Environmental Economics

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ENV-471

Master semester 2 or 4

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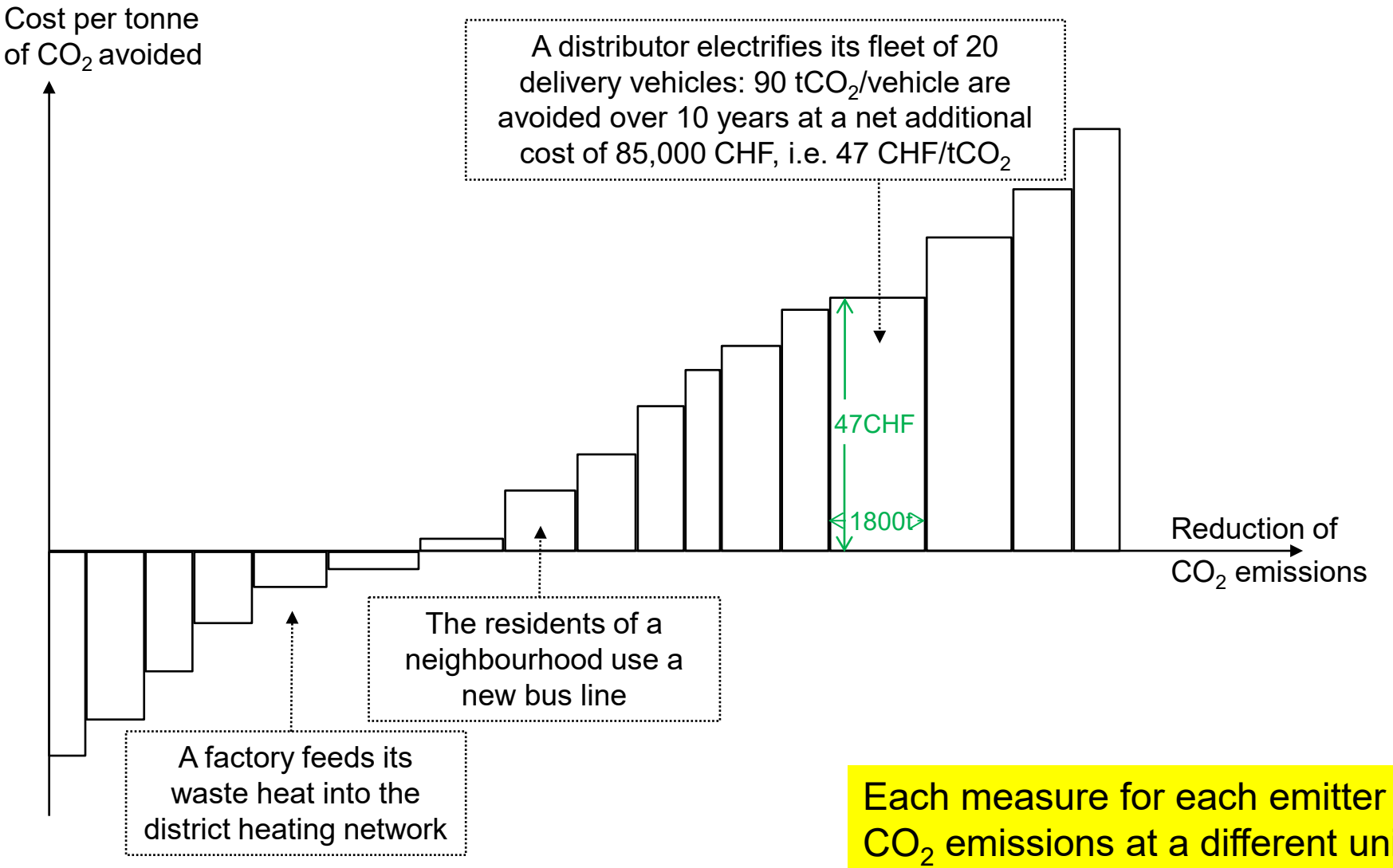
Abatement

ABATEMENT OPTIONS AND INSTRUMENTS FOR PHASING OUT FOSSIL ENERGY

The Problem

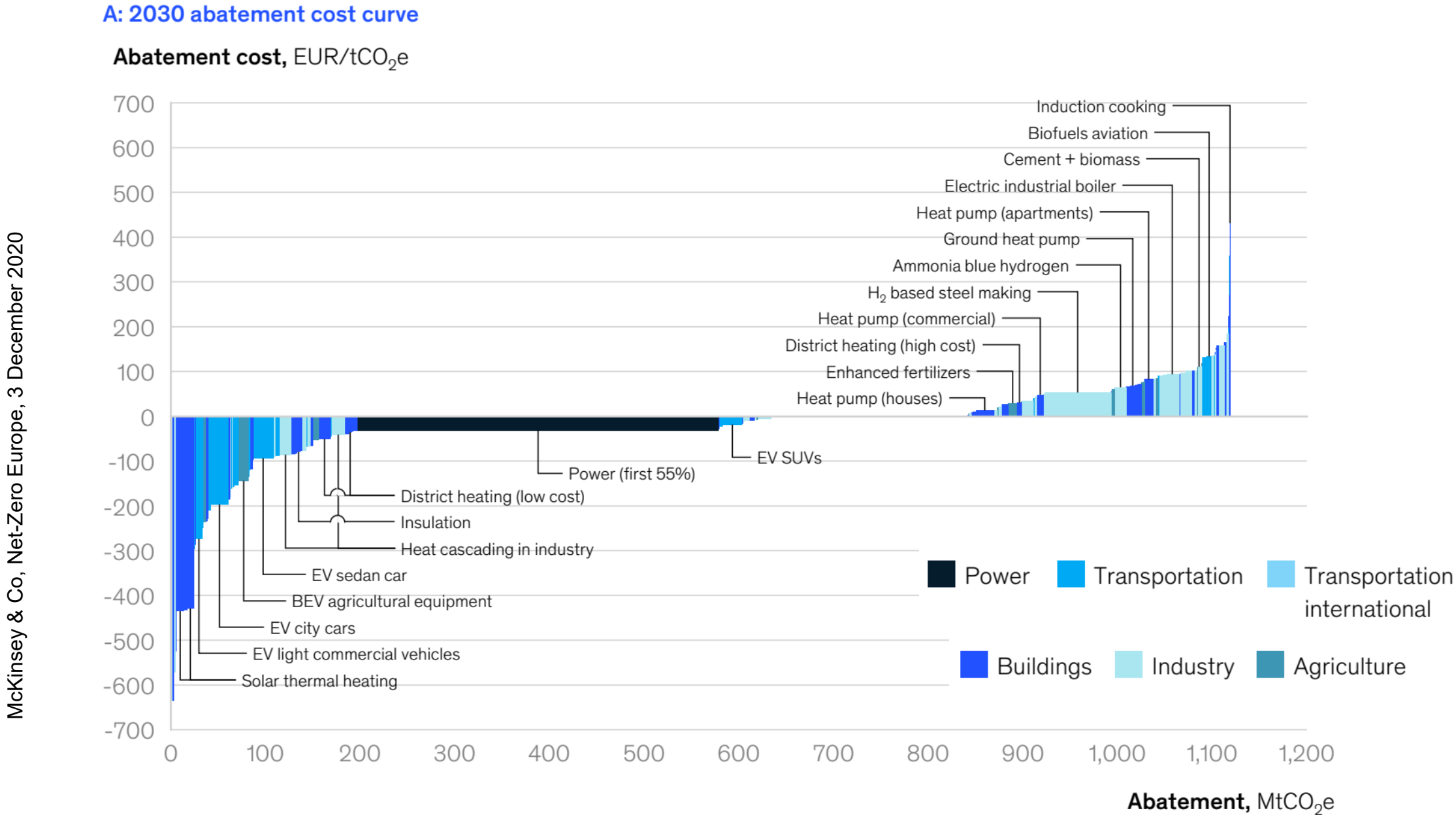
- There are a multitude of sources of CO_2: a multitude of actors and a multitude of actions causing these emissions
- There are therefore a multitude of possible measures to reduce CO_2 emissions
- Example in automotive mobility:
  - Driving more economically (Eco-Drive)
  - Choosing a more energy-efficient car
  - Choosing a car that uses energy with a low CO_2 impact (e.g., electric or hydrogen car)
  - Carpooling
  - Walking, cycling or using public transport
  - Moving less and less far
  - Bringing home and workplace closer together, home office
- **Who should reduce their CO_2 emissions and how?**

If measures could be ordered according to their cost...



Each measure for each emitter reduces CO_2 emissions at a different unit cost

Marginal abatement costs for GHG in the EU

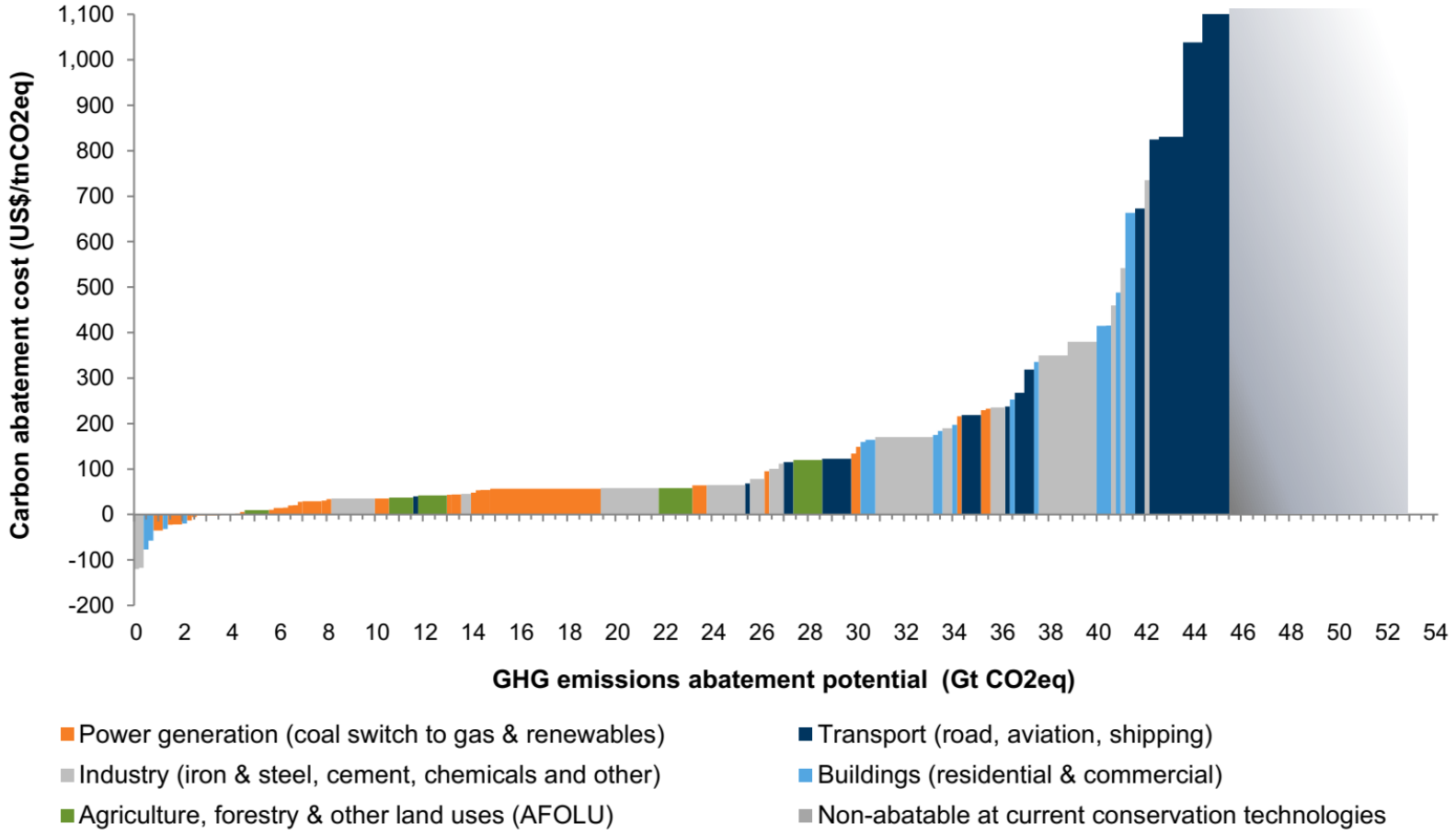


McKinsey & Co, Net-Zero Europe, 3 December 2020

Marginal abatement costs for world GHG

Exhibit 13: The cost curve of de-carbonization has transformed, with new technology additions and cost deflation in others expanding the total GHG emissions abatement potential while widening the range of low-cost investment opportunities

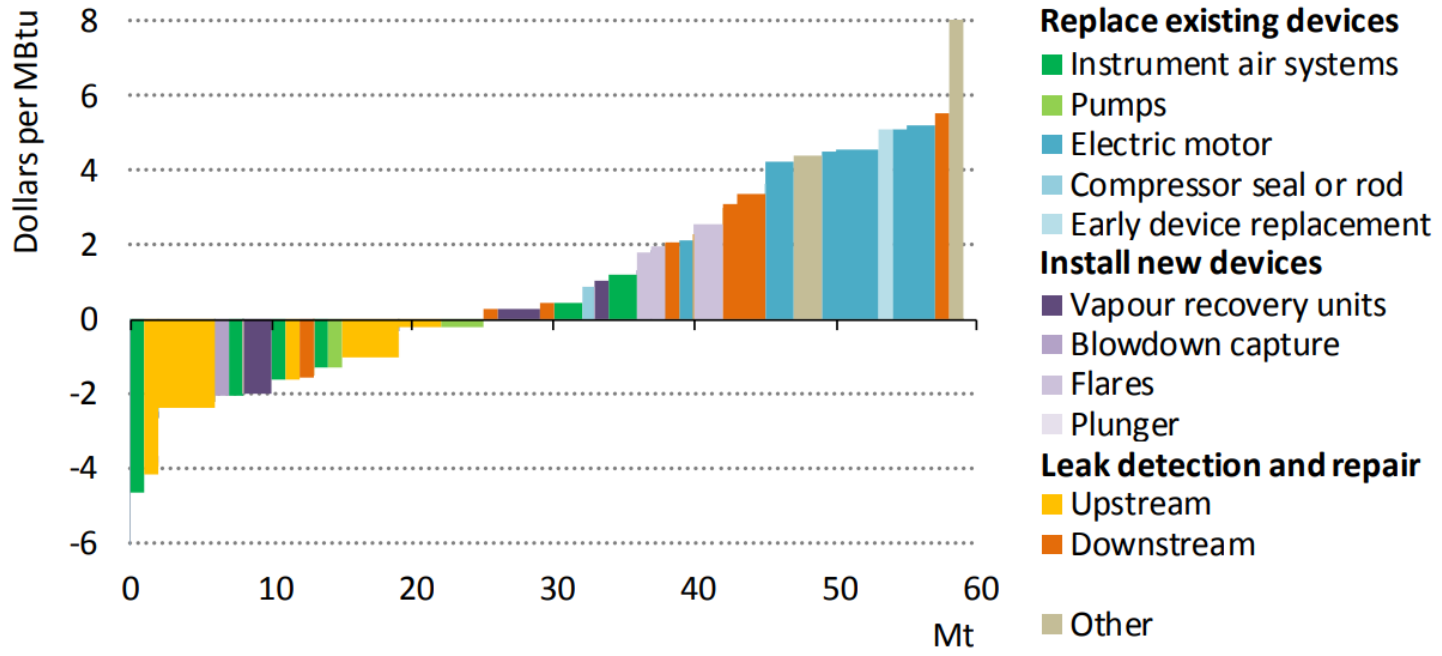
2020 conservation carbon abatement cost curve for anthropogenic GHG emissions, based on current technologies and current costs, assuming economies of scale for technologies in the pilot phase



Goldman Sachs, Carbonomics - Innovation, Deflation and Affordable De-carbonization, EQUITY RESEARCH, October 13, 2020

MAC for world methane emissions

Figure 2.29 ▷ Marginal abatement cost curve for oil- and gas-related methane emissions by mitigation measure, 2019

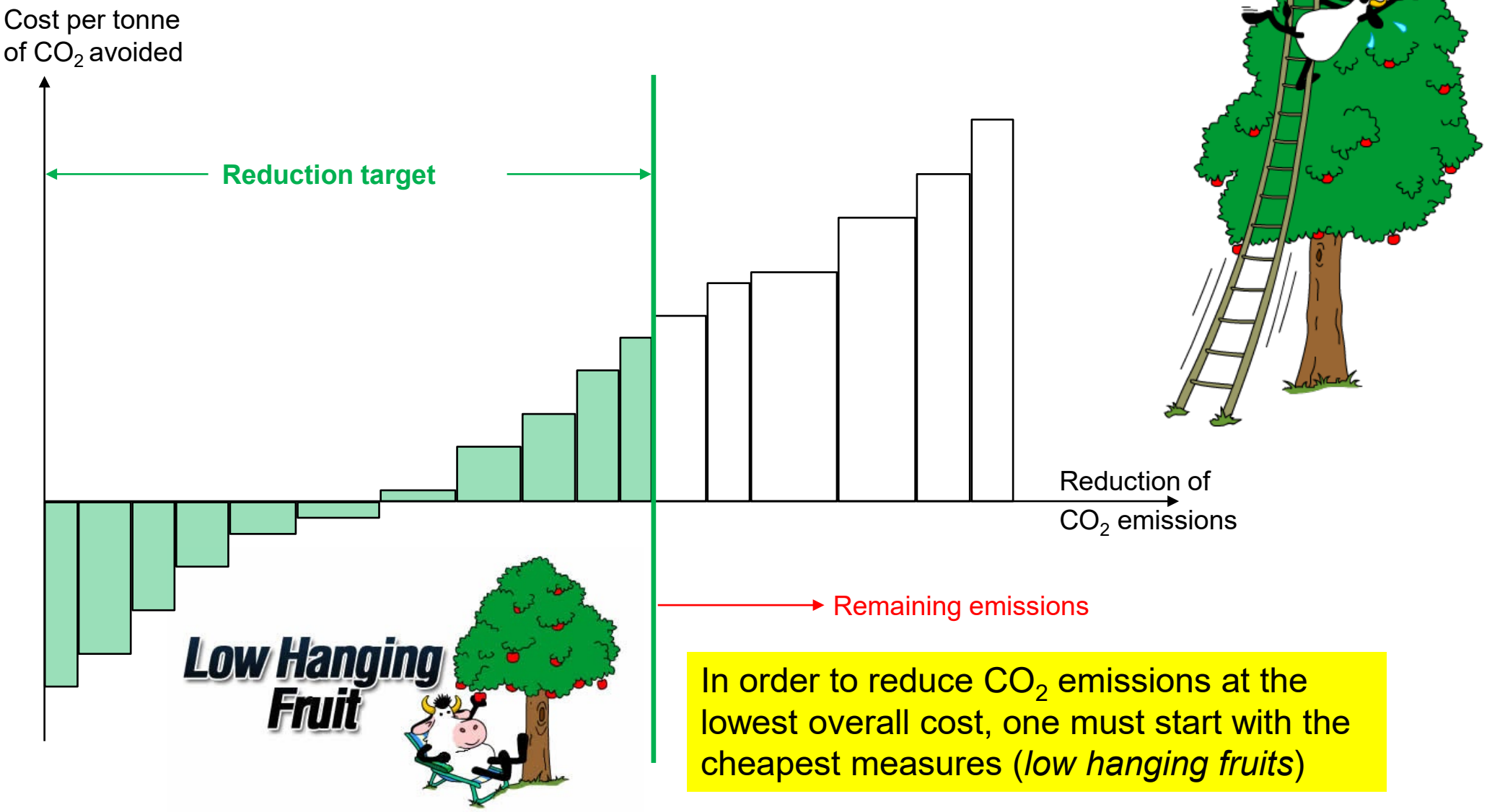


It is technically possible to reduce methane emissions from oil and gas operations by nearly 60 Mt; many of these emissions could be avoided at no net cost.

Note: MBtu = million British thermal units.

IEA, Sustainable Recovery, World Energy Outlook Special Report in collaboration with the International Monetary Fund, 2020

Start with the least expensive measures

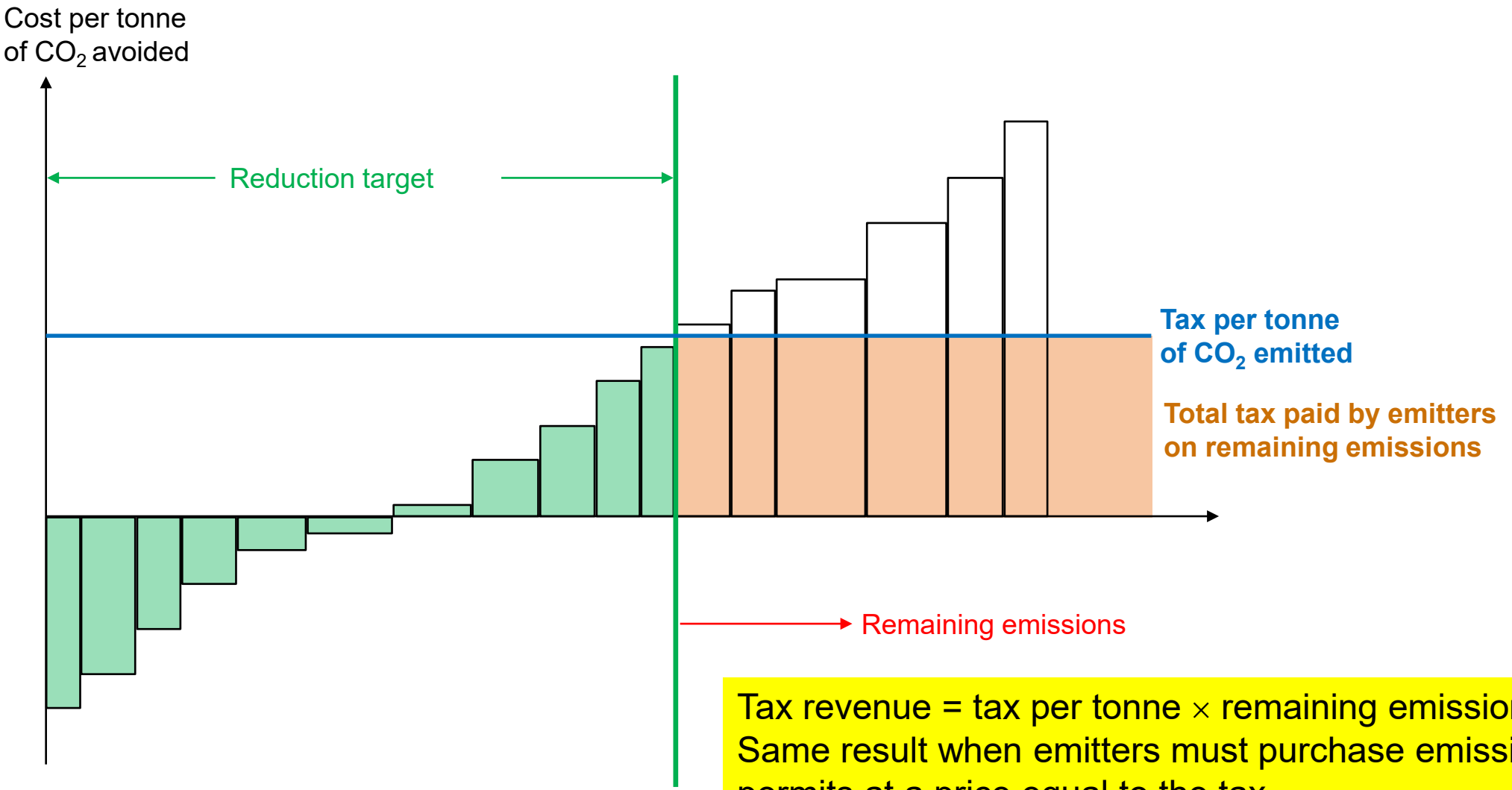


In order to reduce CO_2 emissions at the lowest overall cost, one must start with the cheapest measures (*low hanging fruits*)

Price on emissions

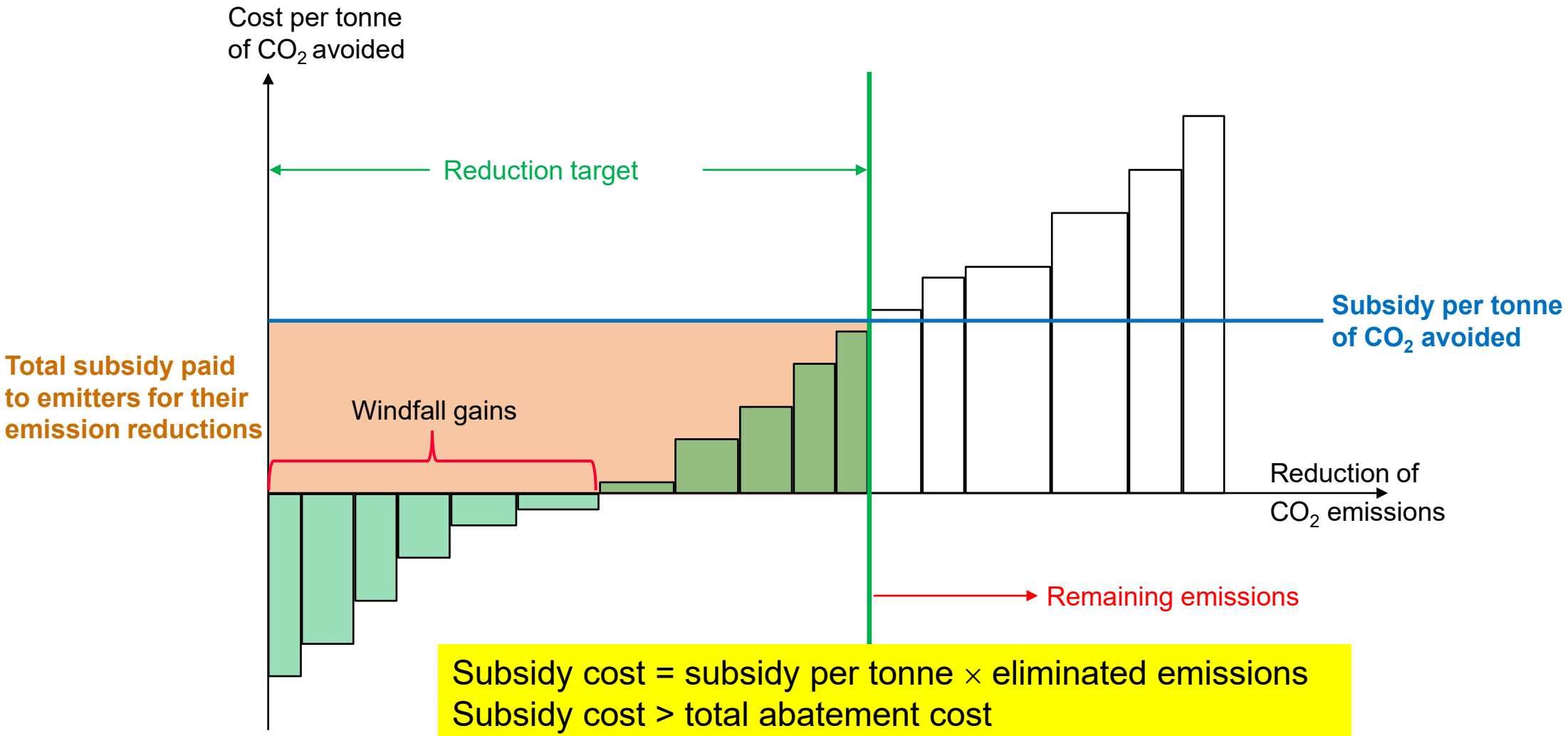
A uniform price for all CO_2 emissions reduces emissions in a decentralised manner at minimum overall cost

Price on emissions
- incentive tax -



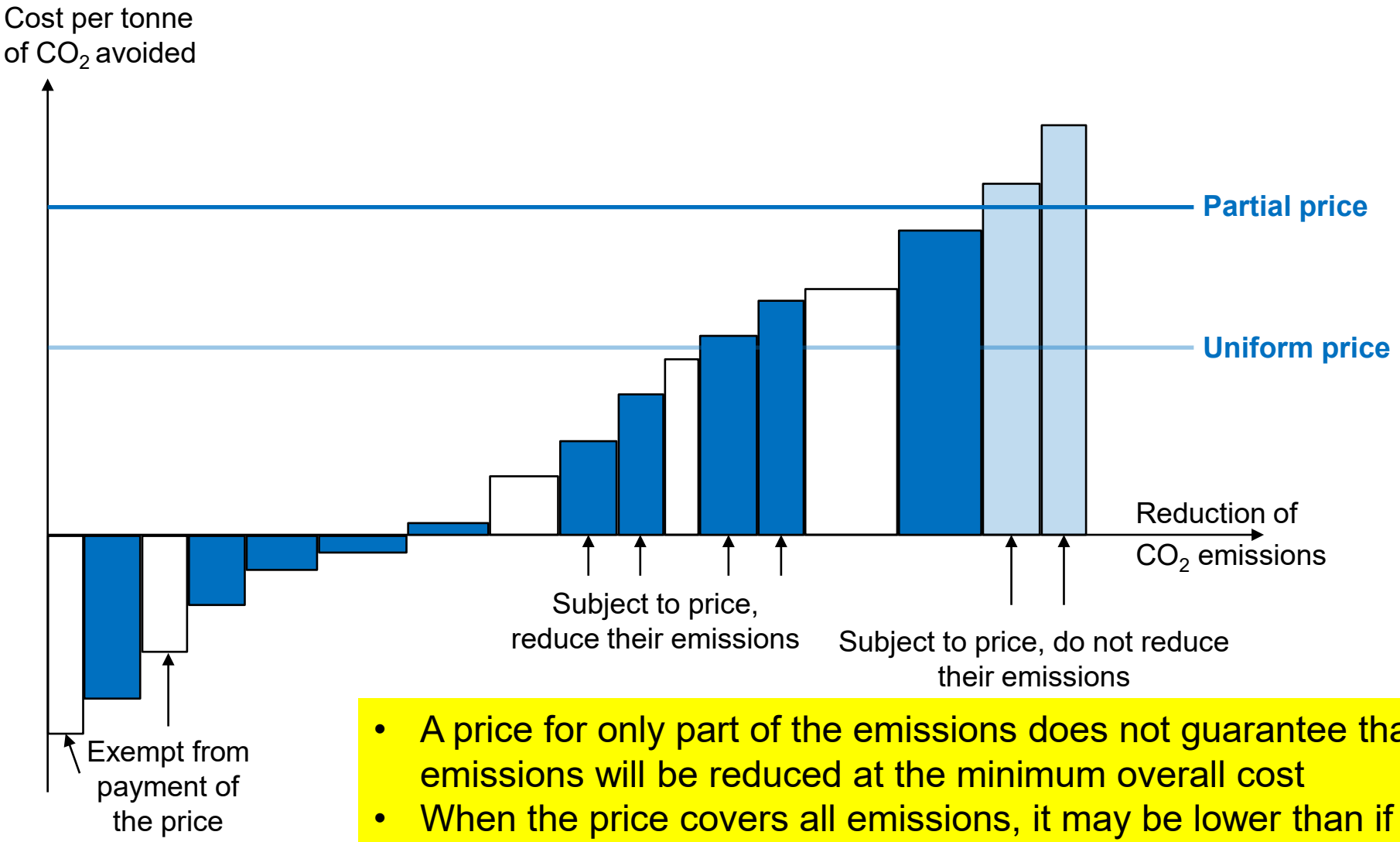
Tax revenue = tax per tonne × remaining emissions
Same result when emitters must purchase emission permits at a price equal to the tax

Price on emissions
- incentive subsidy -



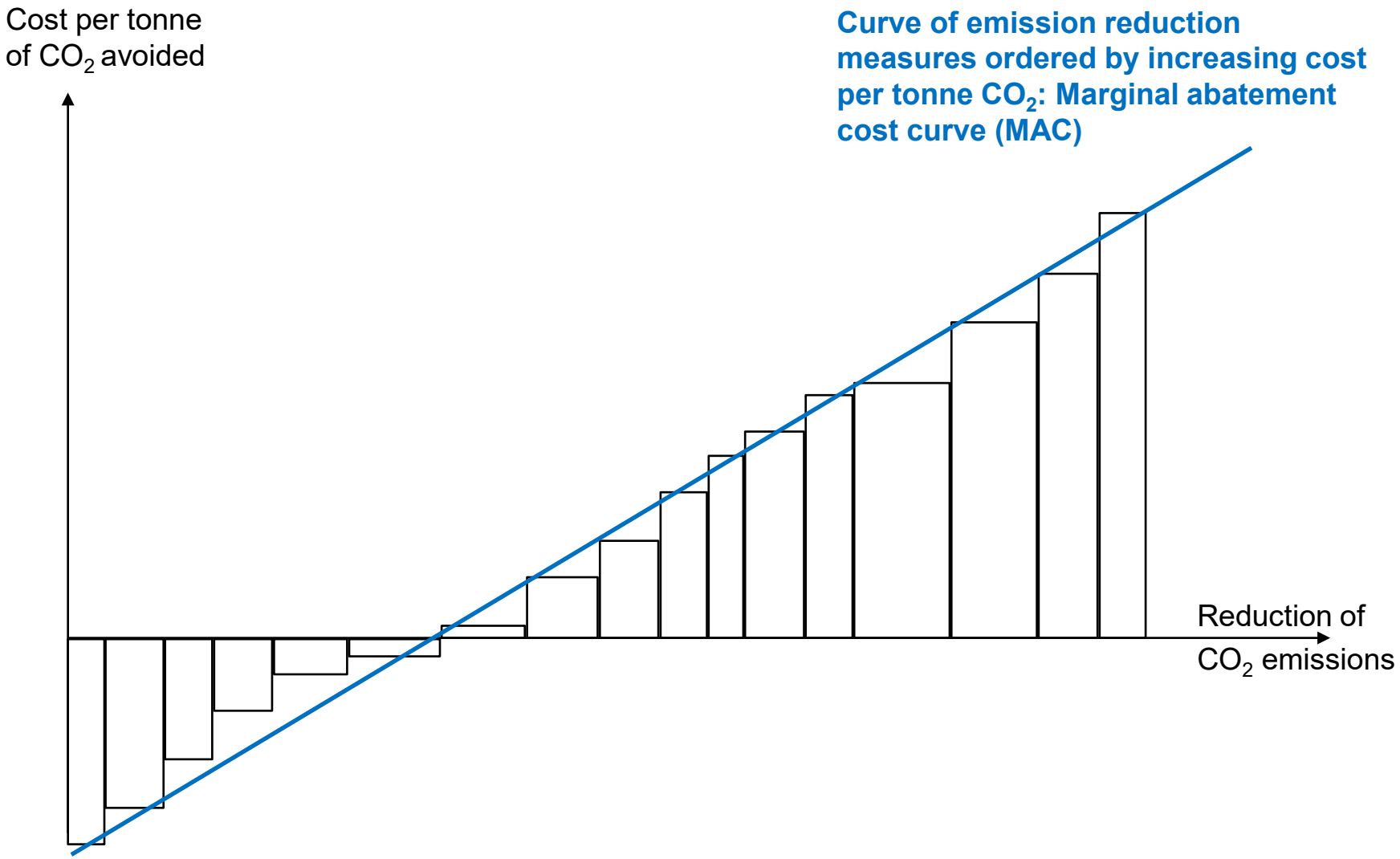
Subsidy cost = subsidy per tonne × eliminated emissions
Subsidy cost > total abatement cost
Same result if all emitters are granted emission permits
and State buys them back at rate of subsidy

Price on part of the emissions only (exemptions for some emitters)

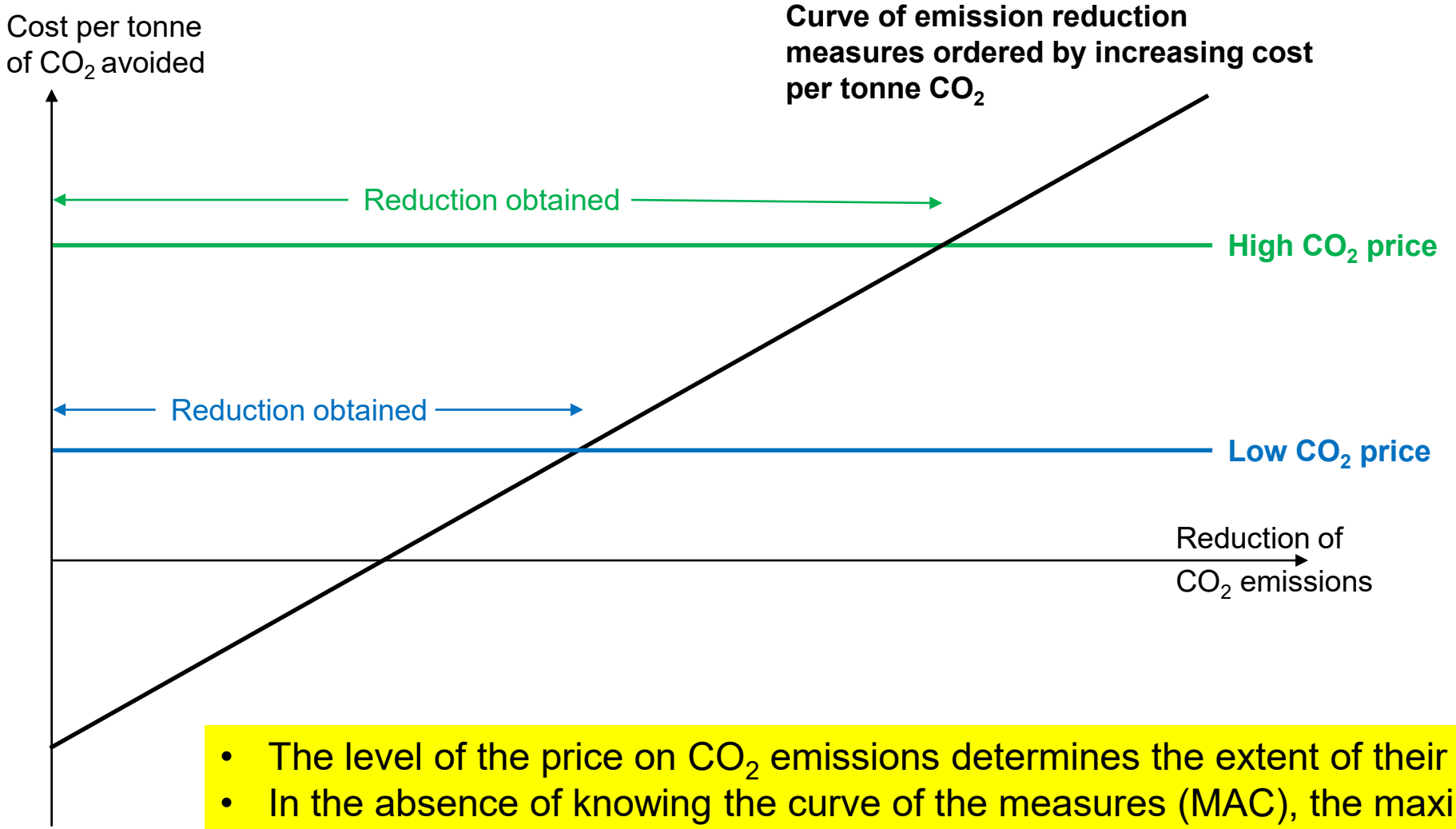


- A price for only part of the emissions does not guarantee that emissions will be reduced at the minimum overall cost
- When the price covers all emissions, it may be lower than if it covers only some of the emissions

Simplifyed curve of possible measures

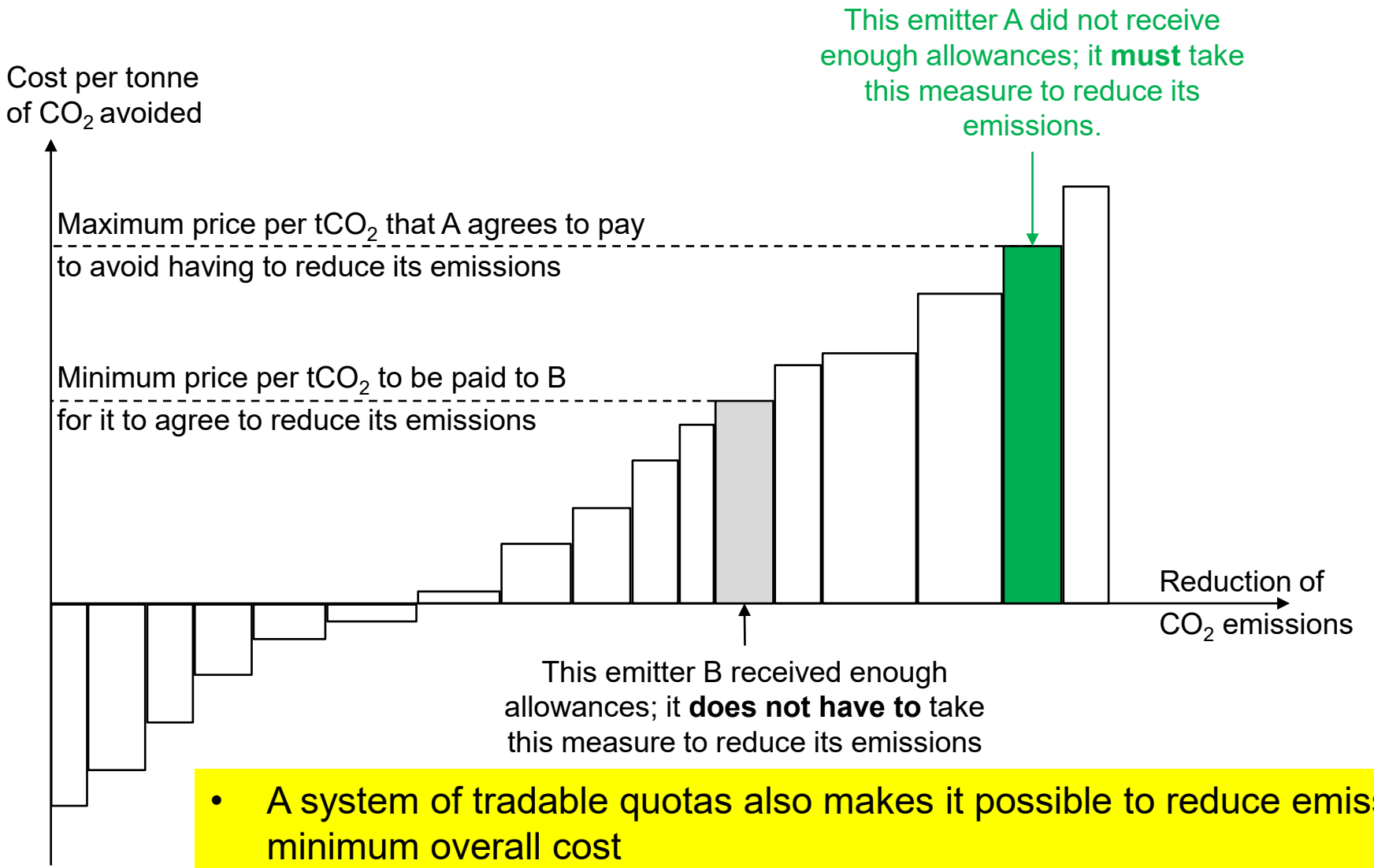


Effect of price changes on emissions



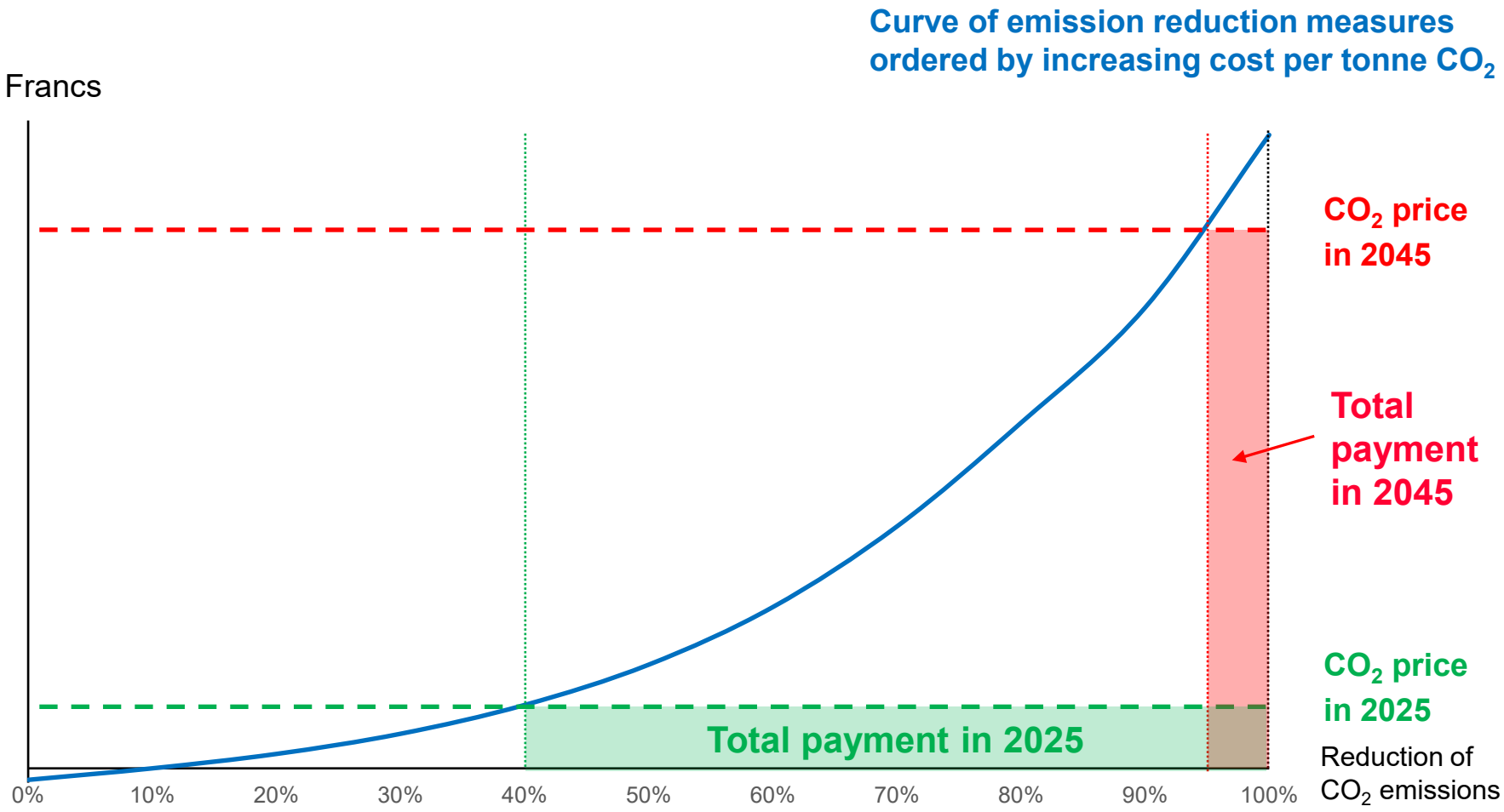
- The level of the price on CO_2 emissions determines the extent of their reduction
- In the absence of knowing the curve of the measures (MAC), the maximum cost of the measures per ton CO_2 is predictable, but not the extent of the reductions

Tradable emissions allowances (*cap & trade*)



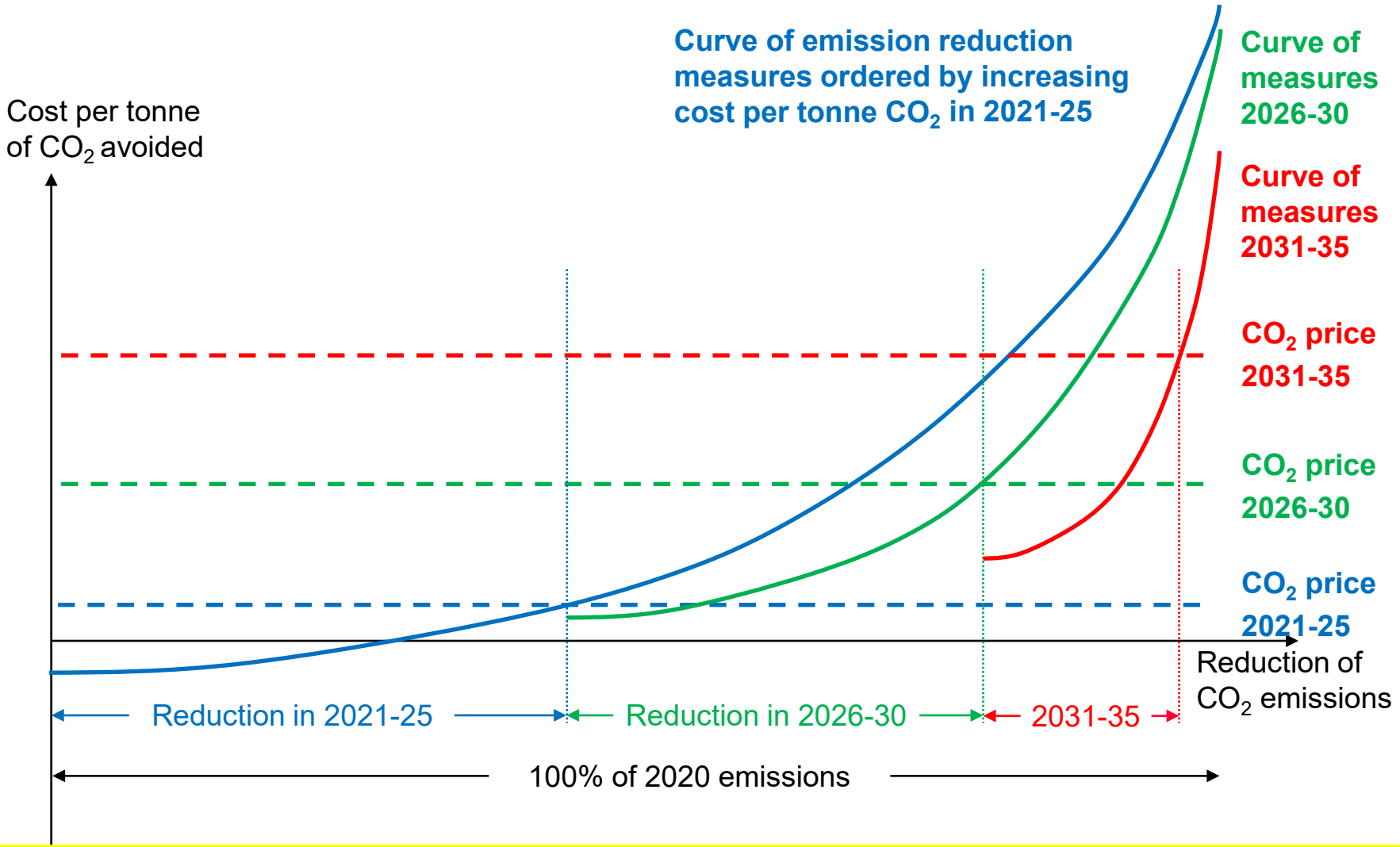
- A system of tradable quotas also makes it possible to reduce emissions at minimum overall cost
- If the curve of possible measures is not known, the magnitude of the remaining emissions can be predicted (= cap), but not the cost of the measures

Dynamic perspective



- The price of CO_2 will have to be continually increased to achieve full decarbonisation
- When the price will be very high, it will be paid by almost nobody

Dynamic perspective

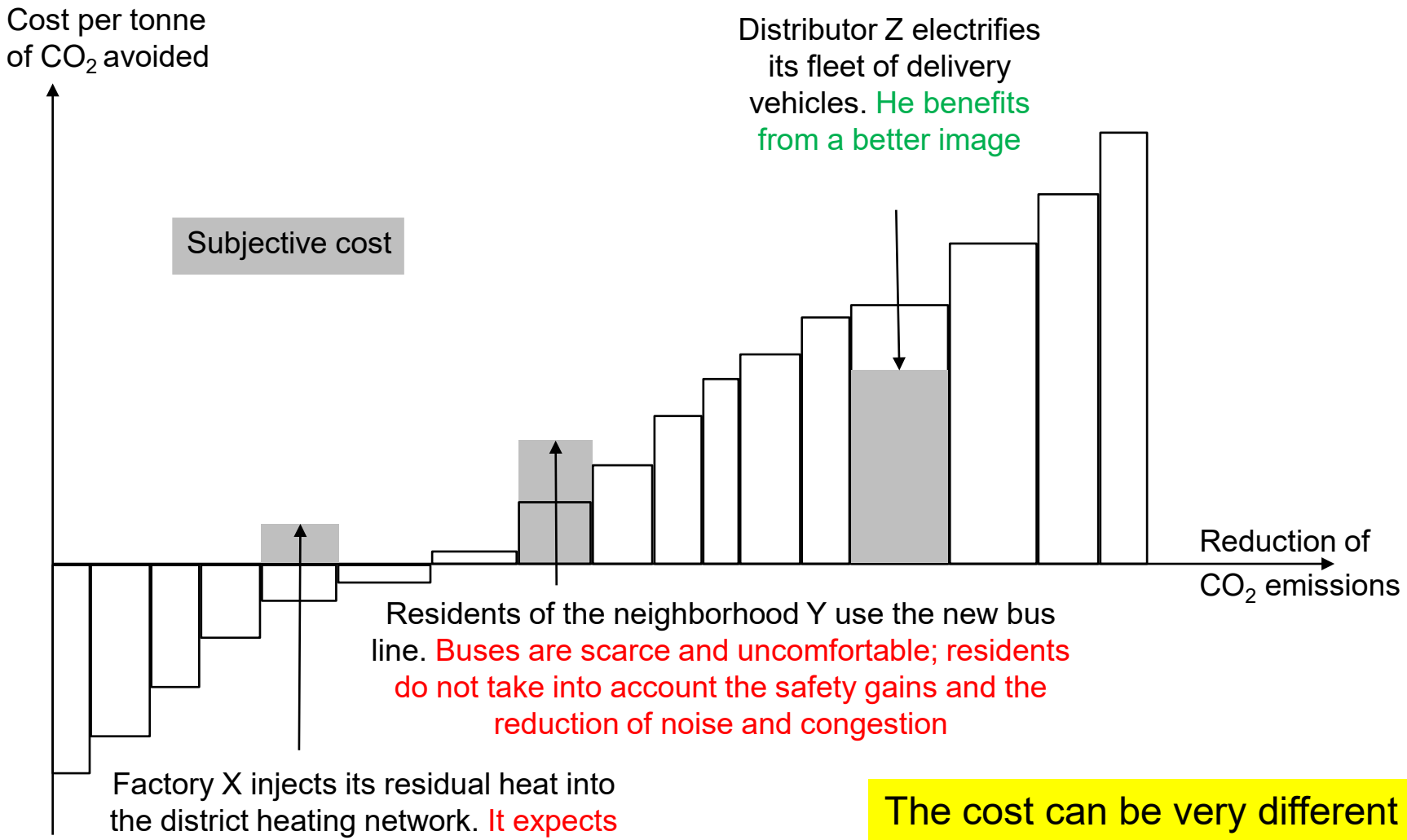


- Technical progress is lowering the cost of the measures, so more emission reductions can be achieved at the same CO_2 price
- However, the price of CO_2 will still have to rise continuously to move towards total decarbonisation

Intermediate conclusions

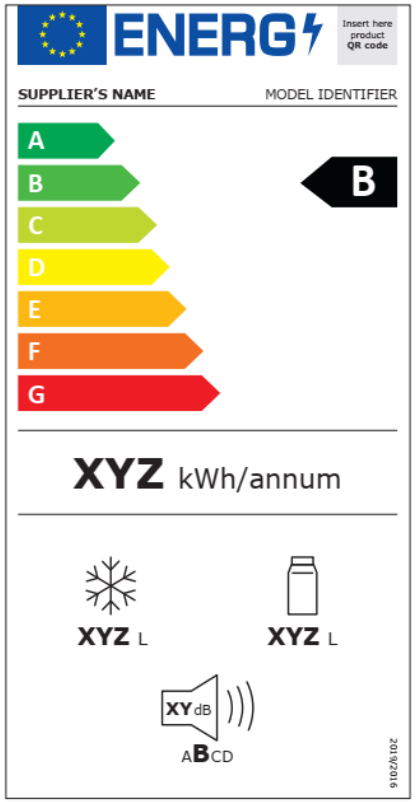
- **Market-based instruments** leave it up to emitters to choose whether and how they want to reduce their emissions
- When these instruments give the same price signal to all emitters, **they ensure that the overall reduction in emissions is achieved at the lowest overall cost…**
- **... provided that emitters take all costs and savings into account in their calculations**
- Examples of discrepancies:
  - Not all costs are borne by the emitters themselves (e.g. landlord-tenant)
  - Emitters calculate the profitability of a measure over a very short period of time (application of the CO_2 Act: 4 years, 8 years for buildings!)
  - They do not take into account all the effects of a measure over its life cycle (e.g. effects on third parties, sharing of experience) → **co-benefits**
  - They do not know all the options for reducing their emissions
- This concerns both businesses and consumers

Differences between objective and subjective costs

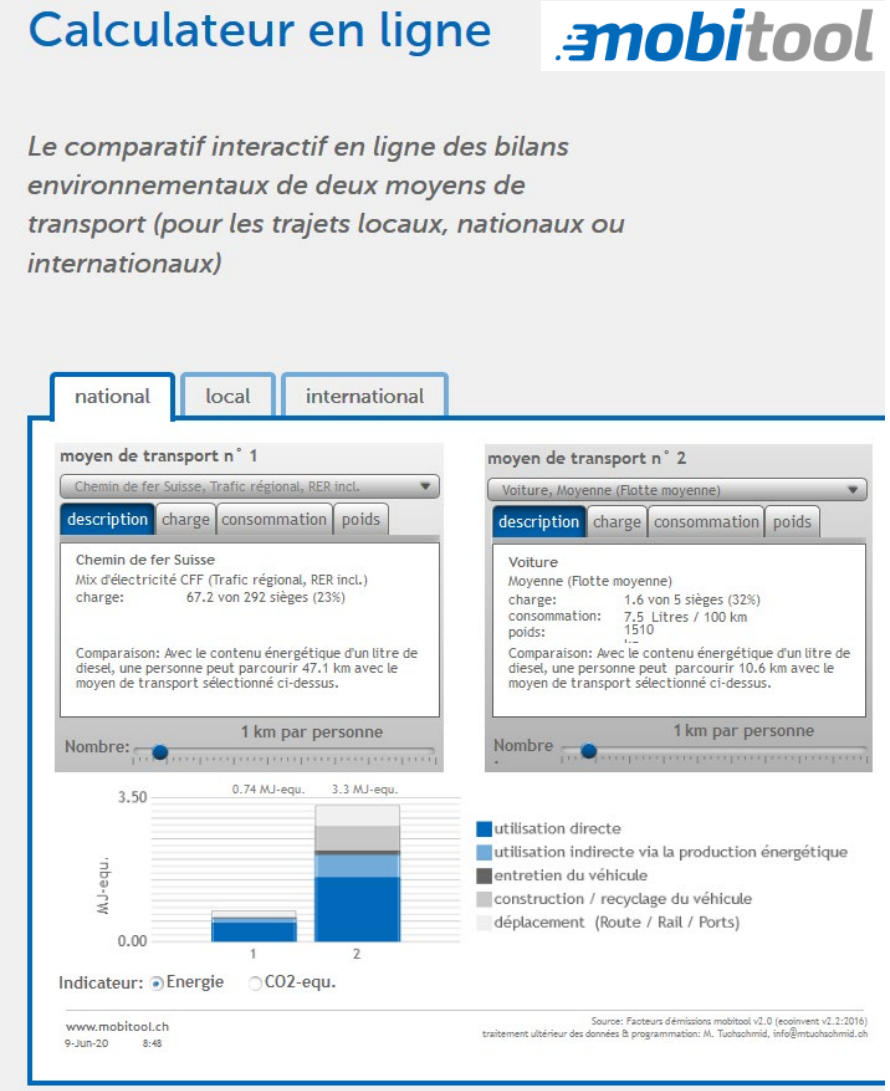


The cost can be very different as seen by the emitter ("subjective") or in the public interest ("objective")

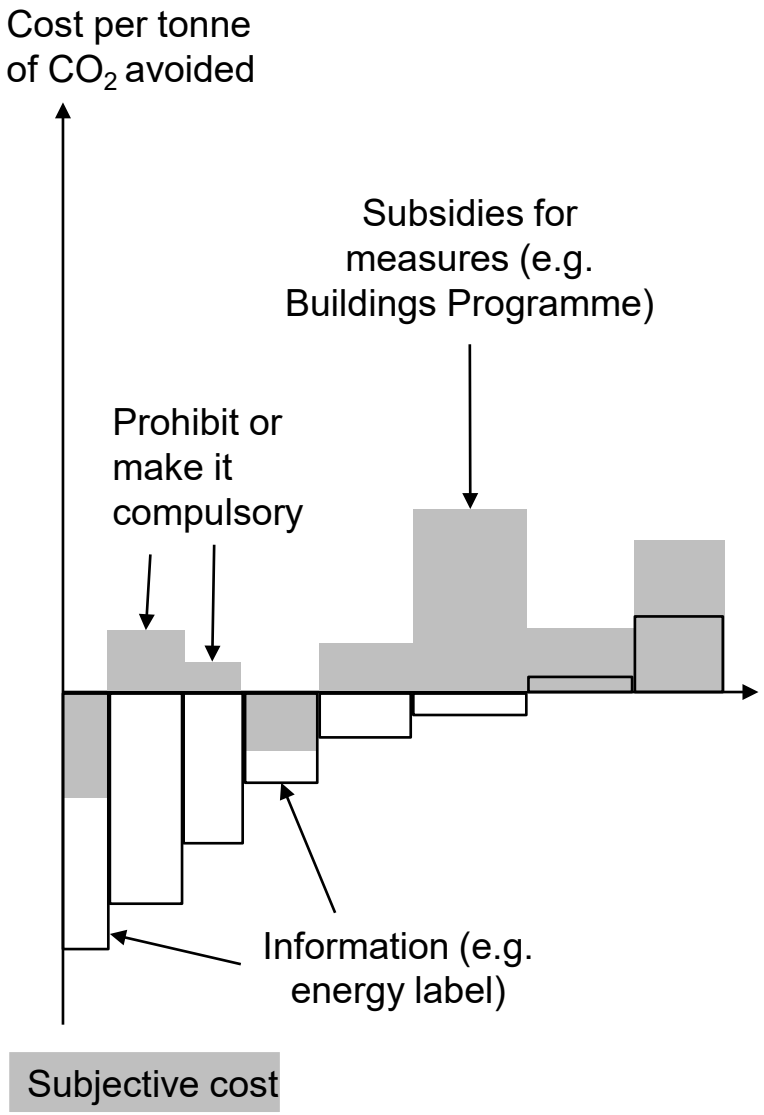
Reconciling subjective costs with objective costs



Less advertising for F & G class cars and more for A & B class cars...



A bundle of State interventions



- Imposing measures that are clearly beneficial (e.g. ban incandescent light bulbs; limit emissions for new cars)
- Granting specific incentives for measures with low objective costs (e.g. energy-efficient electrical appliances, electric cars)
- Directing funding towards low objective cost measures, overcoming the problem of high initial cost and short time horizon
- Supporting public infrastructure (e.g. public transport, bicycle lanes)

- A bundle of targeted interventions brings subjective costs closer to objective costs
- There still needs to be a price on CO_2 emissions

Intermediate conclusions

- **Pure market instruments** do not achieve emission reductions at the minimum cost in the real world
- A **bundle of complementary interventions "**better" achieves the goal (cf. the measures taken by cities in the field of mobility)
- "Better" means:
  - More effective
  - More acceptable: coherence of public interventions, support for decarbonisation, compensation for high burdens
- But it is more complicated:
  - Windfall effects, administrative costs
  - How can this be reconciled with the uniform price for all emitters? Example: instead of refunding the CO_2 tax to certain companies in exchange for a few reductions or letting them buy EU-ETS certificates for their emissions, set a cap on their emissions (according to *best in* class) and make them pay the full CO_2 price for their emissions above that cap
- **It will take all of this to phase out fossil fuels by 2050**

Final conclusions

- The price of CO_2 emissions will have to rise continuously in order to get completely out of fossil fuels by 2050
- Almost nobody will pay the very high emission price!
- Moreover, the revenue, if it is a tax, will tend towards zero
- This does not mean that decarbonisation costs nothing: sum of the costs of measures (including negative-cost measures)
- This can be mitigated through technical progress, a package of support measures and social cushioning measures
- As many types of equipment using fossil fuels have a long life span, it is important to stop installing them; otherwise, they will lock in emissions or become *stranded assets*

RESERVE

Tradable emissions allowances (*cap & trade*)