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Agricultural Policy & Climate Change

Summer School Climate Change Impacts on the MED agro food chain

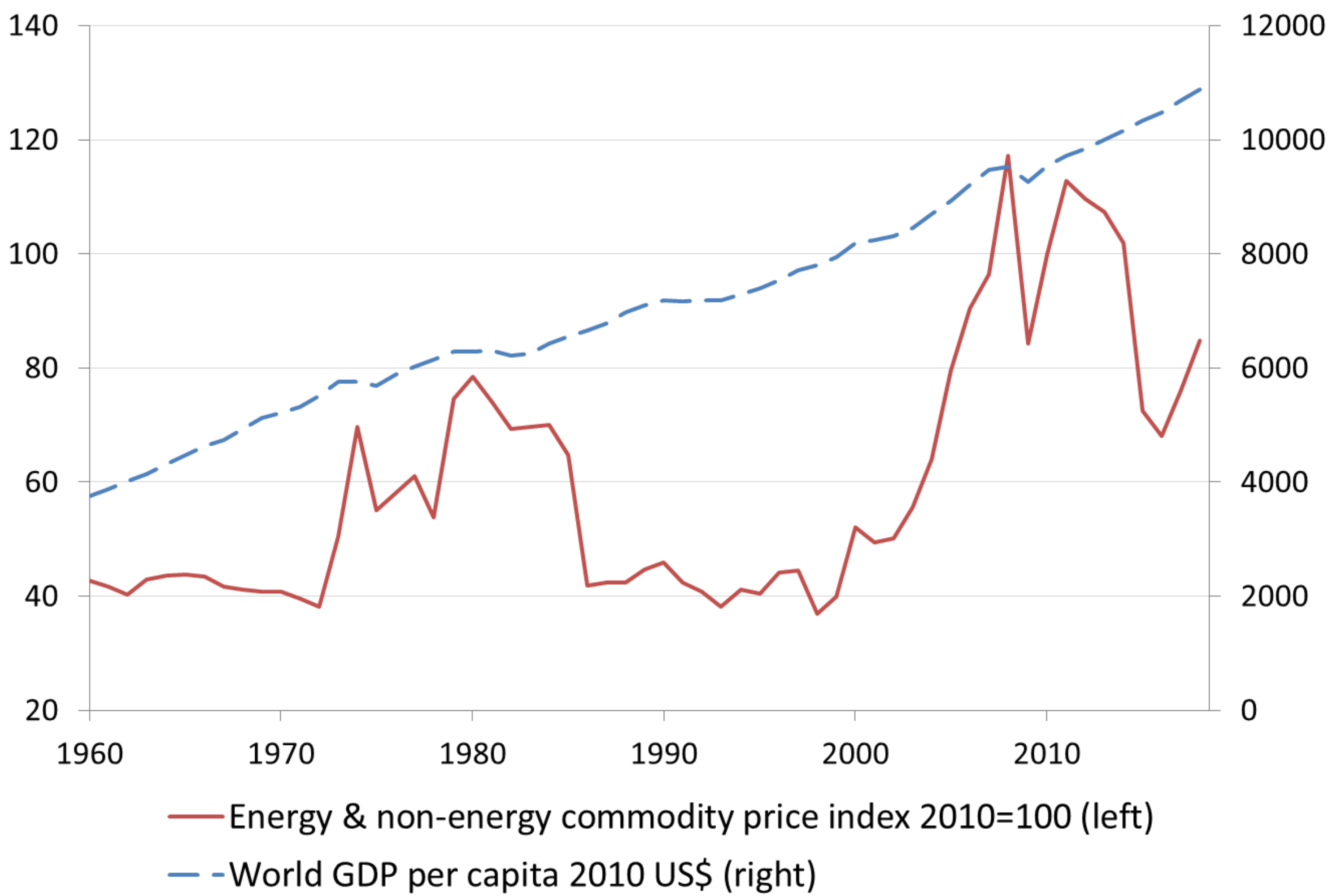
Schloss Rauischholzhausen 12 Sep 2019

Lecture overview

I. The economic approach to abatement policy: costs vs benefits
II. Selected policy options
III. Specific challenges in climate change mitigation policy: vicious circles, collective action, future generations
IV. Policy areas in agriculture & food

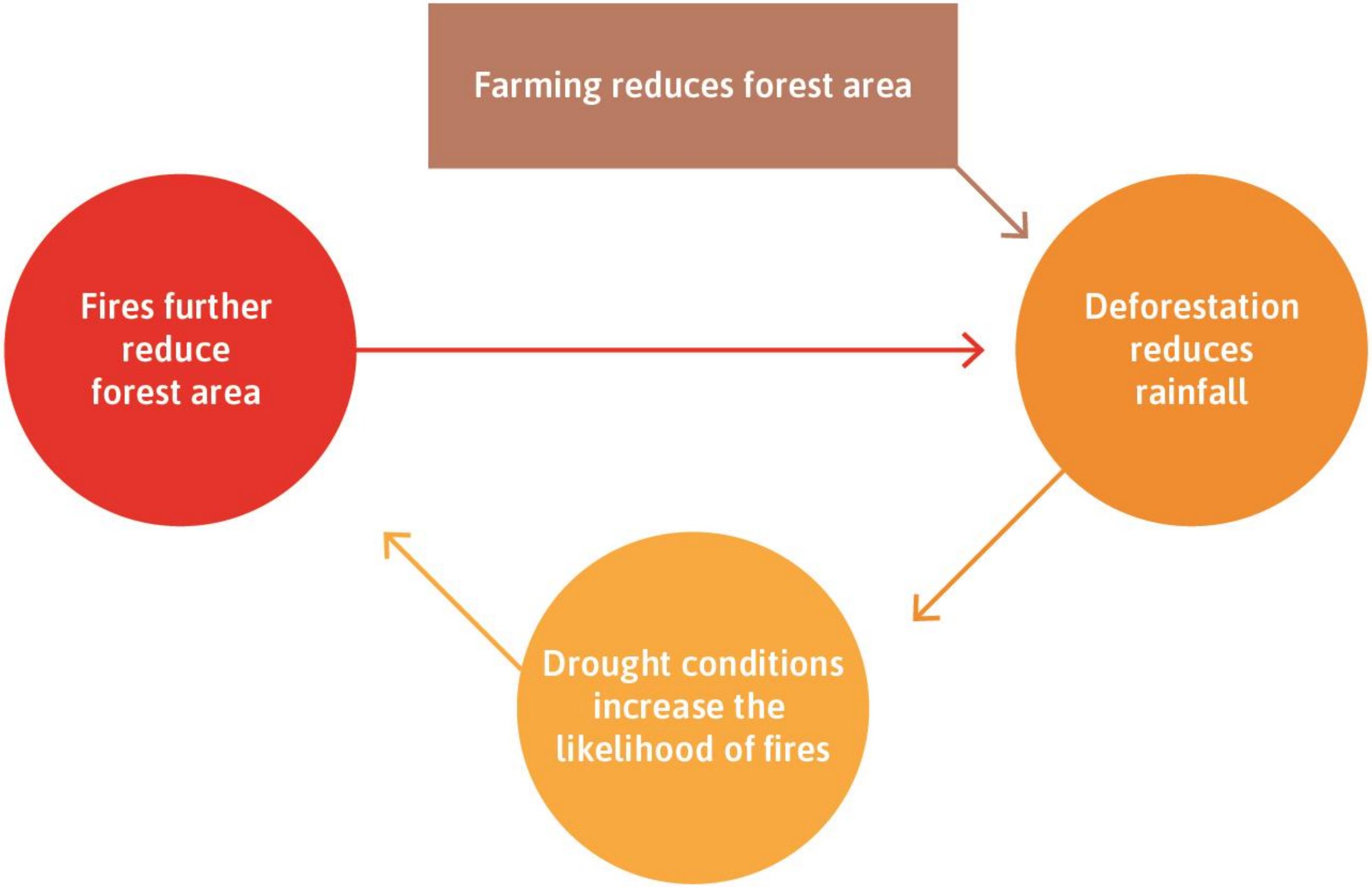
Part I:
The economic approach to abatement policy

Global resource prices & income per capita



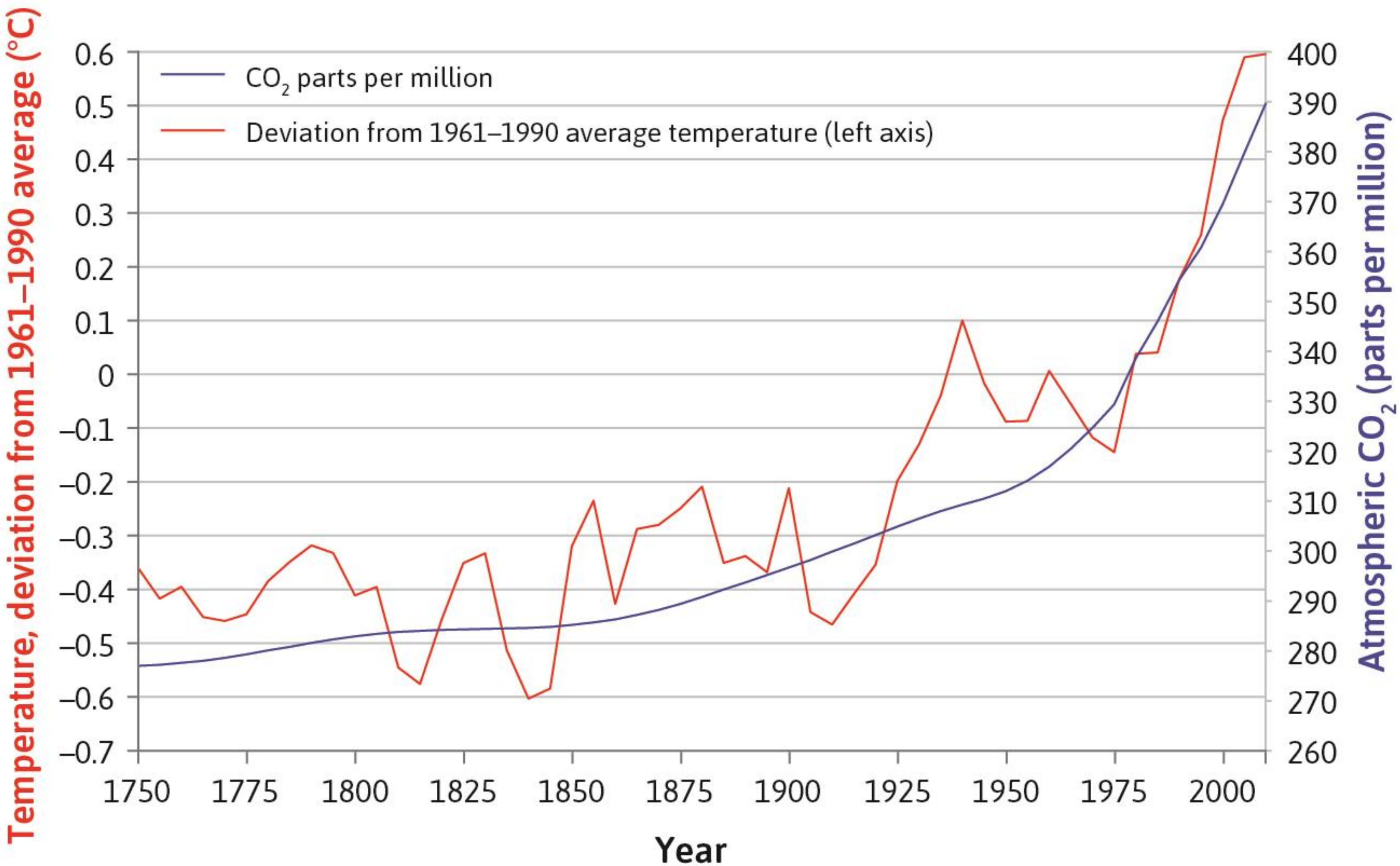
Source: World Bank, CORE 2017 The Economy, p. 902, https://www.core-econ.org.

Runaway deforestation in the Amazon?



Source: CORE 2017 The Economy, p. 904.

Climate change: the record



Source: CORE 2017 The Economy, p. 908, https://www.core-econ.org.

Abatement policies

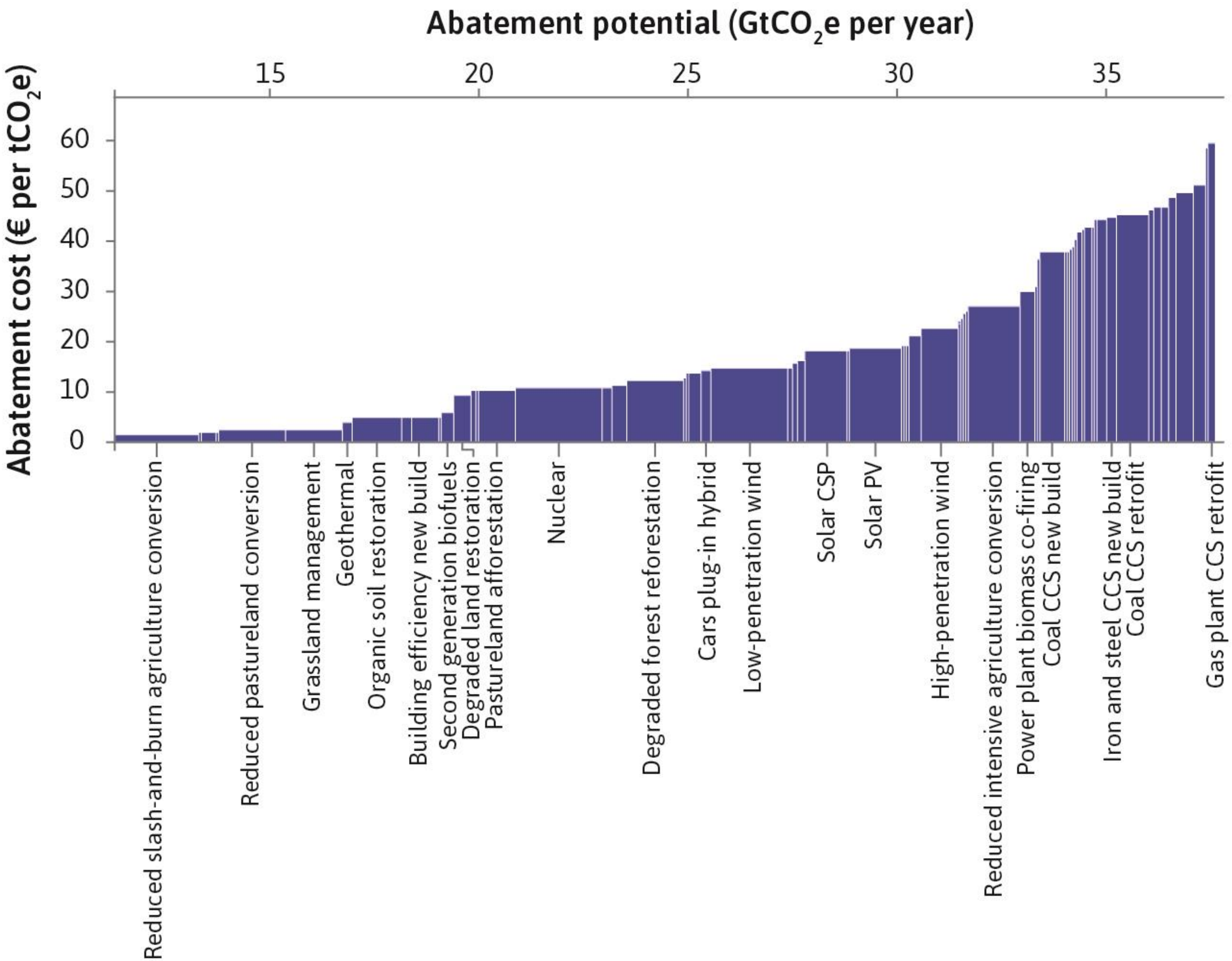
- Discovering & adopting less natural-resource intensive technologies
- Consume less environmentally damaging goods
- Limiting or banning use of environmental harmful substances or activities

Some pertinent questions

- What’s the trade-off between consuming more goods & a less degraded natural environment?
- How should we value environmental quality?
- How should we trade off consumption now vs consumption by future generations?

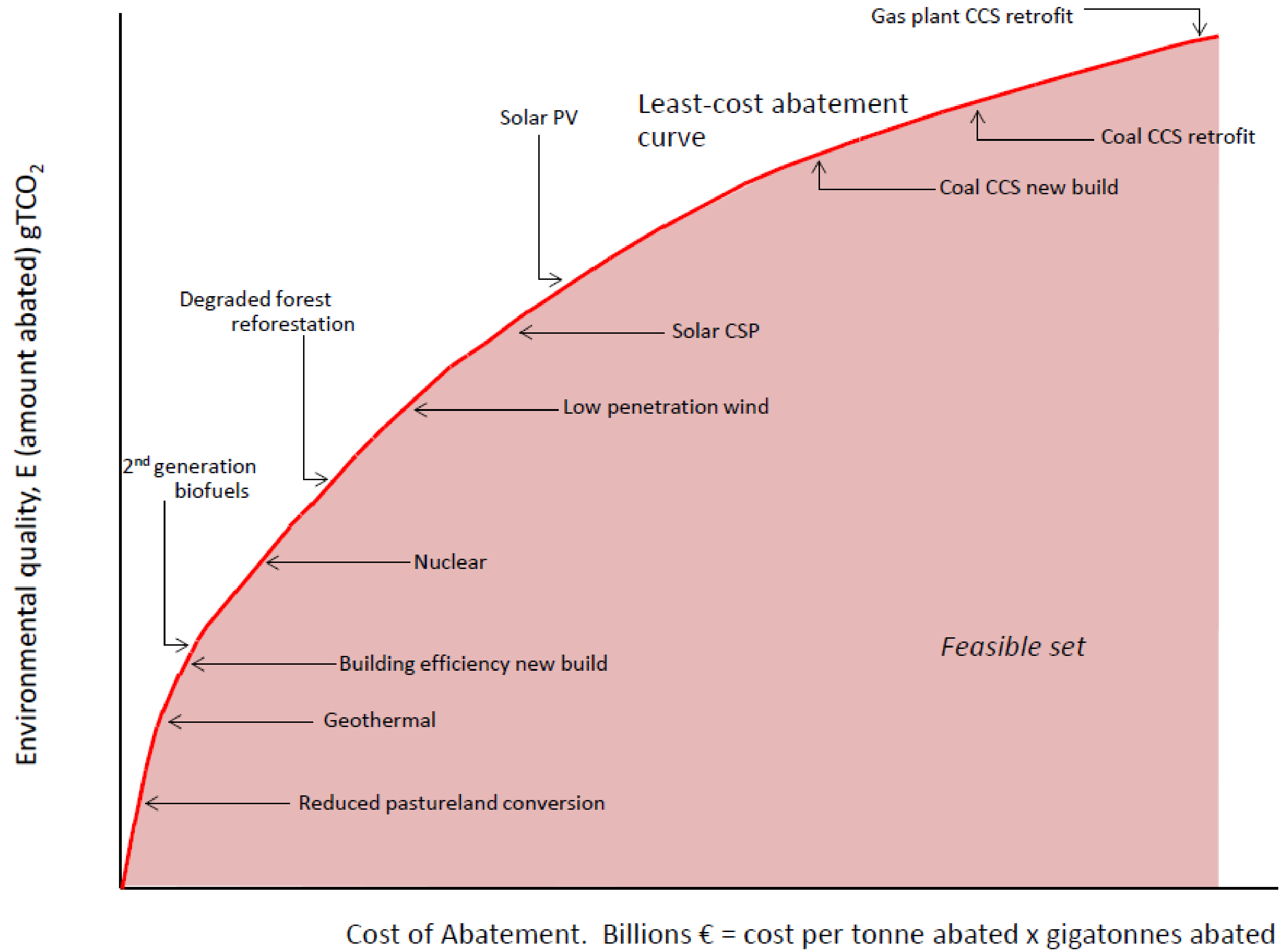
Assumptions to derive a set of policy options

- A population composed of identical individuals
- Everybody lives forever
- Environmental benefit/harm equally distributed
- Policymakers serve citizens’ interest



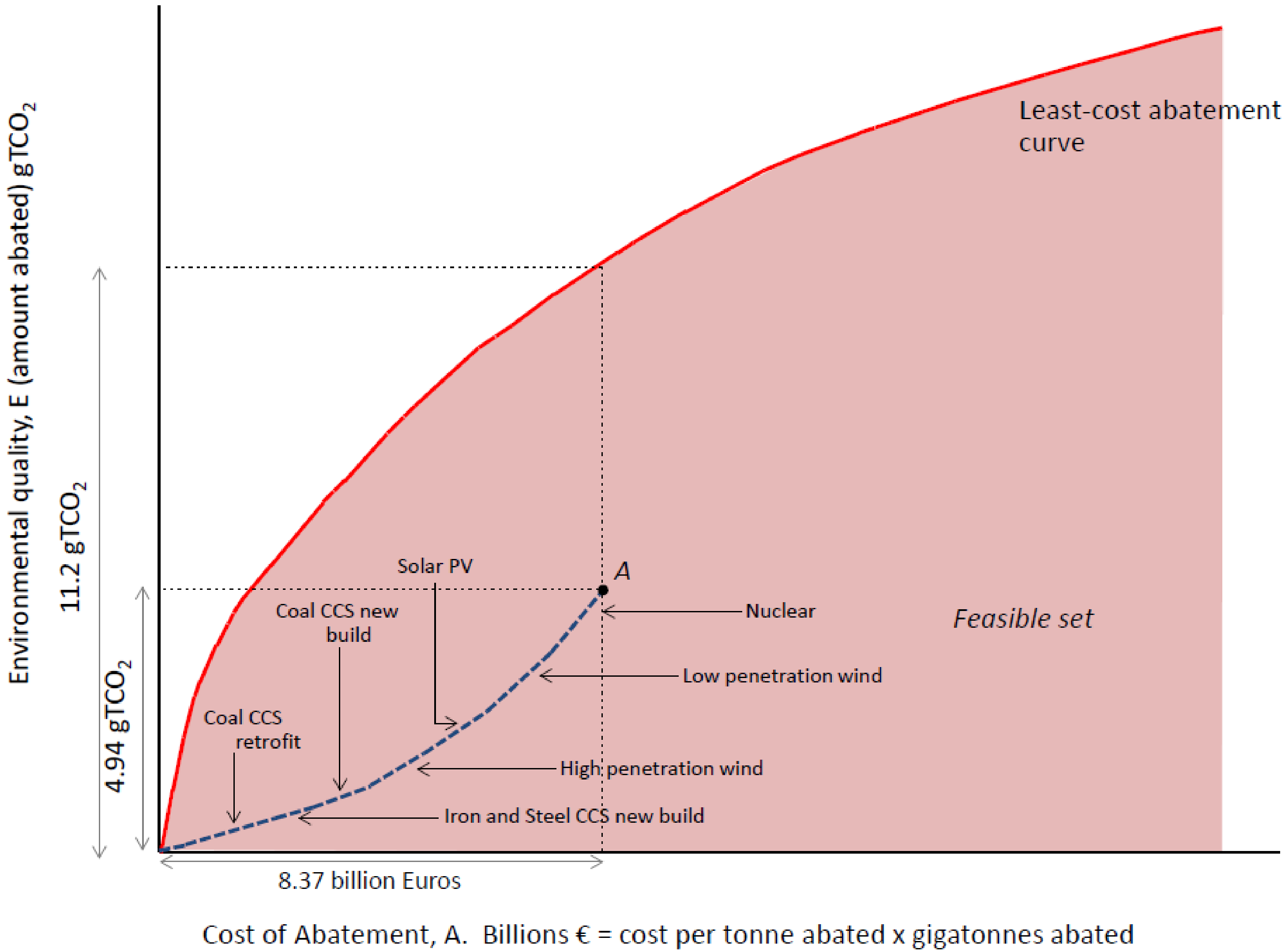
Source: CORE 2017 The Economy, p. 914, based on McKinsey & Co 2013.

Least-cost abatement curve



Source: CORE 2017 The Economy, p. 915.

Abatement cost with inefficient policies

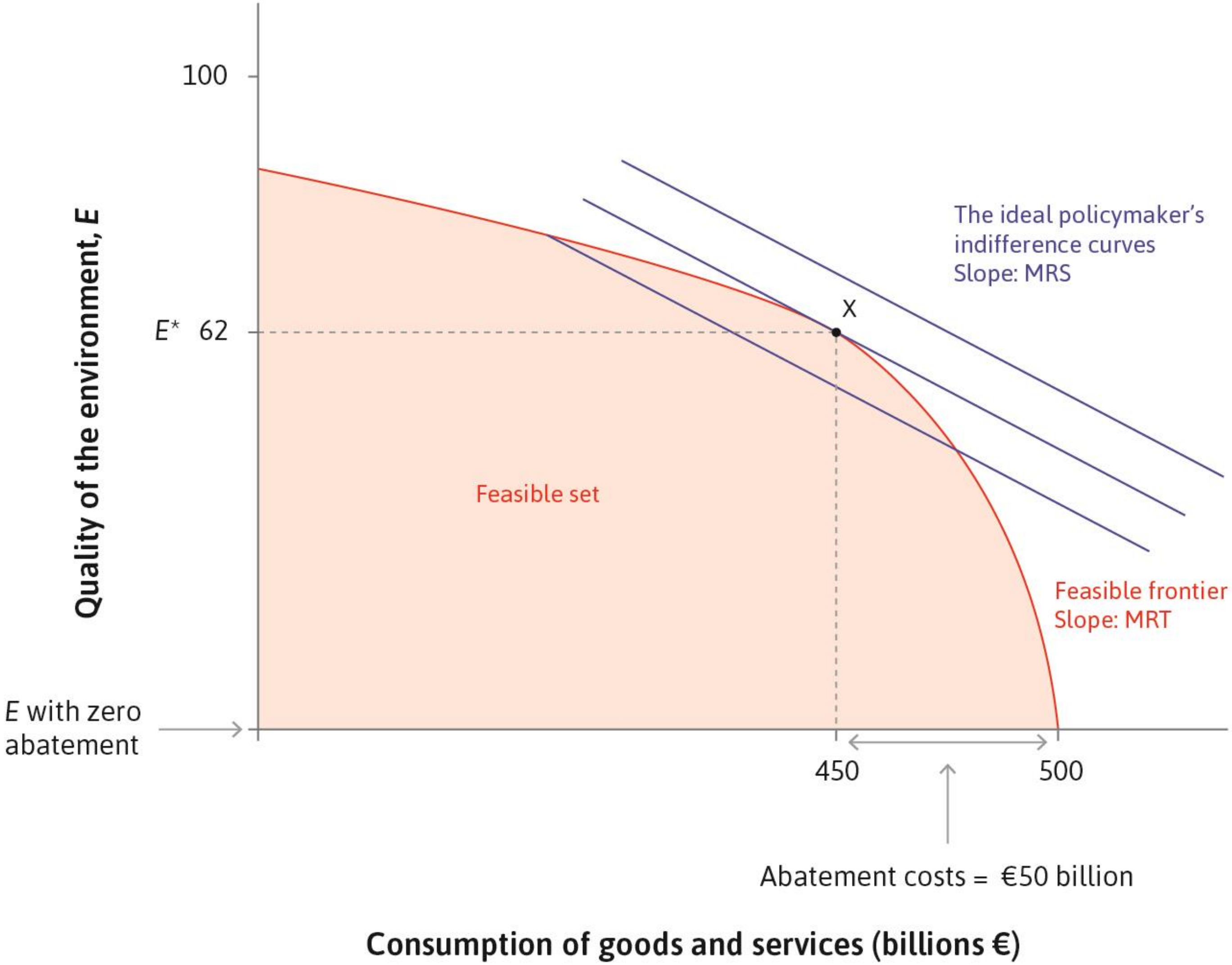


Source: CORE 2017 The Economy, p. 916.

Economic concepts to analyse trade-offs

- Marginal rate of transformation (MRT) = Increase in environmental quality / Decrease in consumption
- Marginal rate of substitution (MRS) = Marginal utility of consumption / Marginal utility of environmental quality

Ideal choice of abatement



Source: CORE 2017 The Economy, p. 918.

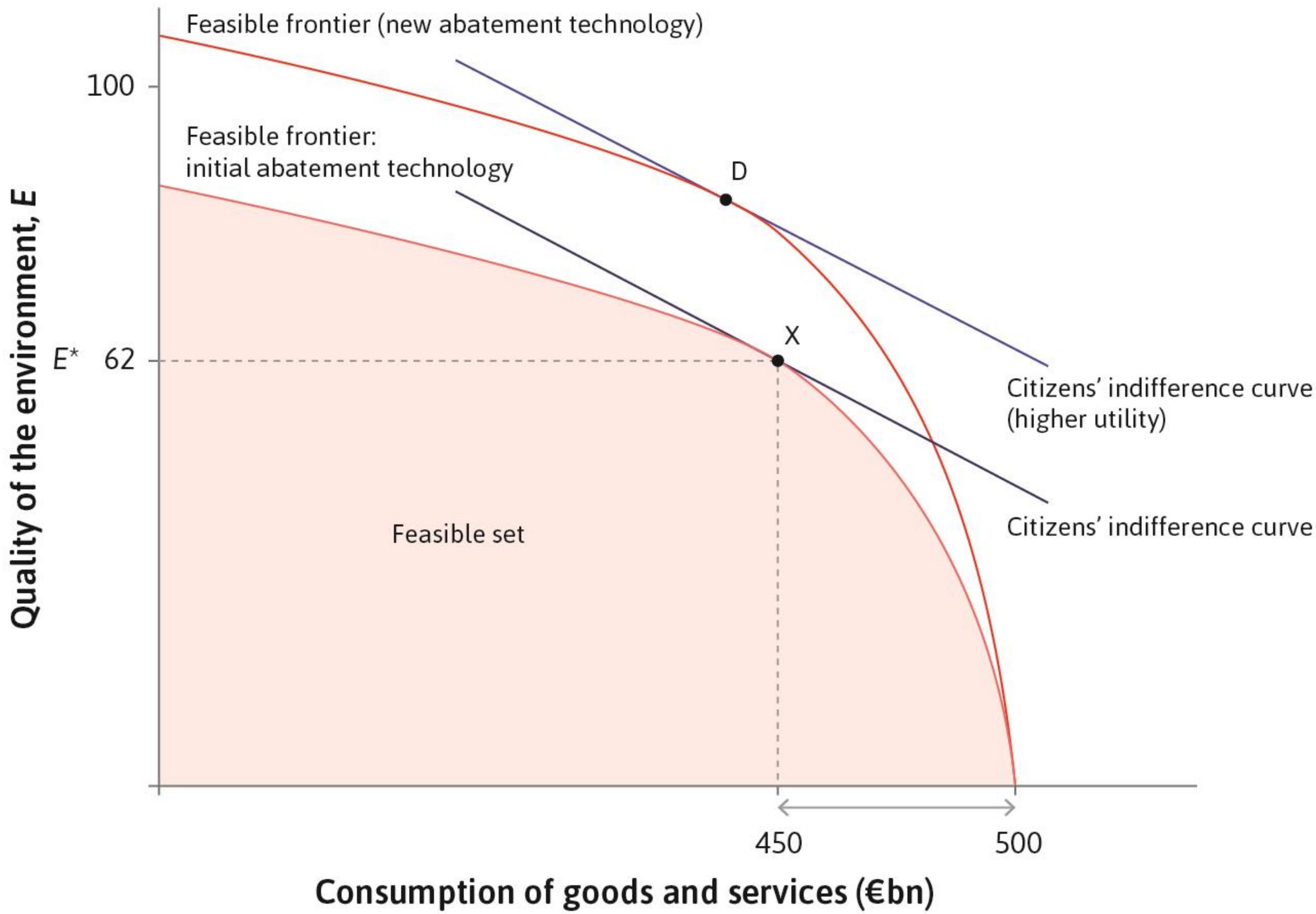
Principles to make a policy choice

- Consider only policies on the frontier of the feasible set
- Choose combination of environmental quality & consumption on the highest possible indifference curve

Questions for understanding

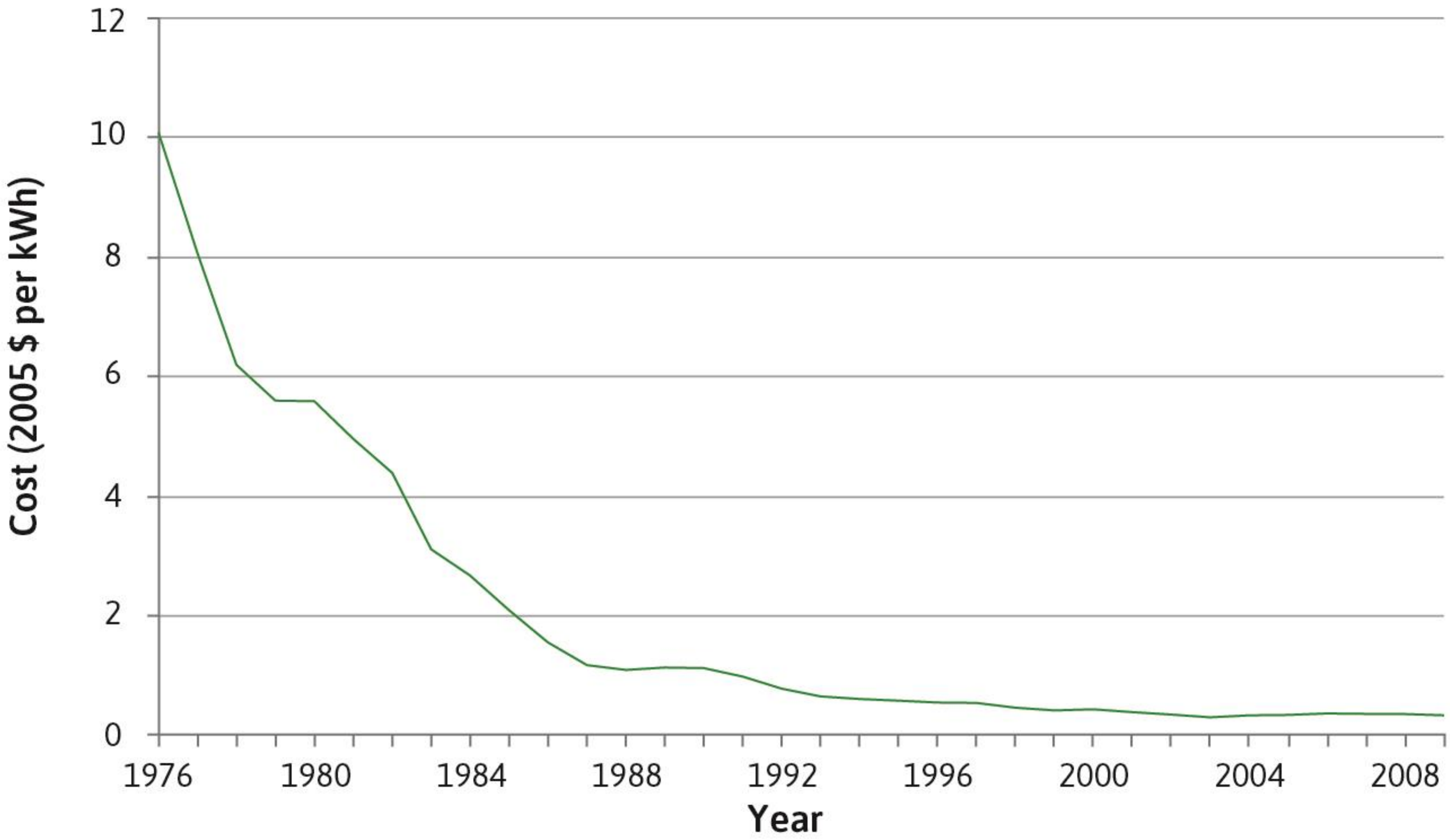
- How would optimal policies differ if consumers cared less about the environment (had different values)?
- How would they differ if abatement became cheaper (different technology)?

Technological progress



Source: CORE 2017 The Economy, p. 935.

Cost of photovoltaic electricity



Source: CORE 2017 The Economy, p. 936.

Our assumptions reconsidered

- A population composed of identical individuals?
- Everybody lives forever?
- Environmental benefit/harm equally distributed?
- Policymakers serve citizens' interest?

Everybody equally affected?

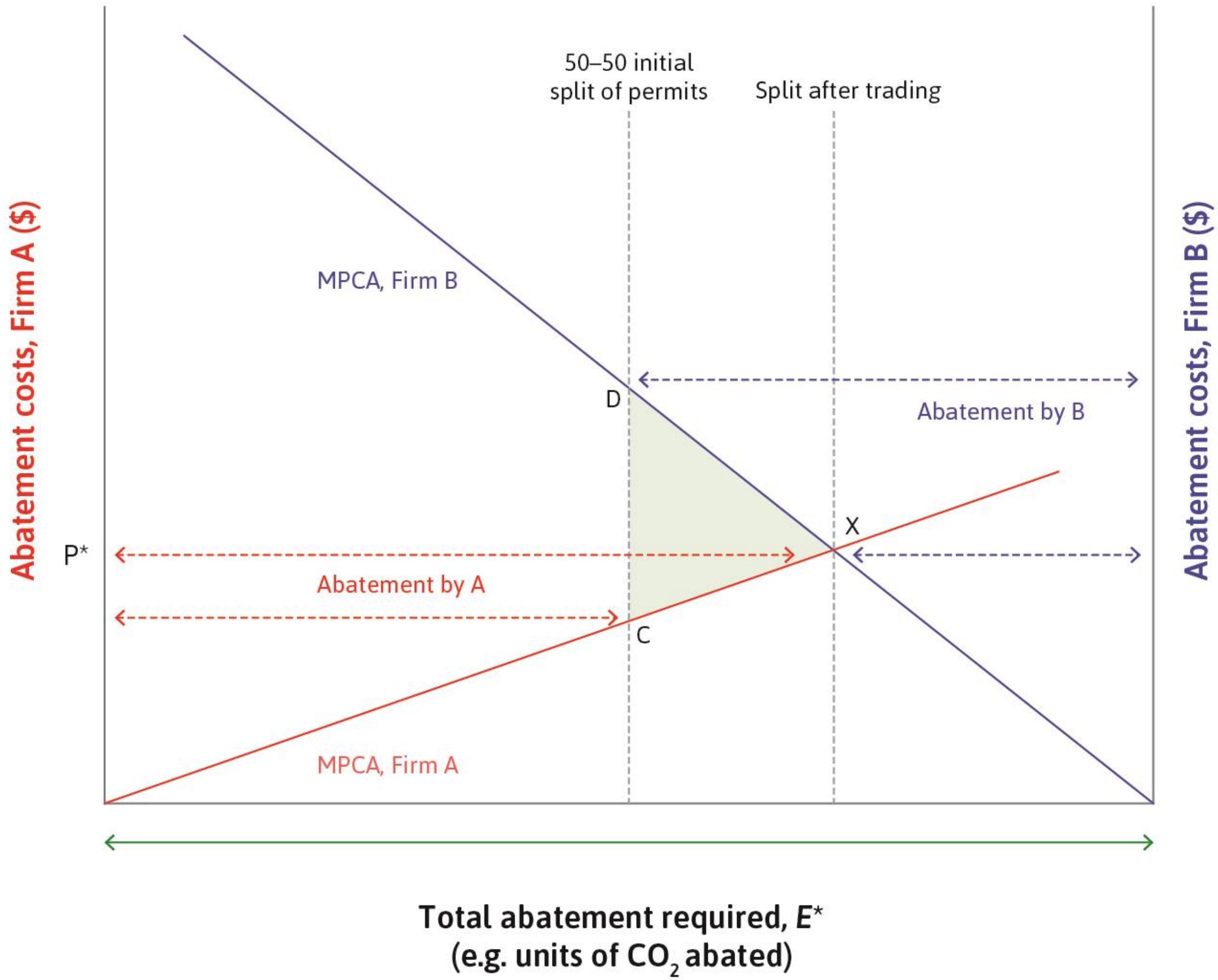
- Rich vs poor countries
- Farmers vs consumers
- Firm owners vs workers

Part II:
Selected policy options

Environmental policy options

- Private bargaining among affected parties (Coase solution)
- Taxes to make the pollutant more expensive (Pigouvian tax)
- Quotas & bans
- Price- vs quantity-based policies

Cap & Trade

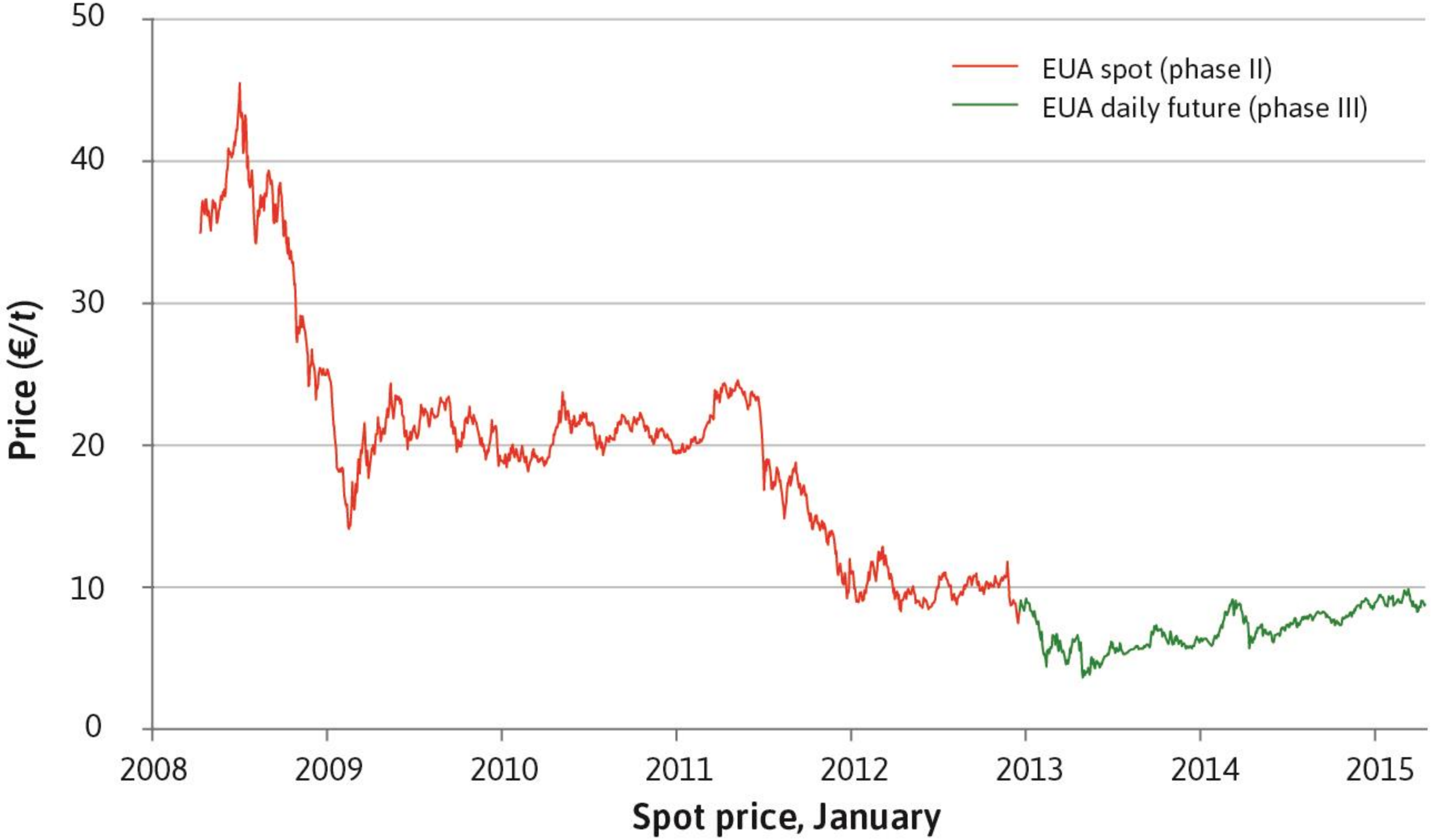


MPCA: Marginal private abatement costs.
Source: CORE 2017 The Economy, p. 928.

Issues in Cap & Trade

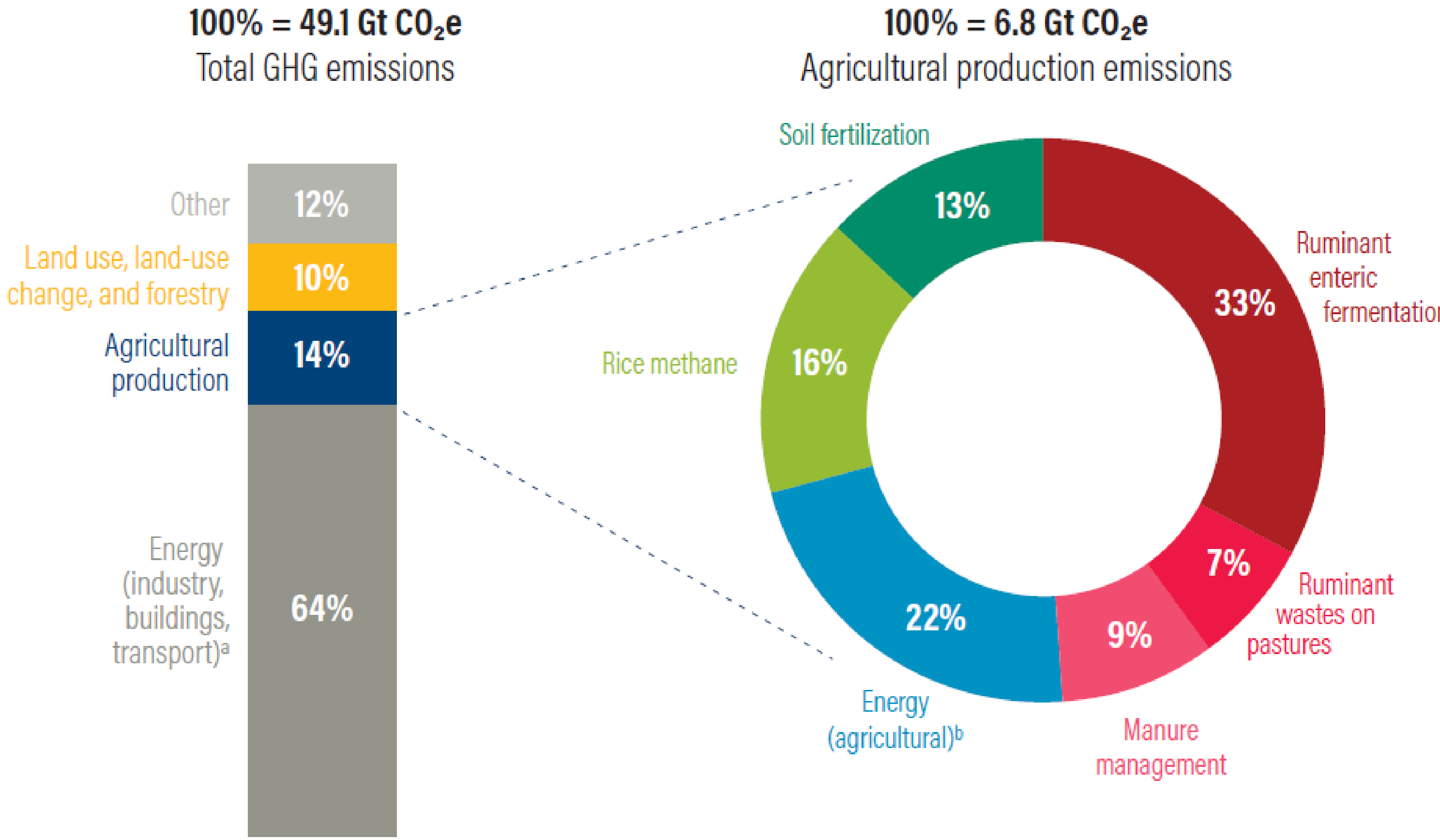
- A potentially efficient abatement tool, BUT…
- Desirable Cap level may be hard to determine
- Pricing may send wrong signals, sometimes making pollution profitable
- Price floors may mitigate collapse due to external shocks (e.g. in UK)

The EU Emissions Trading Scheme



EUA: European Emission Allowances.
Source: CORE 2017 The Economy, p. 929.

GHG emitted by agriculture



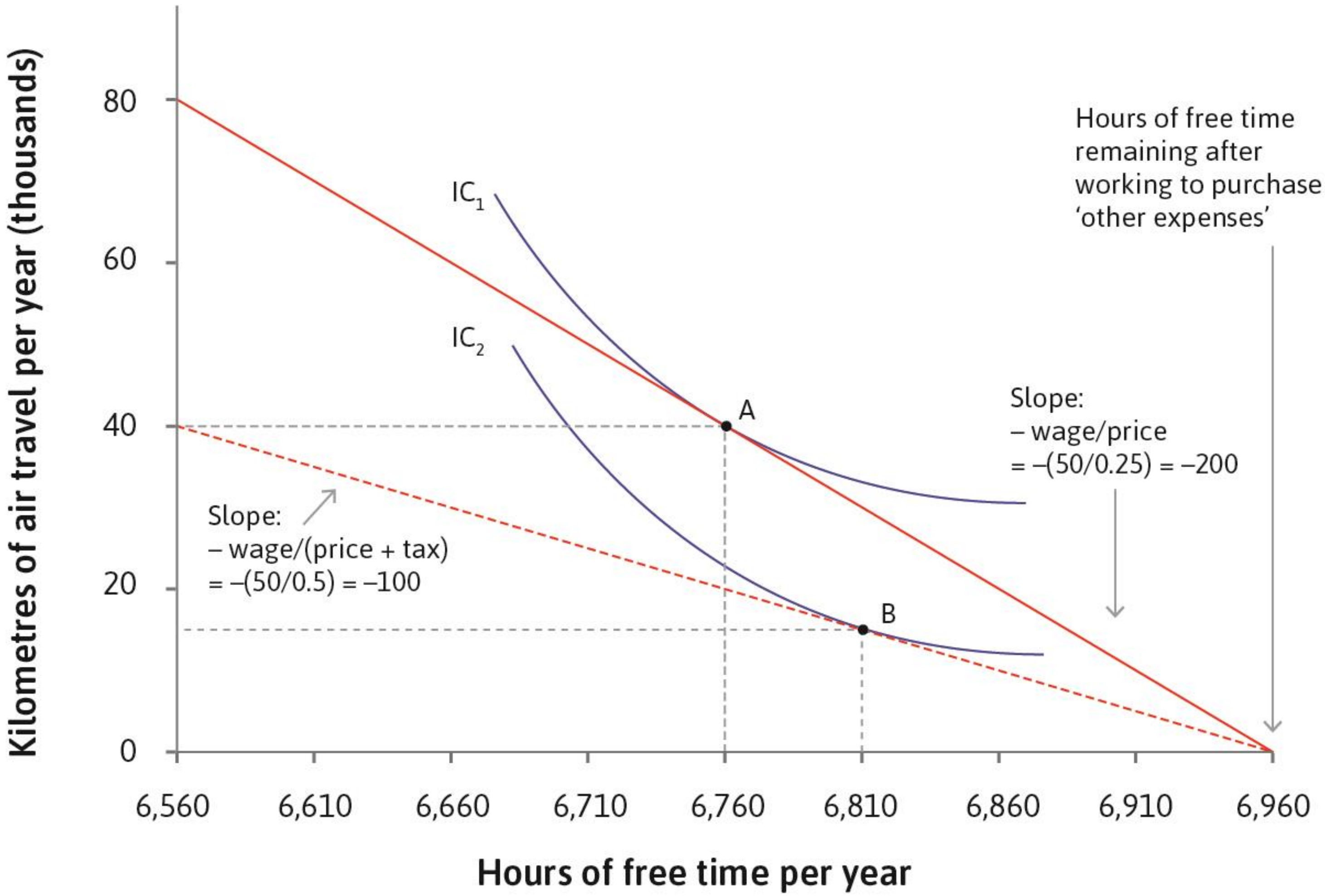
Note: Numbers may not sum to 100% due to rounding.
[a] Excludes emissions from agricultural energy sources described above.
[b] Includes emissions from on-farm energy consumption as well as from manufacturing of farm tractors, irrigation pumps, other machinery, and key inputs such as fertilizer. It excludes emissions from the transport of food.
Sources: GlobAgri-WRR model (agricultural production emissions); WRI analysis based on UNEP (2012); FAO (2012a); EIA (2012); IEA (2012); and Houghton (2008) with adjustments.

Source: World Resources Report 2019 Creating a Sustainable Food Future, p 9.

Cap & Trade in agriculture?

- Highly dispersed polluters
- Emissions hard to measure
- Cap impossible to enforce
- High administration & monitoring costs
- Danger of resource use dumping by producers abroad

Taxing consumers



IC: Indifference curve

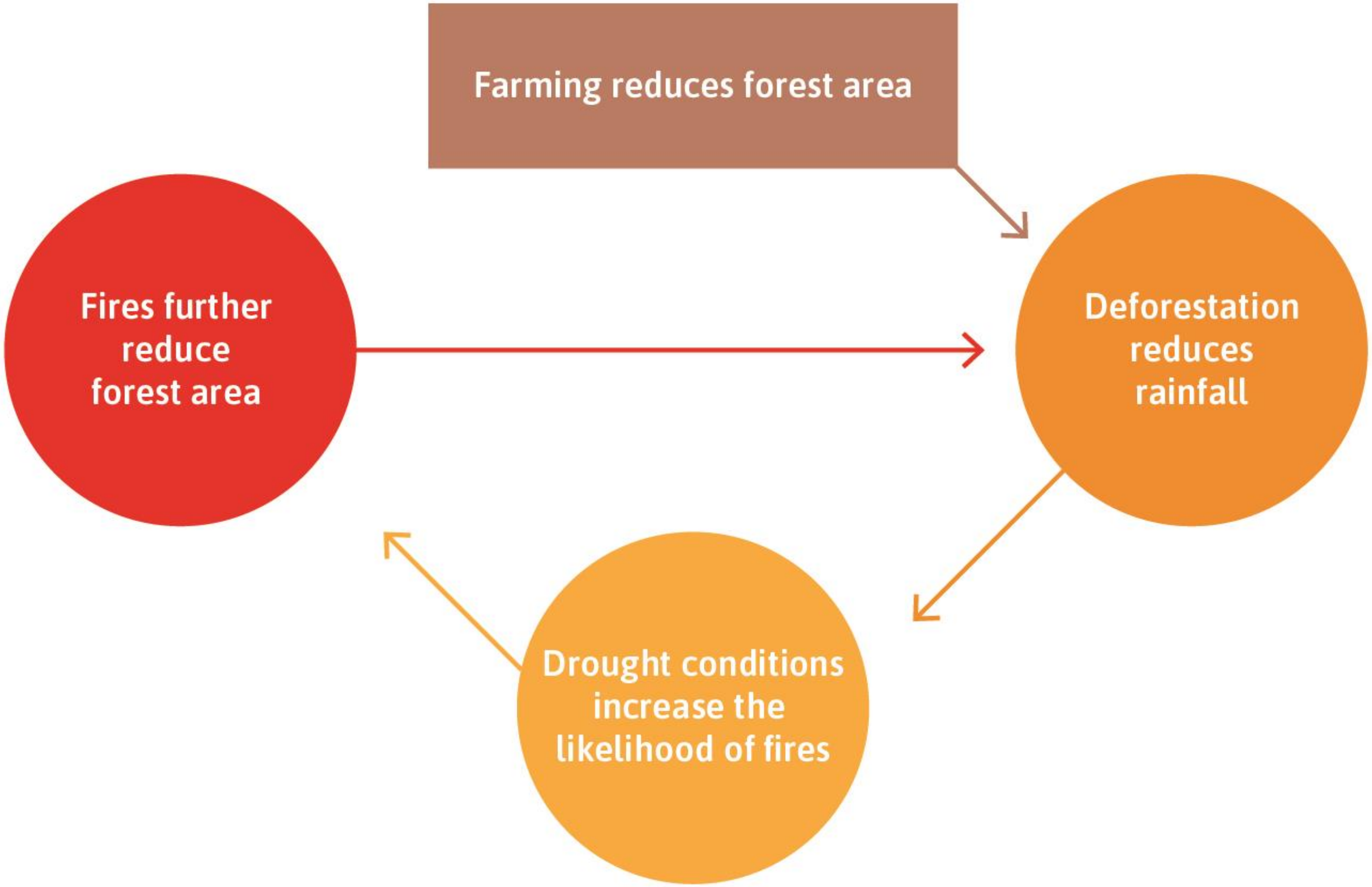
Source: CORE 2017 The Economy, p. 929.

Part III:
Specific challenges in climate change mitigation policy

Intricacies of climate change policies

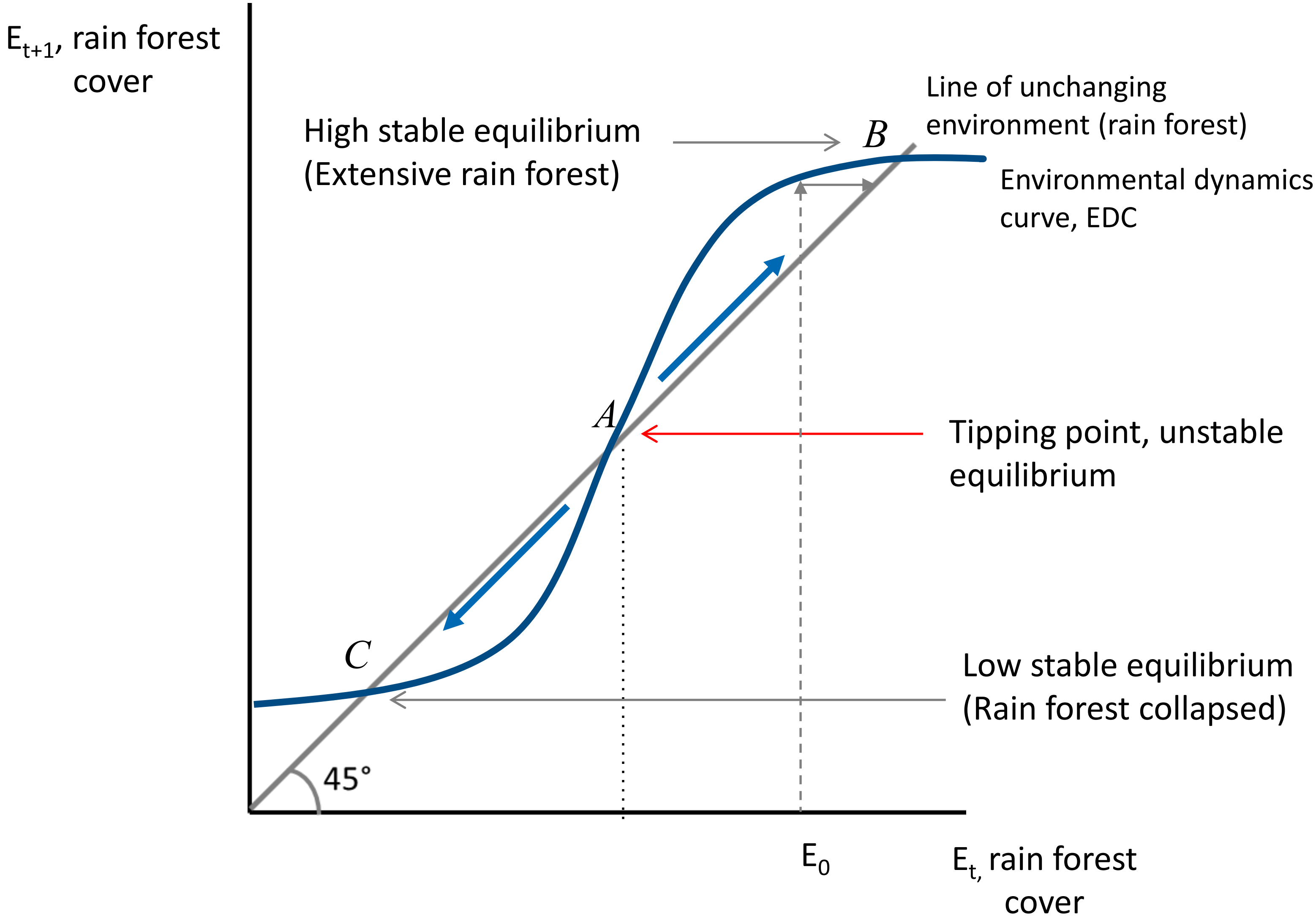
- Complex dynamics (https://regimeshifts.org)
- Global collective action
- Future generations

Runaway deforestation in the Amazon?



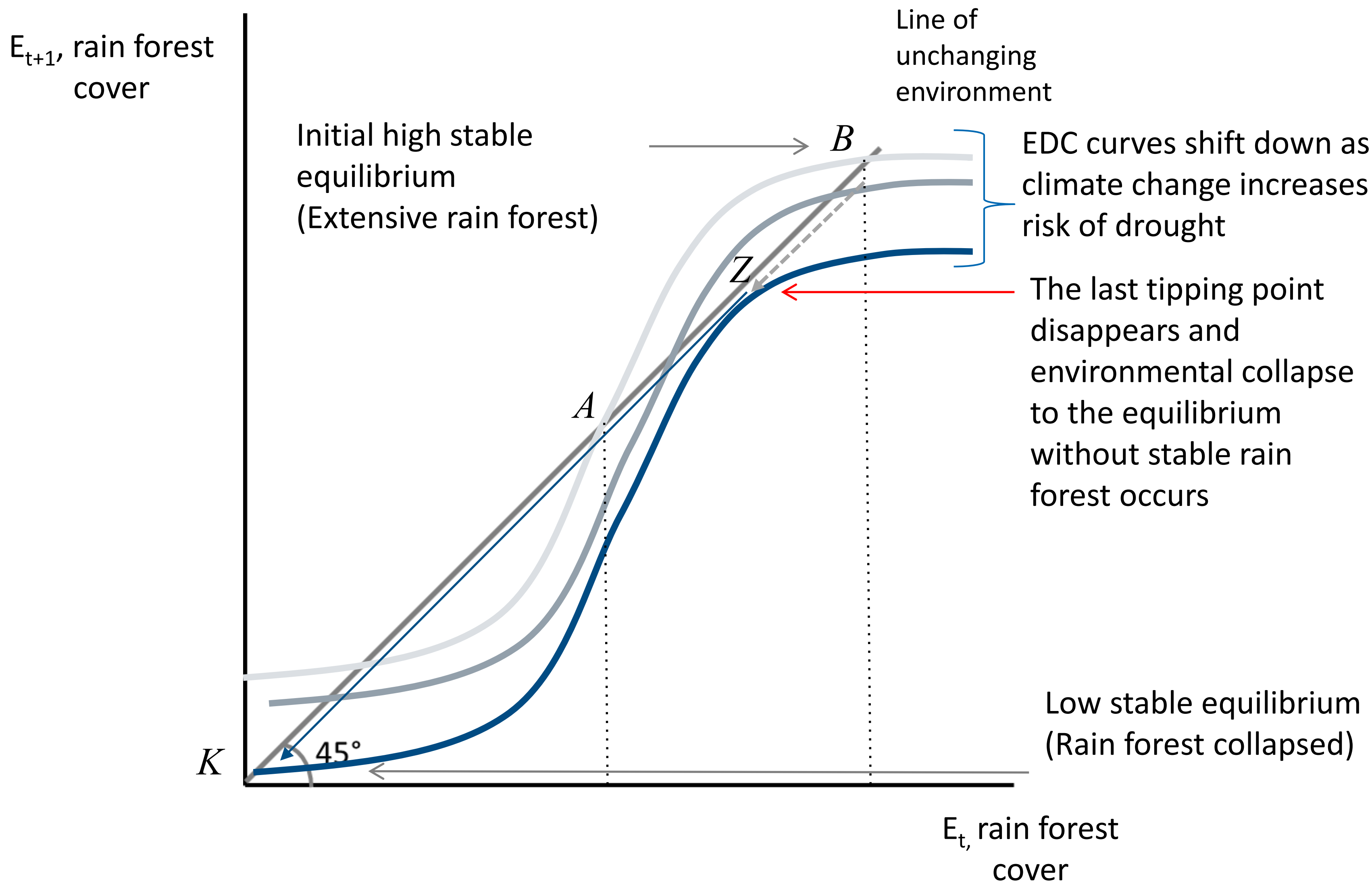
Source: CORE 2017 The Economy, p. 904; The Economist Briefing August 3, 2019.

Environmental dynamics in the Amazon



Source: Author based on CORE 2017 The Economy, p. 946.

Climate change & irreversible deforestation



Source: Author based on CORE 2017 The Economy, p. 947.

Policies to address tipping points

- Reduce risk that tipping points are crossed
- Establish evidence to reduce uncertainty about tipping points
- Respect planetary boundaries, i.e. keep sufficiently far away from tipping points
- Caps may be more effective than taxes in face of uncertainty

Game theory of global GHG emissions

- Players – who is involved in the interaction
- Feasible strategies – actions each player can take
- Information – what each player knows when choosing their action
- Payoffs – outcomes for every possible combination of actions

Simplifying assumptions

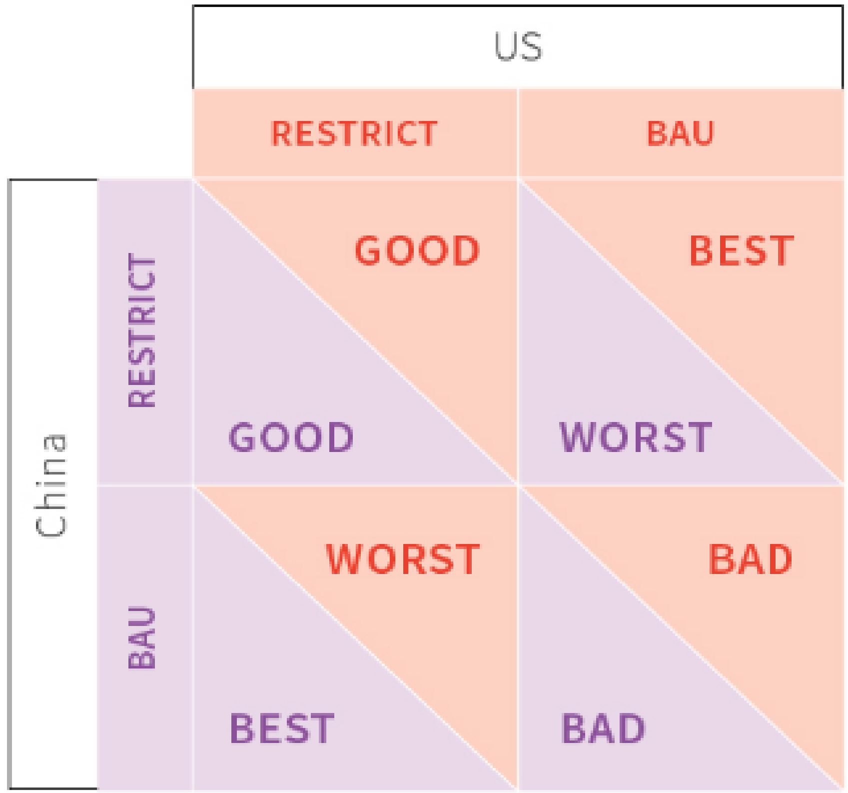
- No other people involved or affected
- No other decision to take than which crop to grow
- Players interact only once
- They decide simultaneously, without knowing what the other does

Reduction in global GHG emissions

		US	
		RESTRICT	BAU
China	RESTRICT	Reduction in emissions sufficient to moderate climate change	US free rides on Chinese emissions cutbacks
	BAU	China free rides on US emissions cutbacks	No reduction in emissions

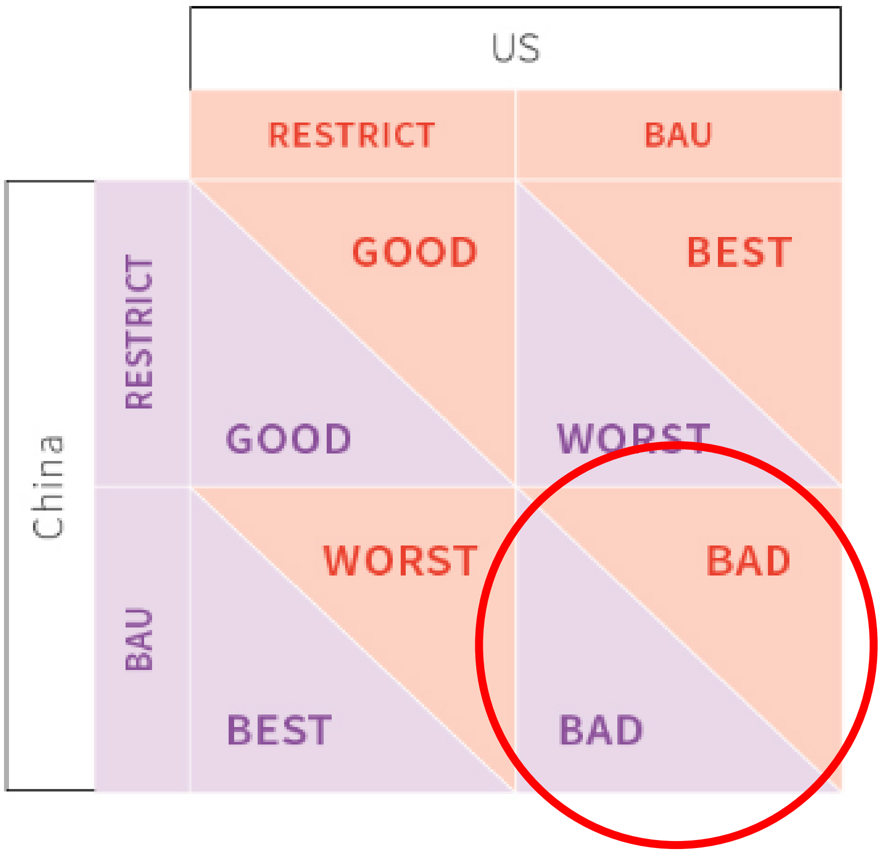
Source: CORE 2017 The Economy, p. 177.

Reduction in global GHG emissions: payoffs



Source: CORE 2017 The Economy, p. 177.

Reduction in global GHG emissions: payoffs



Source: CORE 2017 The Economy, p. 177.

GHG reduction as a “prisoners’ dilemma”

- Both China & US pursuing their self-interest yielded an unfavourable outcome for both of them
- Their joint reduction always threatened by “free-riding”
- Both have an interest in alternative outcome that global collective action hardly achieves

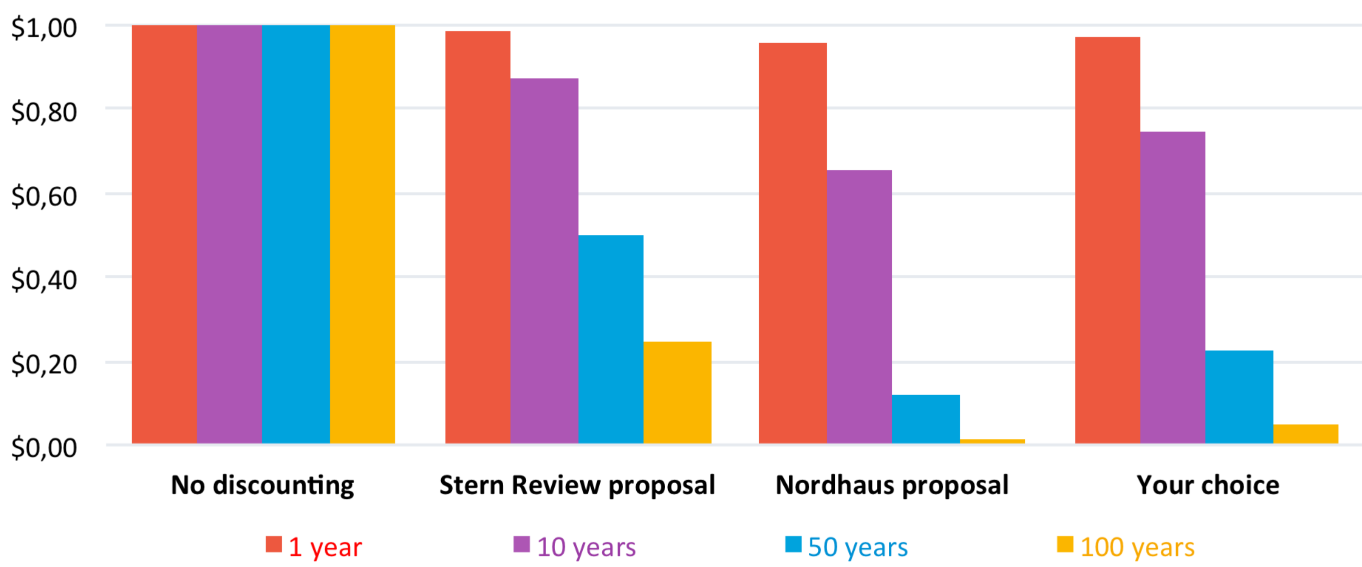
The Stern-Nordhaus debate about discounting

- Future generations may be richer
- Small chance that humankind will be extinguished
- Impatience of current decision makers
- Stern advocates 1.4%, assuming no impatience
- Criticised by Nordhaus arguing that current generation needs to decide, using 4.3%

Source: CORE 2017 The Economy, p. 951.

Discounting future benefits

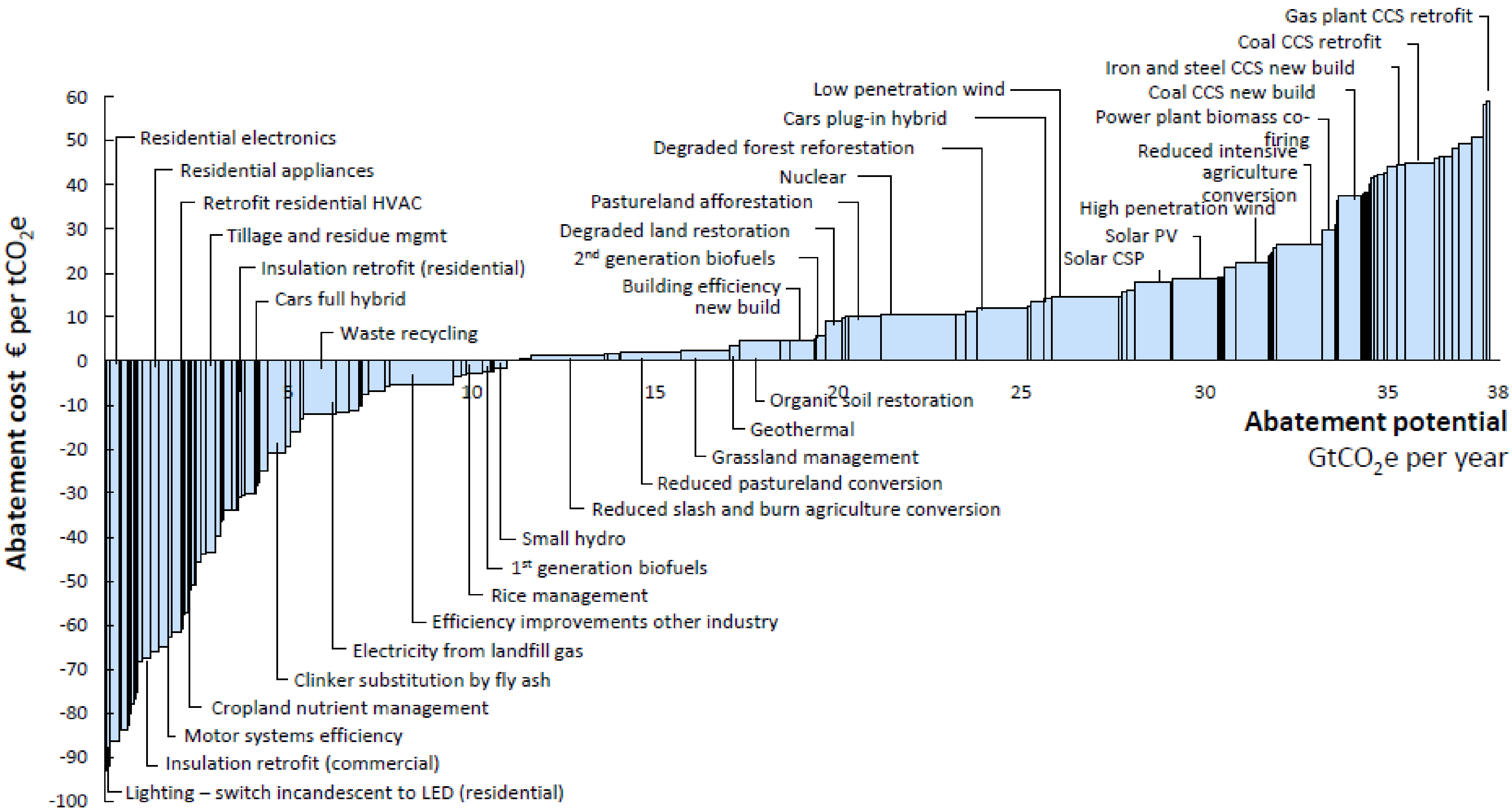
Discount rate (%)	Source	Years in the future				
		0	1	10	50	100
0,0	No discounting	$1,00	$1,00	$1,00	$1,00	$1,00
1,4	Stern Review proposal	$1,00	$0,99	$0,87	$0,50	$0,25
4,3	Nordhaus proposal	$1,00	$0,96	$0,66	$0,12	$0,01
3,0		$1,00	$0,97	$0,74	$0,23	$0,05



Source: Goulder, L. and Williams, R. 2012. The choice of discount rate for climate change policy evaluation, Climate Change Economics, Vol. 3, No. 4.

Source: CORE 2017 The Economy, p. 953.

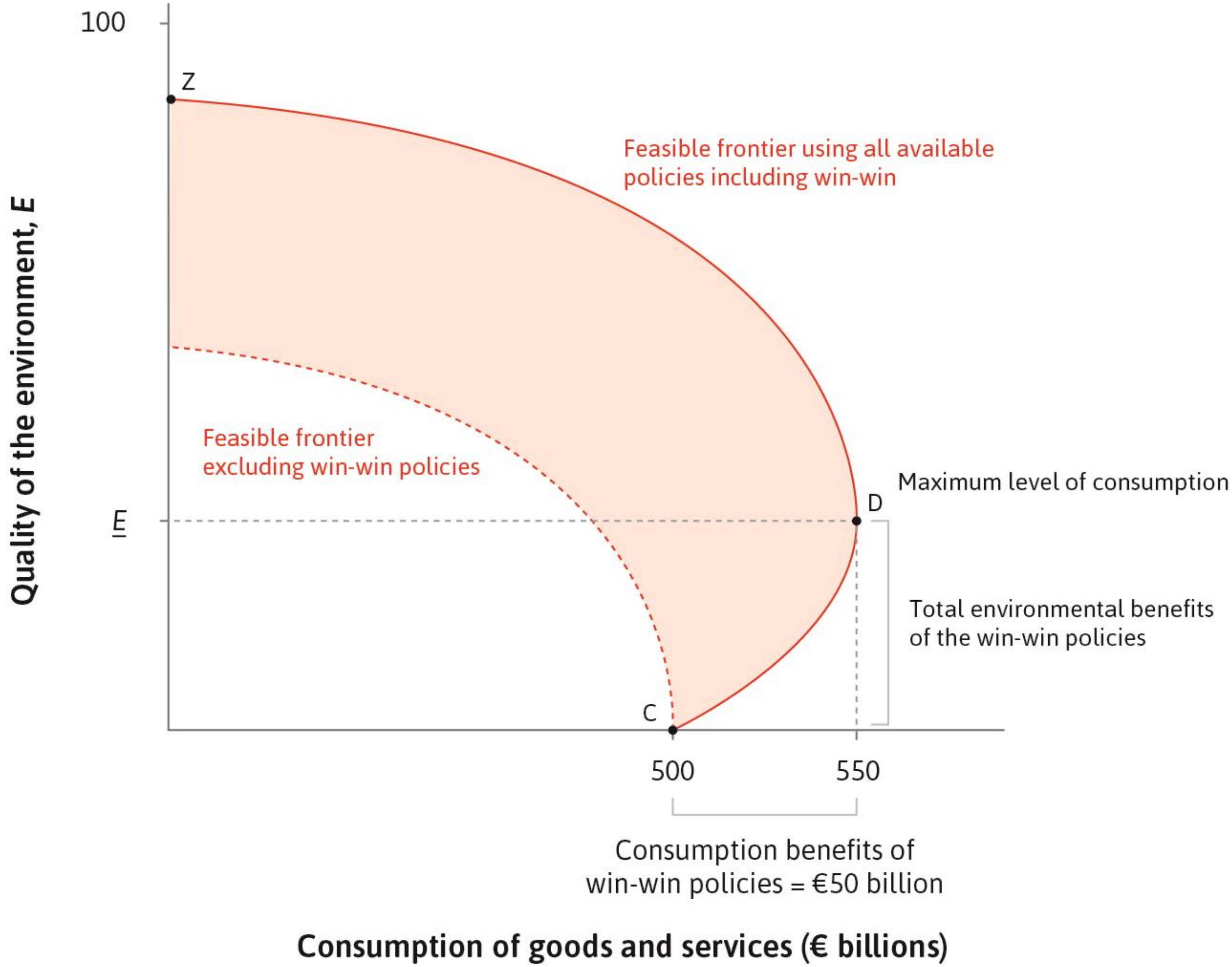
Policies with negative abatement cost



HVAC: Heating, ventilation, air conditioning.

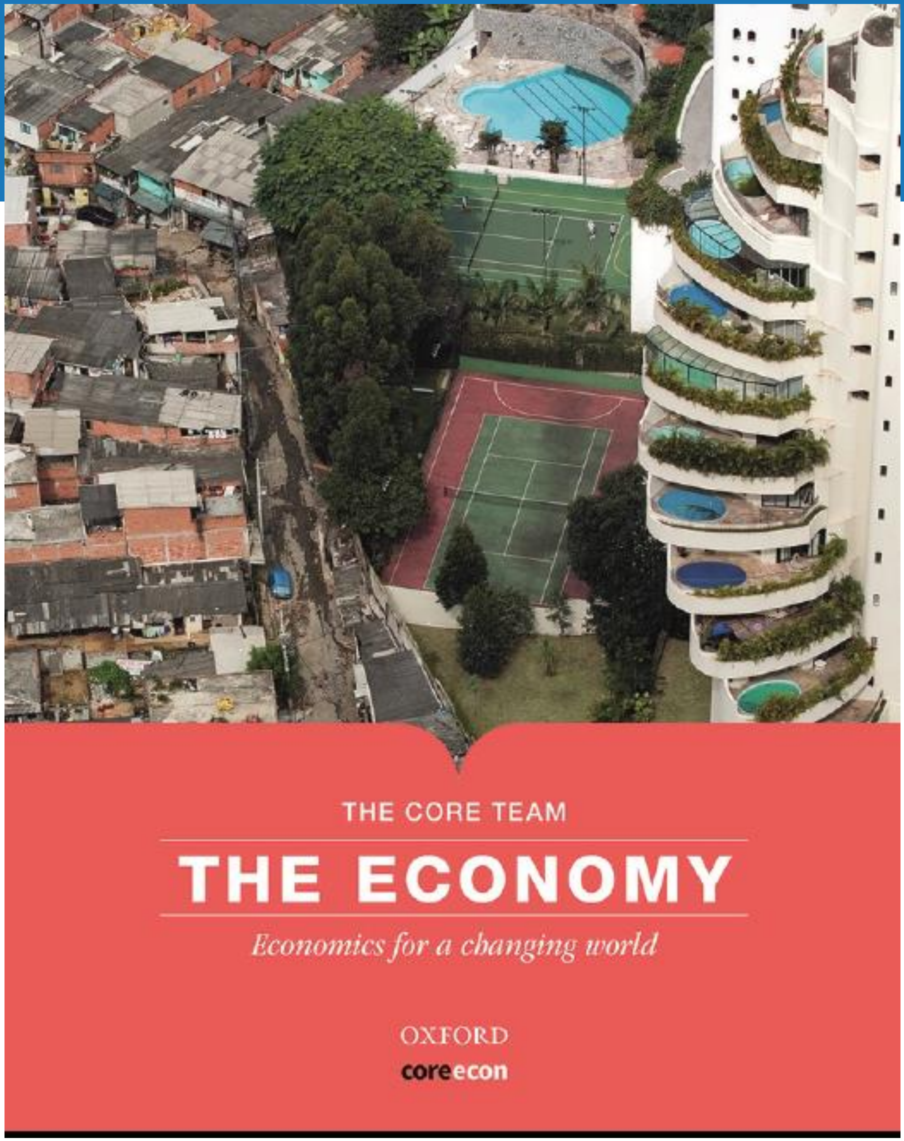
Source: Author based on CORE 2017 The Economy, p. 956.

Potentials of win-win policies



Source: Author based on CORE 2017 The Economy, p. 946.

Further reading



https://www.core-econ.org/

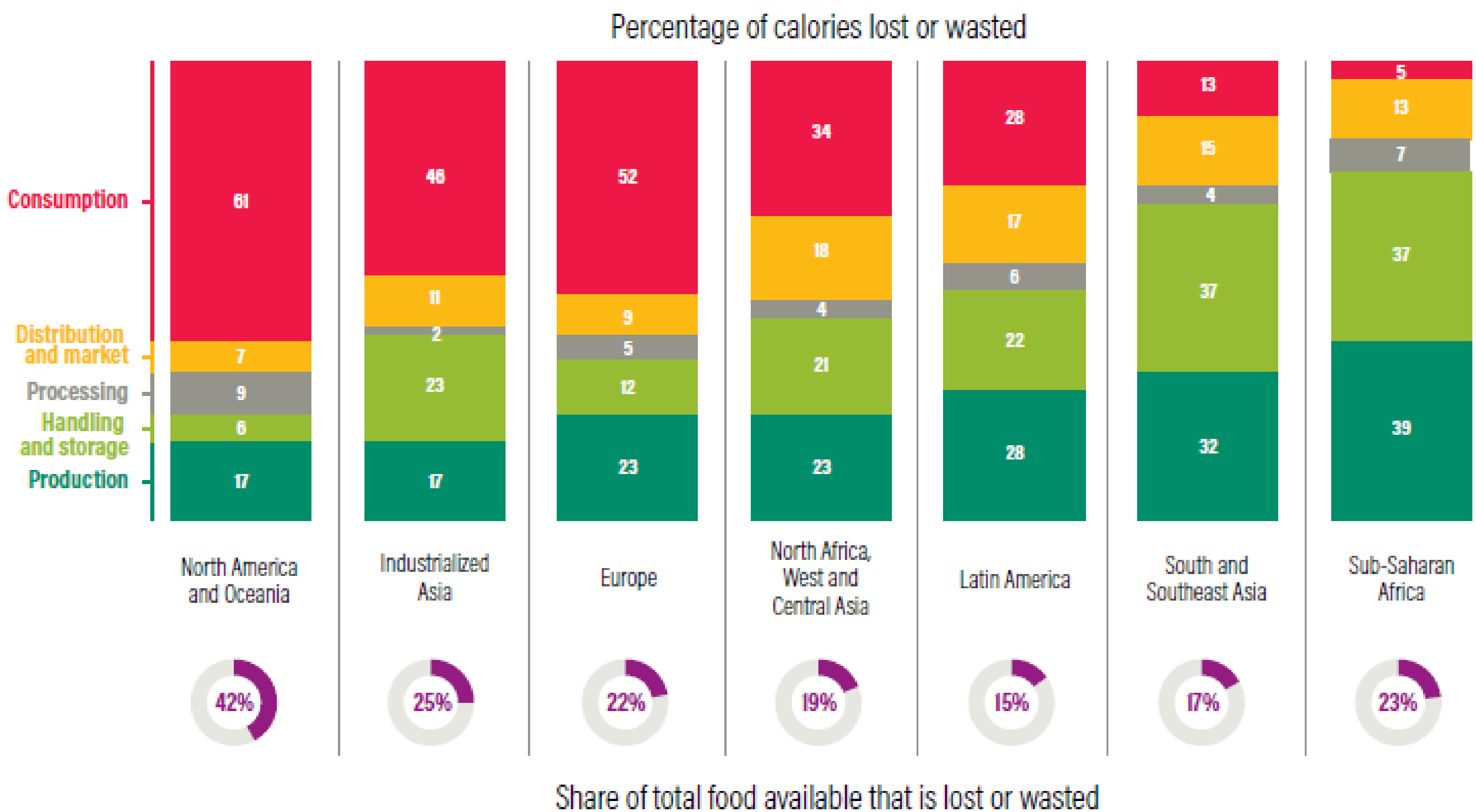
Part IV:
Policy areas in agriculture & food

Five major policy areas

1. Reduce growth in demand for food & other agricultural products
2. Reduce GHG emissions from agricultural production
3. Increase food production without expanding agricultural land
4. Protect &restore natural ecosystems & limit agricultural land-shifting
5. Increase fish supply

Source: World Resources Report 2019 Creating a Sustainable Food Future, p. 36.

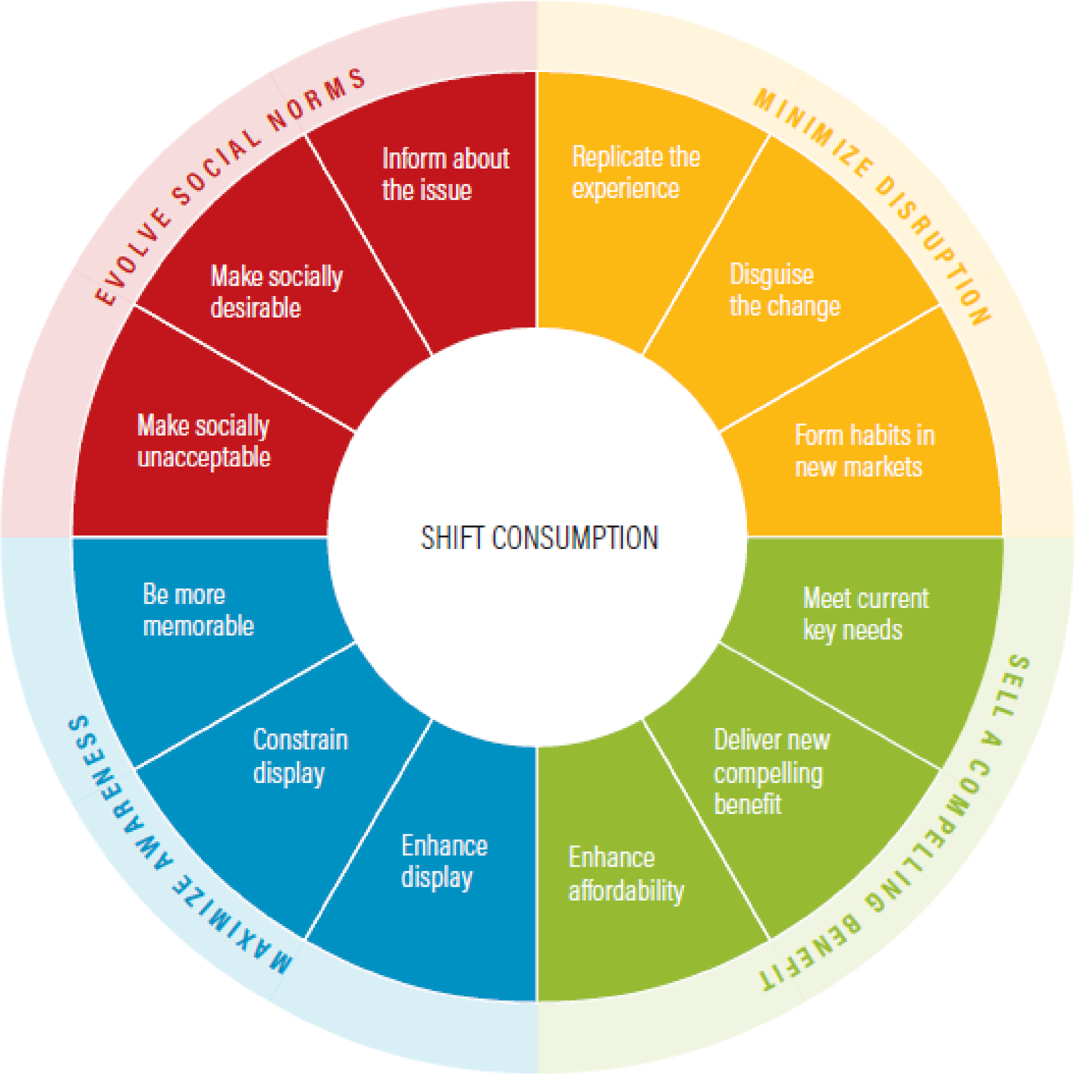
Reducing food loss & waste



Note: Numbers may not sum to 100 due to rounding. Data are for the year 2009.
Source: WRI analysis based on FAO (2011c).

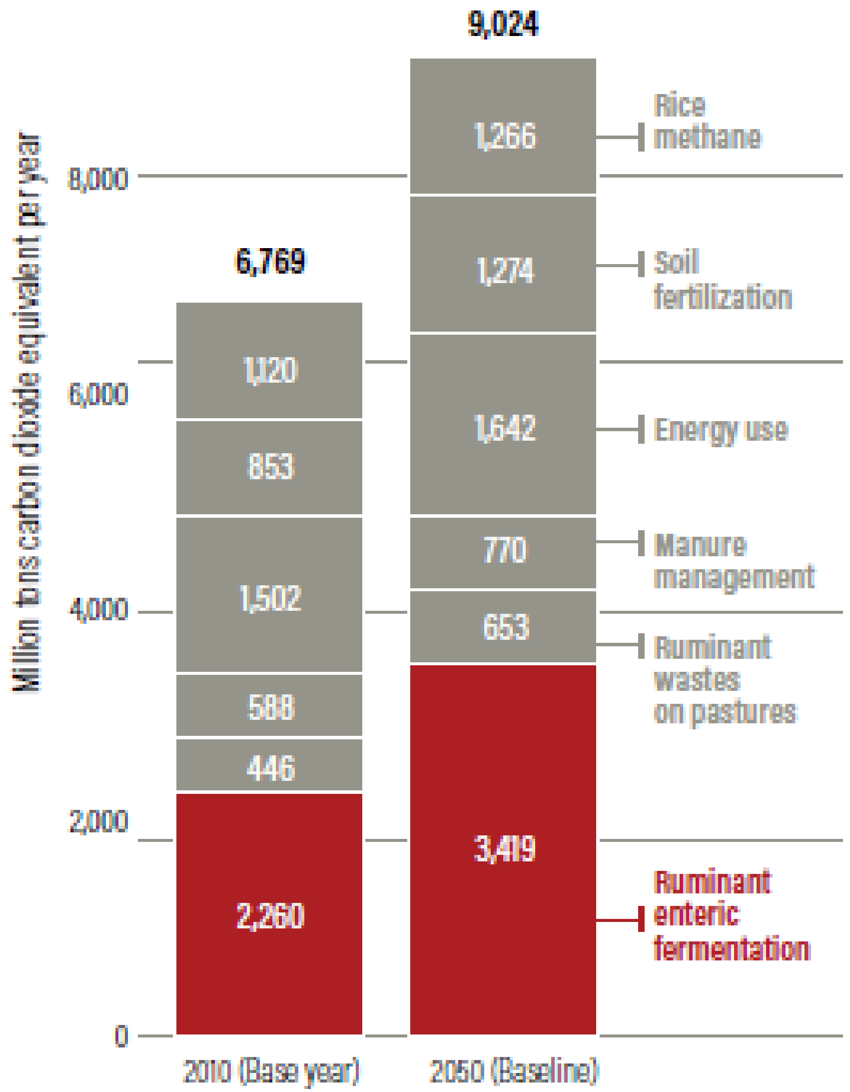
Source: World Resources Report 2019 Creating a Sustainable Food Future, p. 55.

Promote less meat in diets



Source: World Resources Report 2019 Creating a Sustainable Food Future, p. 90.

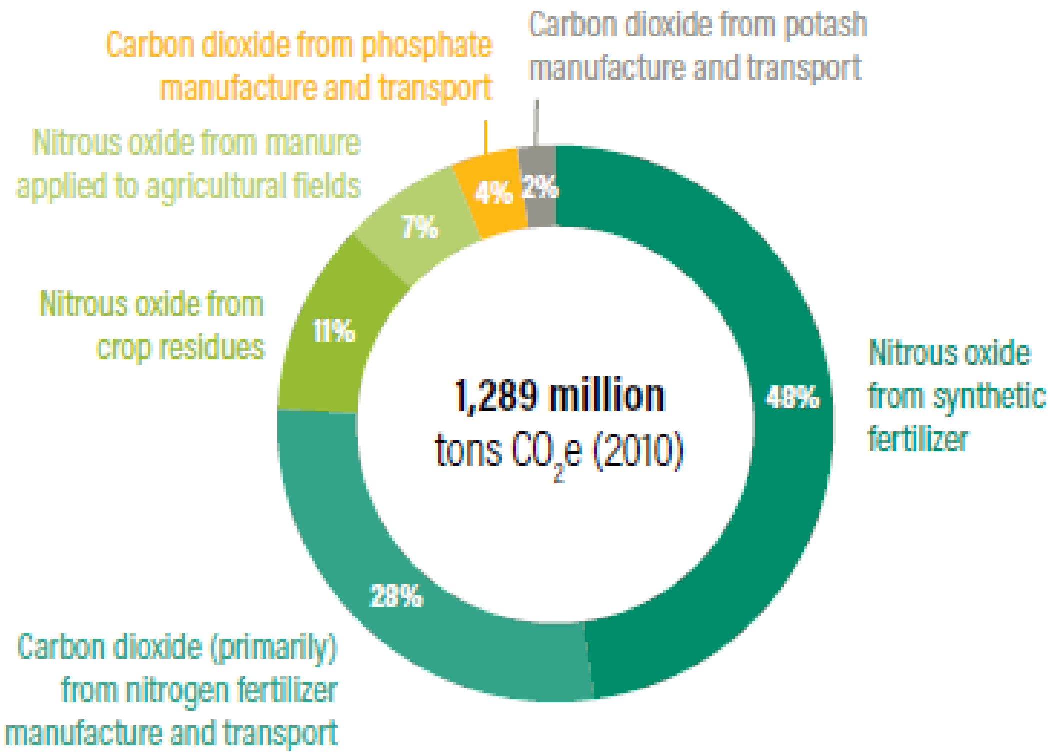
Reduce GHG emissions from ruminants



Source: World Resources Report 2019 Creating a Sustainable Food Future, p. 316.

Improve fertiliser management

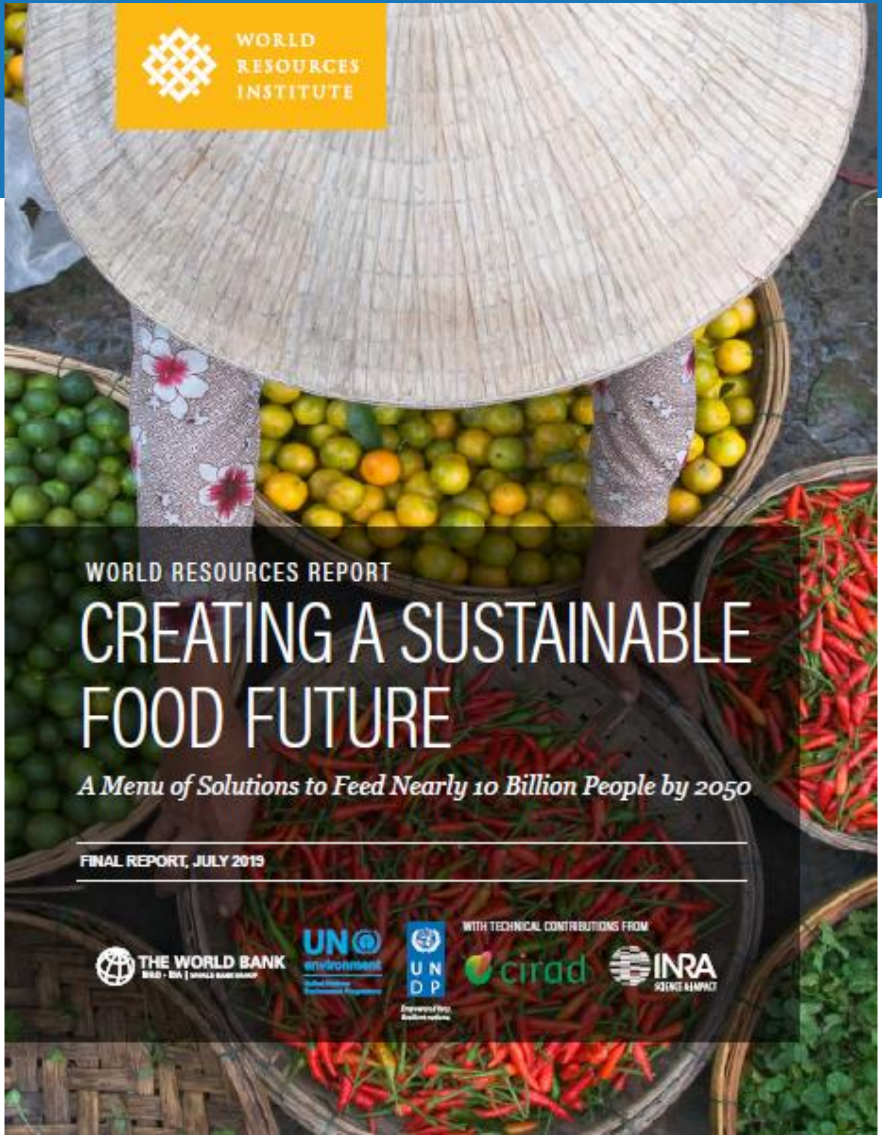
Global emissions from soil fertilisation:



Note: This chart excludes emissions from manure left on paddocks and pasture, discussed above, and differs from FAOSTAT estimates in part because GlobAgri-WRR is based on nitrogen estimates underlying Zhang et al. (2015b) and nitrogen availability in manure from a livestock management component based on Herrero et al. (2013).
Source: GlobAgri-WRR model.

Source: World Resources Report 2019 Creating a Sustainable Food Future, p. 341.

Further reading



https://wrr-food.wri.org/

Conclusions

- Optimal environmental policy does not mean maximal abatement
- Innovation may be a powerful tool to combat excessive resource use
- Formal analysis helps highlighting tradeoffs (but does not necessarily solve them)
- Specific models shed light on complexities of policymaking (tipping points, collective action)