

Macroeconomic trade-offs and co-benefits of mitigation pathways

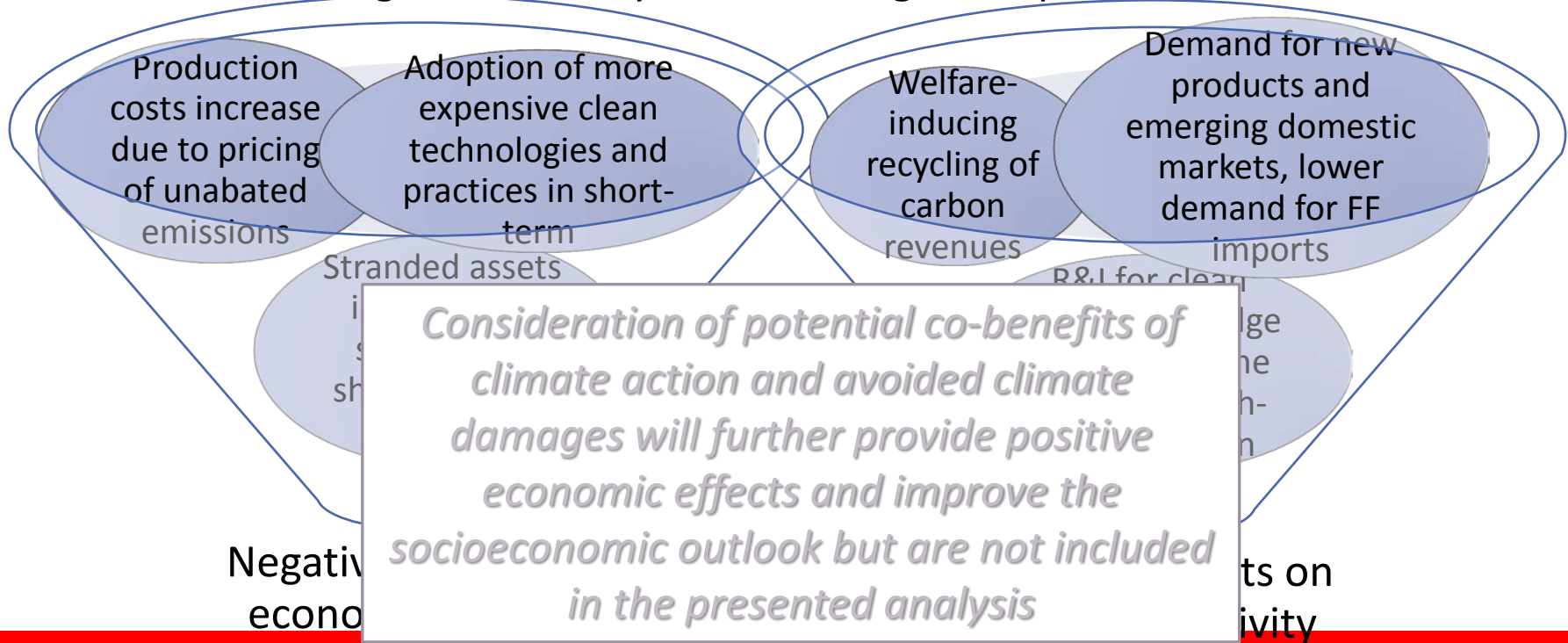
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Socioeconomic impacts of mitigation action

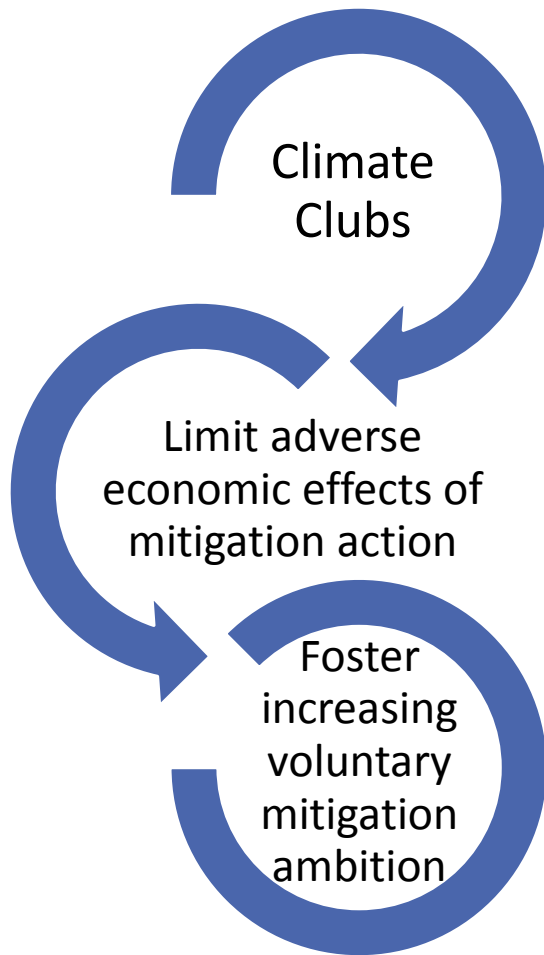
Macroeconomic effects are determined by:

- Direct multiplier effects (demand shifts, value chain)
- International industrial competitiveness
- Household income, skill restructuring and labour market implications
- Financial market implications
- Knowledge diffusion dynamics with growth potentials



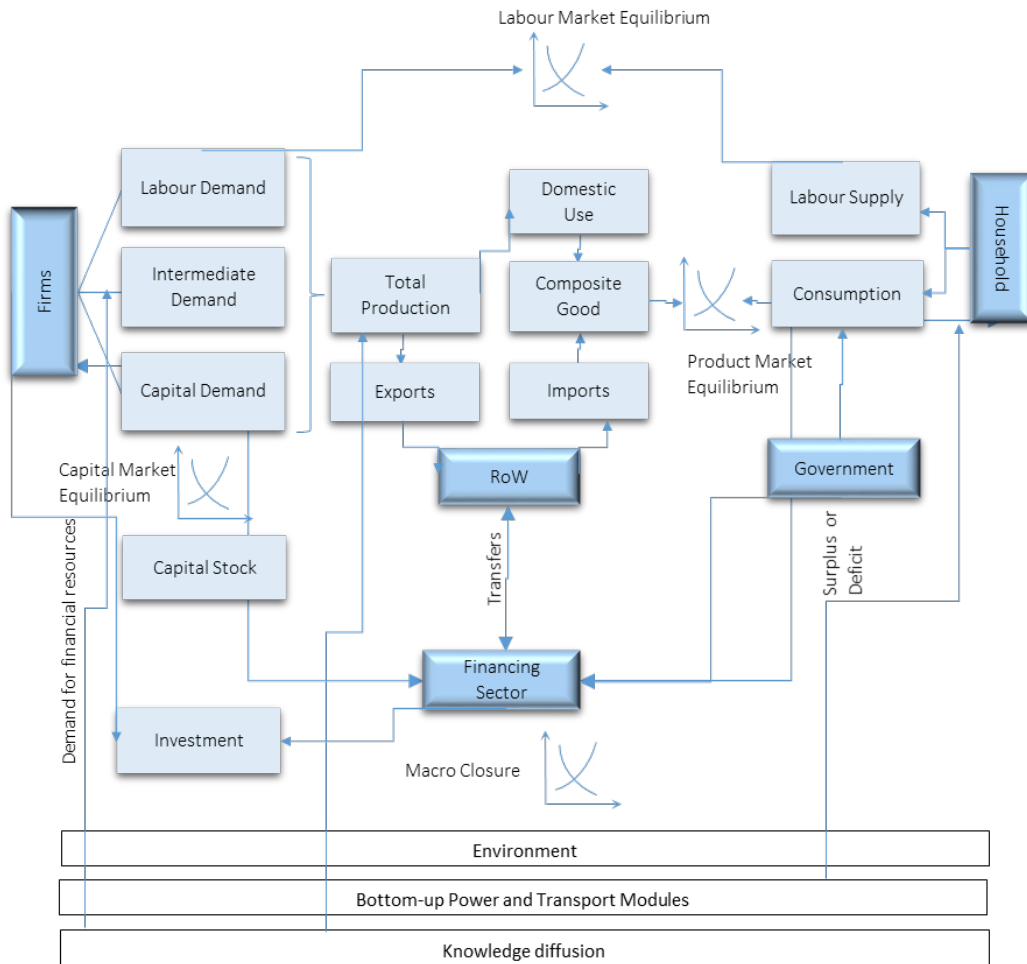
Economic co-benefits of mitigation action through international cooperation

Hypothesis: can an international policy design provide win-win benefits for mitigation action?



- Climate change mitigation is an archetypal example of a global public good
- Carbon clubs provide incentives for efficient coordination among the “willing” parties
- Key challenge to identify excludable, measurable benefits
- Quantify the costs and benefits of carbon clubs as a form of international cooperation with GEM-E3 CGE model

GEM-E3 model



GEM-E3 is a large-scale, applied general equilibrium model used to represent the world economy with high regional and sectoral detail. The model features:

- detailed energy system with option to soft-link with energy models,
- imperfect labour market allowing for unemployment
- endogenous bilateral trade
- GHG emissions module and carbon market formulations
- Semi-endogenous growth through technical progress & knowledge spillovers
- Financial markets through differentiated interest rates, risk premiums and a world bank

Scenario framework

Club membership criteria resulting in 51% of global GHG emissions:

Criteria (weight)	NDC Ambition (40%)	Clean Exports (5%)	Fossil Exports (15%)	GHG Importance (15%)	GHG potential (10%)	Equity (15%)	Weighted sum of criteria	Club Member
EU28	1	1	1	1	1	1	1	1
USA	0	1	0	1	1	1	0,45	
Japan	1	1	1	0	0	0	0,6	1
Canada	1	0	0	0	0	0	0,4	
Brazil	1	0	1	0	0	0	0,55	1
China	1	1	1	1	1	1	1	1
India	1	1	1	1	1	0	0,85	1
South Korea	1	1	1	0	0	0	0,6	1
Indonesia	1	0	0	0	1	0	0,5	1
Mexico	1	1	0	0	0	0	0,45	
Argentina	1	0	1	0	0	0	0,55	1
Turkey	0	0	1	0	0	0	0,15	
Saudi Arabia	0	0	0	0	1	0	0,1	
Oceania	1	0	0	0	0	0	0,4	
Russia	0	0	0	1	1	0	0,25	
Other Energy	0	0	0	0	1	0	0,1	
South Africa	0	0	0	0	0	0	0	
Rest Europe	1	0	1	0	0	0	0,55	1
Rest World	0	1	0	1	1	1	0,45	

Scenarios

1. NDC: Global implementation of NDCs, no increasing ambition

2. Global 2°C: Cost-efficient common global mitigation action

3. Mitigation-only club: carbon club without explicit benefits

4. Finance club: lift risk premiums for low-carbon investments of club members

5. Finance and Technology club: above + lift intellectual property restrictions among members

6. Finance and Technology and Trade club: above + common trade area for low-carbon equipment

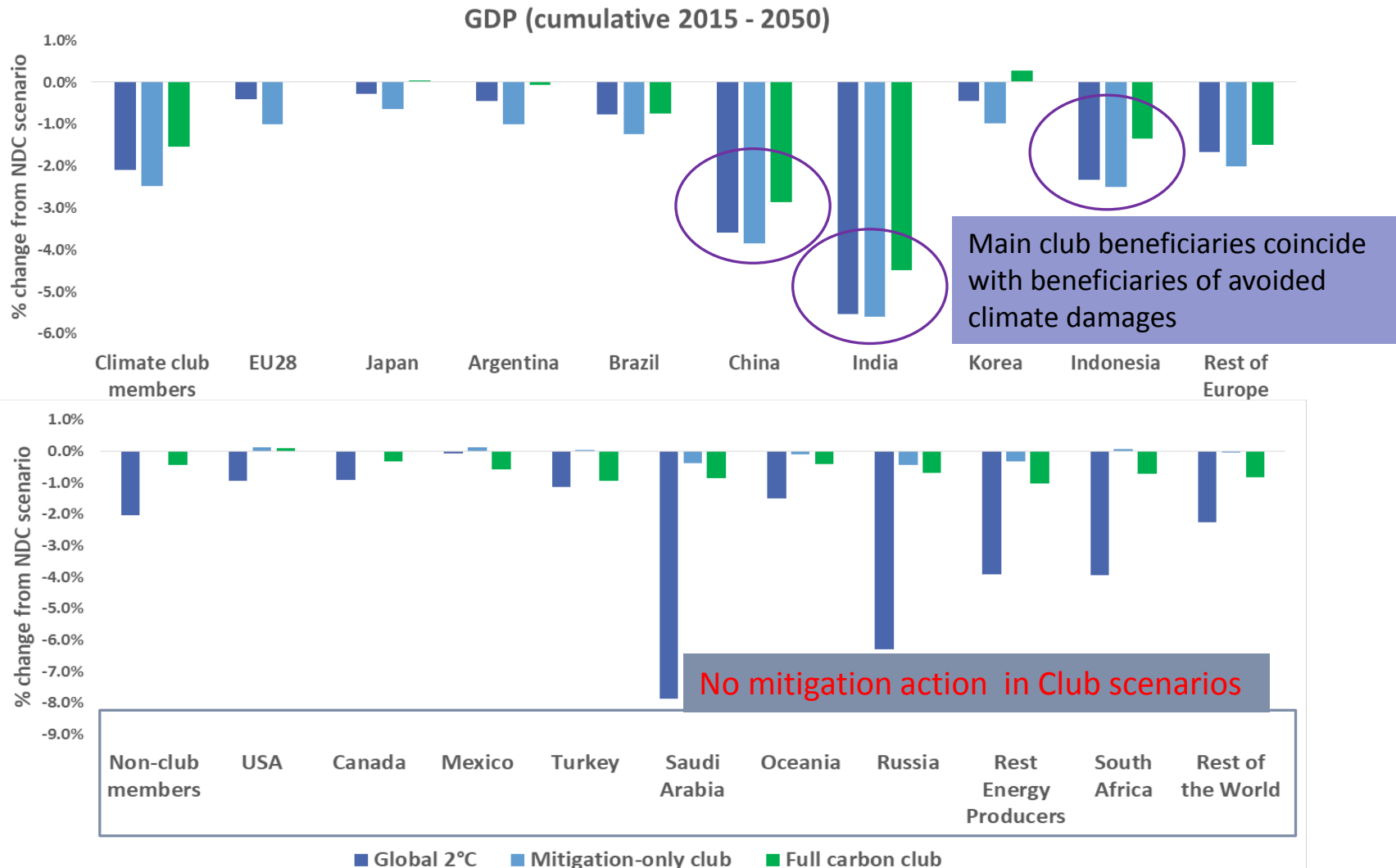
Investment requirements

- Financial requirements for the Global 2°C scenario
- Providing the amounts of loans for low-carbon investments is critical – we assume 70% financed through loans

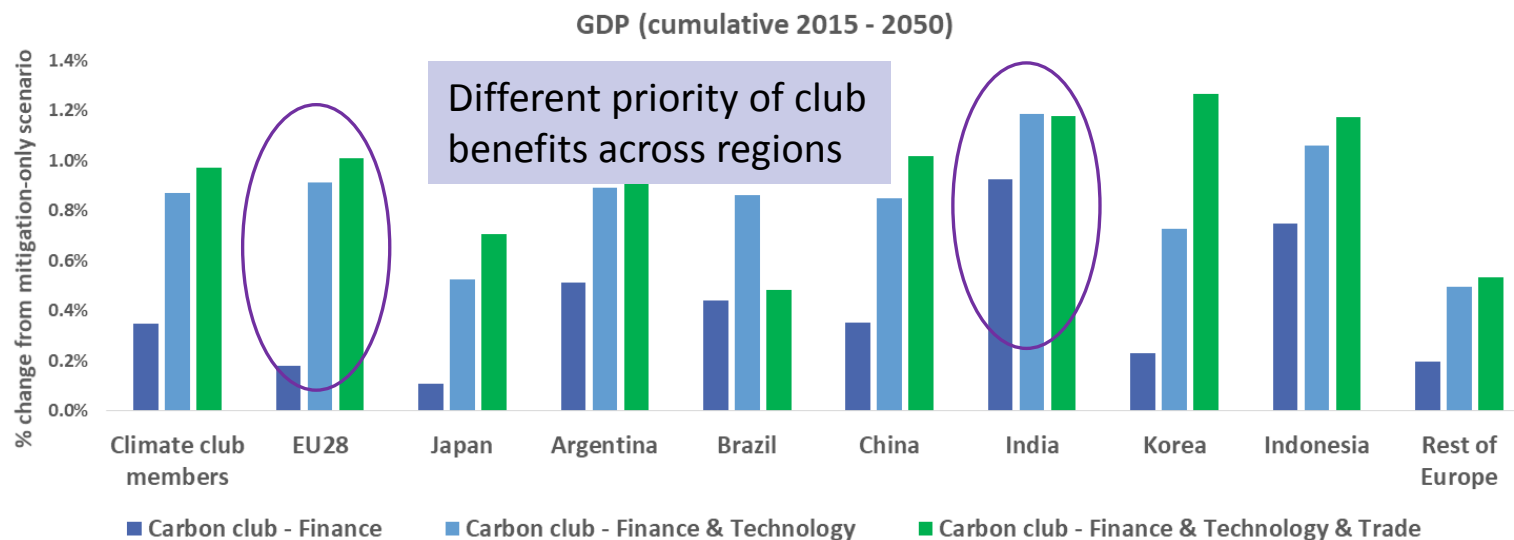
	Loans (b. \$)	Interest Payments (b. \$)	Loans paid back (b. \$)	Loans remaining after 2050
EU28	4776	310	3169	1607
Japan	1439	43	955	484
Brazil	1911	241	1268	643
China	5732	619	3803	1929
India	1911	245	1268	643
South Korea	511	32	339	172
Indonesia	955	121	634	321
Argentina	478	61	317	161
Rest of Europe	516	33	343	174

Region	WACC	risk premium
EU28	2,20%	0,7%
Japan	0,91%	-0,6%
China	3,89%	2,4%
Brazil	4,48%	3,0%
India	4,48%	3,0%
Korea	2,20%	0,7%
Indonesia	4,48%	3,0%
Argentina	4,48%	3,0%
Rest of Europe	2,20%	0,7%

Benefits of carbon club by member



Assessment of different club benefits



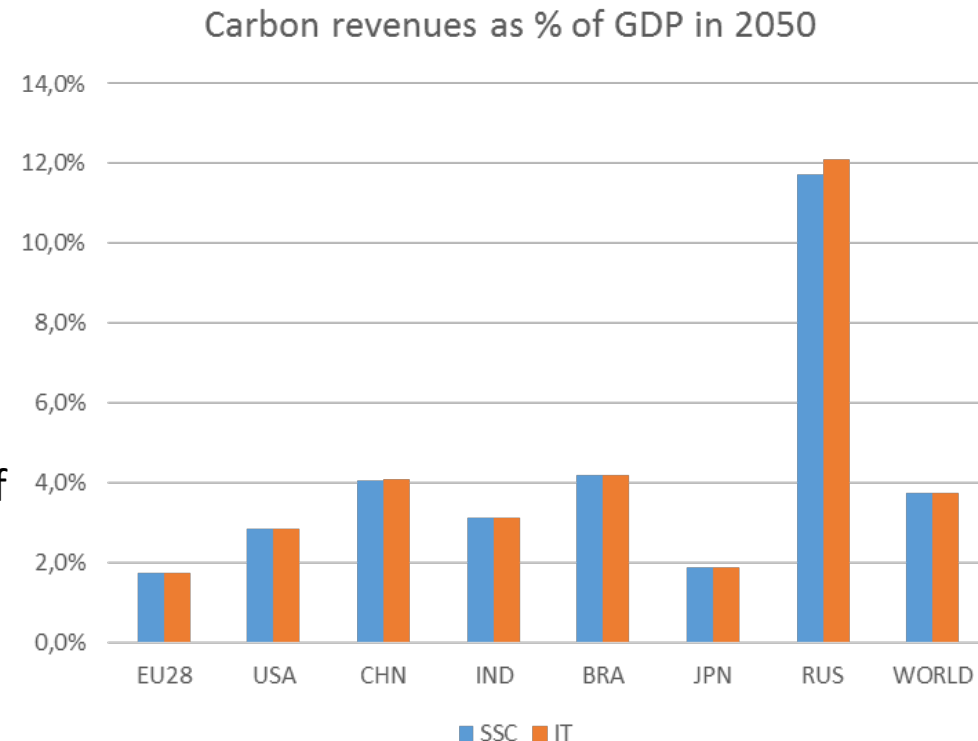
- Technology transfer through knowledge spillovers has the most positive impact on club members
- Low-cost climate finance has a substantive positive impact
- Trade integration for low-carbon goods has lowest impacts as club economy is already integrated

Employment co-benefits of mitigation action through carbon revenue recycling

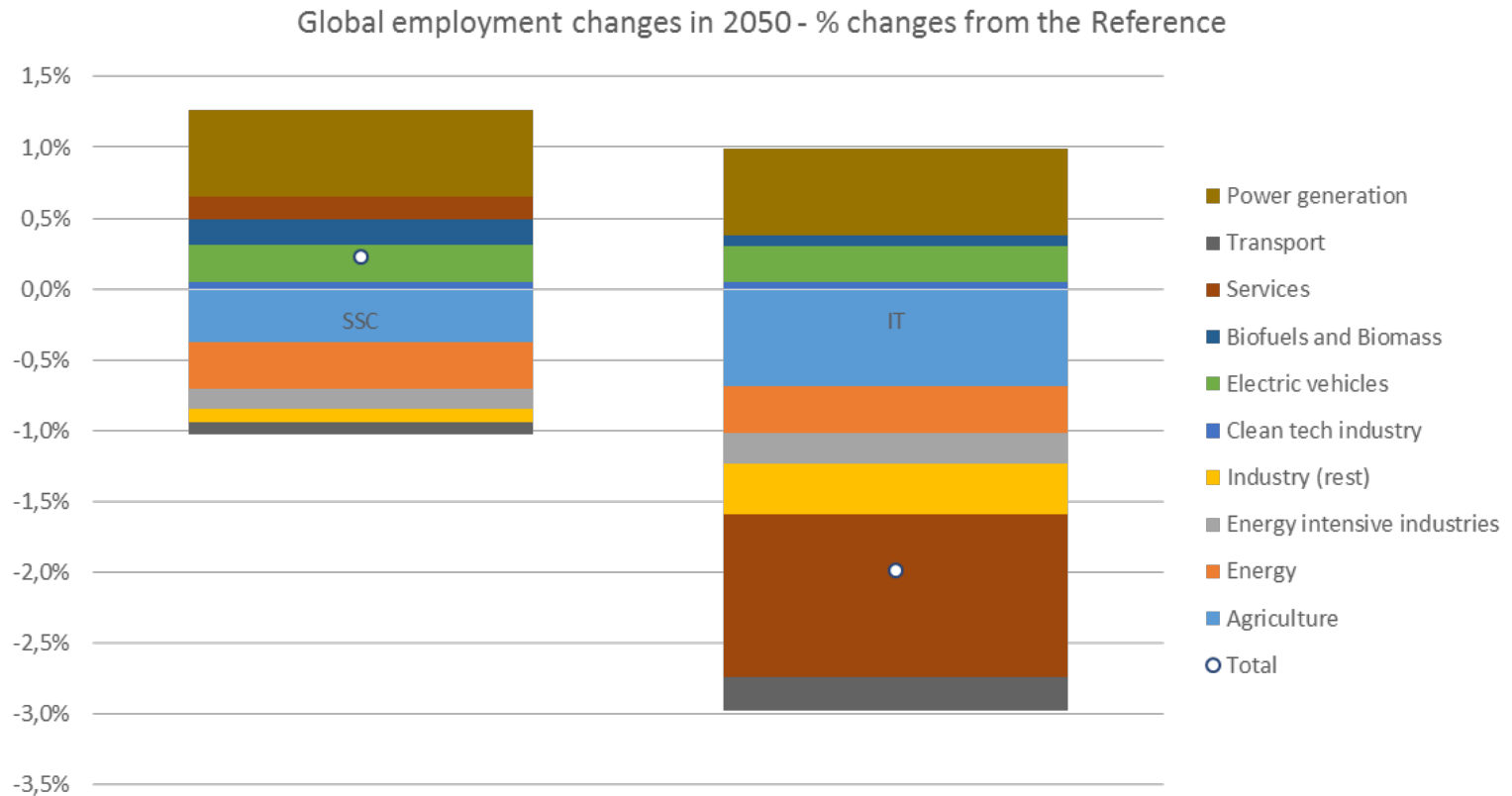
Carbon tax revenues in global 2C common mitigation action

Two options examined

- Reduction of indirect taxes: reducing prices for all end users through tax reductions
- Reduction of social security contribution: reducing the unit cost of labour for firms



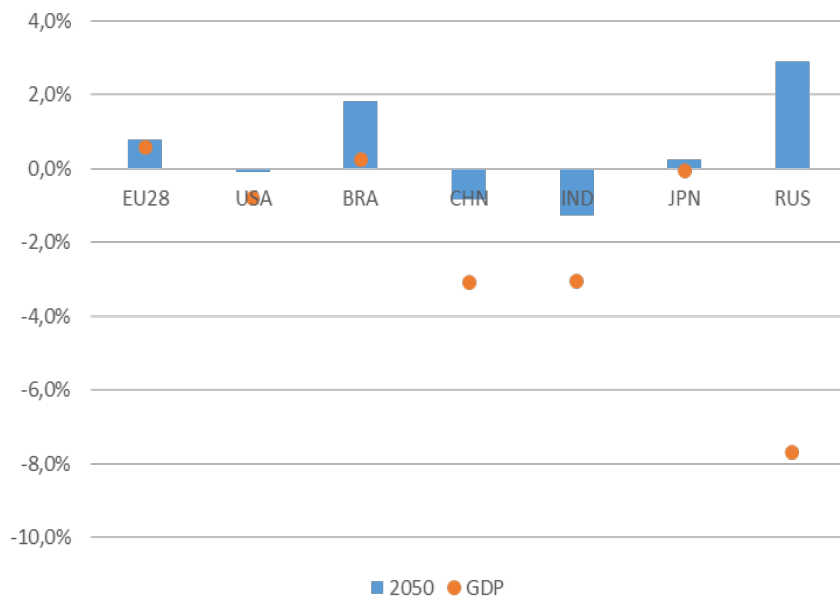
Global Employment Impacts



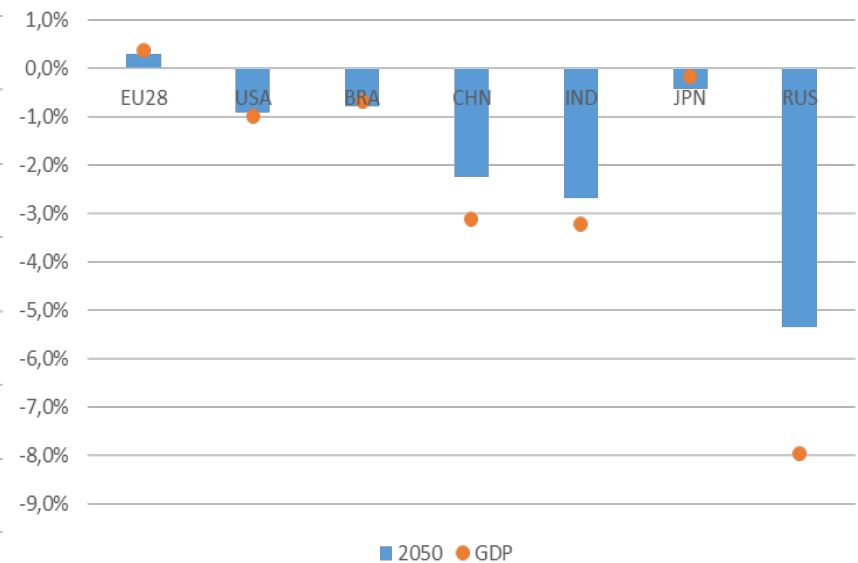
Both recycling schemes see a shift of employment from traditional sectors to clean energy sectors but total employment increases with recycling thorough social security contributions

Regional Employment impacts

Employment impacts (SSC) in 2050 - % change from the Reference



Employment impacts (IT) in 2050 - % change from the Reference



Thank you for your attention