

ECONOMICS OF CLIMATE CHANGE MITIGATION, CARBON MARKET AND OTHER MARKET INSTRUMENTS

IN 00.41: Climate Change Challenges and Responses

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Key Questions

1. What do the economics of climate change tell us about the needs for climate change mitigation?
2. Why do we need to put a price on Carbon? What are the approaches of putting a price on Carbon?
3. What type of carbon markets exist globally and how they work?
4. What is Carbon Tax? How they are implemented?

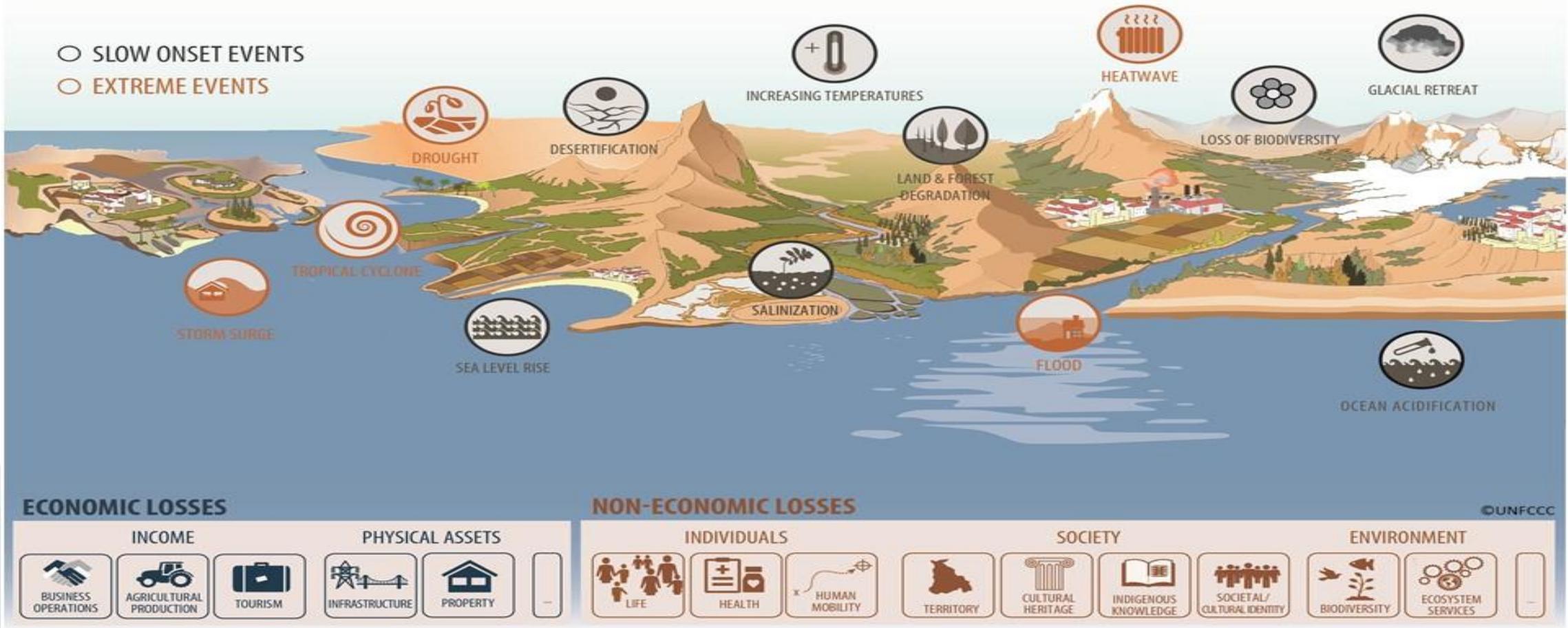
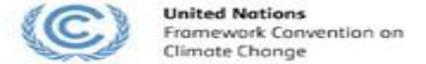
This lecture focuses on the economic rationales of climate change mitigation and carbon pricing as a tool to enable climate change mitigation. It will explore existing direct and indirect way to put price on carbon, through carbon emission trading systems and the carbon tax schemes from around the world.

What do the economics of climate change tell us about the needs for climate change mitigation?



Loss and Damages Associated with Climate Change are diverse

LOSS AND DAMAGE ASSOCIATED WITH THE IMPACTS OF CLIMATE CHANGE



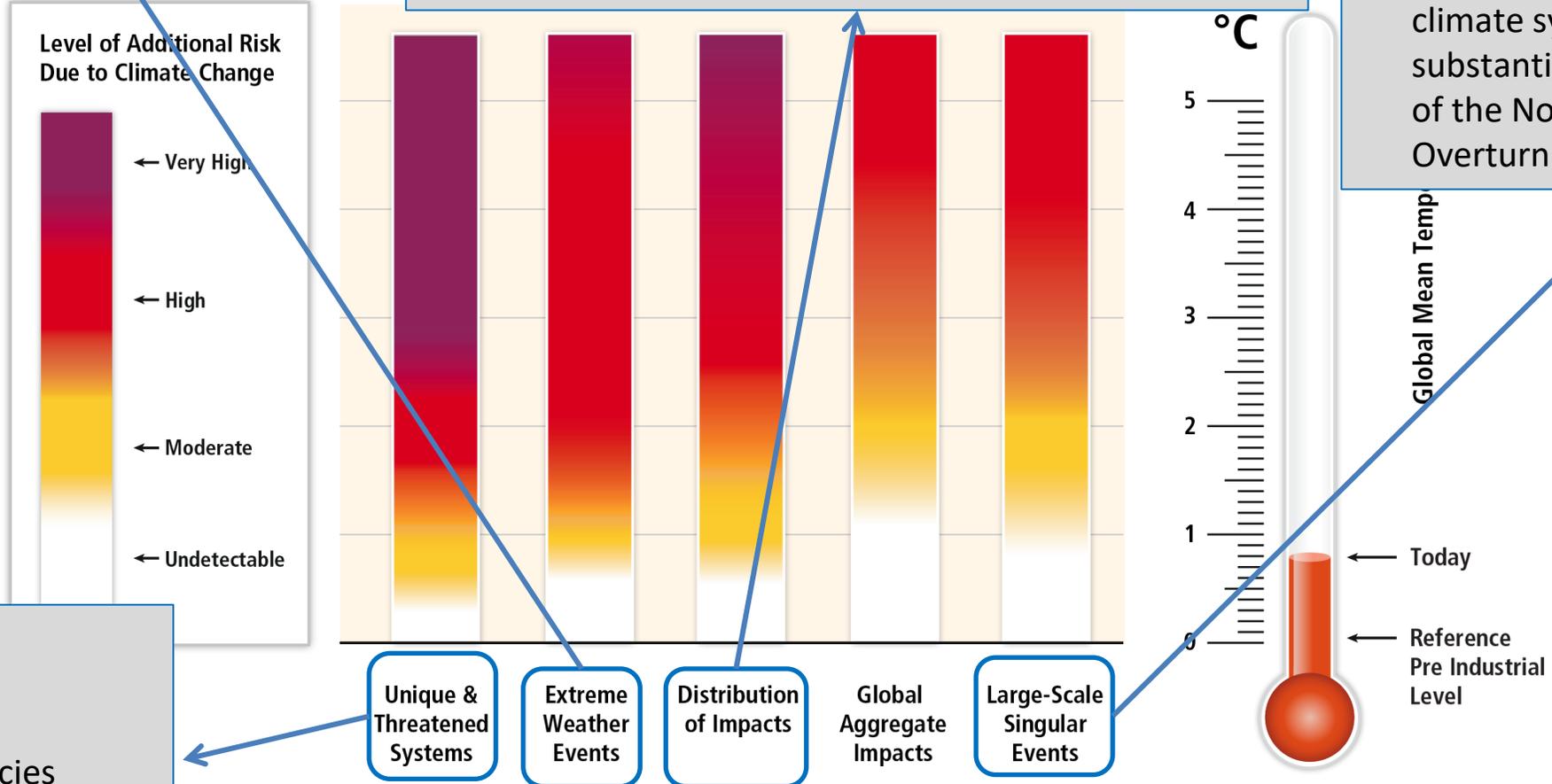
Such as:

- frequency, intensity, or consequences of heat waves, floods, droughts, wildfires, or tropical cyclones

Such as: Some regions, countries, and populations face greater harm from climate change, whereas other regions, countries, or populations would be much less harmed—and some may benefit; the magnitude of harm can also vary within regions and across sectors and populations.

Such as:

- deglaciation (partial or complete) of the West Antarctic or Greenland ice sheets
- major changes in some components of the Earth's climate system, such as a substantial reduction or collapse of the North Atlantic Meridional Overturning Circulation



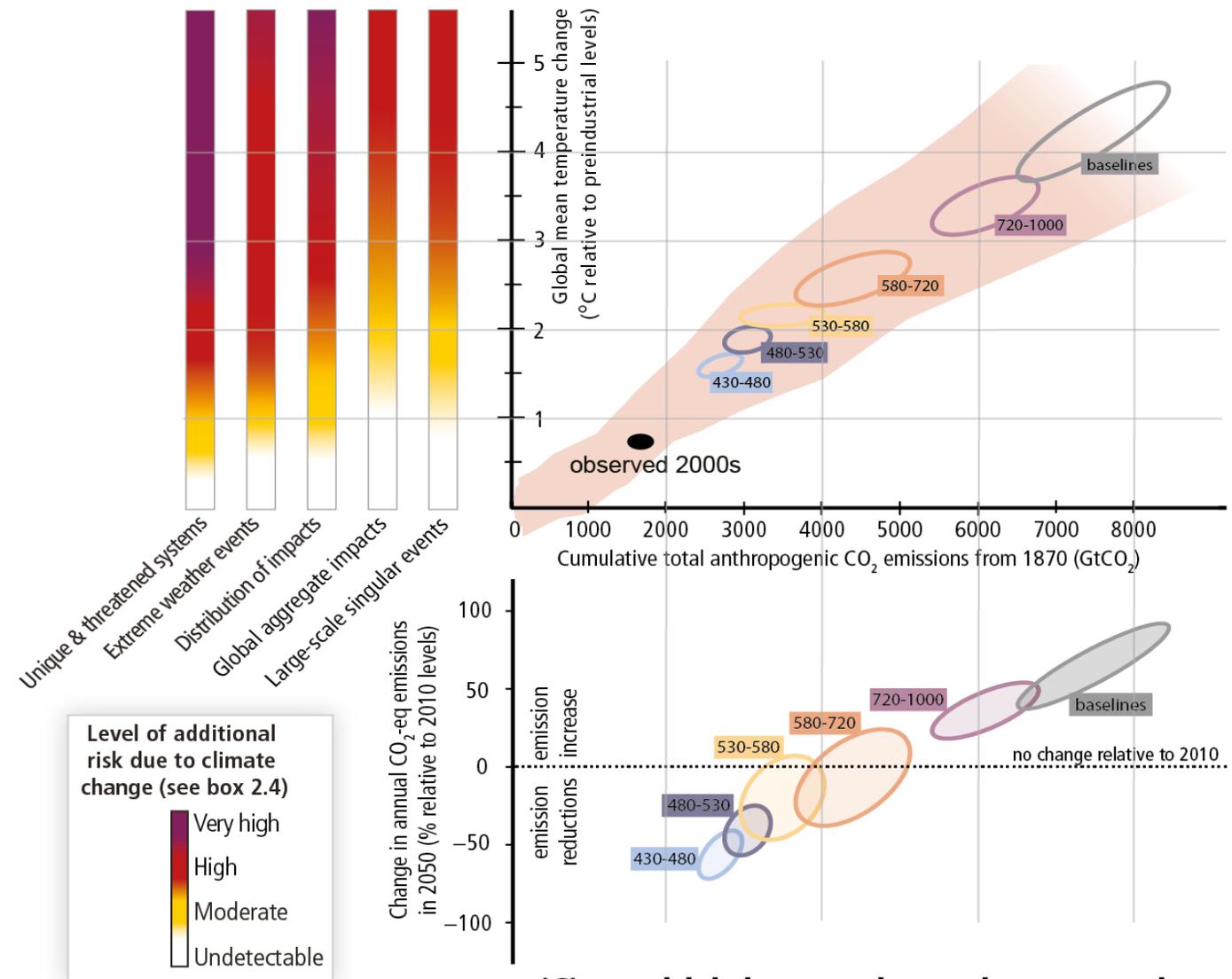
Such as:

- coral reefs
- tropical glaciers
- endangered species
- unique ecosystems
- biodiversity hotspots
- small island states, and
- indigenous communities

Based on IPCC WGII AR5 Figure 19.4

FUTURE RISKS: DEPEND ON CUMULATIVE CO₂ EMISSIONS

(A) Risks from climate change... (B) ...depend on cumulative CO₂ emissions...



(C) ...which in turn depend on annual emissions over the next decades

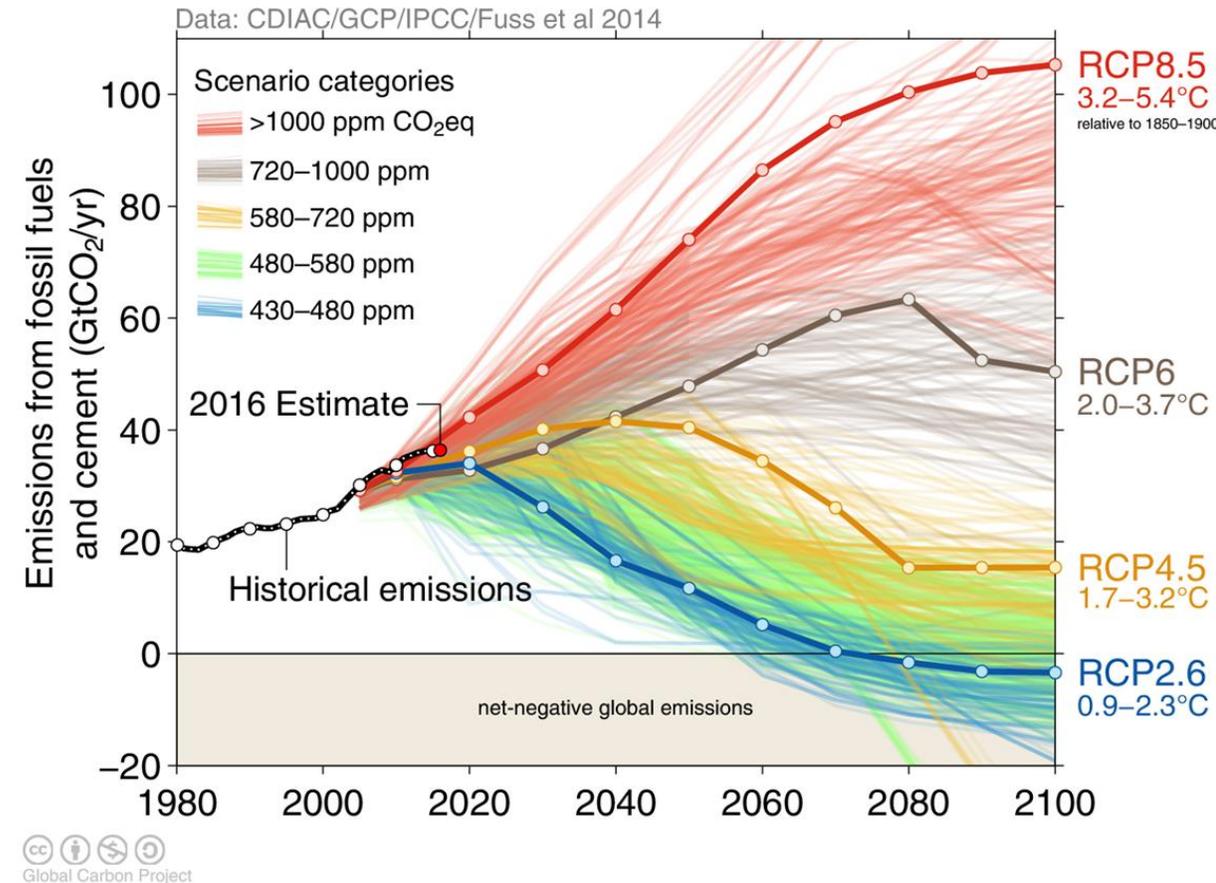
Climate change costs

1. Total costs:

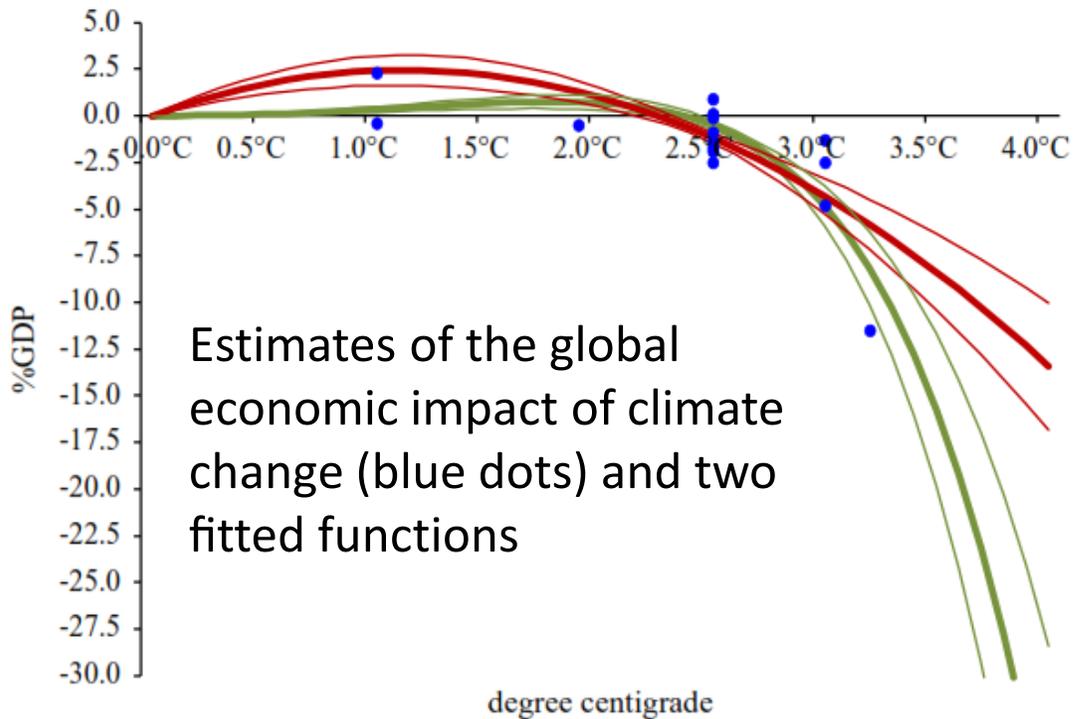
- The costs of mitigating GHGs
- The costs of adaptation to climate impacts
- The (damage) costs after adaptation (when adaptation activities cannot mitigate climate change impacts fully)
- **Total cost** = costs of mitigation + costs of adaptation + cost of residual damages - benefits of climate change impacts (if any)

2. To what level climate should be stabilized? 2 degree? 1.5 degree? (and corresponding level of GHG emissions)

- Should be stabilized at the level where "total cost is minimum"



Climate damages



Richard S.J. Tol (2013), *Targets for global climate policy: An overview*, *Journal of Economic Dynamics & Control*, 37: 911-928

Estimates of the welfare loss due to climate change (as equivalent income loss in percent); estimates of the uncertainty are given in bracket as standard deviations or 95% confidence intervals.

| Study | Warming (°C) | Impact (%GDP) |
|--|--------------|-----------------------------------|
| Nordhaus (1994b) | 3.0 | -1.3 |
| Nordhaus (1994a) | 3.0 | -4.8 (-30.0 to 0.0) |
| Fankhauser (1995) | 2.5 | -1.4 |
| Tol (1995) | 2.5 | -1.9 |
| Nordhaus and Yang (1996) ^a | 2.5 | -1.7 |
| Plamberk and Hope (1996) ^a | 2.5 | -2.5 (-0.5 to -11.4) |
| Mendelsohn et al. (2000a) ^{a,b,c} | 2.5 | 0.0 ^b 0.1 ^b |
| Nordhaus and Boyer (2000) | 2.5 | -1.5 |
| Tol (2002a) | 1.0 | 2.3 (1.0) |
| Maddison (2003) ^{a,d} | 2.5 | -0.1 |
| Rehdanz and Maddison (2005) ^{a,c} | 1.0 | -0.4 |
| Hope (2006) ^{a,e} | 2.5 | 0.9 (-0.2 to 2.7) |
| Nordhaus (2006) | 2.5 | -0.9 (0.1) |
| Nordhaus (2008) | 3.0 | -2.5 |
| Maddison and Rehdanz (2011) ^a | 3.2 | -11.5 |
| Bosello et al. (2012) | 1.9 | -0.5 |

^a Note that the global results were aggregated by the current author.

^b The top estimate is for the “experimental” model, the bottom estimate for the “cross-sectional” model.

^c Mendelsohn et al. only include market impacts.

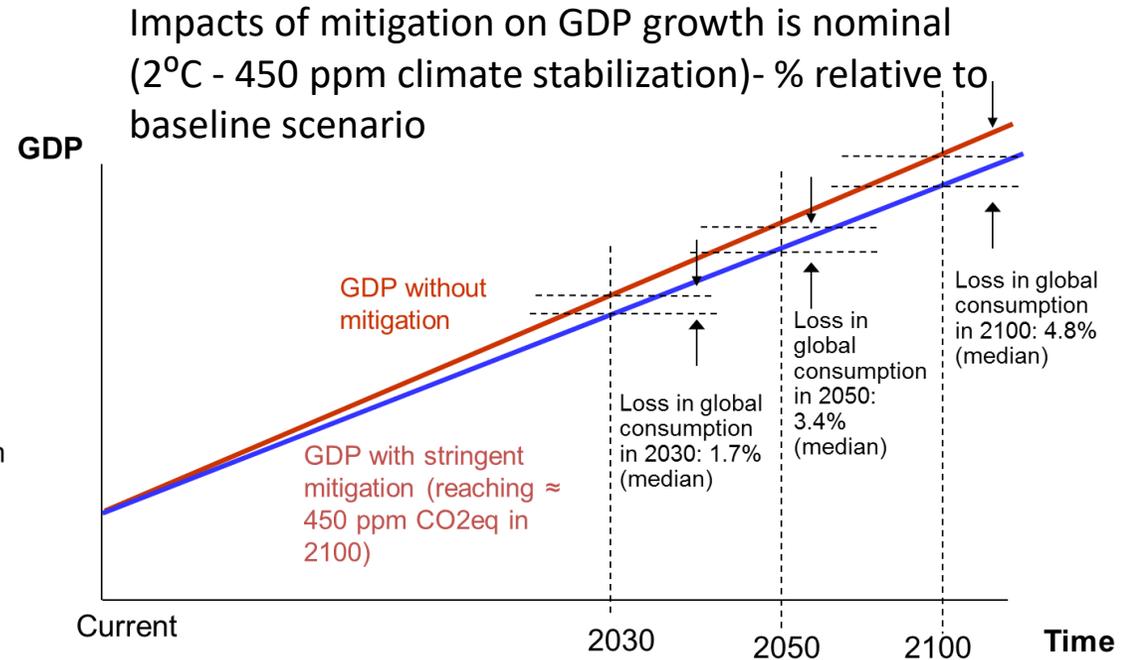
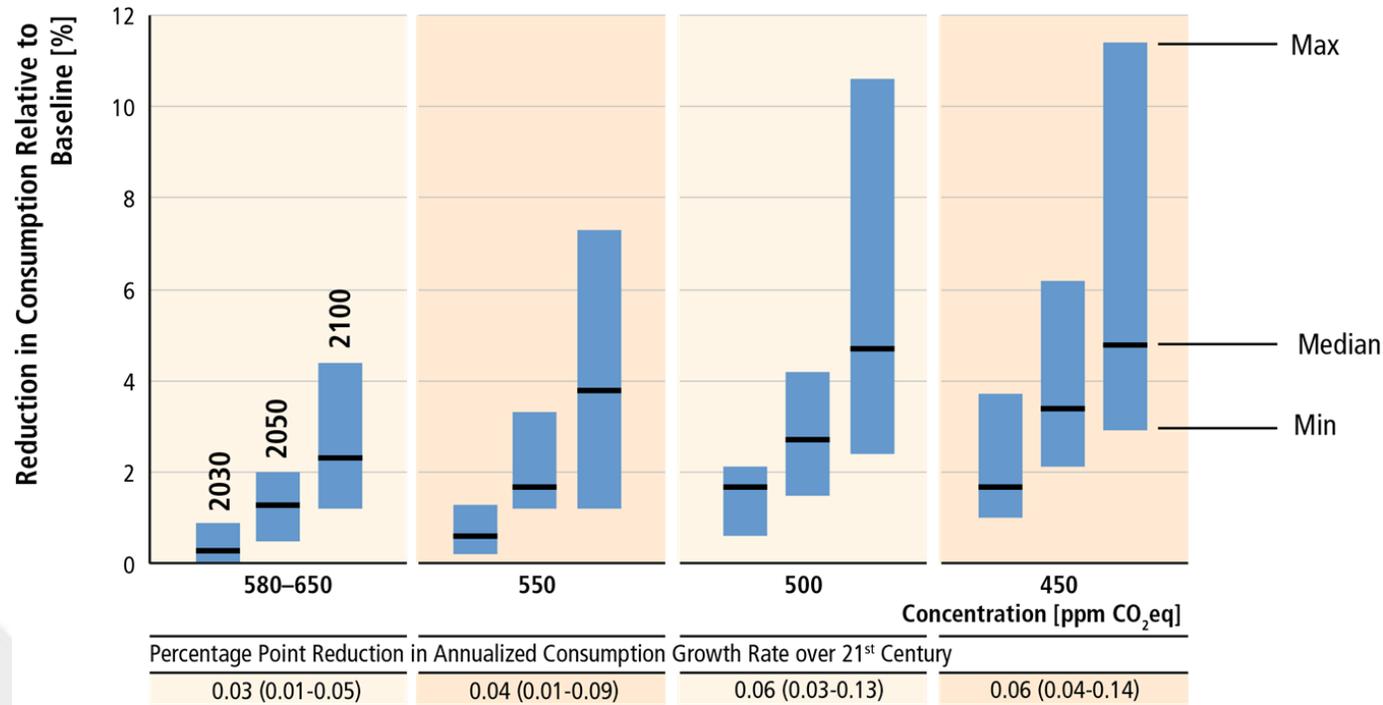
^d Maddison only considers non-market impacts on households.

^e The numbers used by Hope are averages of previous estimates by Fankhauser (1995) and Tol (2002a); Stern et al. (2006) adopted the work of Hope.

Stern review on economics of climate change

1. 2006 report commissioned by UK government to assess the evidence of climate change's impact and the climate costs
2. Very influential report that shaped many debates
3. Damage cost is equivalent to losing of about 5% of GDP each year; however if broader range of risks and impacts are considered, it could go to 20% of GDP
4. If the world is to stabilize climate change to 500-550 ppm CO₂eq, the cost of mitigation would be equivalent to losing global GDP each year by around 1%
5. Concludes that the benefits of climate change actions far outweigh the cost of inaction; early action is strongly favored
6. Is it in line with other studies? → Yes, but it is in higher cost-band of published literatures (low discount rate !!)

Costs of mitigation of climate change



Estimates do not include the benefits of reduced climate change as well as co-benefits and adverse side-effects of mitigation

Co-benefits: Such as cleaner air, greener land, safe and secure energy, less waste, a stronger economy, health and well-being etc

Climate Change Mitigation 2014, WG3's contribution to 5th Assessment Report of IPCC, 2014 April

➤ The IPCC says that the longer we wait to mitigate more, the higher would be the costs of mitigation in medium to long term.

Optimal climate change

- In climate change , costs are cost of mitigation, and benefits are damage avoided
- In a static optimum: *Marginal costs* (MC) should be equal to *Marginal benefits* (MB), means

$$\frac{\partial \text{Benefits}}{\partial \text{Emission}} = \frac{\partial \text{Costs}}{\partial \text{Emission}}$$

- But, in case of climate change which involves stock and flow problems →
- MC should be equal the Net Present Value of the Marginal Benefits, i.e.

$$\frac{\partial C_t}{\partial E_t} = \sum_s \frac{1}{(1+r)^s} \frac{\partial B_{t+s}}{\partial E_t}$$

'Climate Economics', Richard Toll, Edward Elgar, 2014.

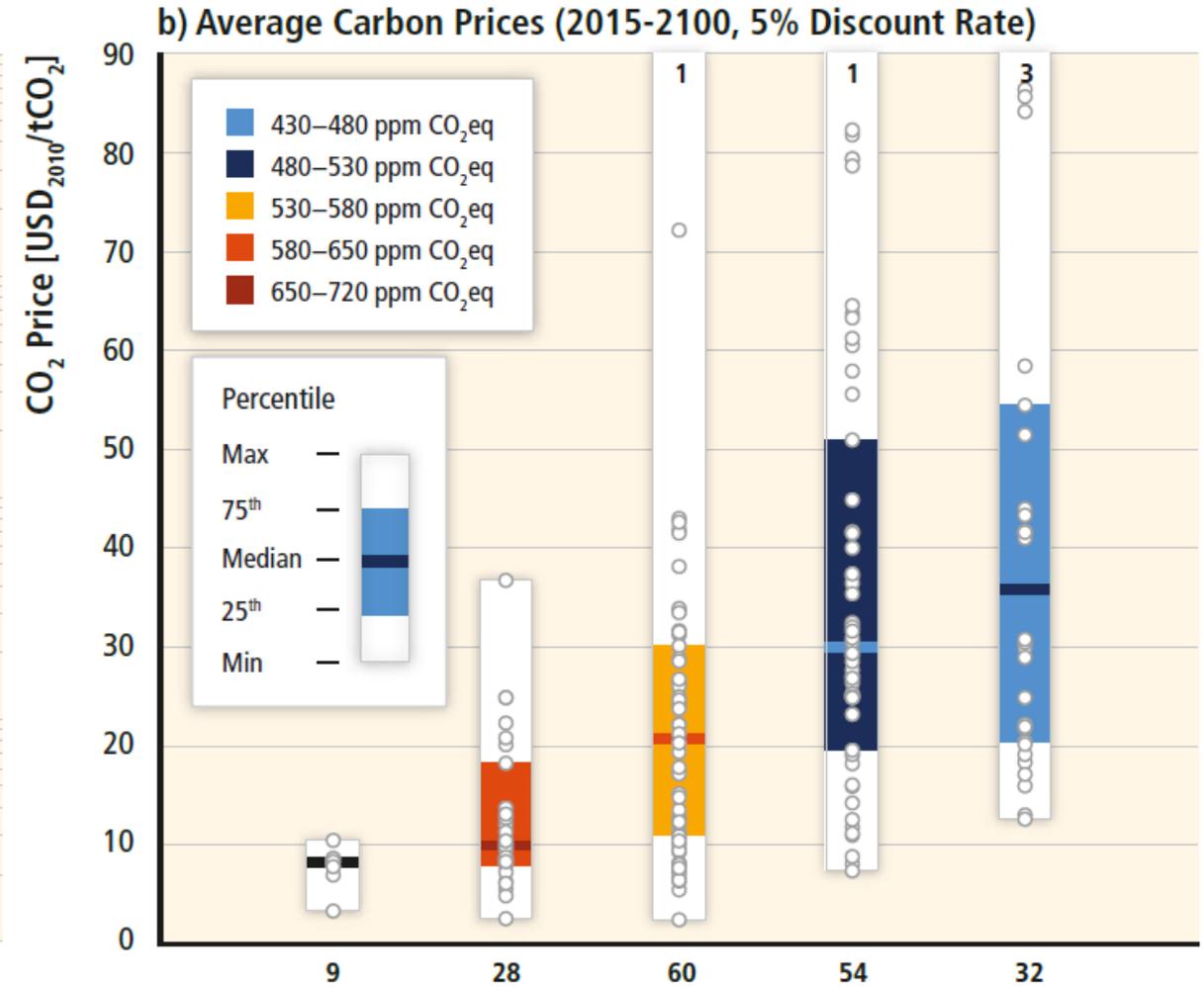
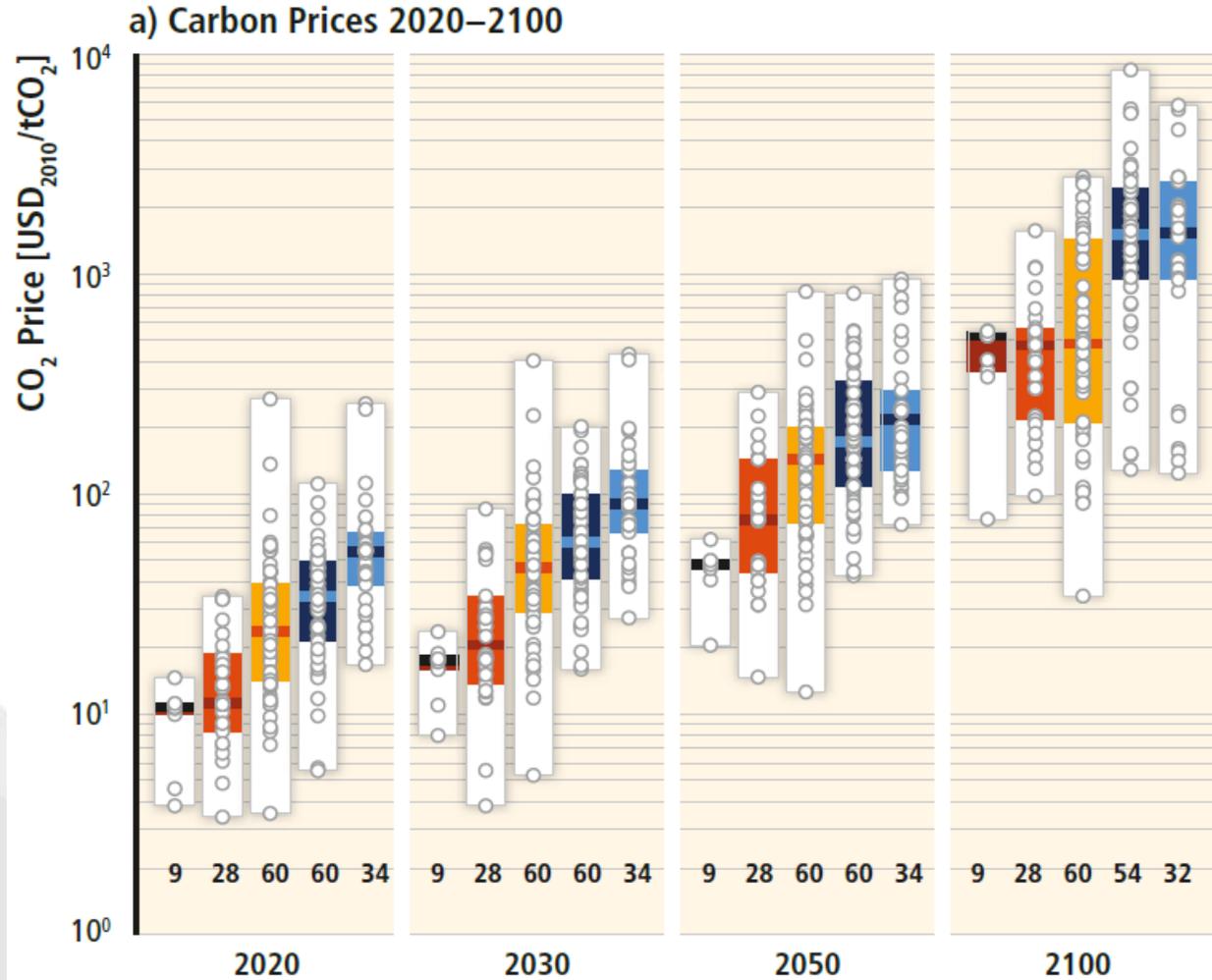
Optimal carbon pricing

- Economists believe that the most cost-effective method to reduce GHG is by putting price-tag on them
- If we put price on emissions, people will emit less
- If the 'price of GHG emissions', is higher than the 'cost of abatement' of measures, then those measures will be implemented

Carbon pricing approaches

- **'Social cost of carbon' approach**
 - For economic efficiency, carbon price should be equal to the 'social cost of carbon' which is its 'damage cost'
 - Based on damage costs assuming we do not abate carbon
- **Shadow price approach**
 - Mitigation target/goals oriented; not damage
 - Carbon price = marginal carbon abatement cost (MAC)
 - Need to estimate MAC function which sorts abatement measures in terms of \$/tCO₂e and inform how much mitigation can be achieved at what price?

Carbon prices needed for different transformation pathways



Carbon price is yet low



To reach the temperature goals of the Paris Agreement, we need high carbon price

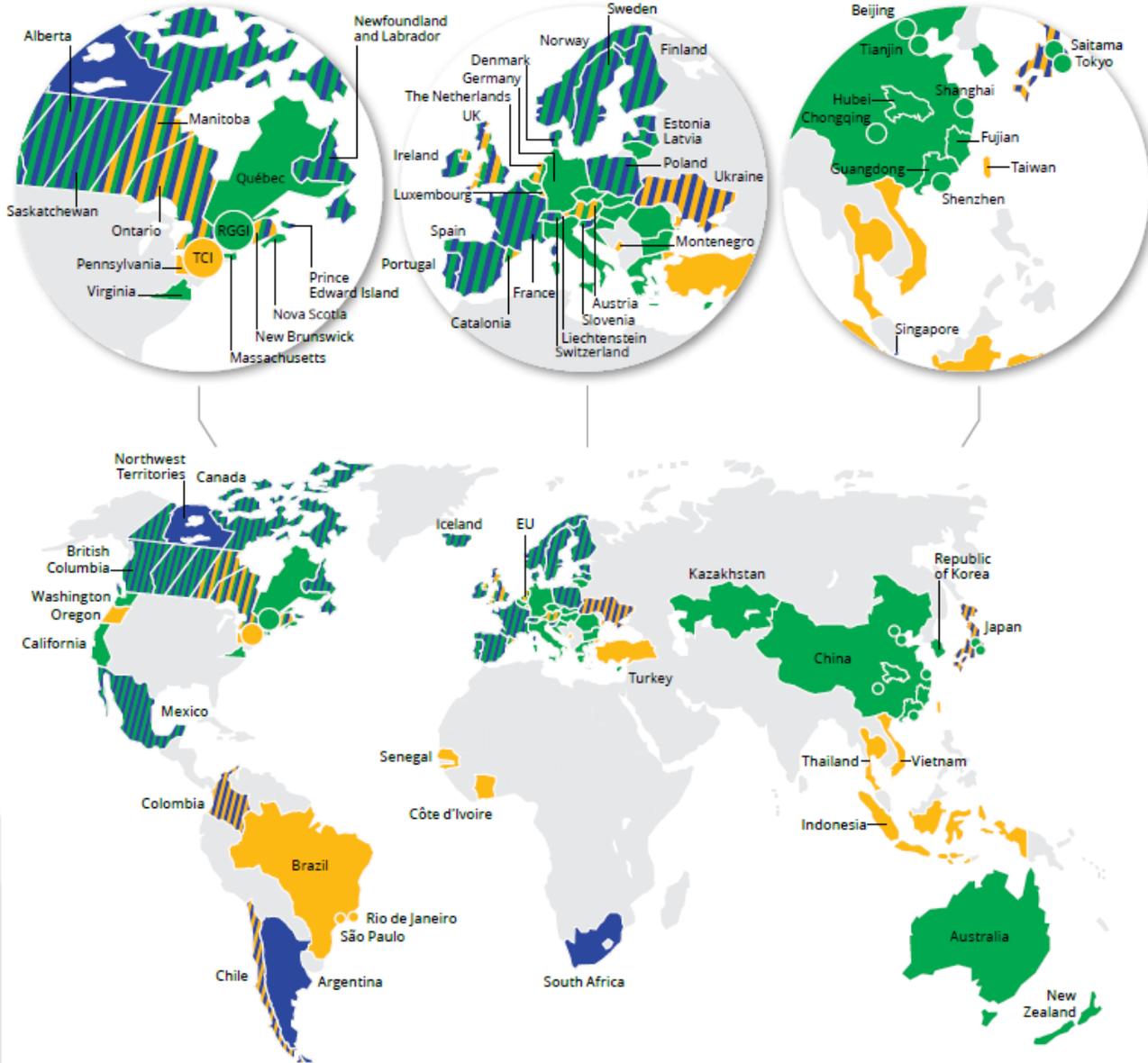
US\$40-80/tCO₂ by 2020

US\$50/tCO₂- US\$100/tCO₂ by 2030



BUT Less than 5% of currently priced-emissions are at levels consistent with this.

Carbon pricing initiatives implemented, scheduled for implementation and under consideration (ETS and carbon tax)



61

61 carbon pricing initiatives implemented/scheduled



31 ETS and 30 carbon taxes



46 national, 32 subnational jurisdictions

Carbon prices range from less than US\$1/tCO₂e to US\$119/tCO₂e, with almost half of the covered emissions priced at less than US\$10/tCO₂e

22%

Covering 12 GtCO₂e (22% of global GHG emissions)



US\$45 billion raised in carbon pricing revenues in 2019

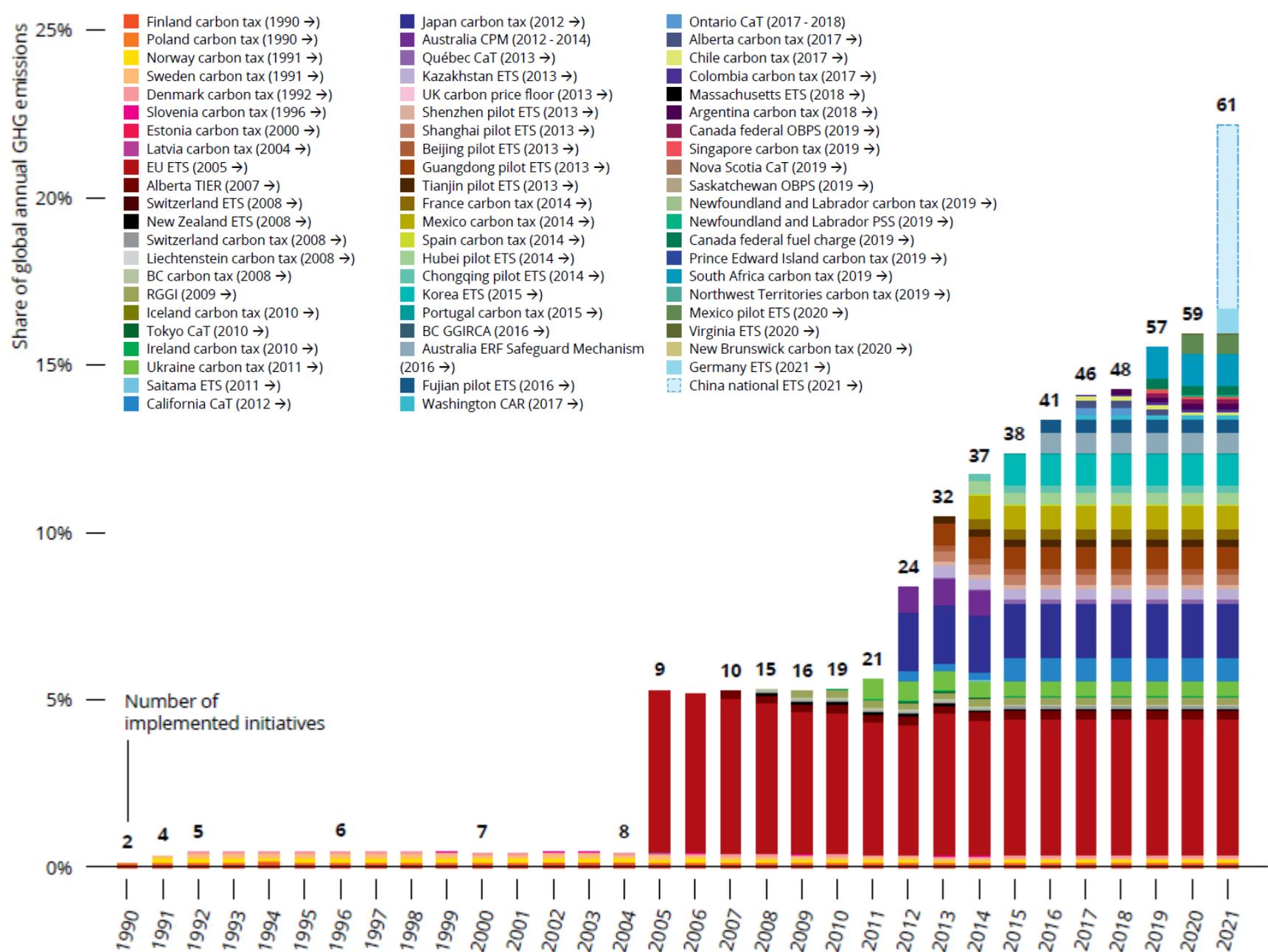


More than 14,500 registered crediting projects to date, generating almost 4 billion tCO₂e of cumulative carbon credits

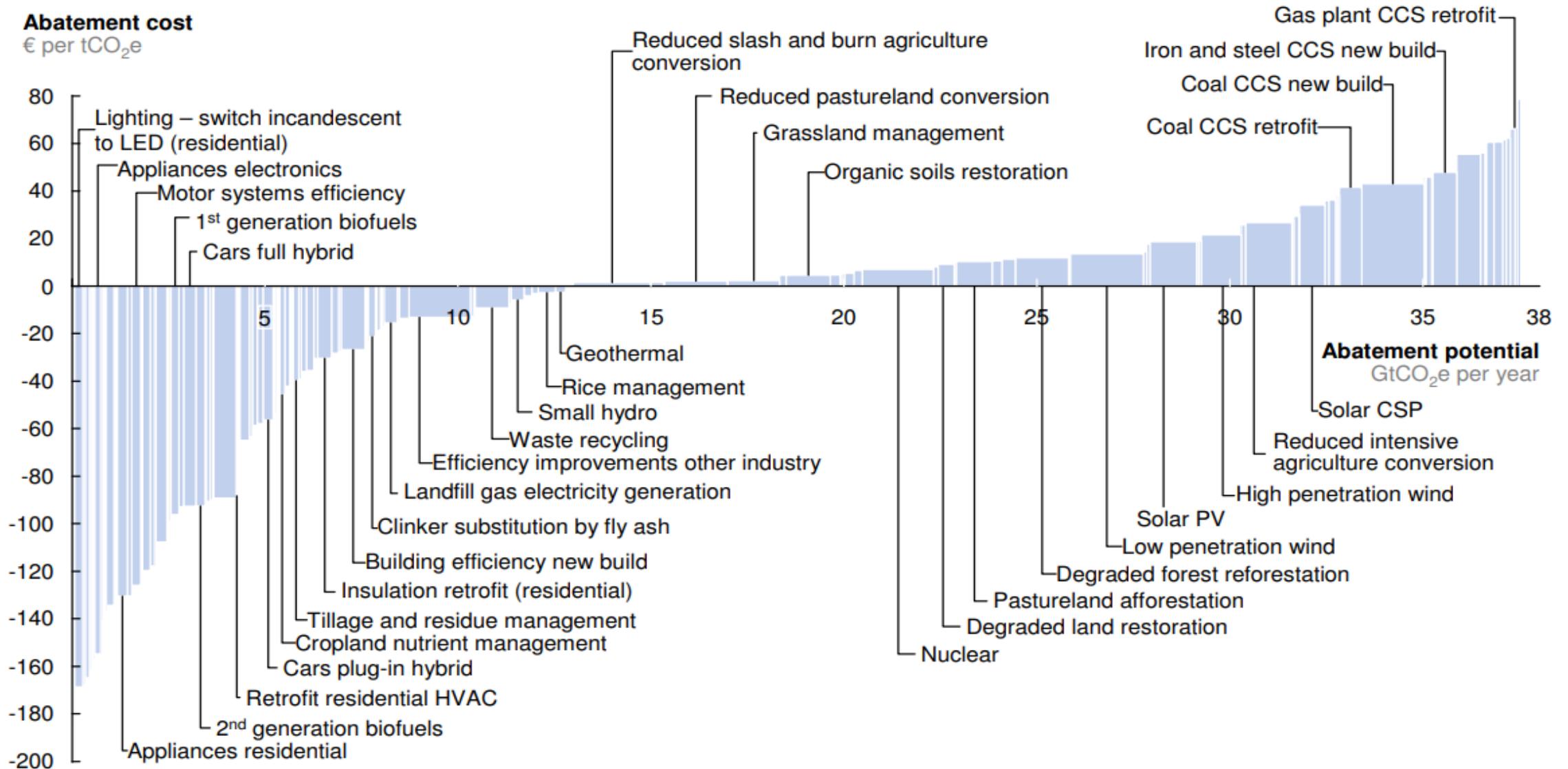


Forestry sector credits make up 42% of all credits issued in last five years

Share of Annual Global GHG in Tax and ETS

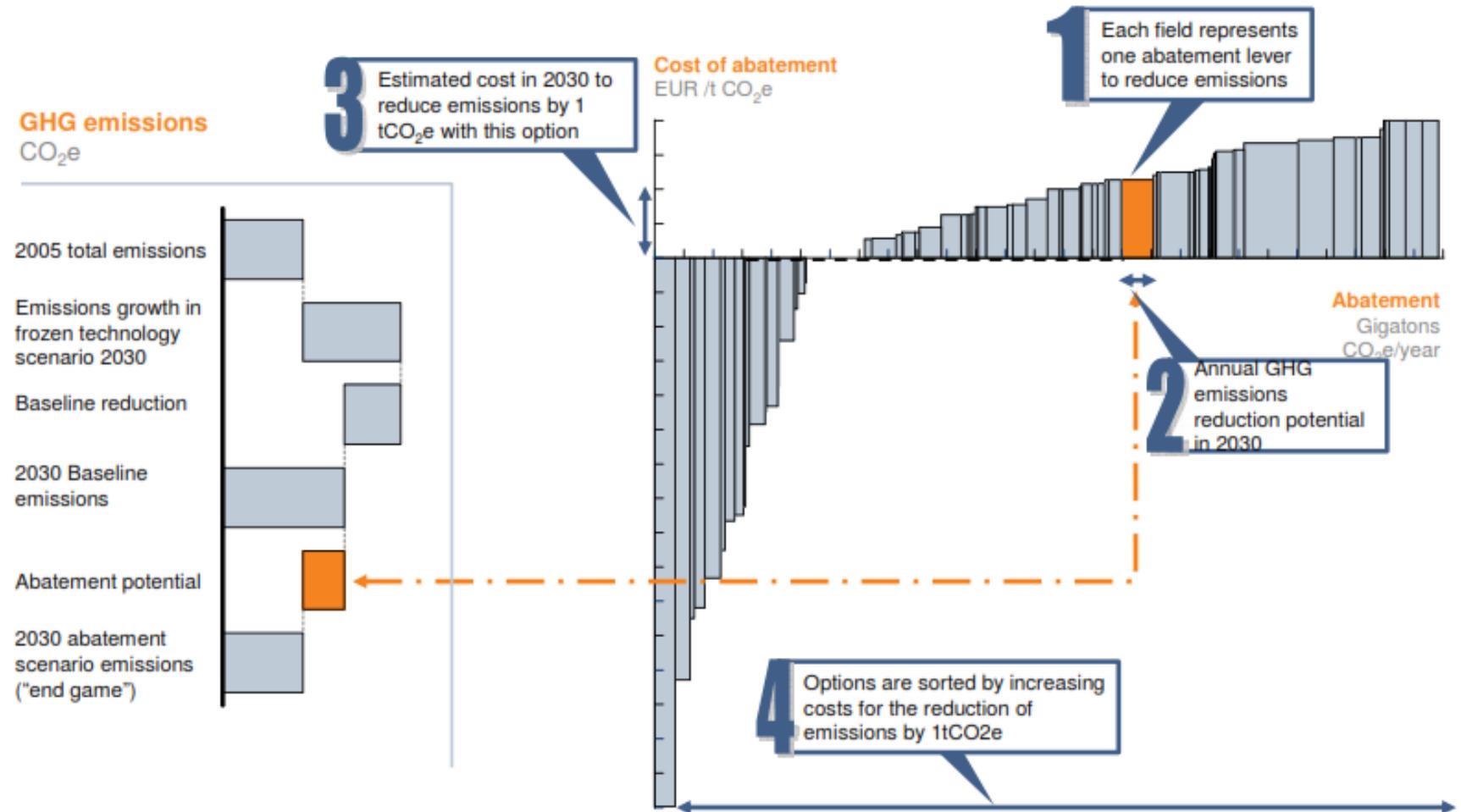


Global GHG MAC curve and how it helps to provide idea on carbon price?



MCKINSEY MAC CURVE

THE COST CURVE DISPLAYS ABATEMENT POTENTIAL, AND CORRESPONDING COST, FOR EACH ABATEMENT LEVER RELATIVE TO A “BASELINE” SCENARIO



Source: McKinsey analysis

<http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/chinas-green-revolution-prioritizing-technologies-to-achieve-energy-and-environmental-sustainability>

Two pricing instruments: Carbon Tax and Carbon Trading

Carbon Tax

- Price-based, provides stable price signal to market/investors, less uncertain, usually
- able to impose higher price than ETS

Emission Trading

- Quantity-based, good for emission targets, better economic efficiency (emitter can choose the lowest-cost mitigation options across covered-sectors), needs a well-functioning market, need many participants to trade, transaction cost could be high, need better management/operating capacity of regulator

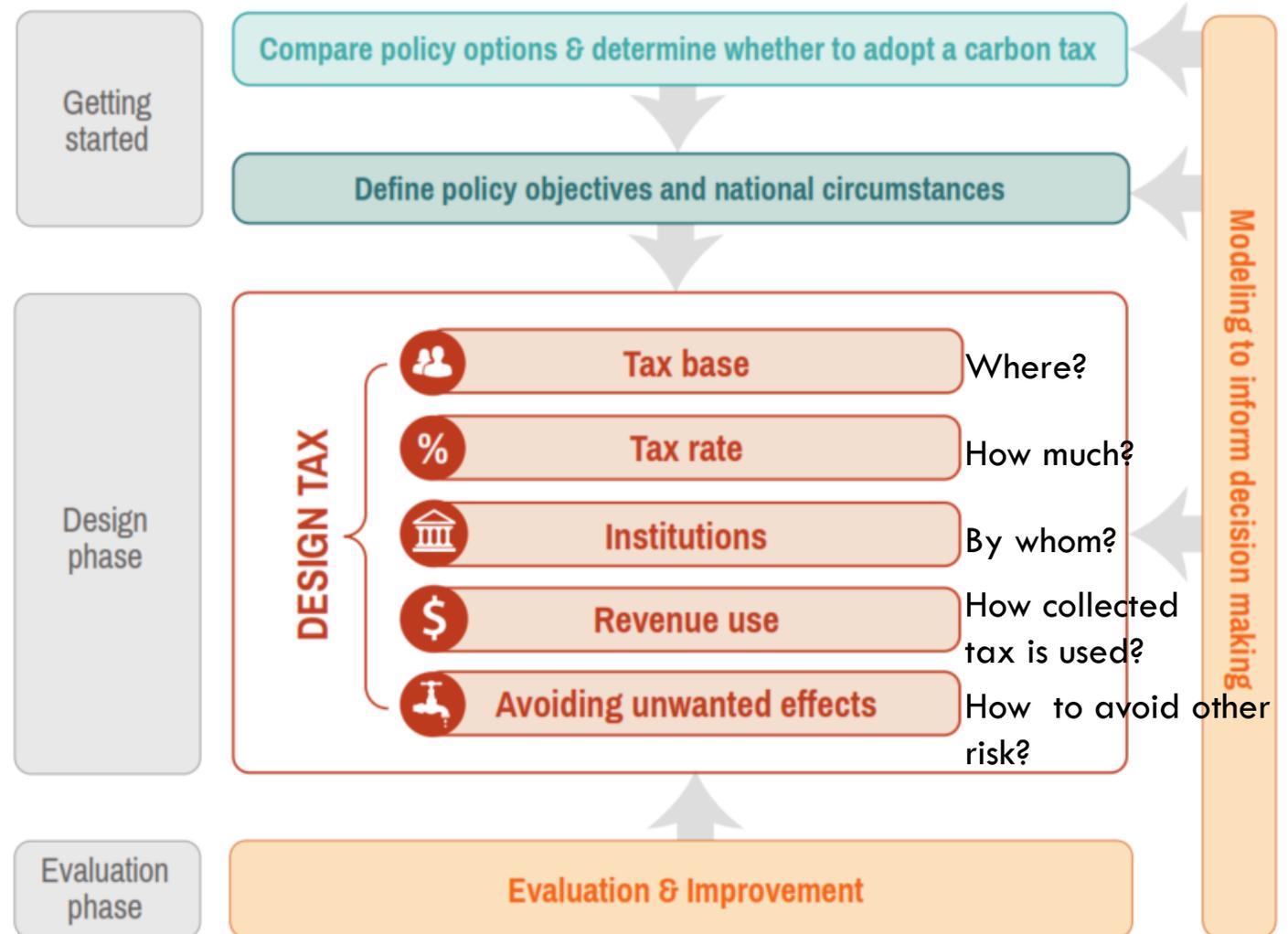
Carbon taxes in practice

| | |
|------|---|
| 1990 | Finland adopts first carbon tax Poland carbon tax |
| 1991 | Sweden carbon tax Norway carbon tax |
| 1992 | Denmark carbon tax |
| 1995 | Latvia carbon tax |
| 1996 | Slovenia carbon tax |
| 2000 | Estonia carbon tax |
| 2008 | Switzerland carbon tax British Columbia carbon tax |
| 2010 | Ireland carbon tax Iceland carbon tax India Clean Environment Cess |
| 2012 | Australia Carbon Pricing Mechanism |
| 2013 | United Kingdom Carbon Price Floor |
| 2014 | France carbon tax Mexico carbon tax Australia Carbon Pricing Mechanism repealed |
| 2015 | South Africa publishes Carbon Tax Bill Portugal carbon tax |
| 2016 | Canada announces national Carbon Price Floor |
| 2017 | Alberta carbon tax Chile carbon tax Colombia carbon tax Singapore carbon tax announced |

HOW CARBON TAX WORKS?

1. Taxing goods/processes which produce GHG emissions
2. Targeting carbon-intensive goods/processes to incentivize emission reductions, imposing tax as \$ per ton of CO₂e
3. Important to ascertain if price signal will be effective in emission reduction behavior (price elasticity) – next slide

Stages of Carbon Tax Design



Types of Carbon Markets

1. Offset Market related to UNFCCC- Clean Development Mechanism
2. Regulated/Compliance Carbon Market (ETS/Cap-and-Trade)
3. Unregulated/Volunteer Carbon Market
4. CORSIA/ICAO Market/IMO/BOCM-JCM
5. REDD+ Carbon Market
6. Carbon-Insetting in Corporate Sector
7. Further Prospects under Paris Agreement

1. Offset Market – Clean Development Mechanism

- Projects in developing countries can earn certified emission reduction (CER) credits
- Each CER credits are equivalent to one tonne of CO2
- CERs can be traded and sold
- CER can be used by developed-countries with emission-reduction-commitments to contribute (a part) of their Kyoto Protocol emission reduction targets
- What CDM should do?
 - Contribute to sustainable development in developing countries
 - Give some flexibility to industrialized countries on meeting their emission reduction targets
 - Supports adaptation fund (2%)

Countries included in Annex B to the Kyoto Protocol and their emissions targets

| Country | Target (1990** - 2008/2012) |
|---|-----------------------------|
| EU-15*, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland | -8% |
| US*** | -7% |
| Canada, Hungary, Japan, Poland | -6% |
| Croatia | -5% |
| New Zealand, Russian Federation, Ukraine | 0 |
| Norway | +1% |
| Australia | +8% |
| Iceland | +10% |

By 2019 end

- Over 250 methodologies

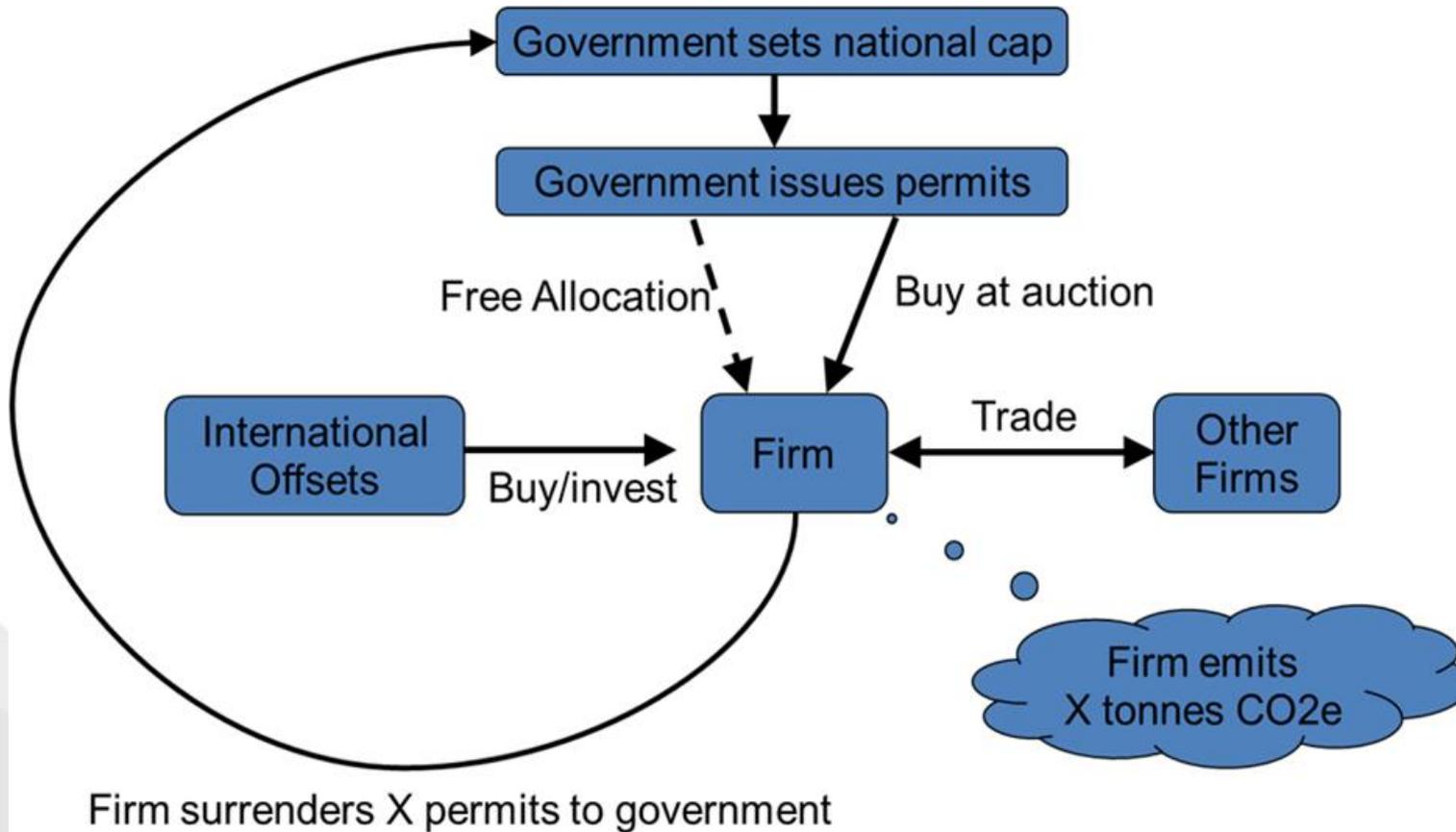
Not doing great because world efforts shift away from Kyoto Protocol

Clean Development Mechanism (CDM)



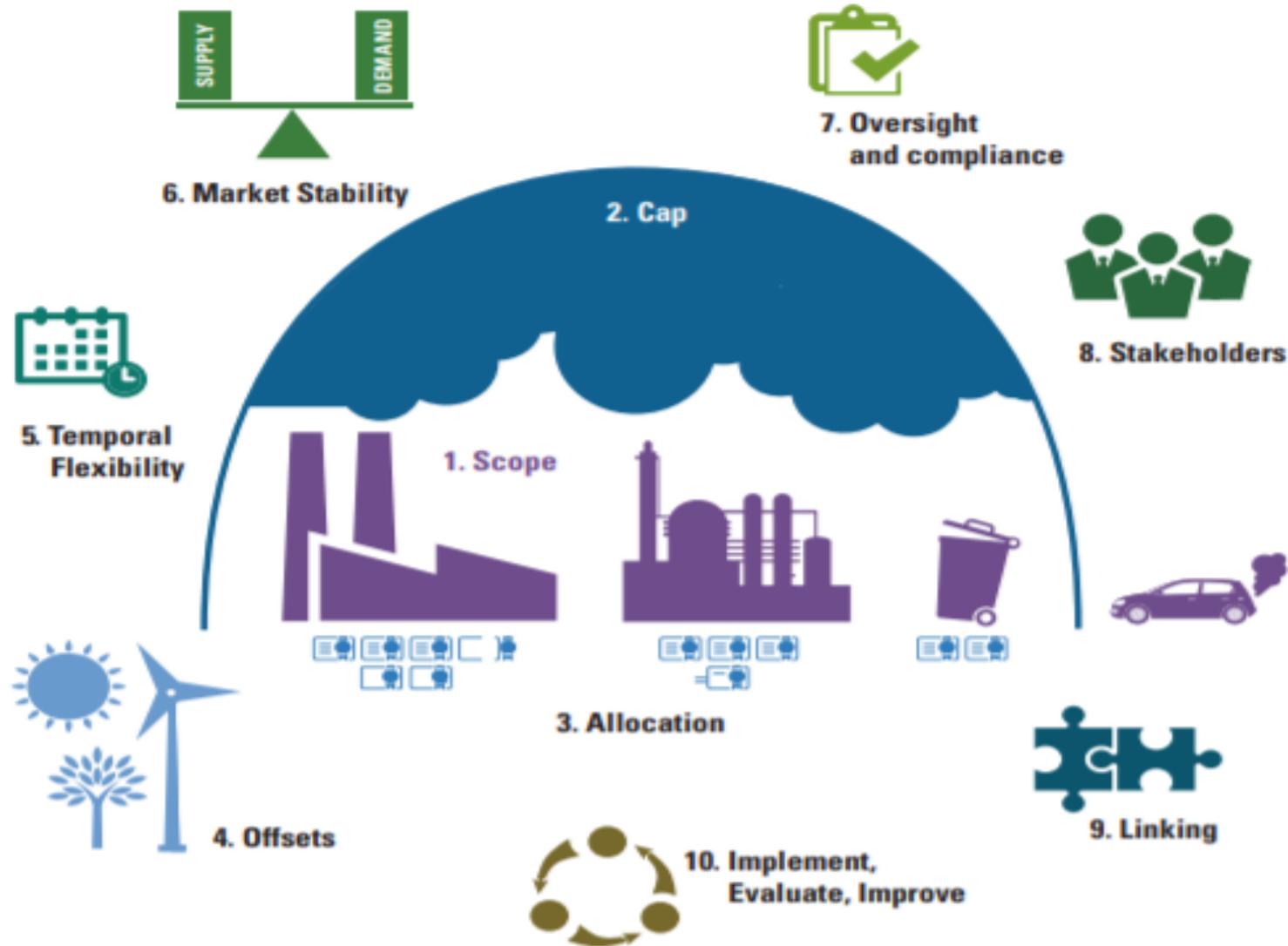
| | | | |
|---|--------------------------------------|---|--|
| Administered by | UNFCCC | Geographic coverage | Any Non Annex I country of the Kyoto Protocol ¹⁴² |
| Established in | 1997 | Countries with projects | 111 |
| Type | International | Price data for 2019 | US\$0.15–0.24/tCO ₂ e ¹⁴³ |
| Registered activities | 8142 | Carbon pricing initiatives accepting issued credits for compliance | Colombia carbon tax, CORSIA ¹⁴⁴ , EU ETS, Mexico carbon tax, Republic of Korea ETS, South Africa carbon tax |
| Credit name | Certified Emission Reductions (CERs) | Sectoral coverage | 10 sectors |
| Credits issued (MtCO₂e) | 2002 | <0.01% CCS/CCU | |
| Credits retired or cancelled (MtCO₂e) | 1192 | 6% Energy efficiency | |
| | | 0.8% Forestry | |
| | | 4% Fuel switch | |
| | | 5% Fugitive emissions | |
| | | 45% Industrial gases | |
| | | 0.6% Manufacturing | |
| | | 32% Renewable energy | |
| | | 0.3% Transport | |
| | | 7% Waste | |

2. The basic mechanics of carbon trading scheme



- **Allocation**: Regulator sets overall caps and allocates to installation under the cap
- **Trading**: Firms buy more permits or sells excess permits to be under permit holdings
- **Monitoring**: Regulator monitors total emission of firms
- **Compliance**: Regulator checks if all installations under cap have enough permits for emissions

2. Regulated/Compliance Carbon Market (ETS/Cap-and-Trade)



| | | | |
|--------------|-------------|---------------------|----------------|
| Alberta | Australia * | Brazil * | California |
| China * | EU | India | Japan * |
| Kazakhstan * | Mexico | New Zealand * | Norway |
| Québec | RGGI | Republic of Korea * | South Africa * |
| Switzerland | Tokyo | UK | Taiwan * |

<http://www.ieta.org/The-Worlds-Carbon-Markets>

Design of Emission Trading Systems (ETS)

- ✓ Regulator
- ✓ Type of cap: absolute vs intensity
- ✓ Total cap size and changes in cap over time
- ✓ Sector/gases covered
- ✓ Allowance allocation rule (how much allocated? Free or auction or hybrid, how allowance revenue used?)
- ✓ Compliance period (s)
- ✓ Compliant carbon units/commodities
- ✓ Trading methods
- ✓ Monitoring, reporting and verification (registry and oversight, regulation)
- ✓ Banking and borrowing provisions'
- ✓ Offsets and flexibilities
- ✓ Price containment measures
- ✓ Punitive measures for non-compliance
- ✓ Allocation rules for new entrants and rules for opt-out
- ✓ Linkages with other ETS markets- and other carbon commodity

European Union Emission Trading System (EU-ETS)

- EU-ETS Began operation in 2005
- EU28 plus 3 (Liechtenstein, Norway and Iceland); over **11,000 industrial installations** and **airlines** operating between them
- Goal: 21 percent reduction by 2020 from 2005 levels (43% by 2030)
- Covers about half of Europe's CO₂ emissions (@ 45% GHG)
- Traded sector of industry:
 - carbon dioxide (CO₂) from
 - power and heat generation, energy-intensive industry sectors including oil refineries, steel works and production of iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals
 - commercial aviation
 - Nitrous oxide (N₂O) from production of nitric, adipic and glyoxylic acids and glyoxal
 - Perfluorocarbons (PFCs) from aluminium production
- Non-traded sector: Others such as transportation sector (except aviation), agricultural sector

EU-ETS developments

| Key features | Phase 1 (2005–2007) | Phase 2 (2008–2012) | Phase 3 (2013–2020) |
|------------------|---|---|--|
| Geography | EU27 | EU27 + Norway, Iceland, Liechtenstein | EU27 + Norway, Iceland, Liechtenstein Croatia from 1.1.2013 (aviation from 1.1.2014) |
| Sectors | Power stations and other combustion plants ≥20MW Oil refineries Coke ovens Iron and steel plants Cement clinker Glass Lime Bricks Ceramics Pulp Paper and board | Same as phase 1 plus Aviation (from 2012) | Same as phase 1 plus Aluminium Petrochemicals Aviation from 1.1.2014 (aviation from 1.1.2014) Ammonia Nitric, adipic and glyoxylic acid production CO ₂ capture, transport in pipelines and geological storage of CO ₂ Aviation |

| Key features | Phase 1 (2005–2007) | Phase 2 (2008–2012) | Phase 3 (2013–2020) |
|-------------------------------|-------------------------------|--|---|
| GHGs | CO ₂ | CO ₂ , N ₂ O emissions via opt-in | CO ₂ , N ₂ O, PFC from aluminium production |
| Cap | 2058 million tCO ₂ | 1859 million tCO ₂ | 2084 million tCO ₂ in 2013, decreasing in a linear way by 38 million tCO ₂ per year |
| Eligible trading units | EUAs | EUAs, CERs, ERUs Not eligible: Credits from forestry, and large hydropower projects. | EUAs, CERs, ERUs Not eligible: CERs and ERUs from forestry, HFC, N ₂ O or large hydropower projects. Note: CERs from projects registered after 2012 must be from Least Developed Countries |

https://ec.europa.eu/clima/sites/clima/files/docs/ets_handbook_en.pdf

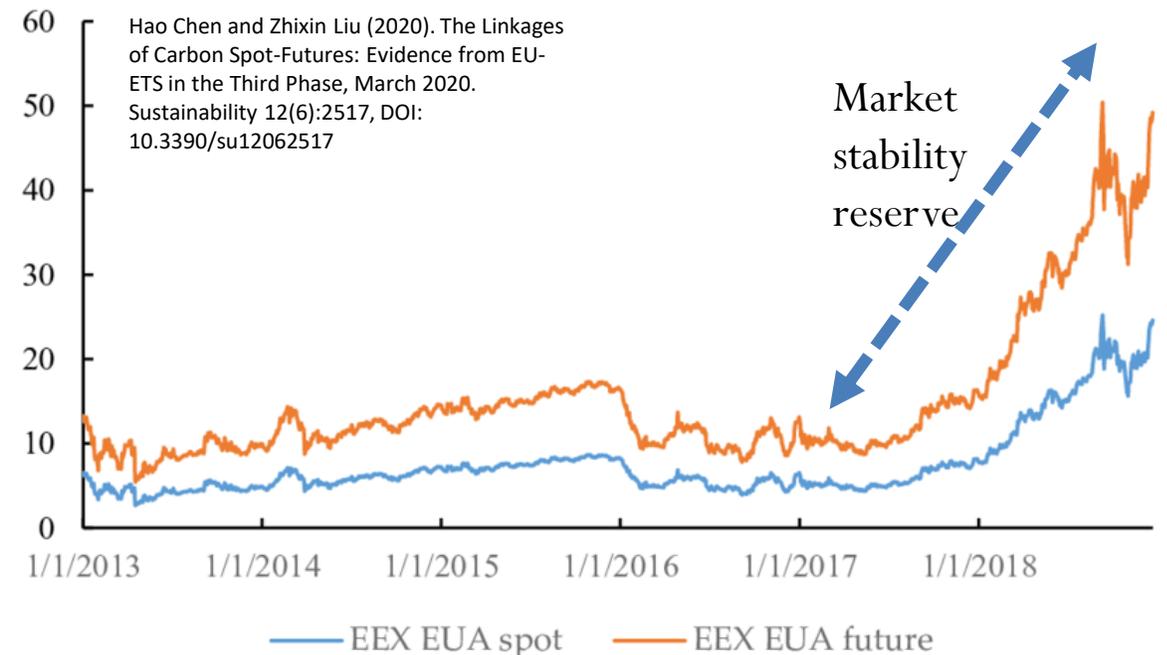
EU-ETS Fourth phase: 2021–2030

- In February 2018, European lawmakers approved the EU ETS phase 4 (2021–2030)
 - Changing the linear annual cap reduction from 1.74 per cent to 2.2 per cent
 - A temporary doubling of the yearly withholding rate of surplus allowances into the Market Stability Reserve (MSR) to 24 per cent until 2023
 - Share of allowances to be auctioned is set at 57 per cent; after 2026, this will decrease linearly to 0 per cent in 2030
 - Low-carbon funding mechanisms for phase 4: the Modernization Fund and the Innovation Fund

(On 5 Feb 2021, EEX)

Spot price: 34.86 Euro/tCO₂

Future price: 38.15 (Feb 21) – 43.18 (Dec 2029)



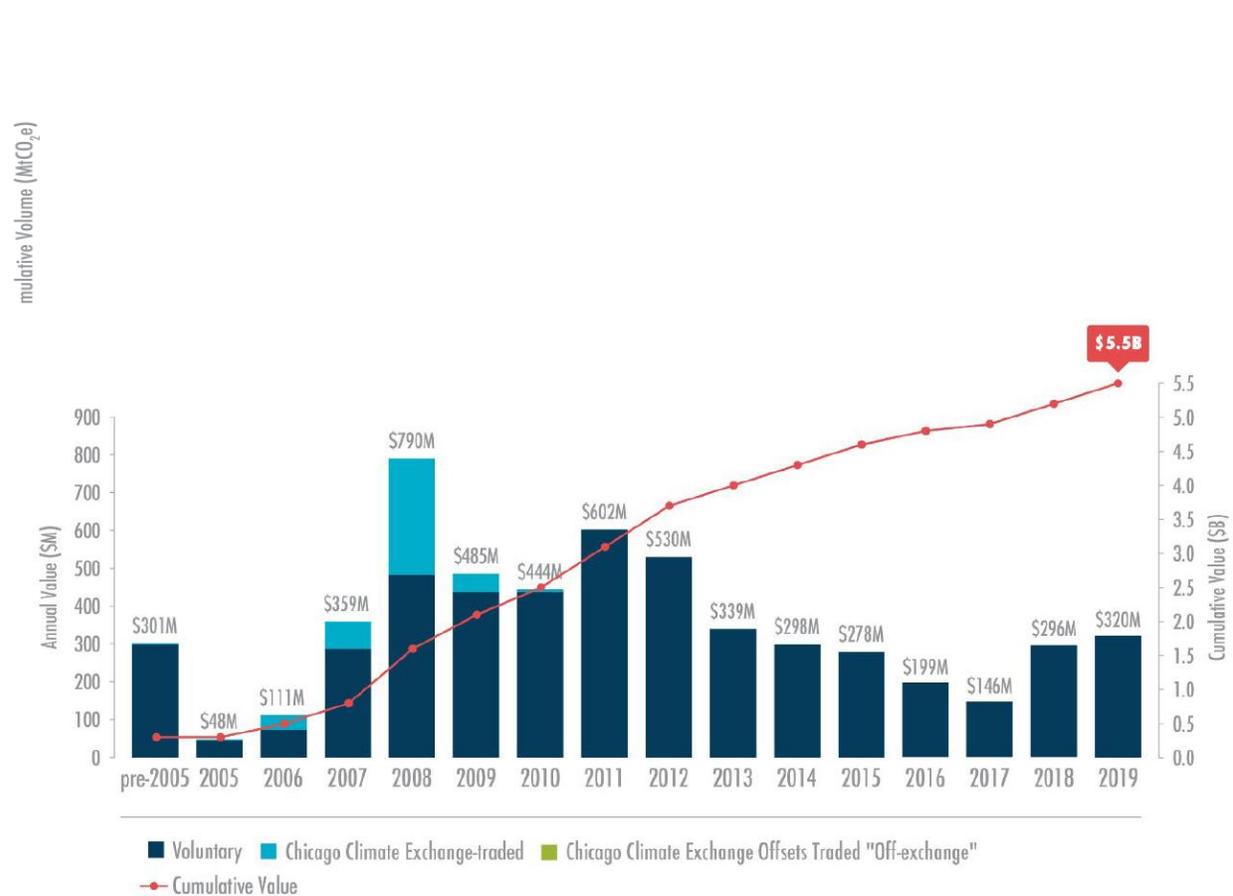
China National ETS China

launched national ETS in Dec 2017 (politically) → long-delayed and expected to launch from middle of this year (2021).

| Features | Details |
|--------------------------------|--|
| GHG Covered | CO2 |
| Sectors covered and thresholds | Power sector (including combined heat and power, as well as captive power plants of other sectors). The scope is expected to be gradually expanded to finally cover a total of eight sectors: petrochemical, chemical, building materials, steel, nonferrous metals, paper, and domestic aviation. There is no specific timeline for this expansion. INCLUSION THRESHOLDS: Entities with annual emissions of ~26,000 tCO2 (energy consumption of more than 10,000 tce) in any year over the period 2013-2015. |
| Cap | ~3,300 MtCO2e/year (30% of national CO2 emissions) |
| Allocation | Free Allocation: Free allocation is expected to be based on subsector benchmarks with export adjustments for changes in actual production. Will change in future (test in 2017) |
| Banking and borrowing | Expected to allow banking across compliance phases, but not to allow borrowing |
| Compliance Period | 1 year |
| Number of Entities liable | 2,225 approx https://www.argusmedia.com/en/news/2174467-china-to-launch-national-emissions-trading-scheme http://mee.gov.cn/xxgk2018/xxgk/xxgk03/202012/W020201230736907682380.pdf |

3. Voluntary carbon market since 2005

Historical Market-Wide Voluntary Offset Transaction Volumes, 2019



- Cumulative Market Volume Tops 1.3 Billion Tons, Value Exceeds \$5.5 Billion
- Corporate pledges keep Voluntary Markets going

<https://www.ecosystemmarketplace.com/carbon-markets/>
 State of the Voluntary Carbon Markets 2020

Transacted Voluntary Carbon Offset Volume, Value, and Weighted Average Price by Project Category, 2019

- In 2019, the volume of renewable energy transactions exceeded that of nature-based solutions in forestry and land use
- But the prices for nature-based solutions averaged more than three times those of renewable energy
- Within the category of Forestry and Land Use, the dominant project type was REDD+

| | 2019 | | |
|---|-------------------------------|------------------|------------------|
| | VOLUME MtCO ₂ e | AVERAGE PRICE | VALUE |
| RENEWABLE ENERGY | 42.4 | \$1.4 | \$60.1 M |
| FORESTRY AND LAND USE | 36.7 | \$4.3 | \$159.1 M |
| WASTE DISPOSAL | 7.3 | \$2.5 | \$18.0 M |
| HOUSEHOLD DEVICES | 6.4 | \$3.8 | \$24.8 M |
| CHEMICAL PROCESSES/ INDUSTRIAL MANUFACTURING | 4.1 | \$1.9 | \$7.7 M |
| ENERGY EFFICIENCY/ FUEL SWITCHING | 3.1 | \$3.9 | \$11.9 M |
| TRANSPORTATION | 0.4 | \$1.7 | \$0.7 M |

<https://www.ecosystemmarketplace.com/carbon-markets/>

State of the Voluntary Carbon Markets 2020

Why firms and individual engaged in voluntary market?

- Global good- Philanthropy
- Green image/branding through off-sets of their own emissions- corporate social responsibility, ethics, reputation, supply chain risk
- Risk management (preemptive strategies)- so that they will not be subjected to stringent compliance market
- As a preparation for entering into regulatory market formally (pre-compliance)

Voluntary Carbon Market Standards

All voluntary standards require that offsets be:

- **Real:** there has to be evidence that the project actually removed or prevented emissions;
 - **Additional:** the emissions reductions would not have occurred without those project activities;
 - **Measurable:** the volume of emissions reductions can be accurately measured; a
 - **Verifiable:** a neutral, third-party auditor has verified the emissions reductions.
-
- **International standards:** An organization or authority issue certificate who specify a clear standard to be meet to receive Carbon Offset Certificate
 - **Over ten independent standards exist** that offer methodologies to guide development of carbon offset project
 - **Standardization** of methodology, verification, tracking (registry) are extremely important to buyers and sellers
 - Somebody has to 'issue' the credit certification with unique identifier
 - **The 'offset' has to be marked 'retire' in registry if purchaser claim their own carbon offset**

Annual Voluntary Carbon Offset Issuances and Retirements, 2007–2019



<https://www.ecosystemmarketplace.com/carbon-markets/>
State of the Voluntary Carbon Markets 2020

4. CORSIA-ICAO Market/IMO

CORSIA

- **Carbon Offsetting and Reduction Scheme for International Aviation:** At the 39th Assembly (Oct 2016) of the International Civil Aviation Organization (ICAO) adopted (66 states representing 87% of international aviation activities) the CORSIA
 - Stabilize net emissions from international aviation at 2020 levels
 - Pilot phase (2021-2023), phase 1 (2024-2026) and phase 2 (2027-2035)
- CORSIA has the potential to generate demand for around 2.5 gigatons of CO₂e offset between 2021 and 2035

International Maritime Organization (IMO)

- **April 13, 2018:** The International Maritime Organization's Marine Environment Protection Committee adopted an initial strategy to reduce GHG emissions from international shipping
- **The strategy:** Peaking GHG emissions from the sector as soon as possible, a reduction of annual GHG emissions by at least 50 percent by 2050 compared to 2008, while at the same time pursuing efforts toward full decarbonization
- **IMO adopted global data collection system** for fuel consumption for ships from October 2016, which entered into force in March 2018.

World Bank, 2018

Joint Crediting Mechanism (JCM/BOCM) Japan

- Compliments CDM as Japan is out from 2nd Kyoto period, and Paris Agreement Article 6.2
- Signed bilateral document with 17 countries (Thailand Nov 2015, Philippines Jan 2017)
- Japan invests/provides low-carbon technology/products/service etc in emissions reduction projects/programs and get GHG offsets credits (similar to CDM)
- Started as non-tradable credits but with trading possibilities
- Total 180 projects (Feb 2021) - <http://gec.jp/jcm/about/>
- 56 projects already registered and operating and are at various stages (Feb 2021)
- Few projects have already issued credits and shared with host country and Japan (Indonesia, Mongolia, Vietnam, Palau)

<https://www.jcm.go.jp/>

<http://www.mmechanisms.org/e/initiatives/index.html>; Ministry of Environment Japan



AIT

Mongolia

Bangladesh

Ethiopia

Kenya

Maldives

Viet Nam

Laos

Indonesia

Costa Rica

Palau

Cambodia

Mexico

Saudi Arabia

Chile

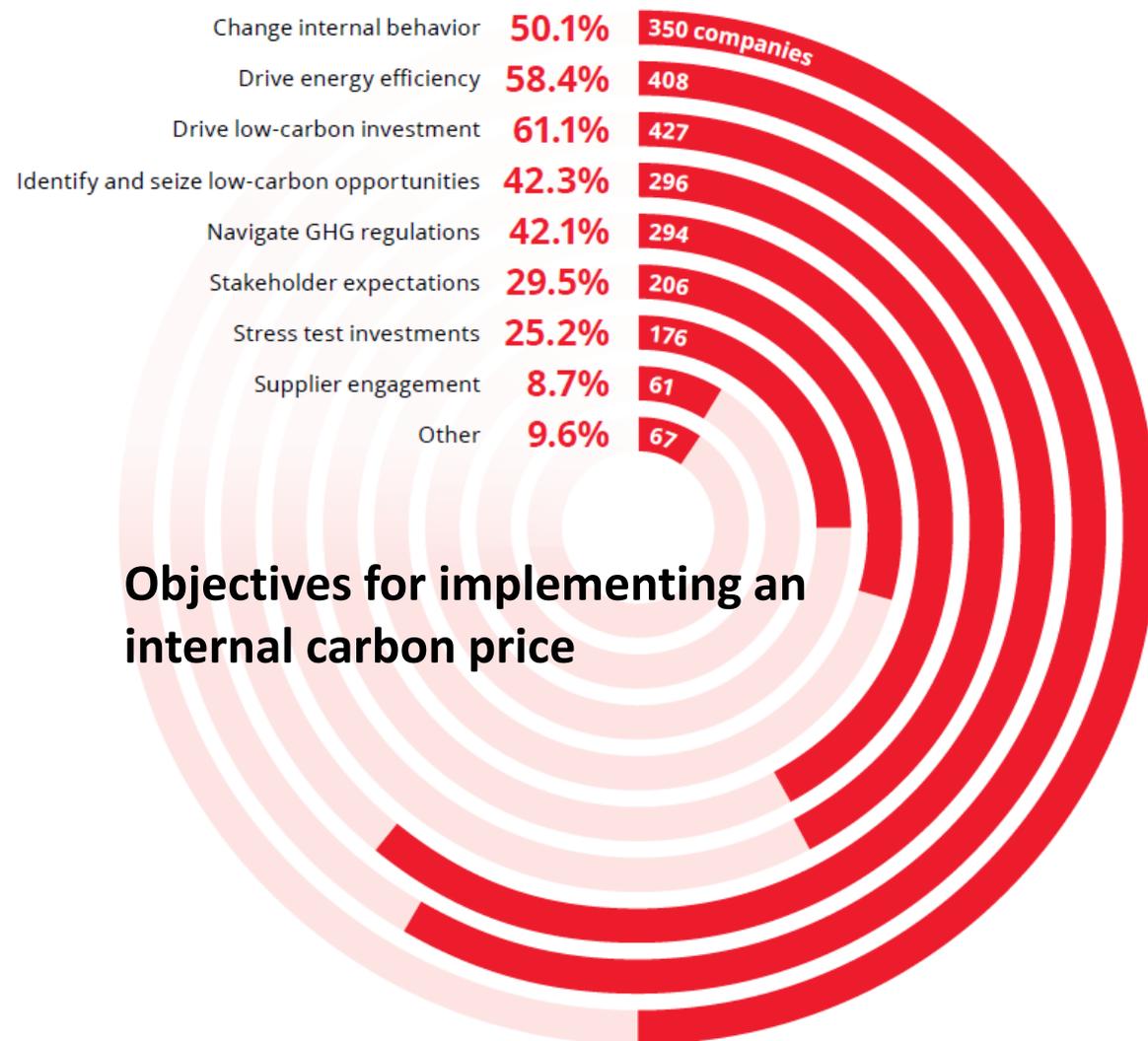
Myanmar

Thailand

Philippines

5. Carbon Insetting in Corporate Sector

- “In 2019, about 1,600 companies disclosed that they are already using internal carbon pricing or anticipating doing so within two years. More than 400 companies reported using a carbon price as a shadow price to monetize the GHG emissions associated with their decisions”.
- “Internal carbon prices companies use, ranging from less than US\$1/tCO₂e to US\$906/tCO₂e”



Internal carbon pricing

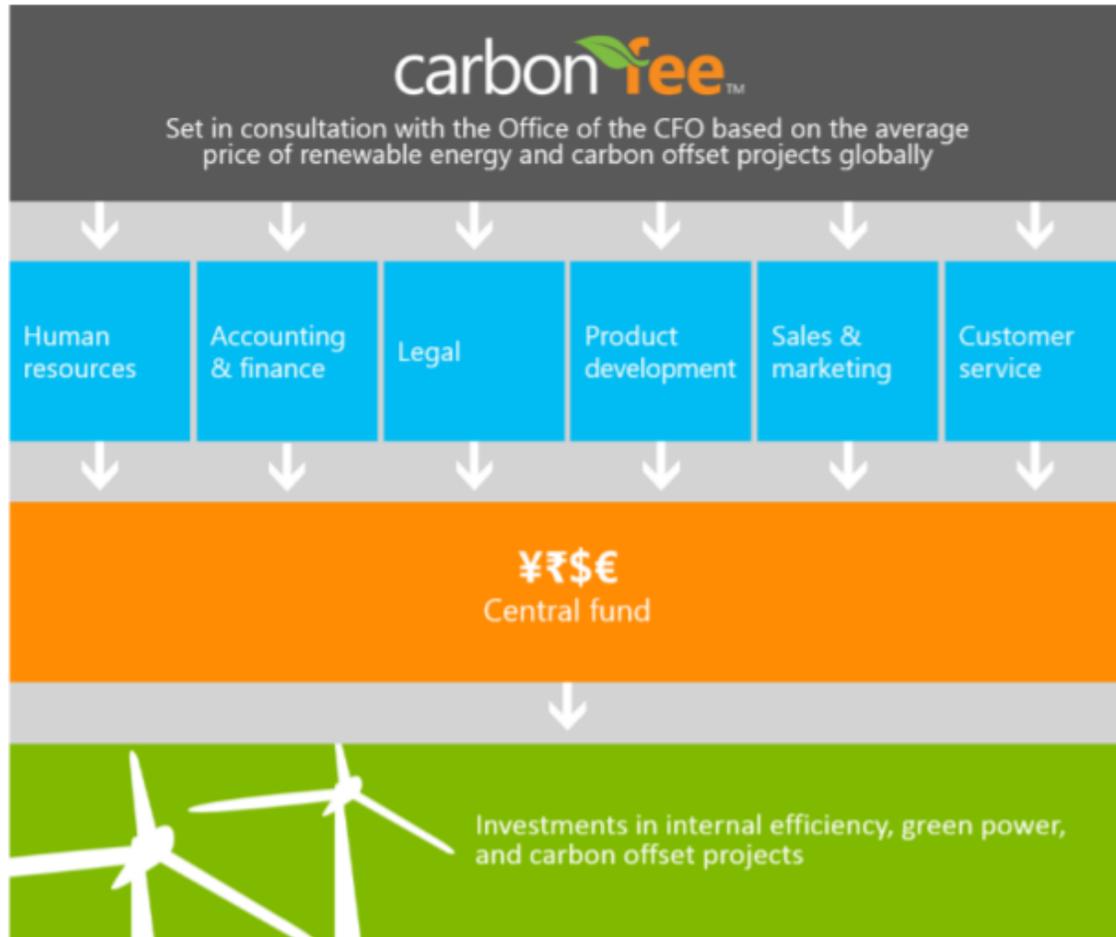
- ❖ Since 2012, **Microsoft** have paid a fee, from \$5 to \$10 per metric ton, on the carbon emissions associated with their electricity consumption and employee air travel. The revenue is used to buy renewable energy, increase energy efficiency and e-waste recycling, and buy carbon offsets. Microsoft has been carbon neutral in its global operations since July 2012.
- ❖ **Shell** has used an internal carbon price of \$40 to \$80 per metric ton since 2000 to evaluate investment decisions. Shell reduced its direct GHG from facilities by 2 million metric tons of carbon dioxide equivalent from 2015 to 2016.
- ❖ **Mahindra & Mahindra (M&M)**, became the first Indian company to launch an internal carbon fee of \$10 per metric ton in 2016. The funds help reduce waste, water usage, and carbon emissions through projects such as LED lighting, energy-efficient motors, and waste-to-energy projects. M&M's goal is to reduce its GHG 25% by 2019 from 2016 levels.
- ❖ Mining company **BHP** has had a shadow price of \$24-\$80 per metric ton of CO₂eq since 2004 to inform decisions to improve energy efficiency, reduce GHG from its existing operations, and diversify its portfolio for a carbon-constrained future. The company reduced emissions 13 percent from 2015 to 2016.
- ❖ **Yale University**: Commitment for carbon neutrality by 2050 → implemented a revenue neutral internal fee on administrative units to incorporate the social costs of climate change into university decisions, raise awareness within the community and inform policy decisions globally

<https://www.c2es.org/2017/09/companies-set-their-own-price-on-carbon/>

State and Trends of Carbon Pricing 2020, The World Bank, Washington DC

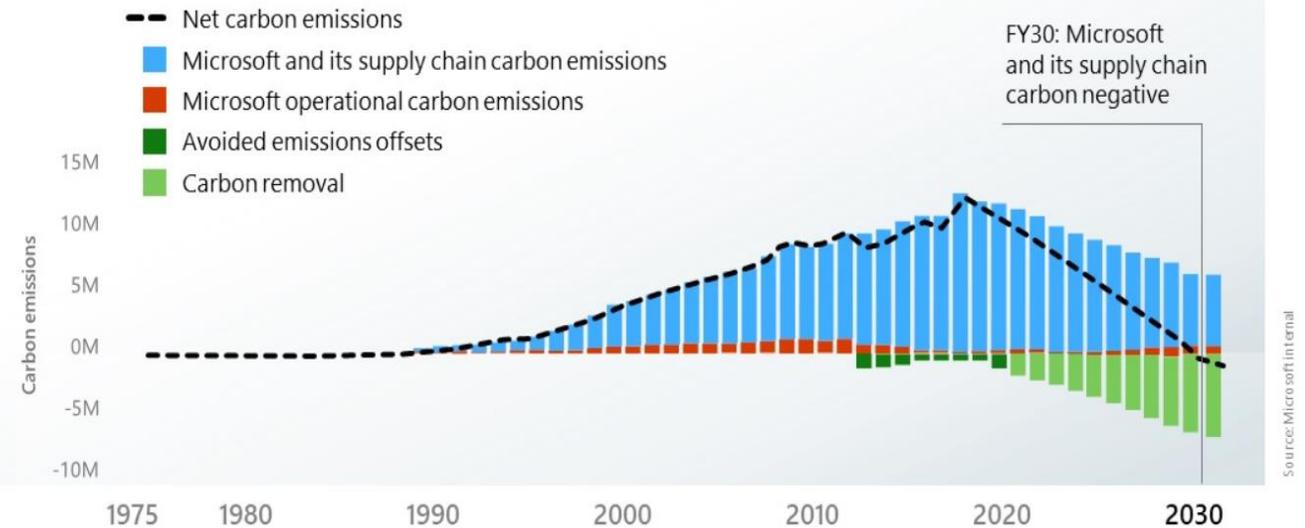


Microsoft



Microsoft's pathway to carbon negative by 2030

Annual carbon emissions



<https://www.microsoft.com/en-us/environment/carbon/our-approach>
<https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/>

<https://www.c2es.org/site/assets/uploads/2017/09/business-pricing-carbon.pdf>

6. Carbon pricing in Paris Agreement

- **Article 6 of the Paris Agreement:** Parties can voluntarily cooperate on the implementation of their NDCs to facilitate higher ambition in mitigation and adaptation actions.
 - Article 6.2: Recognizes that a robust accounting framework for internationally transferred mitigation outcomes (ITMOs) needs to be developed
 - The operationalization of the mechanisms under Article 6 is key for enabling carbon pricing

Key Takeways

- Pricing carbon is key for transformative change – that realization are building up, and on multiple fronts
- Carbon Market are evolving in many new ways despite that it might not be as fast as we want
- The design features of ETS markets are getting more sophisticated
- The price of carbon in these markets are yet low but slowing building on
- Post Paris Agreements developments are key

Thank you

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