



Energy research Centre of the Netherlands

# The political economy of climate change negotiations and the role of technology

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## Energy research Centre of the Netherlands



**Solar Energy**



**Biomass**



**Wind Energy**



**Efficiency & Infrastructure**



**H<sub>2</sub> & Clean Fossil Fuels**



**Policy Studies**

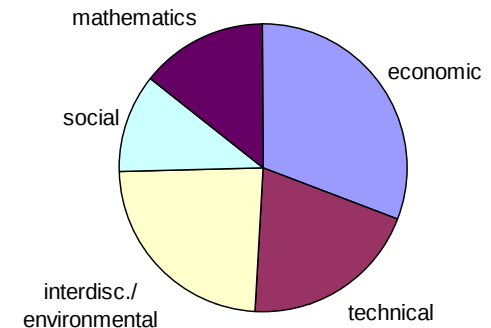
ECN develops cutting-edge knowledge and technologies for a sustainable energy system and brings them to the market

## ECN Policy Studies

Mission: *We provide knowledge and strategies that matter for a sustainable energy future*

### Key characteristics

- Think tank, 70 staff with multi disciplinary background
- Independent
- Integral: combine insights about energy use, markets, technology, behaviour and policies
- Advanced in quantitative analysis
- Offices in Petten and Amsterdam



## Central question

What kind of international agreement works for climate change mitigation?

## Outline

Climate change mitigation: why, how much, where?

International agreements: the basics

Framing of climate change mitigation

- Traditional country-based framing
- Traditional individual-based, moral framing
- “Neo-liberalist” framing

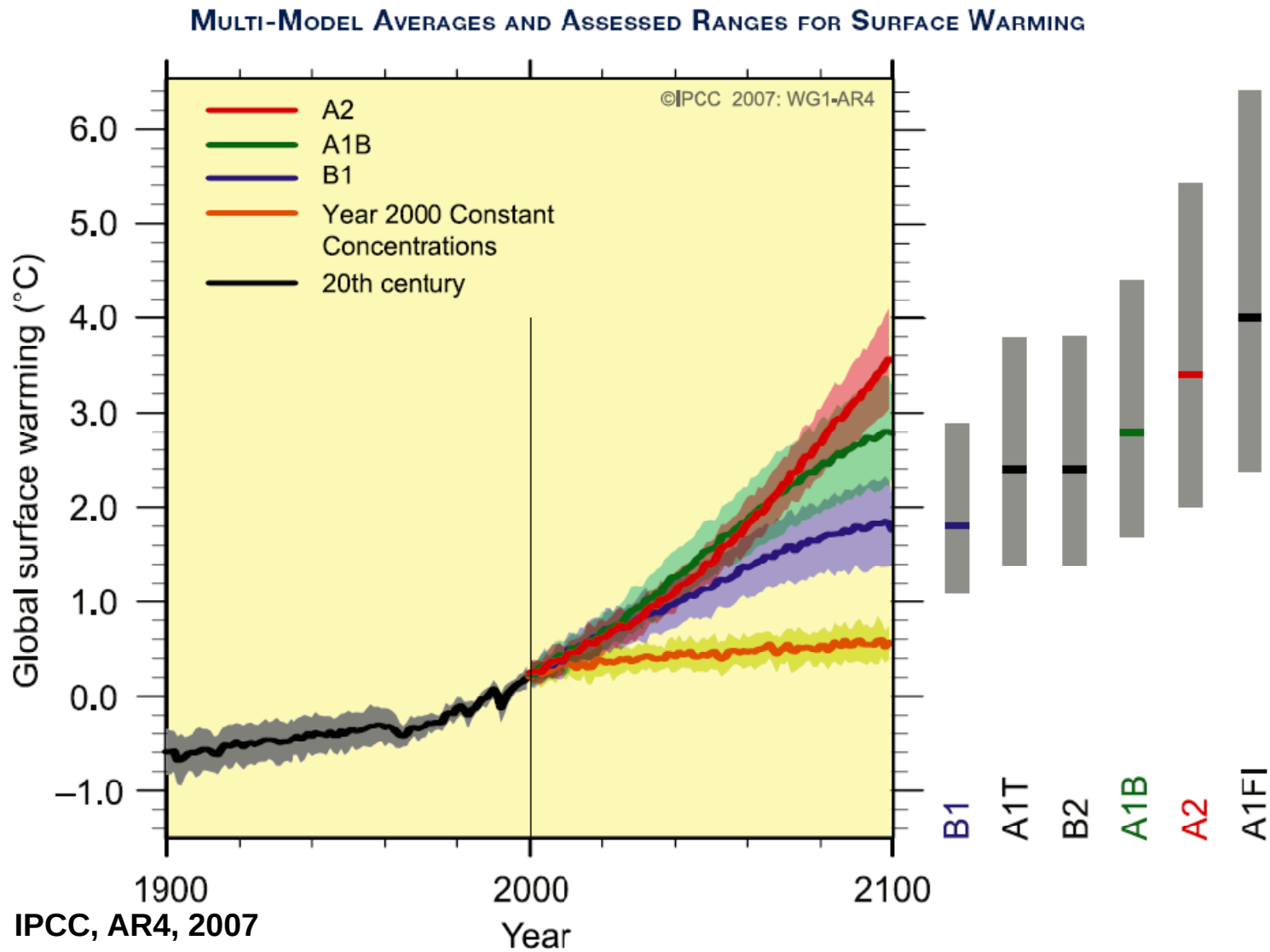
Background on technology

Current situation

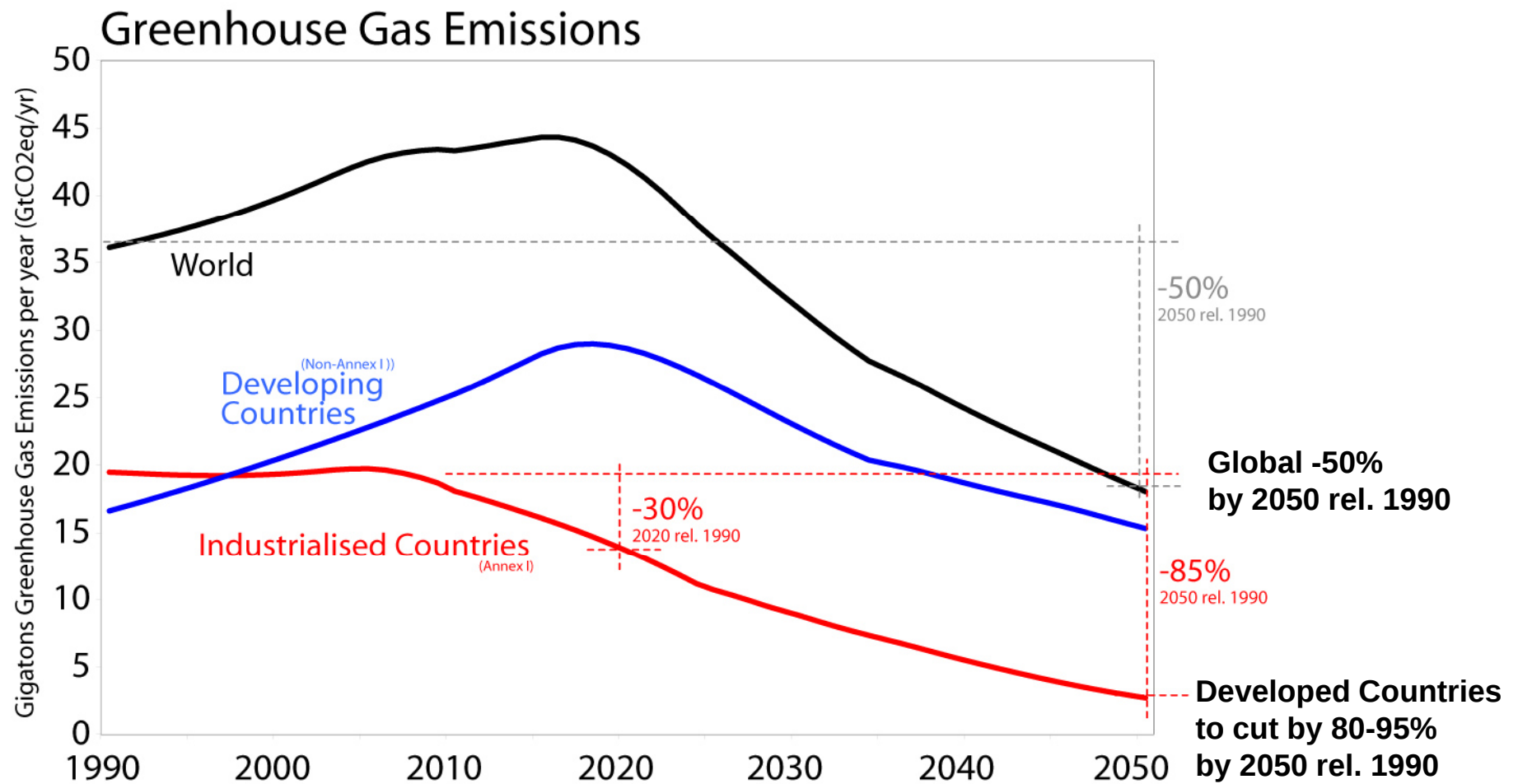
- Kyoto Protocol and Copenhagen Accord
- What's next?

# Climate change mitigation

## Projections of future changes in climate



## Staying below 2°C means peak and reduce now



## **International agreements: the basics**

## International institutions

Build a coalition to address a collective action or cooperation problem

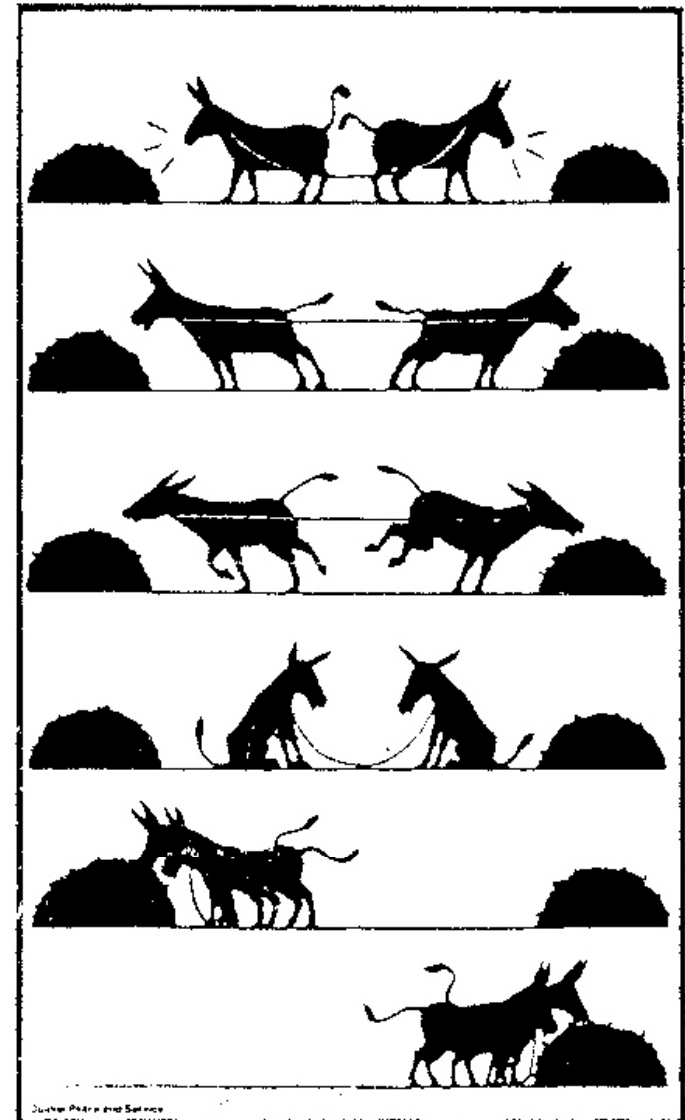
In the UN, actors are exclusively states

International agreements: Characterised by non-enforceability

- Only exceptions: UN Security Council and WTO
- International environmental agreements: soft power and self-enforcing

Preventing climate change: global public good problem

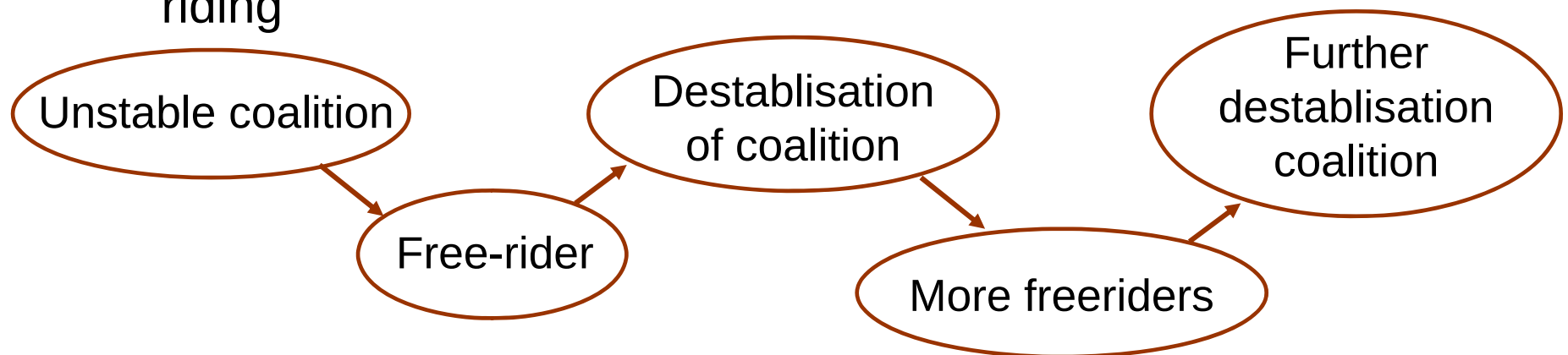
- Non-excludable benefits
- incentives for free-riding



## Consensus is necessary...

Coalitions to provide global public goods are unstable because:

- Often there is asymmetry in country's interests, so complicated deals have to be struck – careful balance
- Non-excludable benefits encourage free-riding
- No supra-national authority to punish or even discourage free-riding



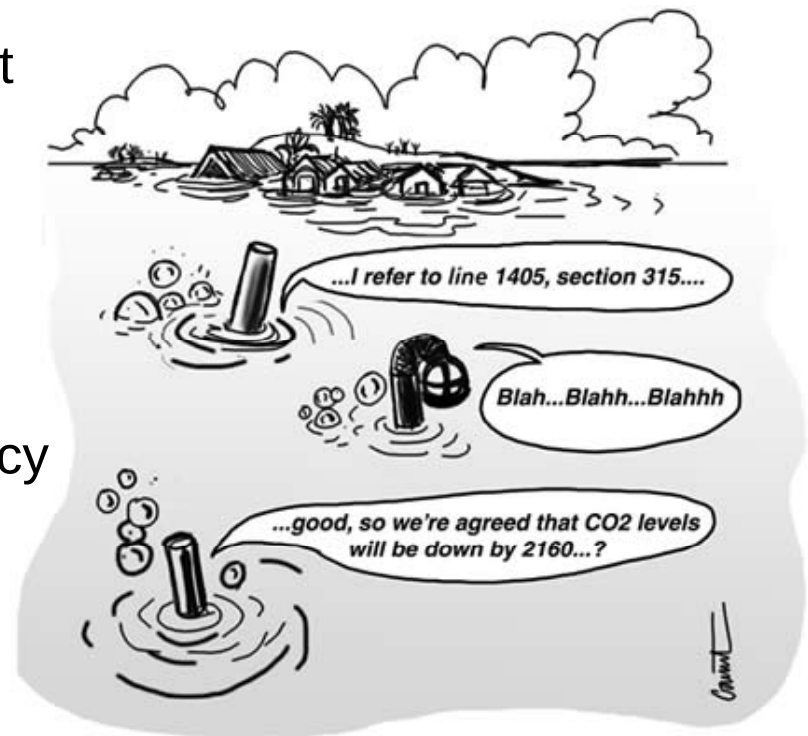
→ **Non-participation and defection threat to agreement**

## ... but slow

Agreeing on Kyoto took only two years, but entry into force took ten since 1995

Negotiation process lengthy:

- Getting every single country on the same level of knowledge
- Agreeing on the problem and urgency
- Time needed to examine the consequences
- Political approval processes
- Agreeing on the solution
- Changing governments and political preferences



## Introducing the process: it's about reciprocity

Victim: the country bothered by the problem

Perpetrator: the country causing the problem

Sometimes they are one and the same:

- Symmetric externality
- Issue-specific reciprocity

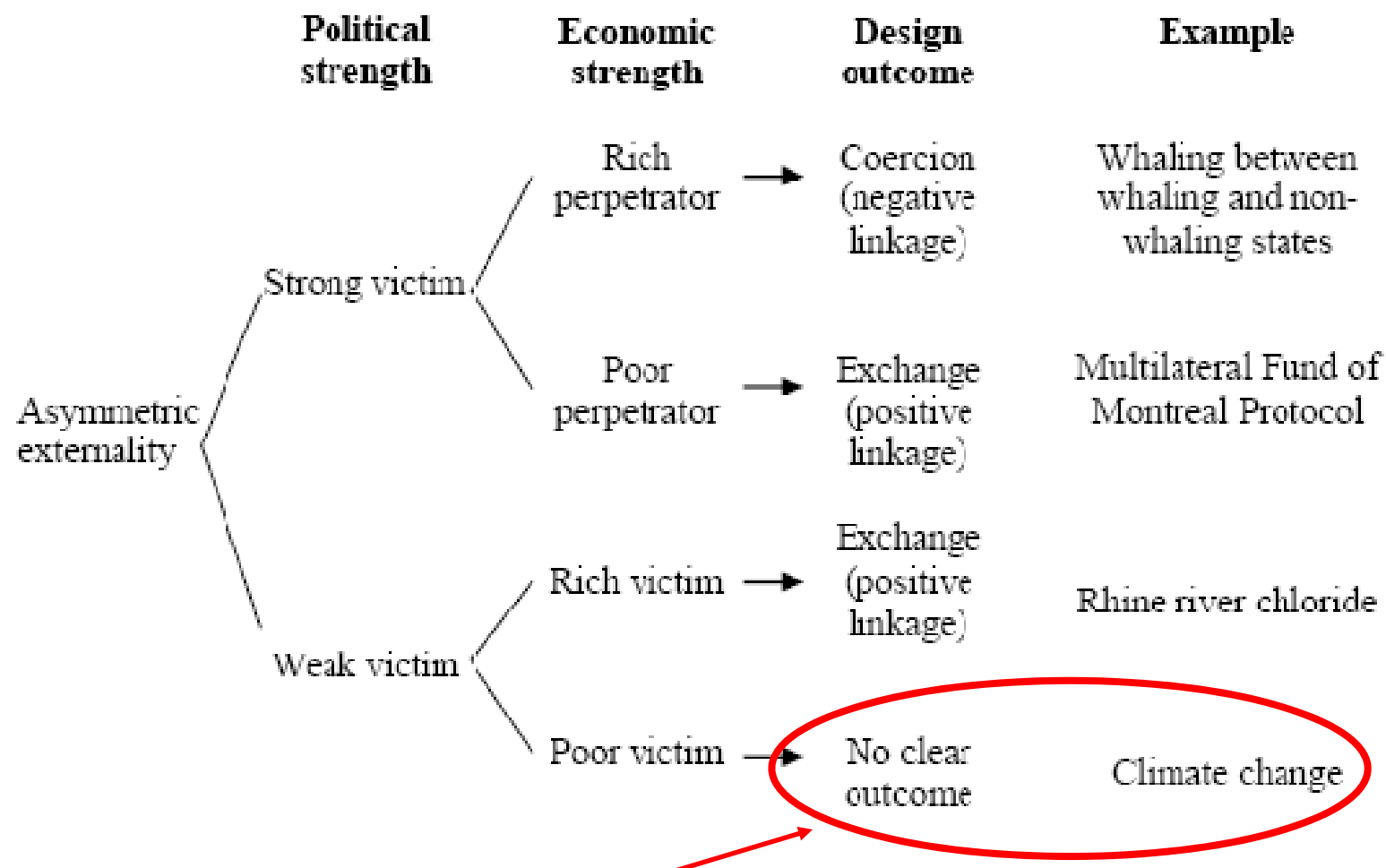
If there is a discrepancy

- Asymmetric externality
- “Positive exchange”: victim pays the perpetrator to address the problem
- “Negative exchange”: victim coerces the perpetrator into addressing the problem

## Some examples...

| Political strength:    | Strong victim                                                    | Weak victim                 | Examples                                                                                                                                                                                                                                       |
|------------------------|------------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symmetric externality  | Issue-specific reciprocity                                       |                             | Whaling among whaling nations<br>Ozone depletion among ozone depleting nations                                                                                                                                                                 |
| Asymmetric externality | Coercion (negative linkage)<br>OR<br>Exchange (positive linkage) | Exchange (positive linkage) | Ozone depletion between industrialised (strong victims) and developing nations<br>Whaling between whaling and non-whaling states (strong victims)<br>Rhine river chloride between France/Germany/Switzerland and the Netherlands (weak victim) |

## .. And climate change



**The source of all trouble**

## Characterisation of negotiations

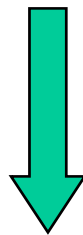
 Developing countries: want everyone to mitigate and pay for adaptation



EU: 20 +

China's per capita income is so low, no justification for action. Annex I first!

China needs to participate



US: only want to participate if China and India do

**Deadlock**

## Framing of climate change mitigation

## Common framing of the climate problem

We are dealing with a problem

- With a global scope
- Of which the root causes lay in welfare and associated energy use
- Which has an obvious metric (greenhouse gas emissions)
- From an economic point of view, greenhouse gas emissions are the externality
- Therefore, we should price the externality
- Global price on CO<sub>2</sub> through tax (impossible) or international emissions trading

## What is a fair way to distribute mitigation responsibilities?

Based on a negotiated outcome?

Based on cumulative historical contribution to climate change?

Based on future contribution to the climate problem?

Based on carbon intensity?

Based on the reduction potentials (geography, climate)?

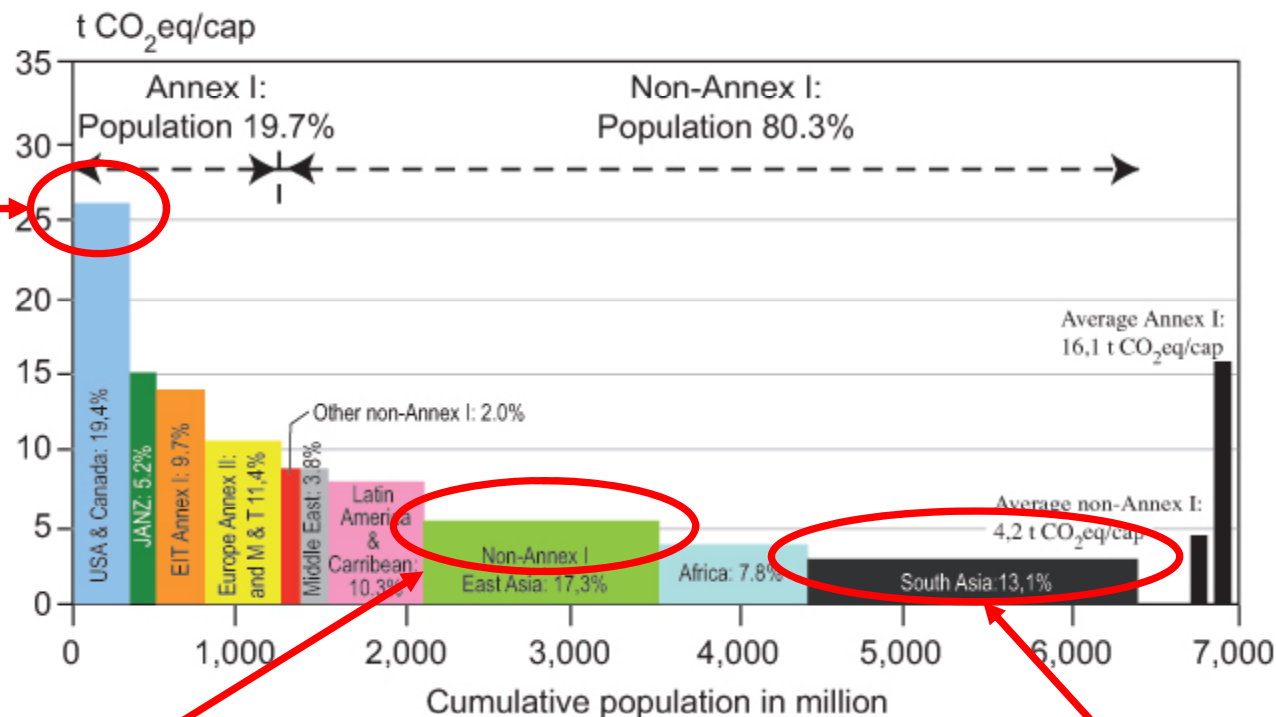
Based on national average greenhouse gas emissions?

Based on the emissions of the individuals in a country?



## Traditional country-based framing: Kyoto

Moral obligation to reduce, but high costs



Increasing emissions but much lower than Annex I

Very low per capita emissions but growing middle class

# What has happened to Kyoto?

Political Map of the World, April 2001



Conclusion: Kyoto has led to some emission reductions, but insufficient to address the problem

April 2001

Source: United Nations Secretariat of the Convention on Biological Diversity, 2001. The map is a reproduction of the United Nations Secretariat of the Convention on Biological Diversity, 2001. The map is a reproduction of the United Nations Secretariat of the Convention on Biological Diversity, 2001.

## Traditional individual-based framing

Every person has a right to emit as much as he wants/can, up to a certain level which is regarded unsustainable

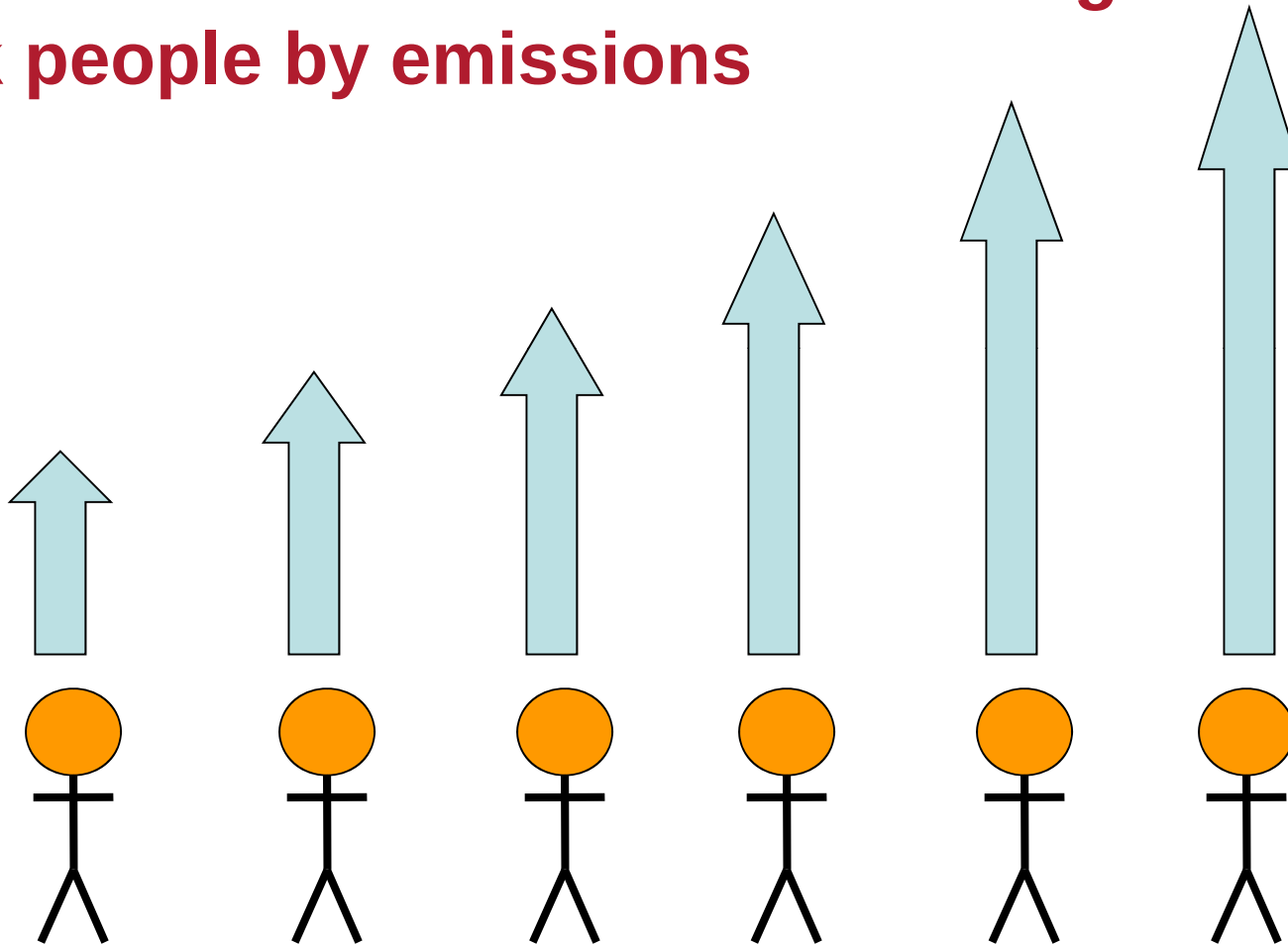
Focus on the individual

Treat every individual the same

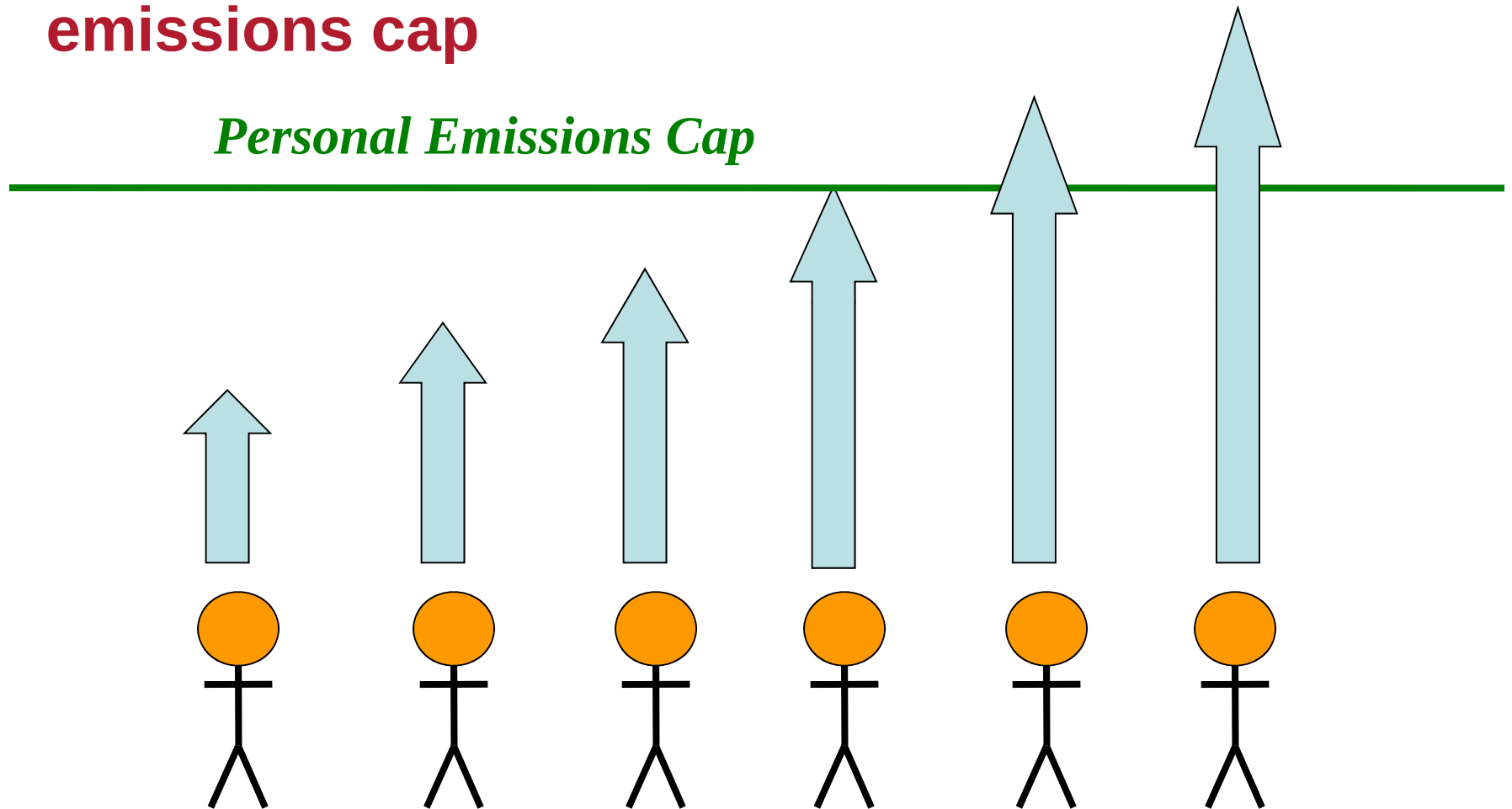
Calculate the appropriate allowance for the emission of an individual

Add up the individual allowances for each citizen in a country to find the nation's cap

## Traditional individual-based framing: rank people by emissions

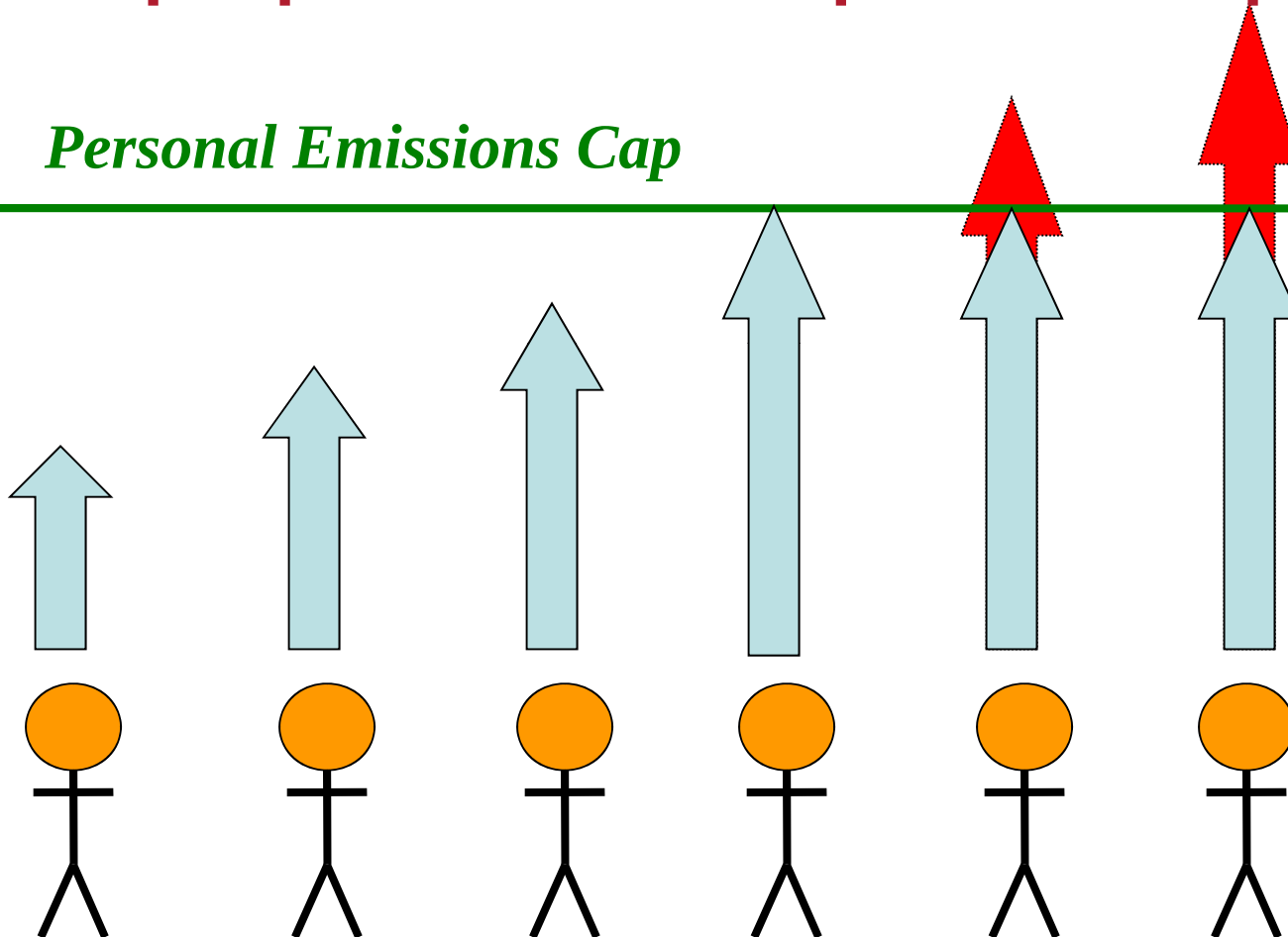


... determine globally applicable personal emissions cap



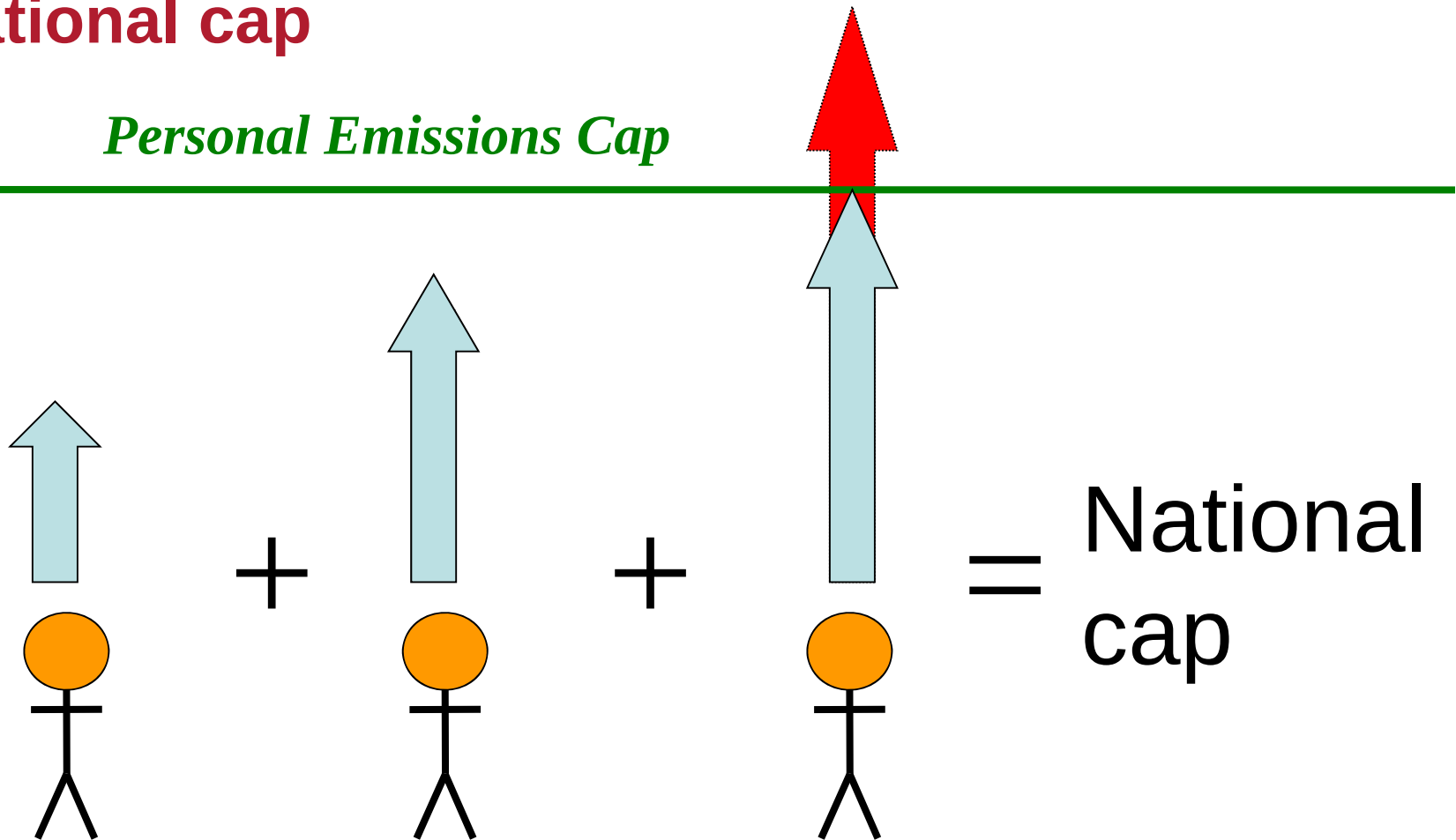
... some people exceed that personal cap

*Personal Emissions Cap*



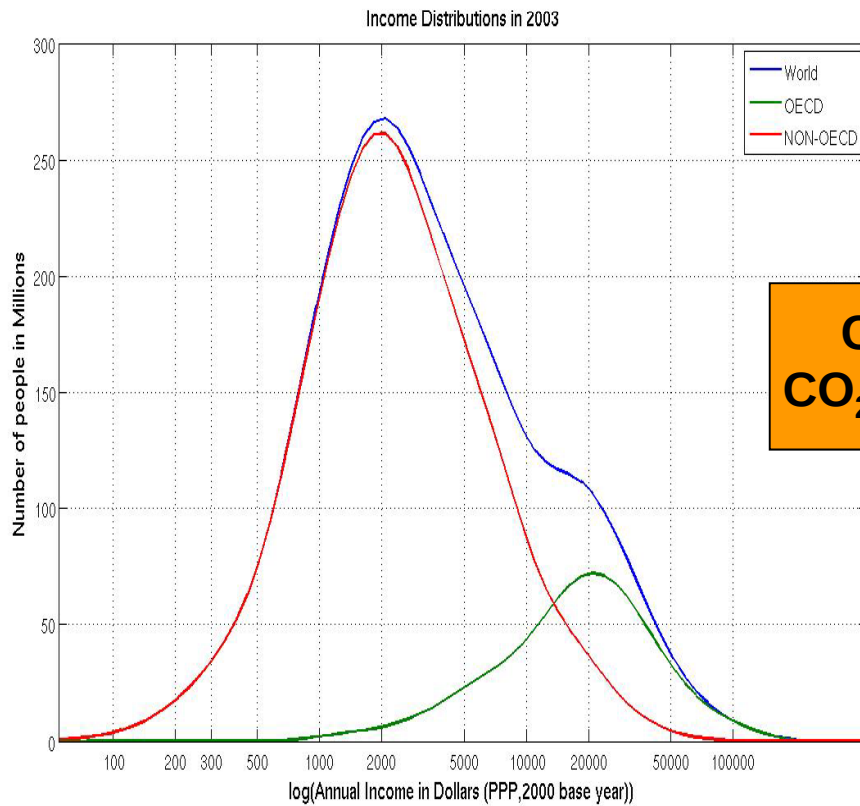
... the people in a nation determine  
national cap

*Personal Emissions Cap*

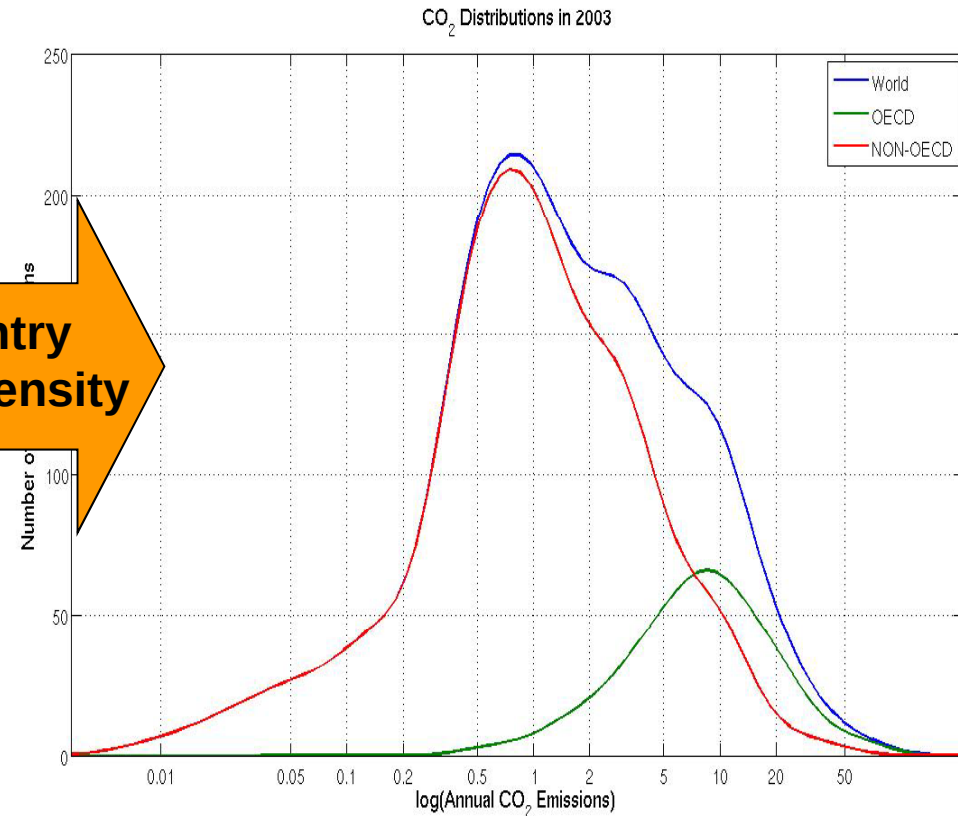


*Those exceeding personal cap need to reduce*

# Traditional individual-based framing

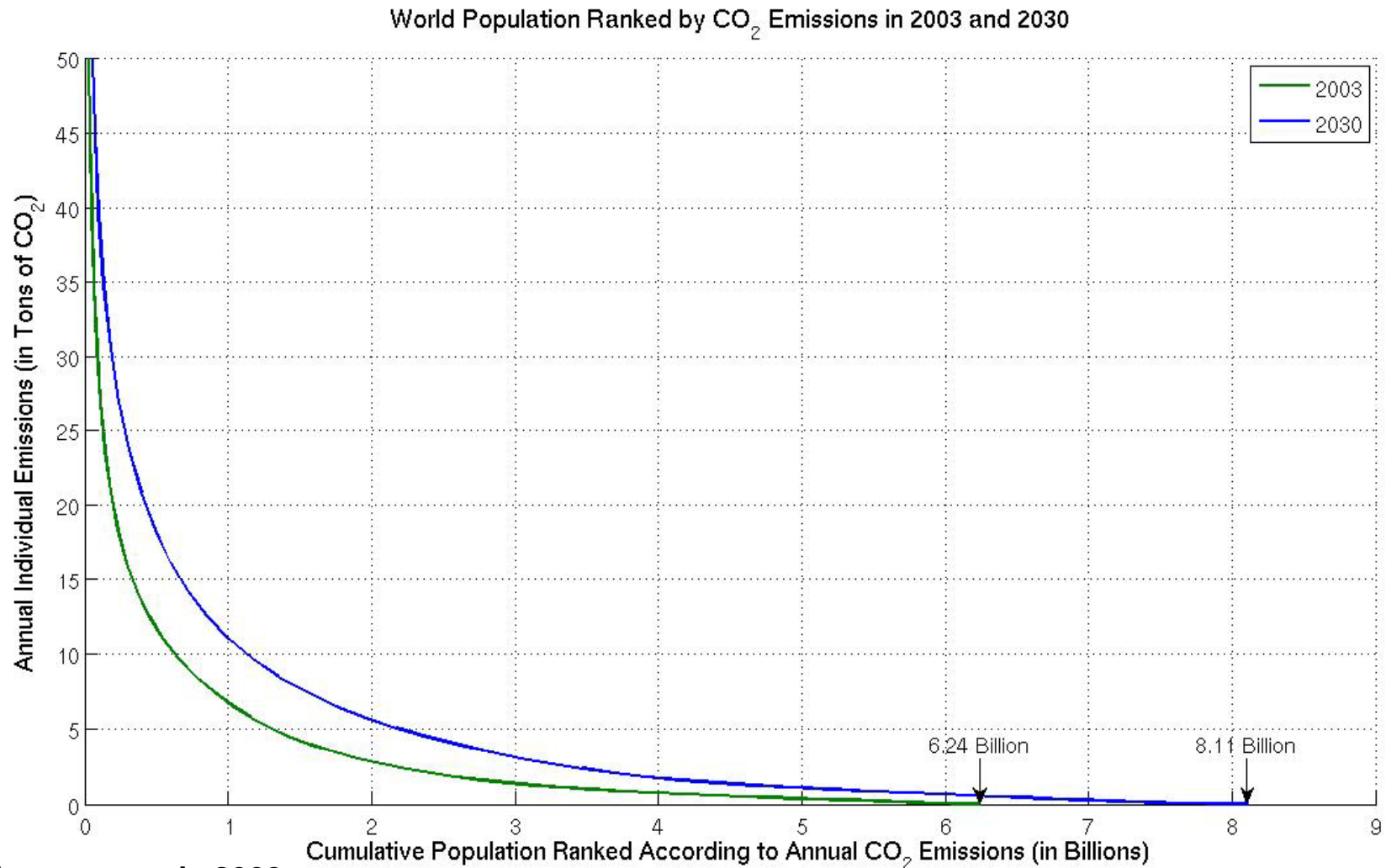


**Country  
CO<sub>2</sub> intensity**



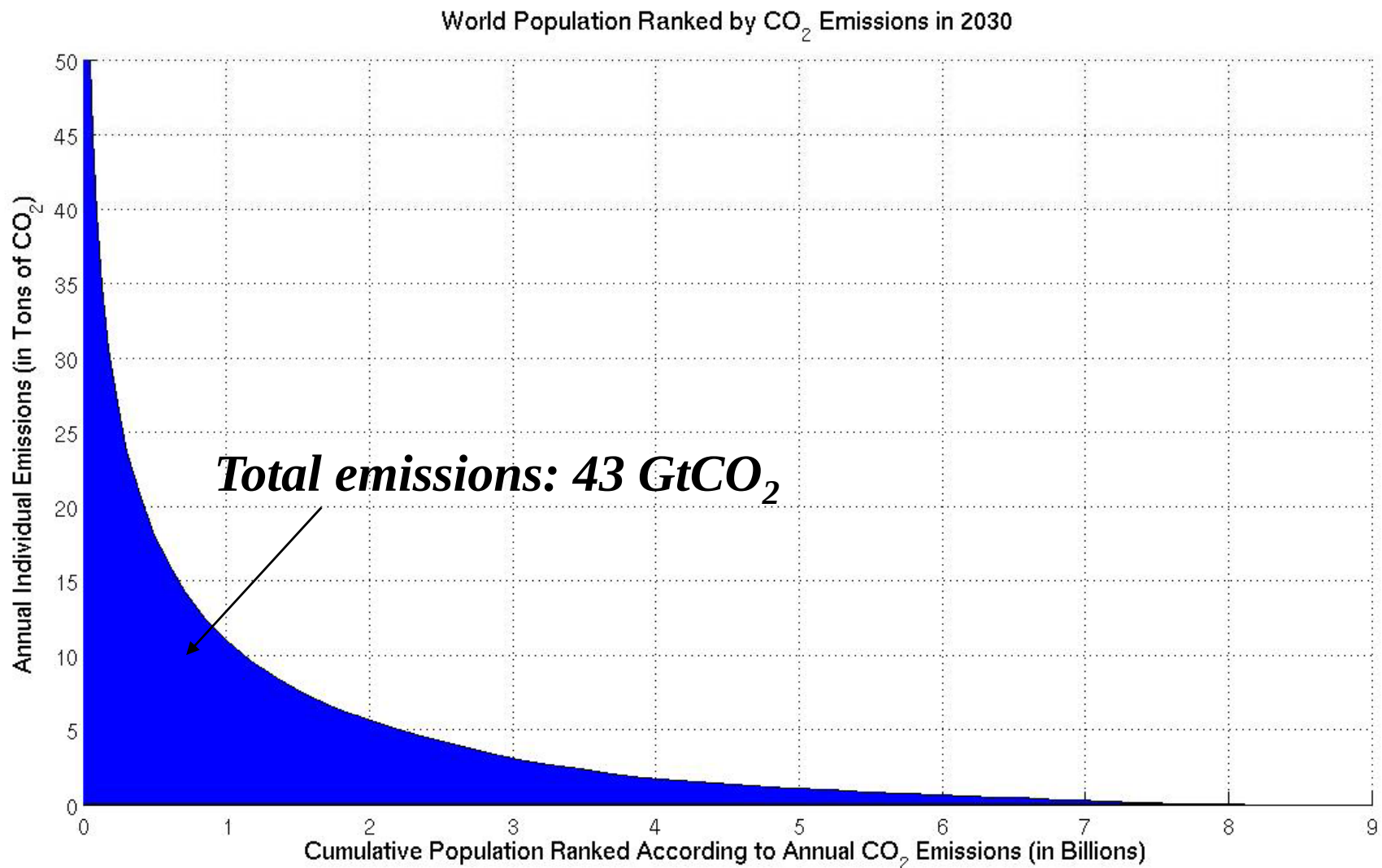
Chakravarty et al., 2009

# Traditional individual-based framing

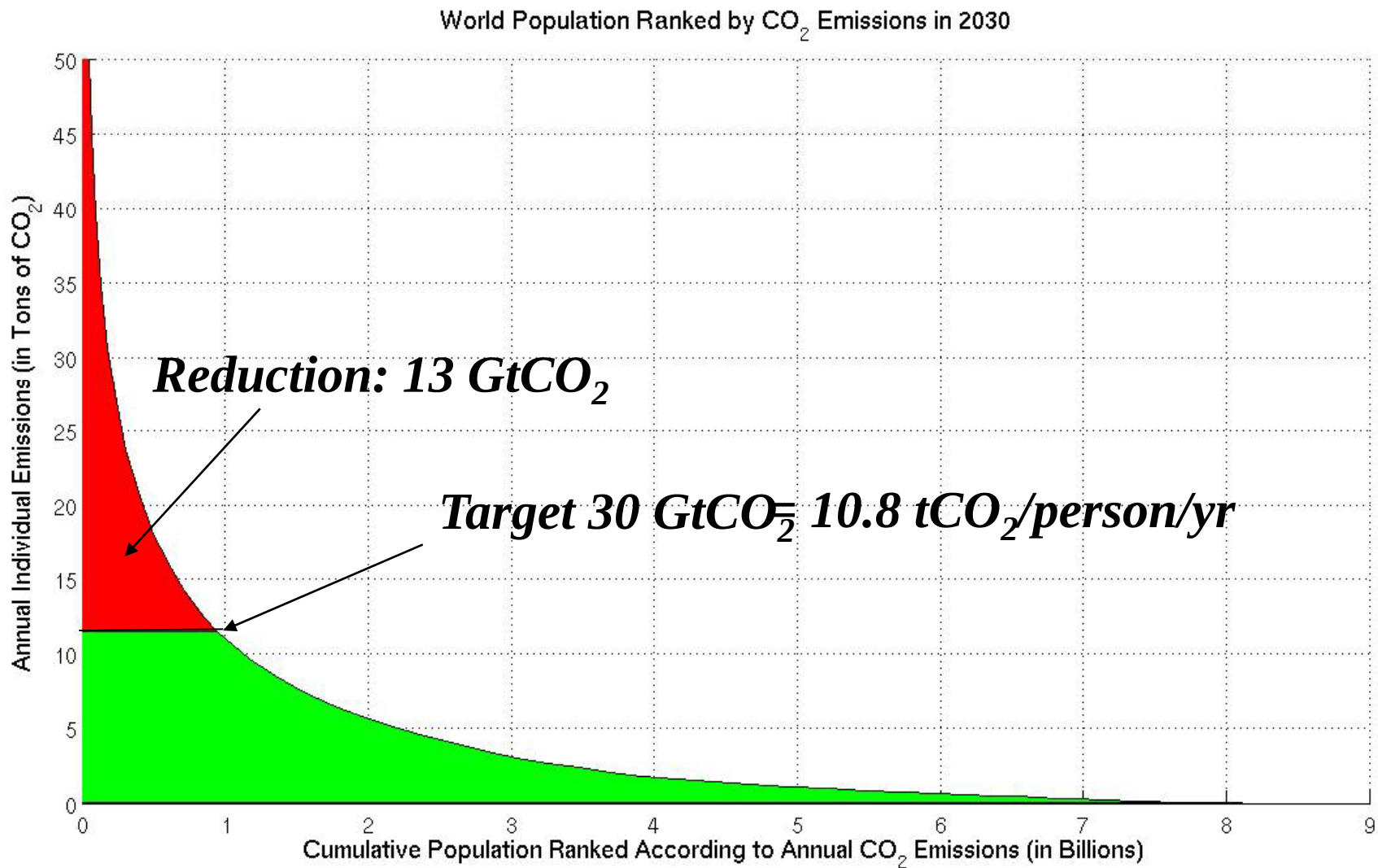


Chakravarty et al., 2009

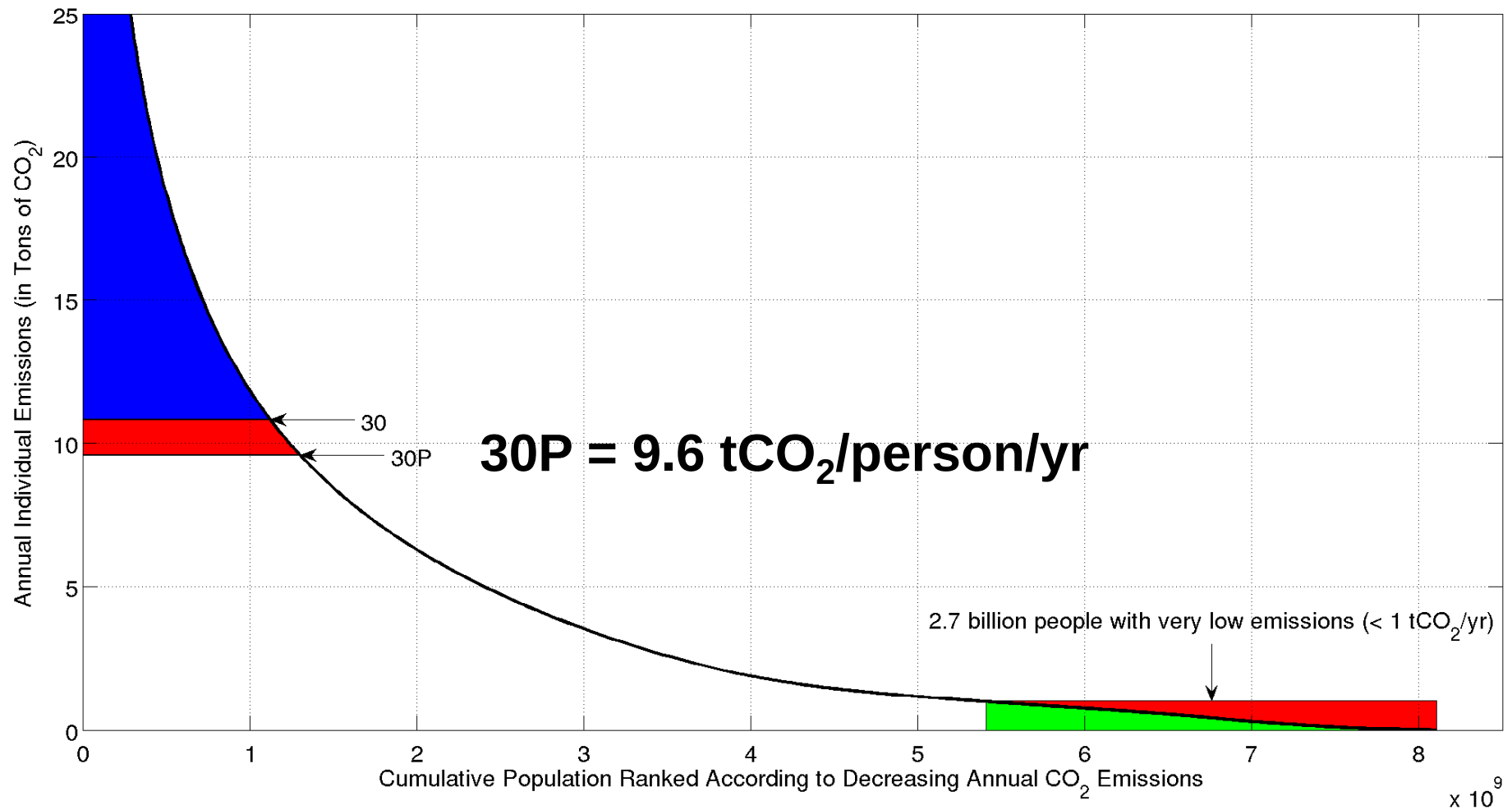
## Choose a global target: 30 GtCO<sub>2</sub> in 2030



## Choose a global target: 30 GtCO<sub>2</sub> in 2030

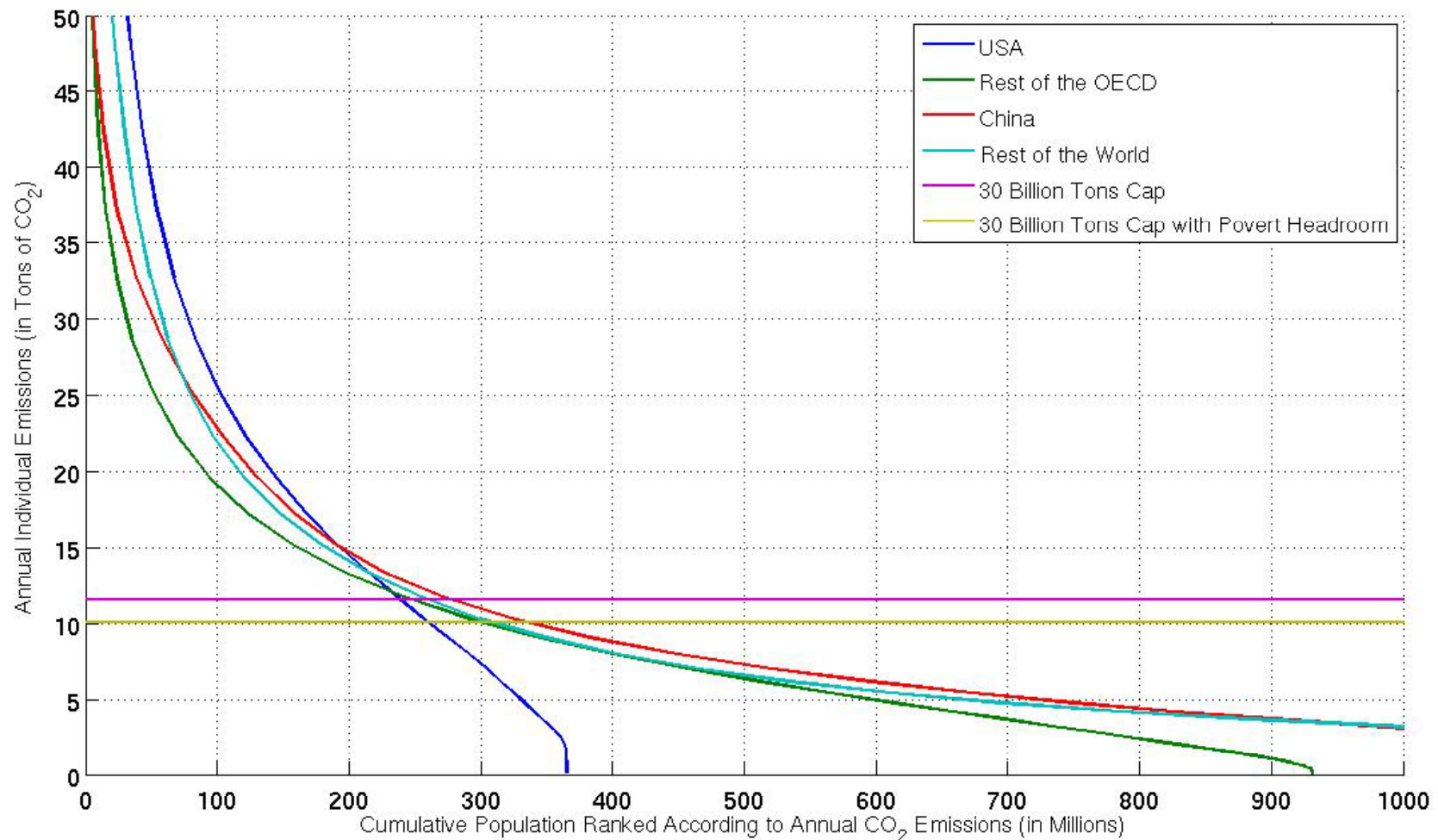


## “Headroom” for the poor



# Distribution between country groupings

Emission Profiles and Cuts for a 30 Billion Tons CO<sub>2</sub> target in 2030



## Conclusion individual-based framing

It is possible to arrive at national caps based on income-based individual emissions

The need of the poorest 2.7 billion people to emit more can be accommodated

Global cap of 30 GtCO<sub>2</sub> in 2030 results in about 1 billion people having to reduce emissions

Equally distributed among regions

Flexibility on policy instrument

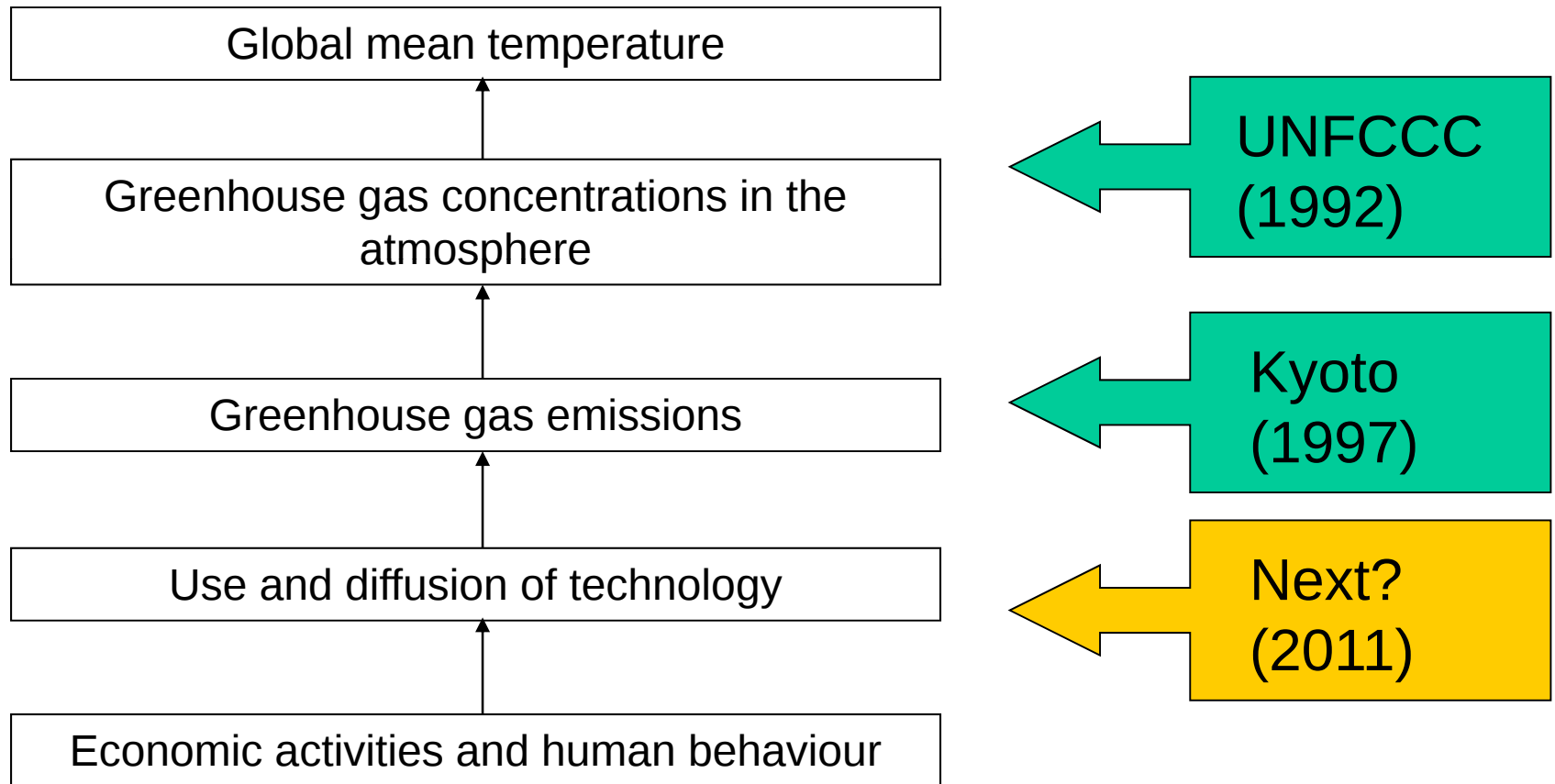
... but we still need to agree on legally binding emission reductions

## “Neo-liberalist” framing

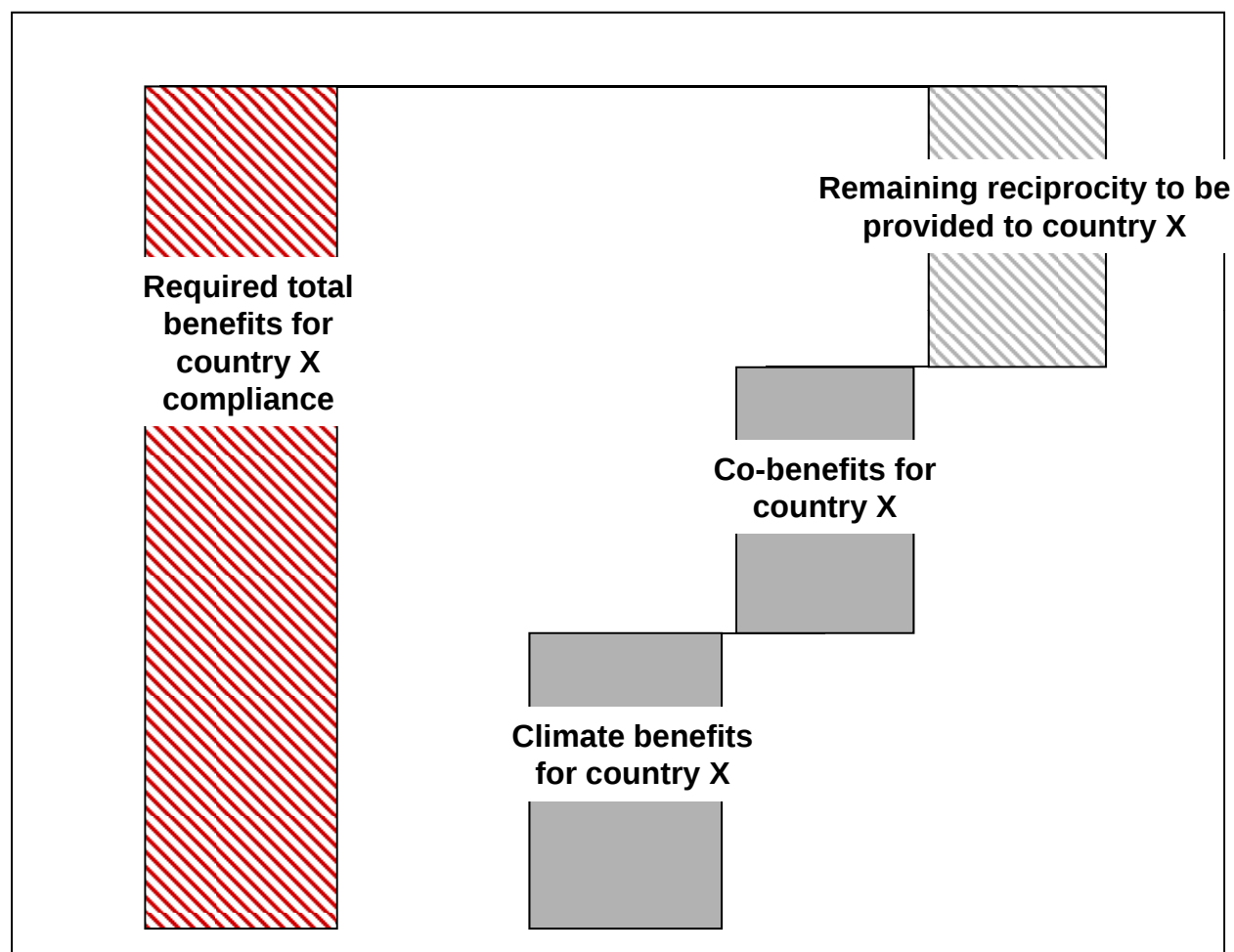
- Emissions: Industrialised countries; impacts: poor countries
- Costs of reducing emissions high, while benefits to others
- Countries act as self-interested rational actors
- Emission reduction agreement is not in the interest of those that should most urgently reduce emissions
- Little means of enforcement of international agreement
- Self-reinforcing agreements: “attractive to sign and want to carry out the terms of agreement”
- Reciprocity “perceived equivalence of costs and benefits between parties”

Can we design an international agreement that is in everyone's interest?

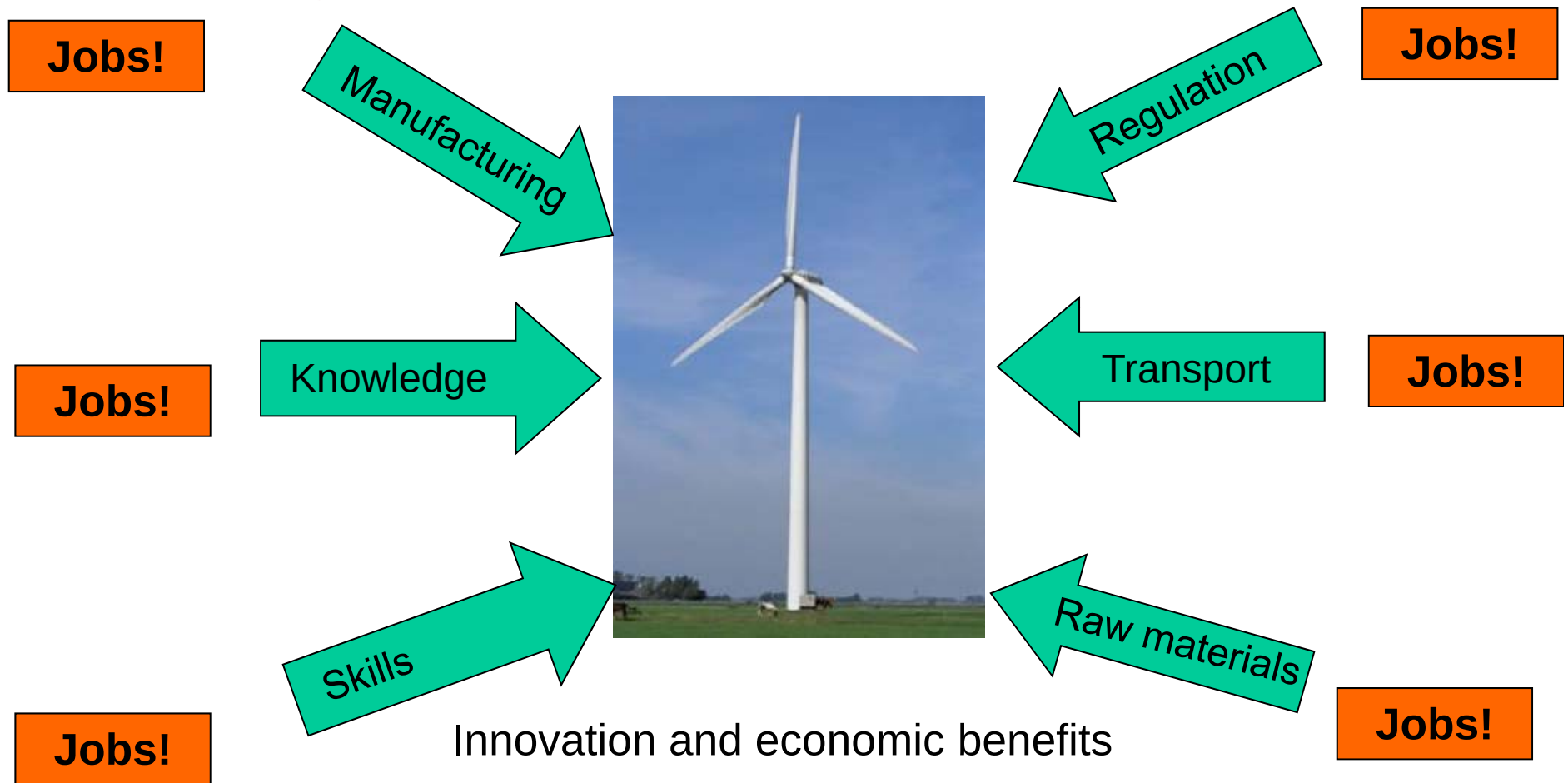
## Climate change causal chain and policy points of intervention



## Three means of reciprocity



## Technology and reciprocity



Innovation and economic benefits  
First-mover advantages and export potential  
Reducing market inefficiencies  
Opportunities, not constraints

## Background on technology

## Technology in climate negotiations

UNFCCC (Art. 4.1c, 4.5)

- Parties should cooperate on advancing technology
- Annex-I should transfer technologies to non-Annex I

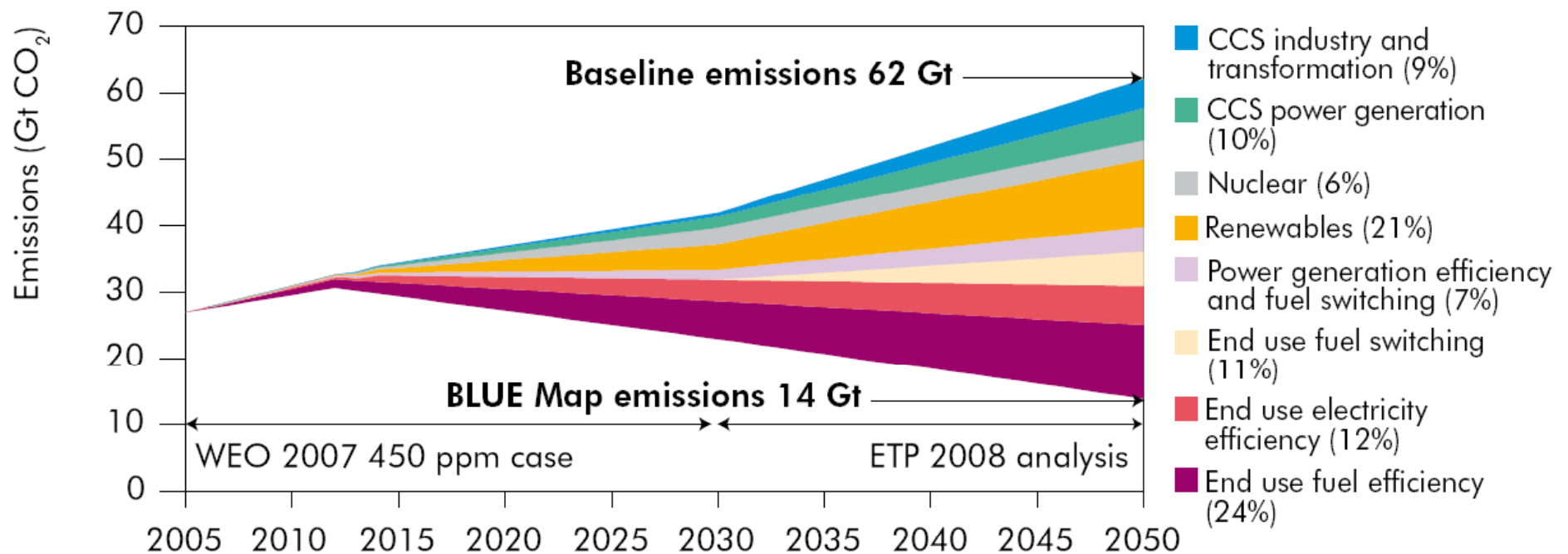
Current Convention sources and vehicles for technology transfer finance

- Technology Needs Assessments – demand for technology
- Global Environment Facility – fund for technology transfer
- CDM (and JI) – market mechanisms

Expert Group on Technology Transfer (EGTT)

- Find ways to advance development and transfer of technology
- New dynamic: from North-South technology transfer to international cooperation

## Technology: we think we know what we want



ADB (2007). Carmody, J. Ritchie, D. (2007) Investing in Clean Energy and Low-Carbon Alternatives in Asia, Manila. Aldy, J., Orszag, P., Stiglitz, J. (2001) Climate Change: An Agenda for Global Action. Pew Centre. USA. Aldy et al. (2003) Thirteen plus one: a comparison of global climate policy architectures, *Climate Policy*, 3, 373-397. Alfsen, K. & Eskeland, G. (2007) The Role of Technology in Climate Policy, Swedish Ministry of Finance. Alic, J. Mowry, D. (2003) US Technology and Innovation Policies: Lessons for Climate Change. In proceedings from Aspen Institute. Nov. 2003. USA. Amin, (2000): The Power of Networks: Renewable Electricity in India and South Africa, DPhil. Andersen, S. Sarma, Madhava, Taddonio, K. (2007) Technology Transfer for the Ozone Layer: Lessons for Climate Change. Earthscan, London, UK. 2007. Anderson, D (2006) Costs and Finance of Abating Carbon Emissions in the Energy Sector, Imperial College, UK. Arrow, K. (1962) "The Economic Implications of Learning by Doing", *Review of Economic Studies*, 29: 155-73. Arthur, W.B. (1989) Competing Technologies, Increasing returns, and Lock-in by Historical Example. *The Economic Journal*. Vol 99 (394). Bagwell, K., and R.W. Staiger (1999) An economic theory of GATT. *The American Economic Review* 89(1): 215-248. Baron R. (2007) Sectoral Approaches to greenhouse Gas Mitigation. OECD. Paris. Baron, R. Barnsley, I. Ellis, J. (2008) Options for Integrating Sectoral Approaches into the UNFCCC. OECD AIEG. Paris. Barrett, S. (2001), "Towards a Better Climate Treaty", *Policy Matters* 01-29, Washington, DC: AEI Brookings Joint Center for Regulatory Studies. Barton J (2007) Intellectual Property and Access to Clean Energy technologies in Developing Countries. Draft. ICTSD. Issue paper 2. Baumert, K., Blanchard, O., Llosa, S., Perkaus, J.F. (eds) (2002) Building on the Kyoto Protocol: Options for Protecting the Climate, World Resources Institute, Washington, DC [available at [http://climate.wri.org/pubs\\_pdf.cfm?PubID=3762](http://climate.wri.org/pubs_pdf.cfm?PubID=3762)]. Baumert, K., Winkler, H. (2005) 'SD-PAMs and international climate agreements', in: R. Bradley, K. Baumert, J. Pershing (eds), *Growing in the Greenhouse: Protecting the Climate by Putting Development First*, World Resources Institute, Washington, DC, 15-23. Bazilian, M., Roques, F. (eds.) (2008) *Analytical Methods for Energy Diversity and Security*, Elsevier Science. Amsterdam. Bell, M., and K. Pavitt (1993) Technological Accumulation and Industrial Growth: Contrasts between Developed and Developing Countries *Industrial and Corporate Change* 2:157 – 210. Benedick, R.E. (2001), "Striking a New Deal on Climate Change", *Issue in Science and Technology*. Fall: 71-76. Bergek, A., Jacobsson, S., Carlsson, B., Lindmark, S. and Rickne, A. (2008) Analyzing the functional dynamics of technological innovation systems: A scheme of analysis, published in *Research Policy*, 37(3), 407-429. Betz, R. and Sato, M. (2006) Emissions trading: lessons learnt from the 1st phase of the EU ETS and prospects for the 2nd phase, *Climate Policy* 6, pp351-359. Blair, T. (2008) Breaking the Climate Deadlock, The Climate Group. London. Boeters, S. (2007) Post-2012 Climate Scenarios. MNP Report 500114006/2007. The Netherlands. Bozeman, B (2000) Technology transfer and public policy: a review of research and theory. *Research Policy* 29:627-655. Bradley, R. Baumert, K. Childs, B. Herzog, T. Pershing, J. (2008) International Sectoral Cooperation on Climate Change. Bradley, R., Pershing, J., (2005) 'Introduction to sustainable development policies and measures', in: R. Bradley, K. Baumert, J. Pershing (eds), *Growing in the Greenhouse: Protecting the Climate by Putting Development First*, World Resources Institute, Washington, DC, 1-14. Braczyk H-J, Cooke P, Heidenreich, M. (1998) Regional innovation systems: the role of governance in a globalized world. London: UCL Press. Brewer, T. (2007) US Climate Change Policies and International Trade Policies. Georgetown University, USA. Brown, M. Chandler, J. (2007) Carbon Lock-in. US ORNL ORNL/TM-2007/124 Bruckner T., Edenhofer O., et al. (2007) Robust Options for Decarbonisation: Background Paper on Energy Security for etc..etc etc etc

## Theorising about technology

*Invention*

*Innovation*

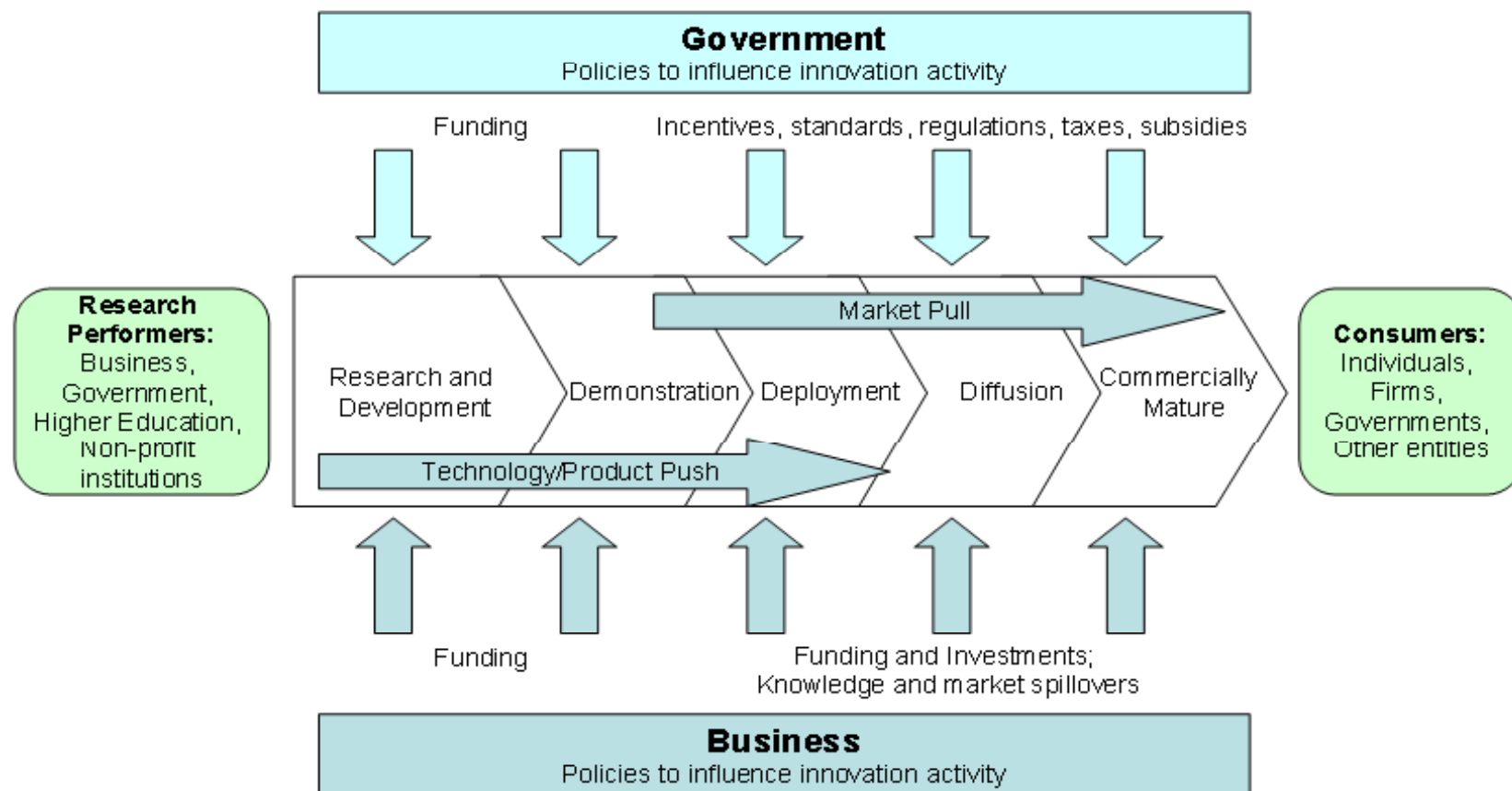
*R&D*

*Demonstration*

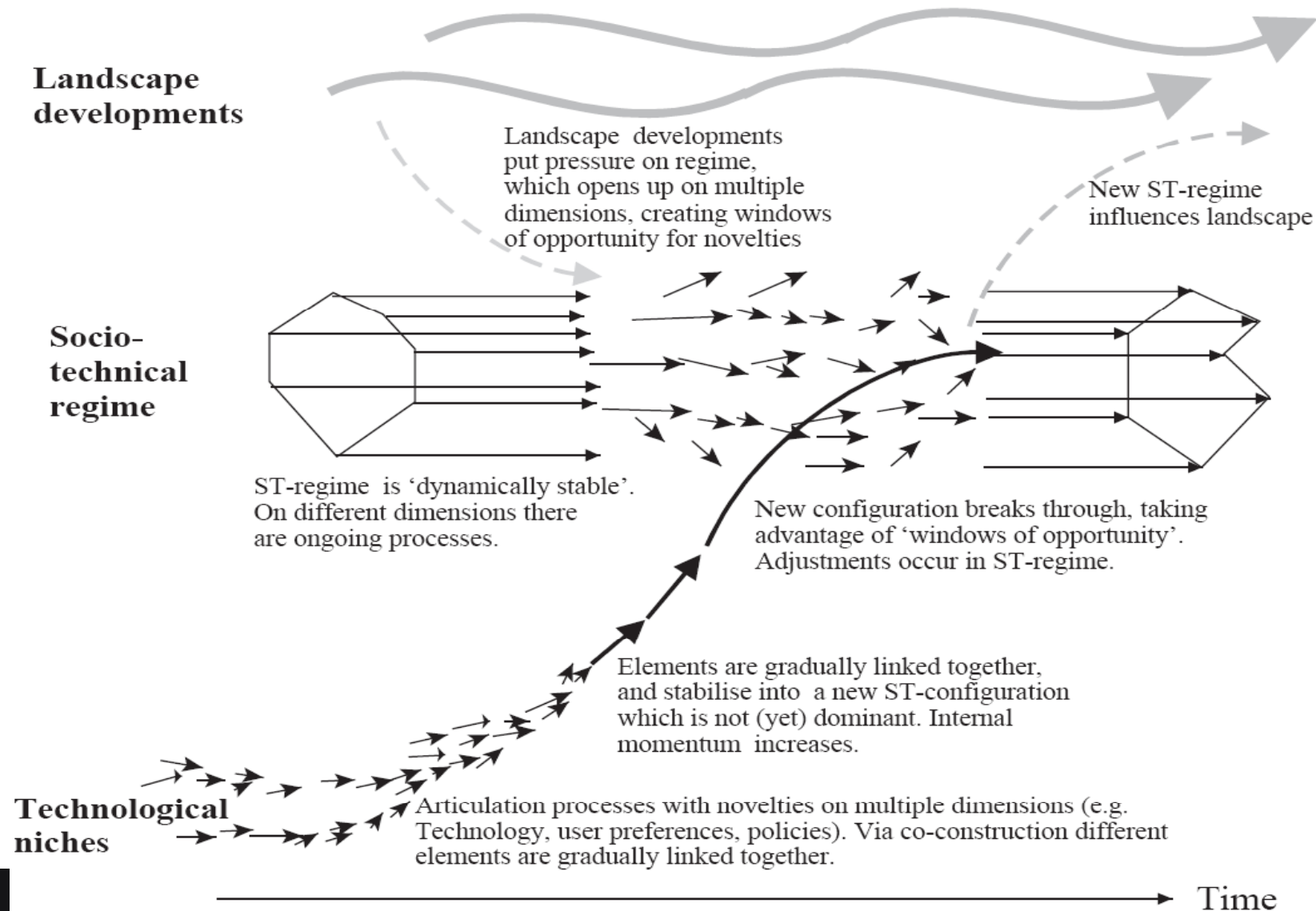
*Deployment*

*Diffusion*

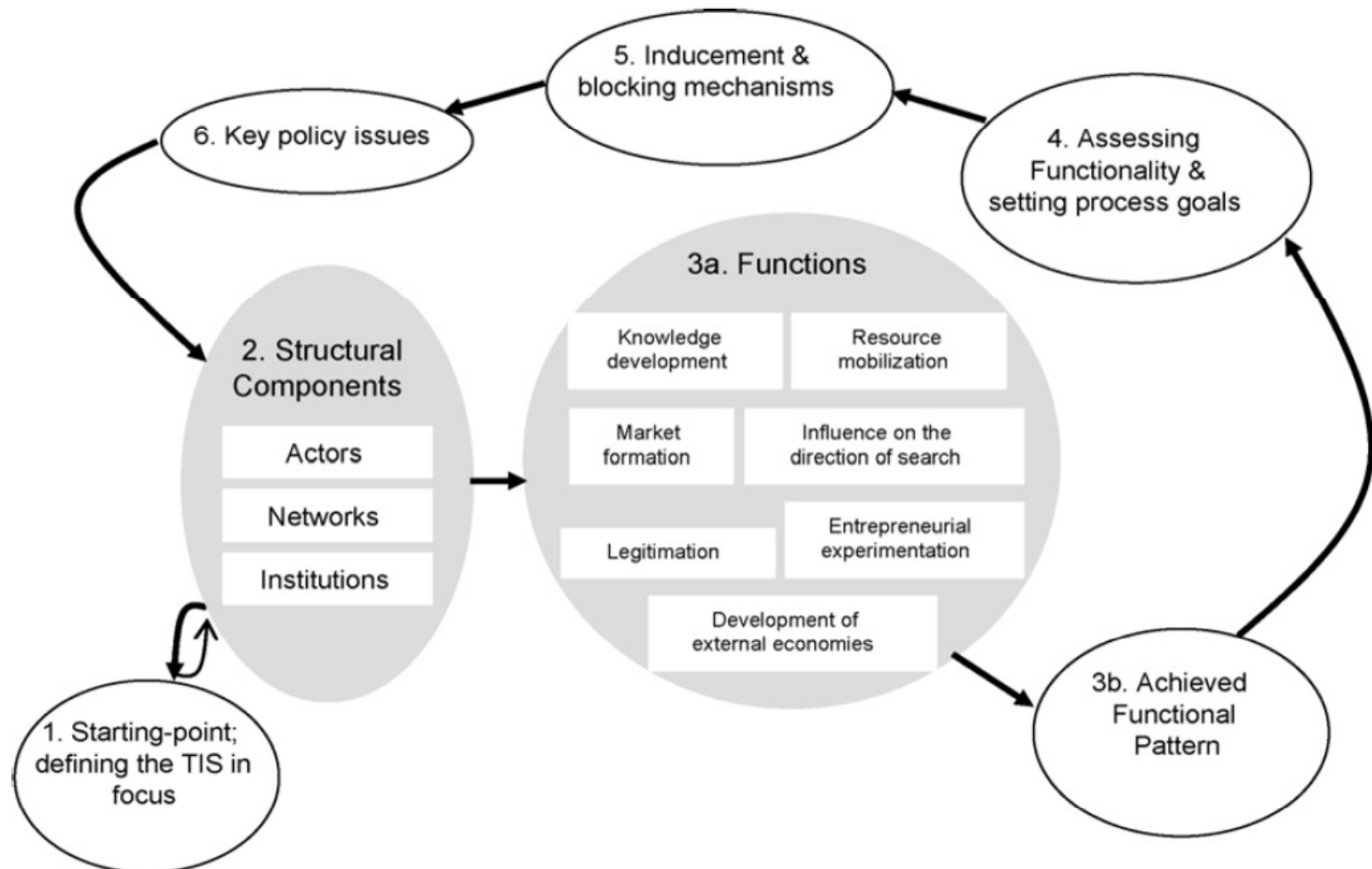
# Technology framework addresses all stages



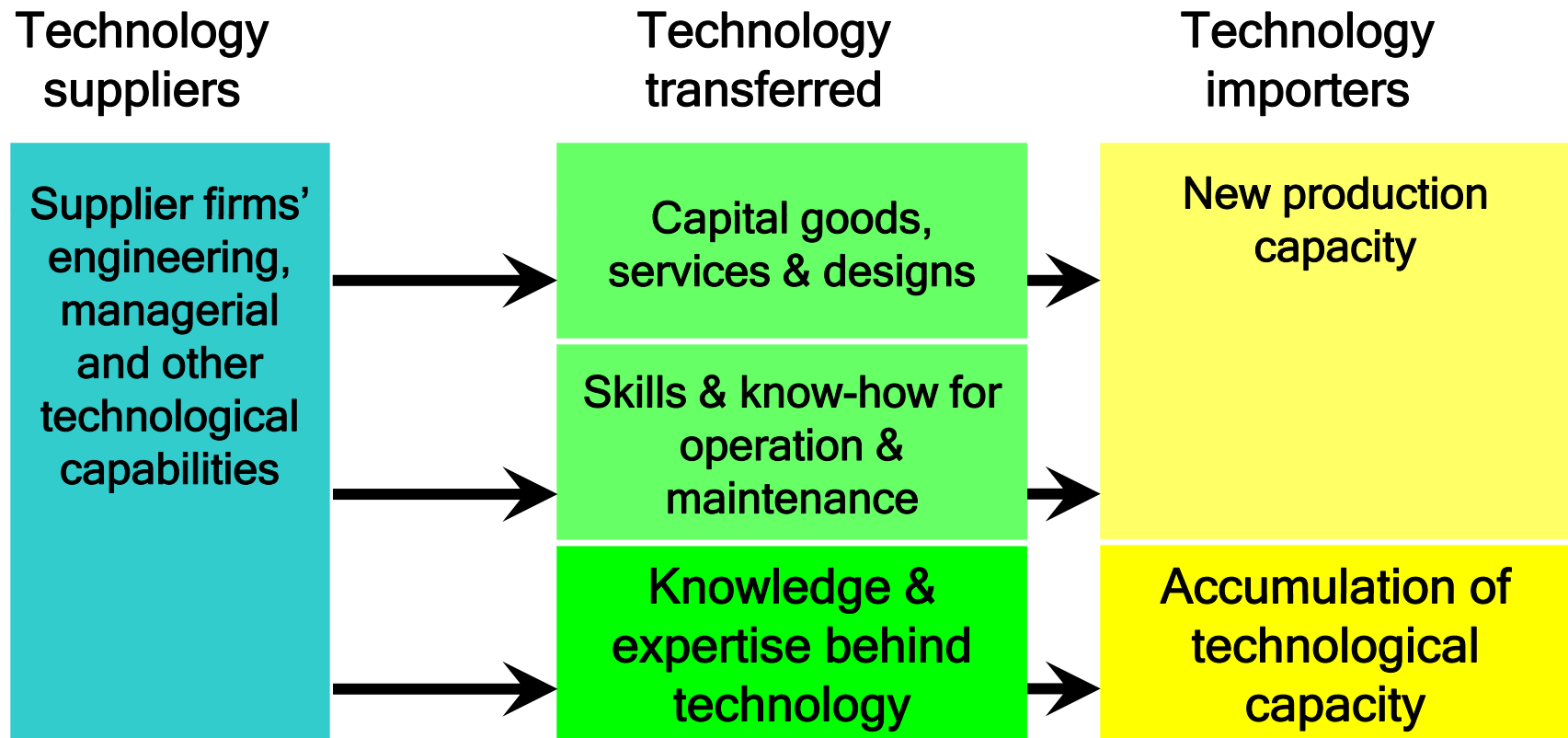
# Socio-technical studies



# Technological innovation systems

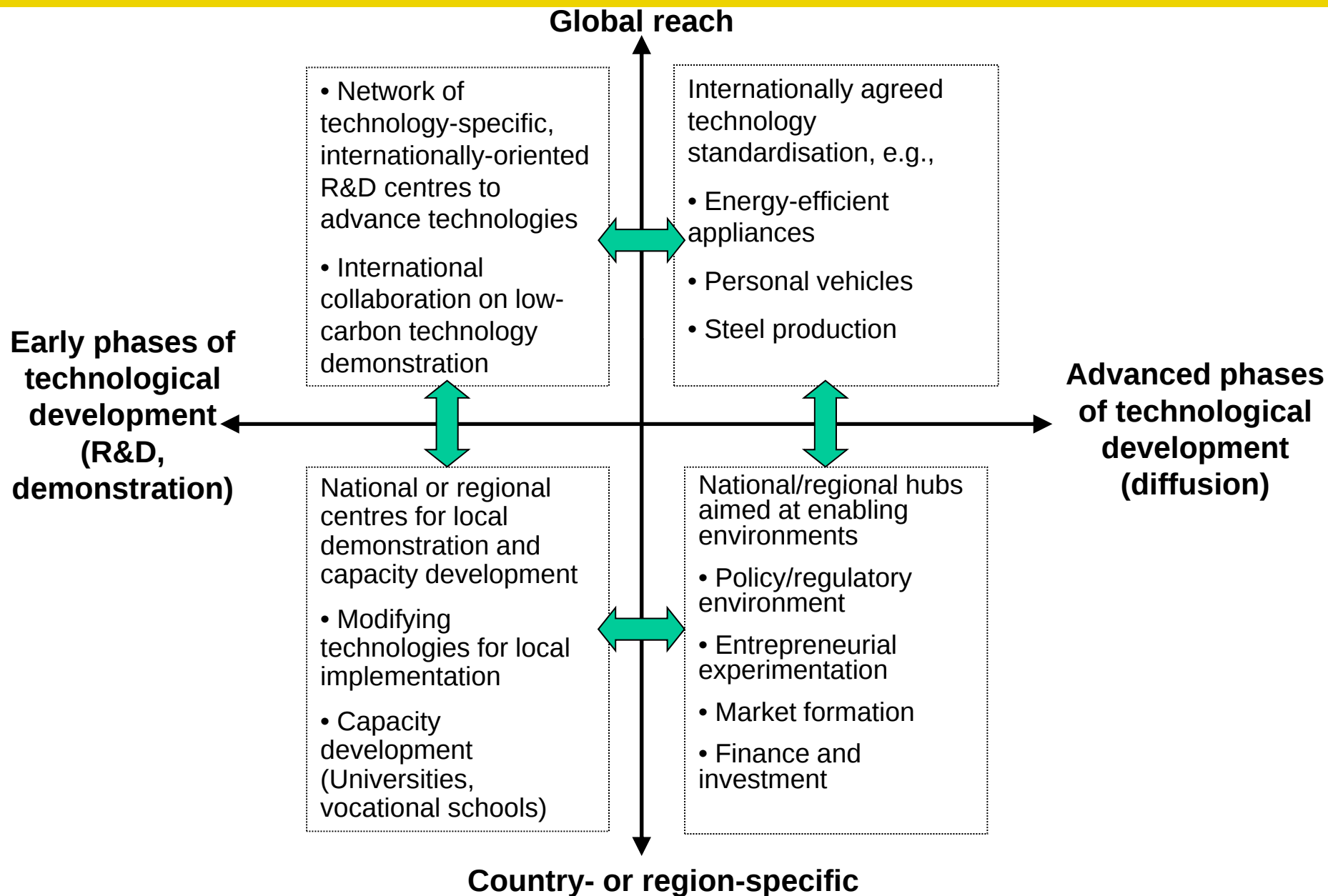


## Technology transfer

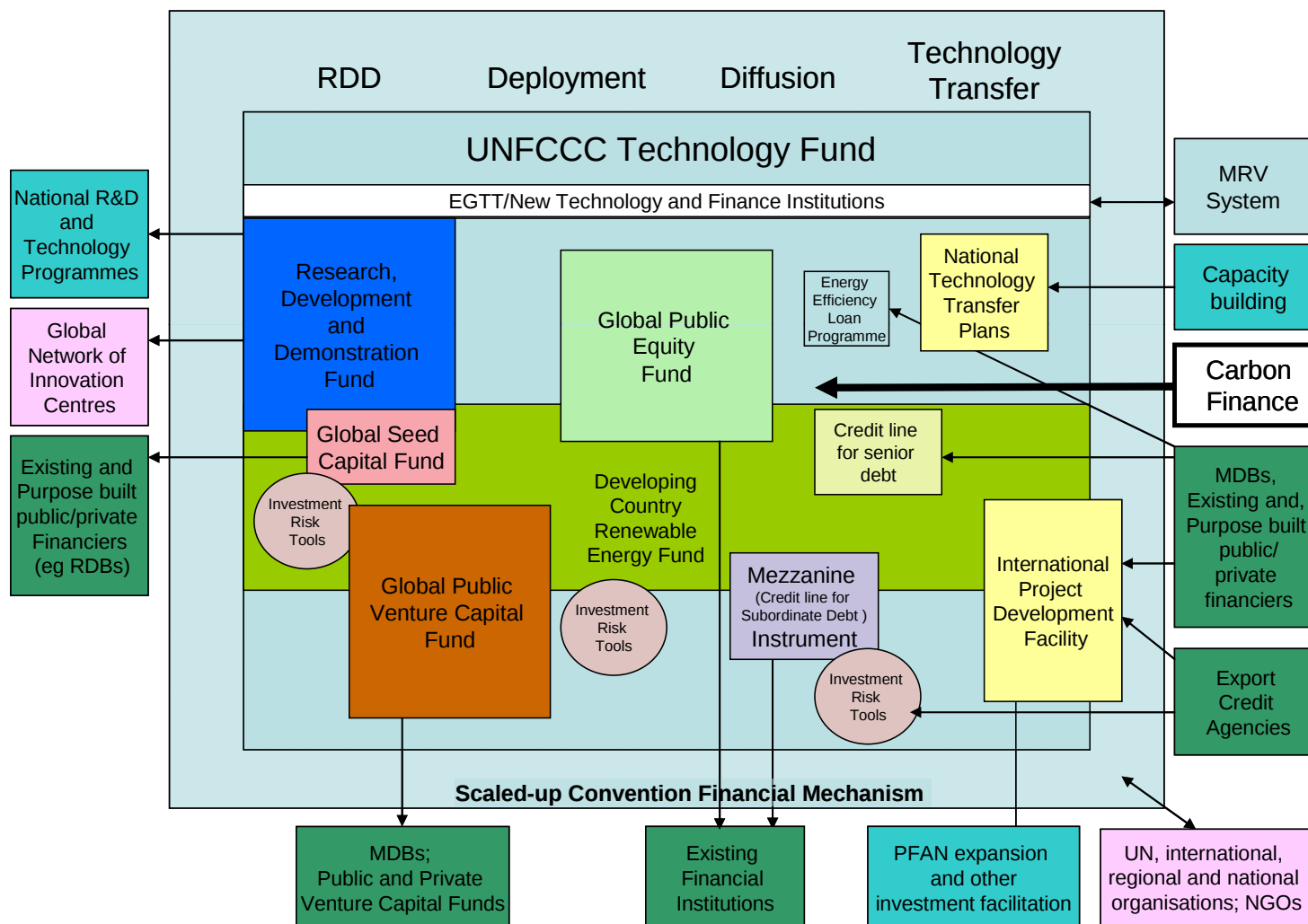


## Existing technology cooperation

|                                               |                                                                                                                                                                                                                                                                             |
|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Type 1: Knowledge sharing and coordination    | <ul style="list-style-type: none"><li>• Carbon Sequestration Leadership Forum (CSLF)</li><li>• Asia-Pacific Partnership (APP)</li><li>• Methane to Markets (M2M)</li><li>• Energy Star bilateral agreements</li><li>• Task sharing in IEA-Implementing Agreements</li></ul> |
| Type 2: Research, Development & Demonstration | <ul style="list-style-type: none"><li>• European Organisation for Nuclear Research (CERN)</li><li>• ITER fusion reactor</li><li>• Cost-sharing in IEA-IA</li><li>• Solvent Refined Coal II</li></ul>                                                                        |
| Type 3: Technology transfer                   | <ul style="list-style-type: none"><li>• Multilateral Fund under the Montreal Protocol</li><li>• Global Environment Facility (GEF)</li></ul>                                                                                                                                 |
| Type 4: Standards, mandates, incentives       | <ul style="list-style-type: none"><li>• International Convention for the Prevention of Pollution from ships (MARPOL)</li></ul>                                                                                                                                              |



# Slowly the complexity is increasing....



## Current situation

## Copenhagen Accord

Collective agreement to meet 2C

“Pledge and review”

- Developed countries emission reductions
- Emerging economies/developing countries “mitigation actions”

Fund for adaptation, mitigation, technology (bilateral and through Green Climate Fund):

- Fast-start finance: 3x10 billion
- Long-term: 100 billion/yr

Technology Mechanism

Measurable, Reportable, Verifiable

- Developed countries: in accordance with Kyoto
- Developing countries: domestic MRV

## How does Copenhagen compare to Kyoto?

| Issue                         | Kyoto                                    | Copenhagen                               |
|-------------------------------|------------------------------------------|------------------------------------------|
| Overall target                | UNFCCC                                   | 2C                                       |
| Developed country mitigation  | “Legally binding emission reductions”    | “Pledge and review”                      |
| Developing country mitigation | Clean Development Mechanism              | Voluntary actions, assistance on policy  |
| Adaptation                    | Fund (slowly starting)                   | Fund (renewed attention)                 |
| Technology                    | -                                        | Technology Mechanism                     |
| Finance                       | Through markets (CDM)                    | 30 billion 2010-2012<br>100 billion 2020 |
| MRV                           | For developed countries only, and in CDM | Developed and developing countries       |

## What kind of international agreement works for climate change mitigation? My guess...

An international agreement that:

- Monitors and registers developed country's actions (emissions *and* finance)
- Actively brokers technology and sectoral agreements between countries and industries
- Stimulates innovation systems in developing countries
- Provides finance for actions in developing countries

Industrialised countries: domestic policy, emission trading schemes (with potential international trading and CDM)

Emerging economies: low-emission growth

Developing countries: voluntary low-emission development planning

## What are your answers?

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