volcanic activity, landslides, tsunamis, or geomagnetic storms
Man-made environmental damage and disasters (e.g. oil spills, radioactive contamination, etc.)	Failure to prevent major man-made damage and disasters, including environmental crime, causing harm to human lives and health, infrastructure, property, economic activity and the environment

Global Risks Report 2024

Top 10 risks

WORLD ECONOMIC FORUM

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period."

Source: World Economic Forum Global Risks Perception Survey 2023-2024.

Climate Change as one of Structural Forces

This year, the Global Risks Report introduces the concept of structural forces to our analysis of global risks over the next decade. We define these as the long-term shift in the arrangement of, and relation between, the systemic elements of the global landscape. These forces have the potential to materially impact the speed, spread or scope of global risks, and will be influenced in turn by each other.

Climate change encompasses the range of possible trajectories of global warming and consequences to Earth systems.

Climate change is characterized as a systemic shift in this year's analysis because the threshold of 1.5°C above pre-industrial temperatures, specified in the 2015 Paris Agreement, is anticipated to be crossed by the early to mid-2030s.

However, global warming pathways will still be influenced by the speed at which decarbonization takes place, and deployment of climate solutions. Degradation of environmental systems could also accelerate estimated trajectories, to the extent that they "naturally" contribute to global warming and related effects (such as the reversal of carbon sinks).

2.3 A 3°C world

FIGURE 2.4

Severity score: Critical change to Earth systems

Long-term, potentially irreversible and self-perpetuating changes to critical planetary systems, as a result of breaching a critical threshold or 'tipping point', at a regional or global level, that have abrupt and severe impacts on planet health or human welfare. Includes, but is not limited to: sea level rise from collapsing ice sheets; carbon release from thawing permafrost; and disruption of ocean or atmospheric currents.

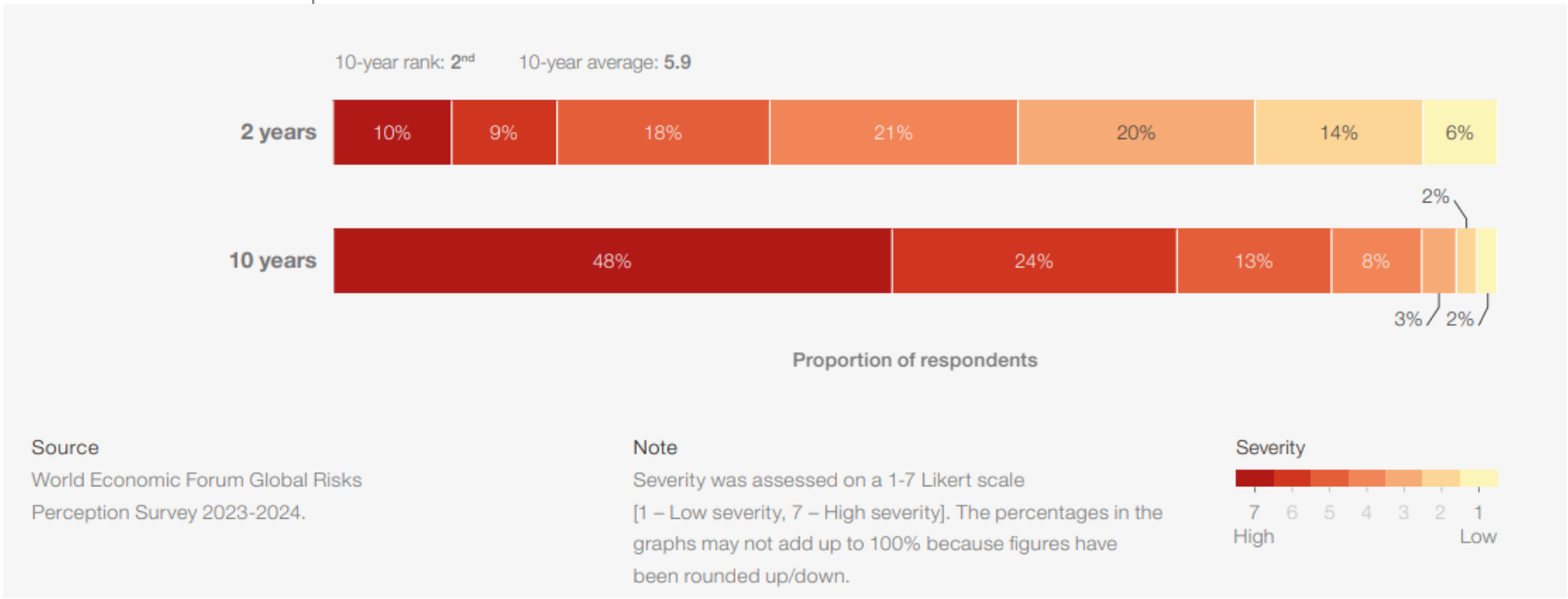


FIGURE 2.3 | **Severity by stakeholder over the long term (10 years)**

Source

World Economic Forum Global Risks Perception Survey 2023-2024.

International Agreements on Climate Change: Milestones

1979	• **1-st World Conference on Climate** – first evidences of the anthropological impact on the climate
1988	• **Intergovernmental Panel on Climate Change (IPCC)** – 1990 – 1-st evaluation Report
1992	• **UN Framework Convention on Climate Change is approved (UNFCCC) on Rio-92** –The aim is to stabilize GHG concentration in the atmosphere on the level that would prevent dangerous anthropogenic impact on climate system –COP – Conference of the Parties, the main agency of UNFCCC, annually –MOP – Meetings of the Parties, the main agency of Kyoto protocol
1994	• **UNFCCC came into force** –Beginning of international talks on the reduction of GHG concentrations in the atmosphere after 2000

International Agreements on Climate Change: Milestones

1997	• **Kyoto Protocol is approved** during 3-d COP –Beginning of elaboration of the Kyoto mechanisms
2001	• **Bonn Accords, Marrakesh Accords** – operational and financial mechanisms are developed • **USA dropped out the Kyoto Protocol**
2004	• **Russia ratified the Kyoto Protocol**
2005	• **Kyoto Protocol came into force** – 55 countries of UNFCCC with min of 55% of the world GHG emissions ratified the protocol
2009	• **Copenhagen Agreement**, COP-15/MOP-5
2012	• **The Kyoto protocol was amended to accommodate the second commitment period till Dec.,2020**
2015	• **Paris Agreement**, COP-21
2021+…	• **Glasgow, COP-26, ….**

Kyoto Protocol Initially

- Annex 1
  - Countries that have taken special commitments about reducing GHG concentration according to UNFCCC
  - Includes developed countries and some countries with the transition economies
- Annex 2
  - Countries that have taken special financial commitments about reducing GHG concentration according to UNFCCC
  - Includes only the most developed countries
- Adaptation Fund
  - Financed from CDM, JP, etc.

Countries that signed Kyoto Protocol had to reduce their GHG emissions by at least 5% comparing to the levels of 1990 during the period of 2008-2012.

Kyoto Protocol participation map (Dec. 2011)

Brown = Countries that have signed and ratified the treaty
(Annex I & II countries in dark brown)
Blue = No intention to ratify at this stage.
Dark blue = Canada, which withdrew from the Protocol in December 2011.
Grey = no position taken or position unknown

Kyoto Protocol participation map
(commitment period: 2013-2020)

Parties; Annex I & II countries with binding targets

Parties; Developing countries without binding targets*

States not Party to the Protocol

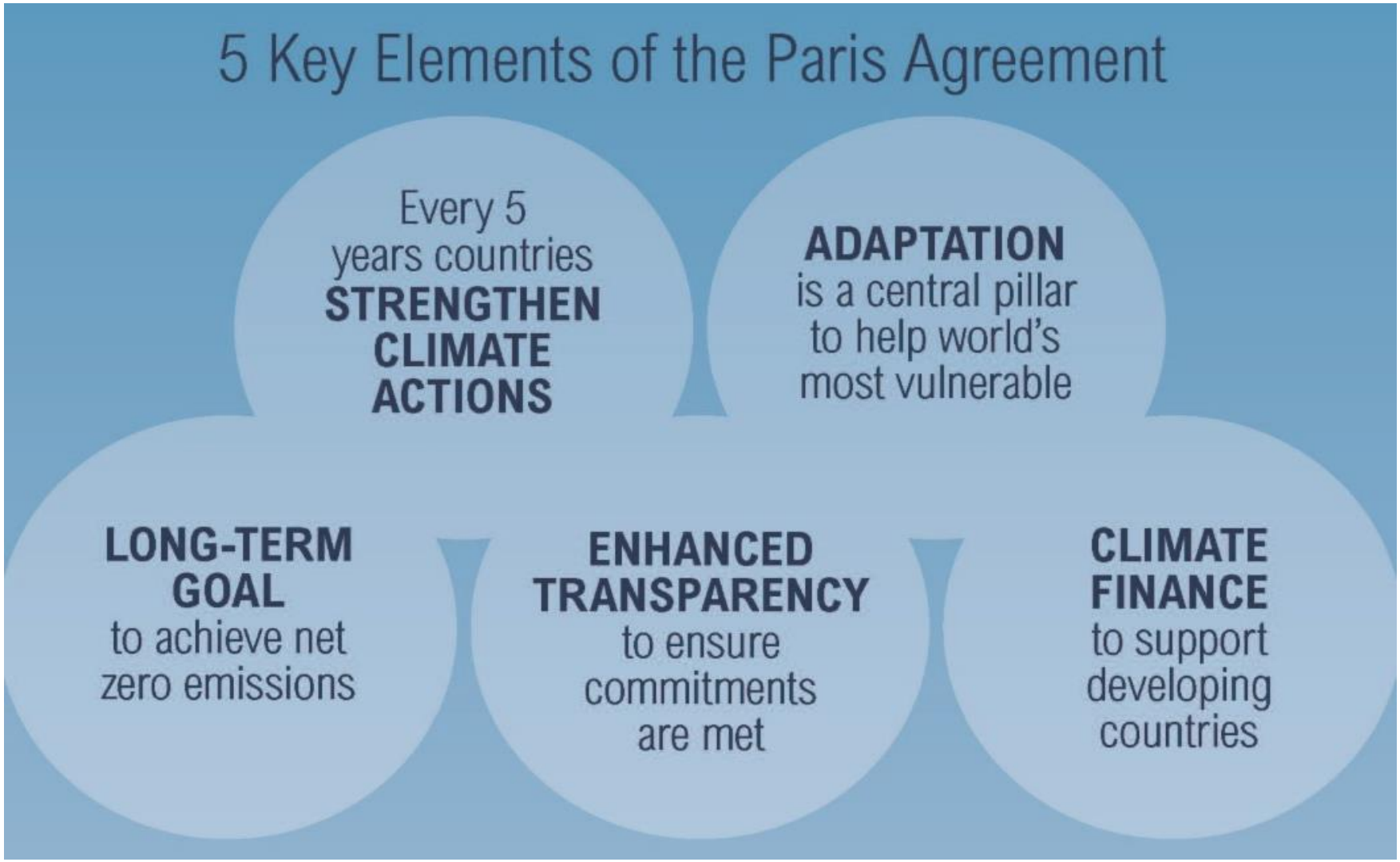
Signatory country with no intention to ratify the treaty, with no binding targets[1]

Countries that have renounced the Protocol, with no binding targets*[2]

Parties with no binding targets in the second period, which previously had targets*[3]

Paris Agreement

COP21 Major Outcomes



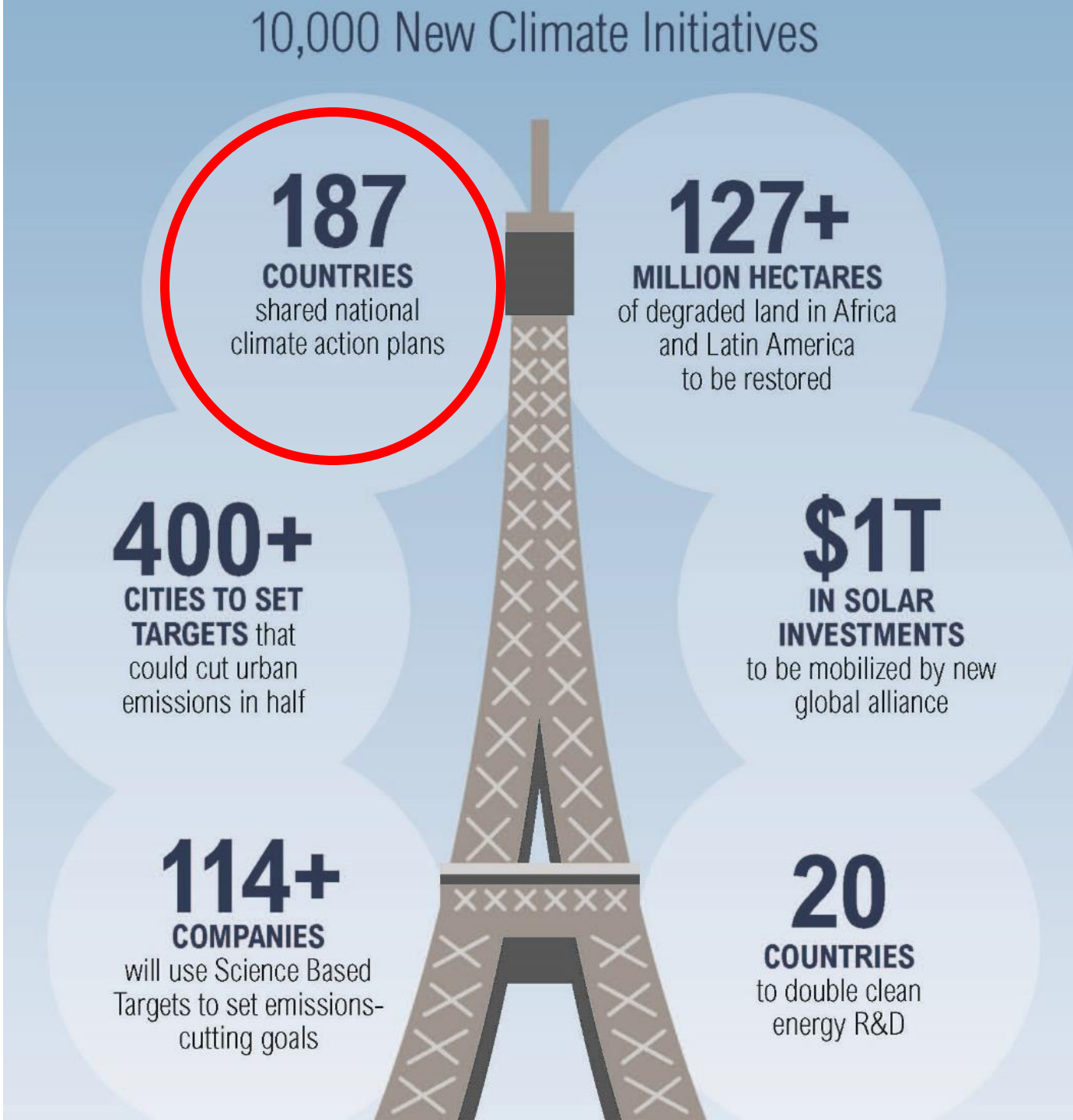
COP21: UN Climate Conference in Paris 2015
(29.11-11.12.2015)

- The agreement is supposed to keep the temperature rise within the 2°C compared to pre-industrial levels and try to stabilize it within 1.5°C.

What kind of approach is being used here?

- Most countries in the world agreed on common goals to reduce emissions.
- The developed countries commit themselves to support developing assistance in the amount of up to $ 100 million annually.
- Commitments of countries - participants of the agreement will be updated every five years since 2022.
- An important factor was the change in China and the US position, the world leaders in terms of emissions.

COP21 Major Outcomes of Paris Agreement in 2015



UN Sustainable Development Goals related to climate

- SDG7 and SDG13

https://sdgs.un.org/goals

Russian Policy on Climate Change

Effects of Climate Change on Russia

Negative effects:

Positive effects:

Goal of the Climate Doctrine of Russia:

To ensure the secure and sustained institutional, economic, ecological and social development of Russia between climate change and the related threats and challenges

Source: Ria Novosti

Президентом утверждена новая Климатическая доктрина РФ

Указ Президента РФ от 26.10.2023 N 812 "Об утверждении Климатической доктрины Российской Федерации"

Доктрина представляет собой систему взглядов на цели, основные принципы, задачи и механизмы реализации единой государственной политики РФ по вопросам, связанным с изменением климата и его последствиями, и является основой для выработки и реализации климатической политики.

Стратегическая цель климатической политики - обеспечение безопасного и устойчивого развития России, включая институциональный, экономический, экологический и социальный, в том числе демографический, факторы, в условиях изменения климата и возникновения сопутствующих ему угроз.

Ключевая долгосрочная цель климатической политики - достижение с учетом национальных интересов и приоритетов социально-экономического развития не позднее 2060 года баланса между антропогенными выбросами парниковых газов и их поглощением.

Признано утратившим силу распоряжение Президента от 17 декабря 2009 г. N 861-рп "О Климатической доктрине Российской Федерации".

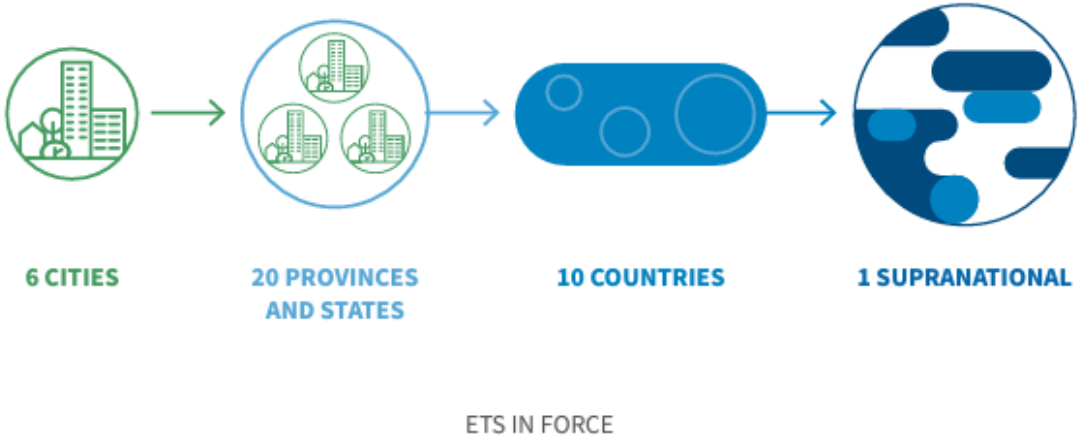
Mechanisms of Carbon Markets

EMISSIONS TRADING AROUND THE WORLD

An emissions trading system (ETS) is a market-based instrument that can be used to reduce greenhouse gas (GHG) emissions. The government determines a limit (cap) on total emissions in one or more sectors of the economy and issues allowances according to this limit. Companies in these sectors need to hold one allowance for every tonne of emissions they release. They may receive these allowances for free from the government or buy them in auctions organized by the government. Emissions trading is spreading around the world as a key instrument to cost effectively decarbonize economies.

Emissions trading is spreading around the world

The first major ETS for GHGs – the European Emissions Trading System (EU ETS) – was established in 2005. To date, there are 29 ETSs in force at the supranational, national, and subnational levels, with 20 more under development or consideration. Jurisdictions making up 55% of global GDP are using emissions trading. Emissions trading has emerged as a key instrument to cost effectively decarbonize economies.



Types of Carbon Markets

1. International
   - Market in terms of Kyoto protocol
   - EU Emissions Trading Scheme (is still the biggest carbon market today)
2. National
   - Norway, UK, Australia, Japan
3. Regional
   - Regional Greenhouse Gas Initiative (internal USA market)
4. Corporative
   - Chicago Climate Exchange in the USA, BP, Shell
5. Voluntary Markets
   - Voluntary purchase of quotas by individual companies

REASONS FOR EMISSIONS TRADING

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1. ETS sets a clear price on carbon

By creating a market for GHG emissions allowances, an ETS puts a clear price on carbon. This means that the costs to society caused by GHG emissions – such as negative effects on public health, damages linked to extreme weather events, or the impacts of climate change on natural ecosystems – are made visible and integrated into the price that people pay for their goods and services.

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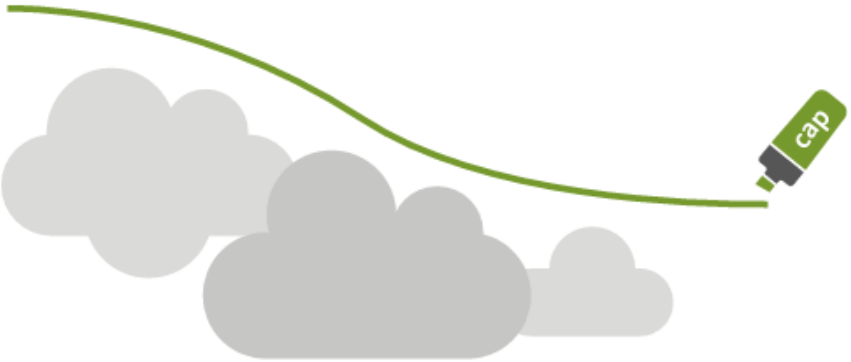
REASONS FOR EMISSIONS TRADING



2. ETS puts a firm limit on emissions

In an ETS, the government sets a clear emissions target, capping the maximum amount of emissions[1] that are allowed in selected sectors of the economy. This ensures that the desired environmental outcome will be reached. With a steadily declining cap, an ETS also delivers a predictable reduction pathway, which provides a long-term signal for businesses and investors.

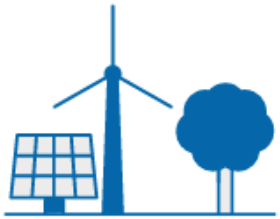
3. Covered entities can choose how, when, and where to reduce emissions

An ETS offers covered entities an inherent level of flexibility regarding their compliance strategies. Depending on their technical, financial, and operational needs, covered entities can choose how they wish to comply. Options typically include: reducing emissions in-house; buying extra allowances from other participants or through auctions; making use of banked allowances; or using offset credits from certain projects.

REDUCE EMISSIONS

BUY EXTRA ALLOWANCES

BANK ALLOWANCES



USE OFFSET CREDITS

1 Intensity-based ETSs impose a limit on the maximum amount of emissions per unit of output.

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REASONS FOR EMISSIONS TRADING

4. ETS fits a variety of economic and political contexts

ETSs can be tailored to suit a wide variety of economic and political contexts. There is no one-size-fits-all approach. Systems are currently operating in a range of jurisdictions covering individual cities, states, provinces, countries, and regions, with the design of each system adapted to the implementing jurisdiction's unique economic and governance profile.

5. ETS can provide an additional source of revenue for the government

ETSs can generate revenues from auctioning allowances. These additional resources are typically collected by the government and can be used in several ways, including supporting climate action beyond the boundaries of the ETS, mitigating the distributional effects of carbon pricing for vulnerable groups, and financing research and development of low-emissions technologies.

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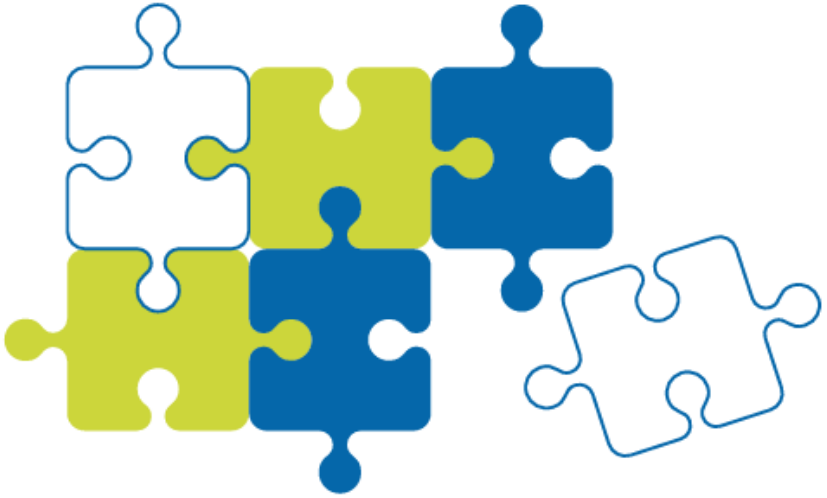
REASONS FOR EMISSIONS TRADING

6. Emissions trading provides a range of additional benefits

While the primary goal of emissions trading is to reduce emissions, a well-designed ETS can deliver substantial environmental, economic, and social co-benefits. These can include cleaner air, improving resource efficiency, ensuring energy security, fostering technology innovation, and creating jobs.



7. ETS can be linked to create a bigger, more efficient carbon market

'Linking' two or more systems creates a larger carbon market, which opens up more (and potentially cheaper) options to reduce emissions. When systems are linked directly, allowances can be used interchangeably for compliance in both systems (see also ICAP ETS Brief #4).

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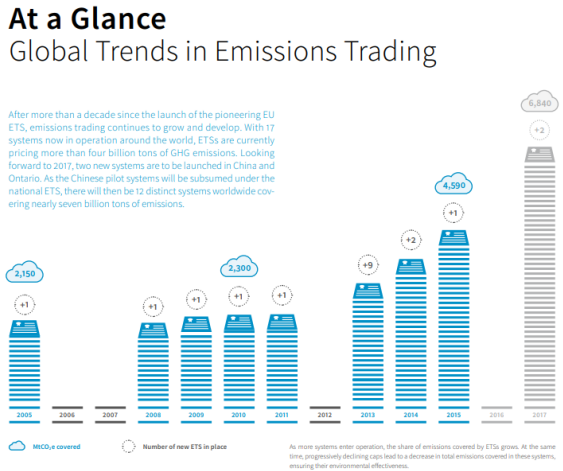
Carbon Border Adjusting Mechanism

- **Carbon trade**
- **Reducing GHG emissions**
  - Producing less
  - Consuming less
- **Doing compensation projects**
  - Forest planting work
  - Using best available technologies
- **Green certificates**
  - International Renewable Energy Certificate (I-REC) is the internationally used standard to certify the renewable origin of electricity

Kyoto Flexibility Mechanisms on Carbon Market

1. Emission Trade

Example. Japan buys quotas from Russia



2. Joint Implementation Projects (JP)

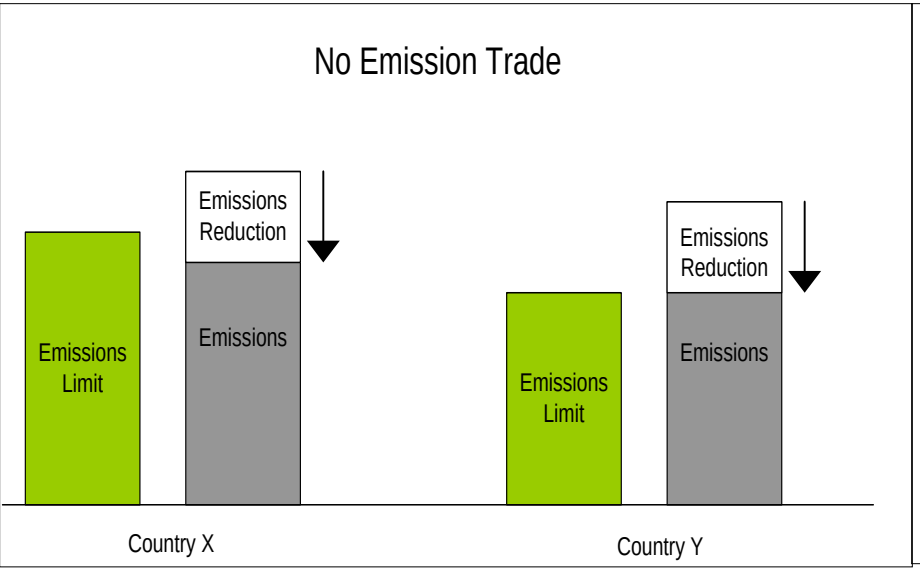
Example. Country A replaces a coal-fired power plant with

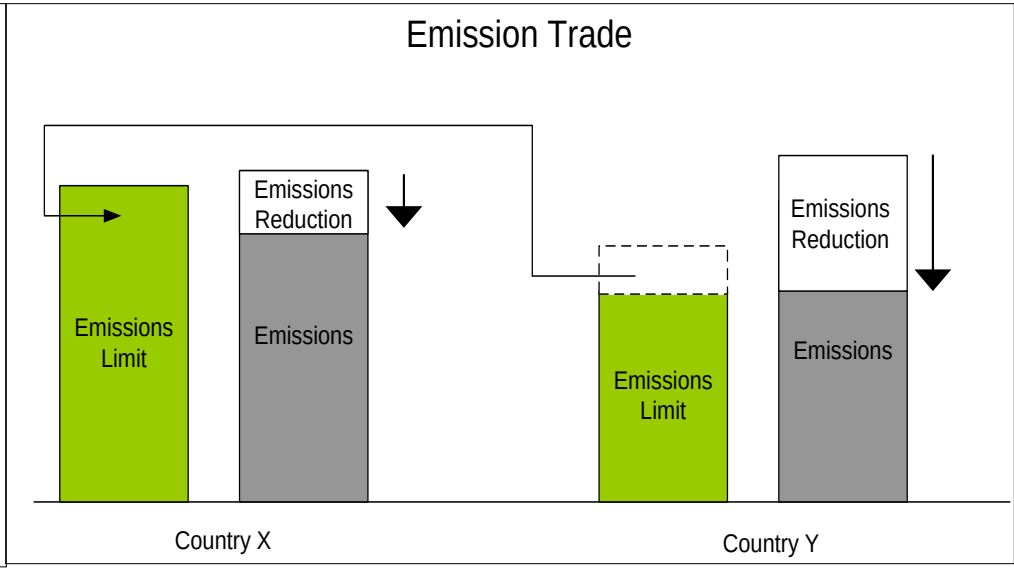
a more efficient combined heat and power plant in a country B

3. Clean Development Mechanisms (CDM)

Example. Japan makes investments in reducing emissions in Russia and receives extra quotas for it

Emission Trade Advantages





Emission Trade Advantages

	No Emission Trade			Emision Trade		
	Country X	Country Y	Total	Country X	Country Y	Total
Initial Emission Limits	10	8	18	10	8	18
Emission Trade	-	-	-	+1	-1	0
Emission Limits after Emission Trade	10	8	18	11	7	18
Emissions	12	10	22	12	10	22
Necessary Reduction	2	2	4	1	3	4
Price per ERU for this especially country	$200	$100	-	$200	$100	-
Total Cost of Reduction	$400	$200	$600	$200	$300	$500
Trade Price*	-	-	-	$150	-$150	0
Total Expenditures of Commitments Acomplishments	$400	$200	$600	$350	$150	$500

* Country Y has sold part of its permitted emission volume to the country X at the price of $150.

Companies Adaptation to Climate Change

Practical Exercise:

How can business survive in a changing climate?

1. How can climate changes influence different industries?
2. What exactly is being influenced?

Climate Change Impacts on Business

	Direct impact (business assets and inputs)	Indirect impact (demand-side effects)
General	▪ Changes in labor conditions ▪ Damage from natural disasters in affected regions	▪ Changes in total productivity of economy ▪ Economic shocks caused by natural disasters
Selec-tive	▪ Assets and inputs of climate dependent industries (agriculture, forestry, tourism, etc.)	▪ Shifts in demand for selected goods and services (electric power, insurance, etc.)

Source: ICSS, Kononova V., Churkina V. (2007), FIRMS' ADAPTATION TO CLIMATE CHANGE: WHAT DOES A HOTTER WORLD MEAN FOR BUSINESS? ПРОЕКТ (icss.ru)

How to Become Climate-Proof Company

	Direct impact (business assets and inputs)	Indirect impact (demand-side effects)
General	▪ Labor conditions adjustments (new labor regime, climate control in production facilities) ▪ Account for probable climatic extremes in infrastructure and facilities planning ▪ Insurance against natural disasters	▪ Additional insurance or re-insurance against economic risks
Selective	▪ Protection and improvement of assets ▪ Reallocation and diversification of assets ▪ Diversification of supplies from climate dependent sources ▪ Climate-induced adjustment in production standards	▪ Adjustment in company product mix ▪ Improvement of energy efficiency and total productivity

Source: ICSS, Kononova V., Churkina V. (2007), FIRMS' ADAPTATION TO CLIMATE CHANGE: WHAT DOES A HOTTER WORLD MEAN FOR BUSINESS? ПРОЕКТ (icss.ru)

Selective Impact: Key Challenges

20 industries (out of 60 on upper level of ISIC) can be considered potentially vulnerable to the industry-specific climate change impact

Most exposed industries to climate change

Direct impact	Indirect impact
▪ agriculture, forestry and logging, fishing,	▪ manufacture of food and beverages,
▪ extraction of crude petroleum and natural gas,	▪ production of wood and paper,
▪ mining,	▪ manufacture of basic metals,
▪ hydropower generation	▪ machinery production
▪ recreational services	▪ insurance services

Sources: Carbon Disclosure Project 2006, company data

Source: ICSS, Kononova V., Churkina V. (2007), FIRMS' ADAPTATION TO CLIMATE CHANGE: WHAT DOES A HOTTER WORLD MEAN FOR BUSINESS? ПРОЕКТ (icss.ru)

New Business Opportunities in Hotter World

Type	Example
Assets Improvement	▪ New economically accessible areas (mining, forestry, some kinds of agriculture) ▪ Productivity growth (agriculture, forestry)
Increase in demand	▪ "Uncovered" demand in regions with limited supply (water in water-stressed territories, metal products in territories with limited energy supplies) ▪ "New" demand (dyke construction, infrastructure adjustment) or shifts in demand peaks (energy, seasonal consumer goods)

Sources: Carbon Disclosure Project 2006, company data