



A quantitative assessment of the adverse impacts of response measures on petroleum-exporting developing countries

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Area (c): Assessment and analysis of impacts
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OPEC: an Intergovernmental Organization

- **12 Member Countries: Algeria, Angola, Ecuador, Islamic Republic of Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates, Bolivarian Republic of Venezuela**
- **OPEC Member Countries are developing countries, with young and rapidly growing population, and whose economies are highly dependent on oil export revenues**
- **They face many constraints, such as water scarcity and limited arable land**

<u>Indicators (2010)</u>	
Population	410 million
GDP per capita	US\$ 6000
Value of petroleum exports as share of total exports	74%
Petroleum sector as % of GDP	37%



Assessing the adverse impacts of response measures

- **Assessment of the costs of climate policy requires the use of models. These could be broadly classified into three types^{*} :**

Macro-economic models	<ul style="list-style-type: none">• Input-Output• Computable general equilibrium• Keynesian
Sectoral models	<ul style="list-style-type: none">• Dynamic energy optimization• Integrated energy-system simulation• Technology-driven
Project assessment approaches	<ul style="list-style-type: none">• Cost-benefit analysis• Cost-effectiveness analysis• Technology assessment

- **To assess the adverse impacts of response measures, using a combination of an energy sector model and a CGE model constitutes a satisfactory approach**

* Adapted from IPCC TAR



The EMF 22 International Scenarios: which scenarios the ten modeling groups were able to provide?

Model		650 CO2-e		550 CO2-e				450 CO2-e			
		Full Not-to- exceed	Delay Not-to- exceed	Full		Delay		Full		Delay	
				Overshoot	Not-to- exceed	Overshoot	Not-to- exceed	Overshoot	Not-to- exceed	Overshoot	Not-to- exceed
1	ETSAP-TIAM	+	+	+	+	+	+	+	+	+	X
2	FUND	+	+	+	+	+	+	+	X	X	X
3	GTEM	+	+	+	+	+	X	+	X	X	X
4	IMAGE	+	+	+	+	+	+	X	X	X	X
	IMAGE-BECS	N/A	N/A	N/A	N/A	N/A	N/A	+	X	X	X
5	MERGE Optimistic	+	+	+	+	X	X	X	X	X	X
	MERGE Pessimistic	+	+	+	+	+	+	X	X	X	X
6	MESSAGE	+	+	+	+	+	X	+	X	X	X
	MESSAGE-NoBECS	+	N/A	+	+	N/A	N/A	+	X	X	X
7	MiniCAM-Base	+	+	+	+	+	X	+	+	+	X
	MiniCAM-LoTech	+	+	+	+	+	X	+	X	X	X
8	POLES	+	+	+	+	+	X	X	X	X	X
9	SGM	+	+	+	+	+	+	X	X	X	X
10	WITCH	+	+	+	+	+	+	X	X	X	X

+ The team was able to produce the scenario

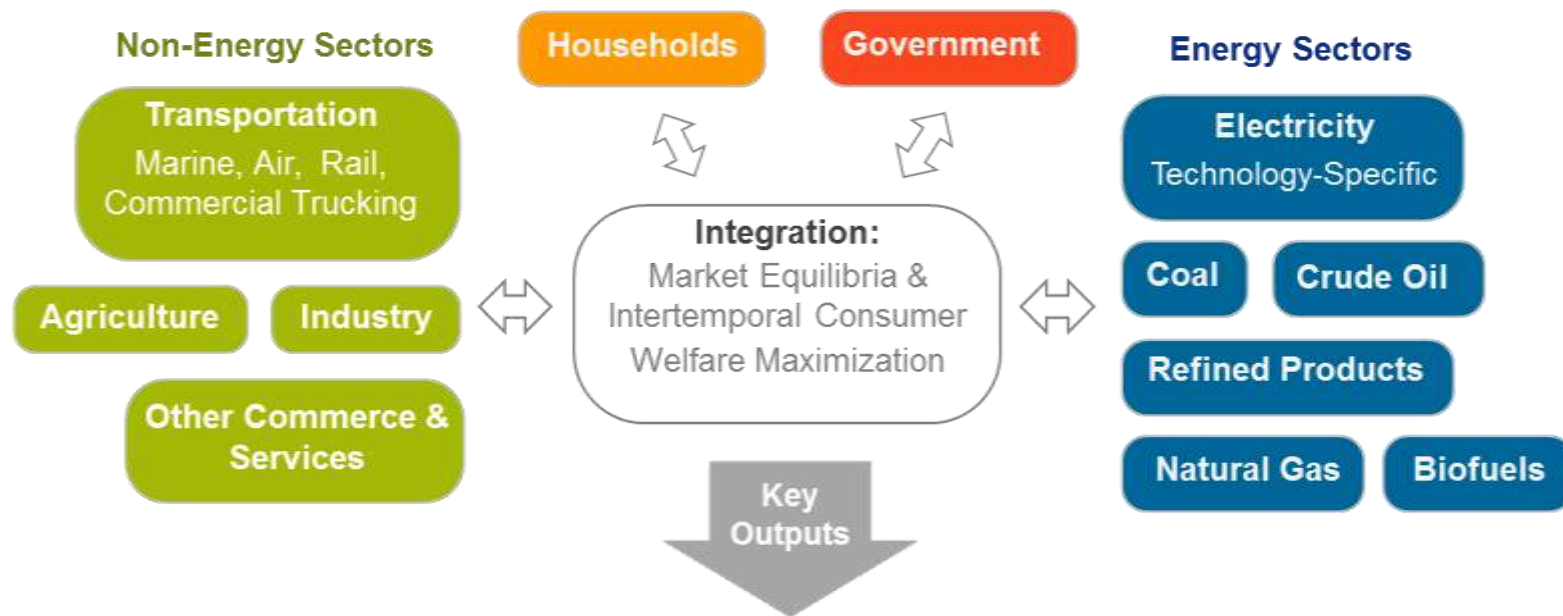
X The team was not able to produce the scenario

“N/A” means that the scenario was not attempted with the given model

Source: Leon Clarke & al, 2009. International climate policy architectures: Overview of the EMF 22 International Scenarios, Energy Economics, S64-S68



Impacts assessment using a general equilibrium model: the Global NERA Model



Macroeconomic

Welfare, GDP
Consumption, Investment
Output by Sector,
Tax Revenue

Energy & Electricity

Demand, Prices, Production
CO₂ Emissions, Price
Builds, Retrofits, Retirements
Personal Transportation
Demand

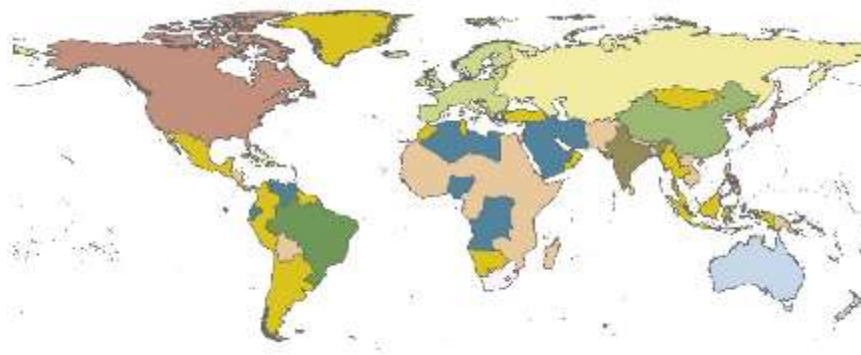
Trade

Merchandise Exports/Imports to/from
every other region
Net Oil Exports/Imports to/from world
market
Tariffs



Impacts assessment using a general equilibrium model: the Global NERA Model (cont.)

- **12 Regions**



- **Baseline: EIA 2011 IEO (up to 2035, extrapolated to 2050)**
- **CO₂ emission global caps taken from EMF 22 study emissions trajectories consistent with 450 and 550 ppm CO₂-eq (with overshoot)**
- **Main Policies considered:**
 - Cap-and-trade with and without global trading
 - Corporate average fuel efficiency standards
 - Low-carbon fuel standards
 - Clean energy standards
 - Efficiency standards
 - Forestry
 - Financial support for, and diversification in OPEC Member Countries



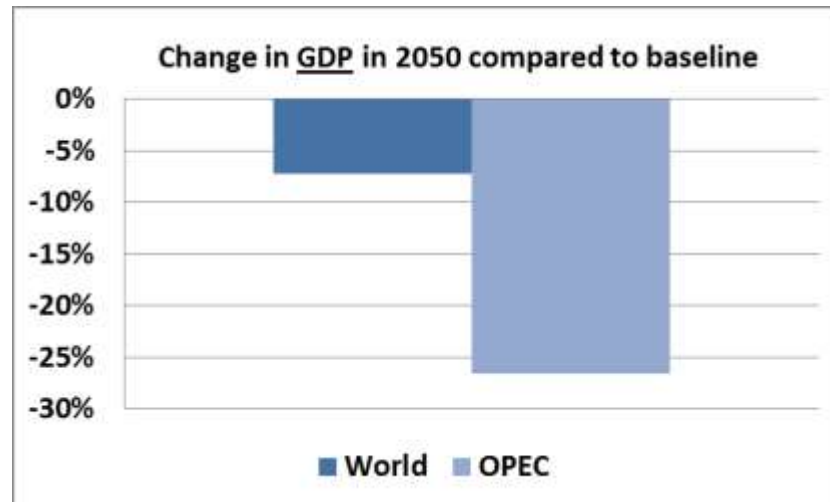
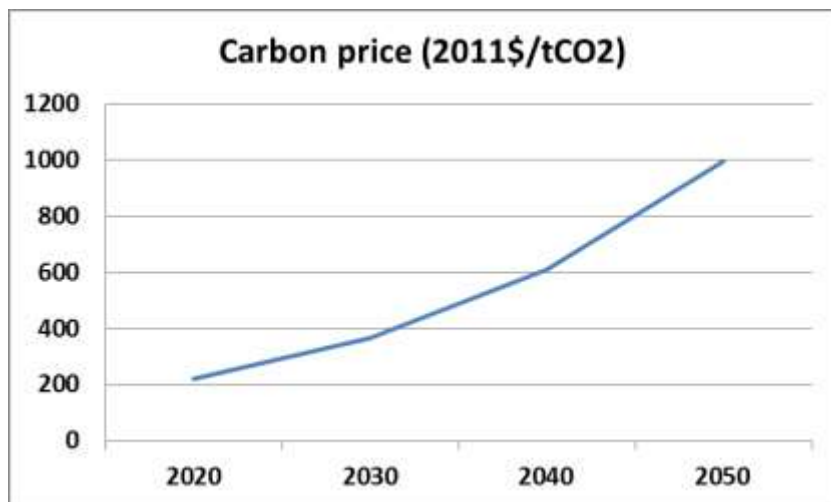
Some preliminary observations

- **Base year 2010: therefore, adverse impacts of policies and measures that were implemented before 2010 are not accounted for in this assessment**
- **It is assumed that non-CO₂ gases mitigation contributes to reaching emissions targets; should this not be the case, then the adverse impacts are greater**
- **Transitional dislocation costs, as resources are reallocated across sectors, are not considered: they could substantially add to the adverse impacts**
- **The model has perfect foresight and maximises consumer welfare: in the real world, the adverse impacts could be therefore higher than estimated**



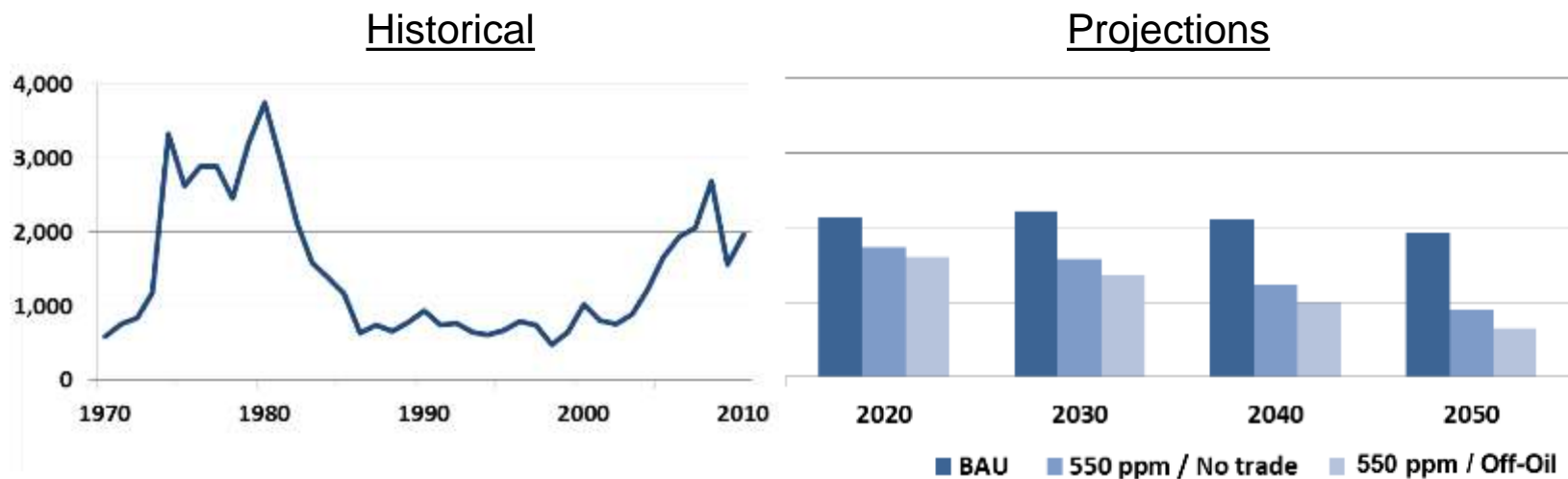
The 450 ppm CO₂-eq stabilization scenario (with overshoot) with carbon trade

Scenario with carbon trade





OPEC oil export revenues per capita (2011\$)

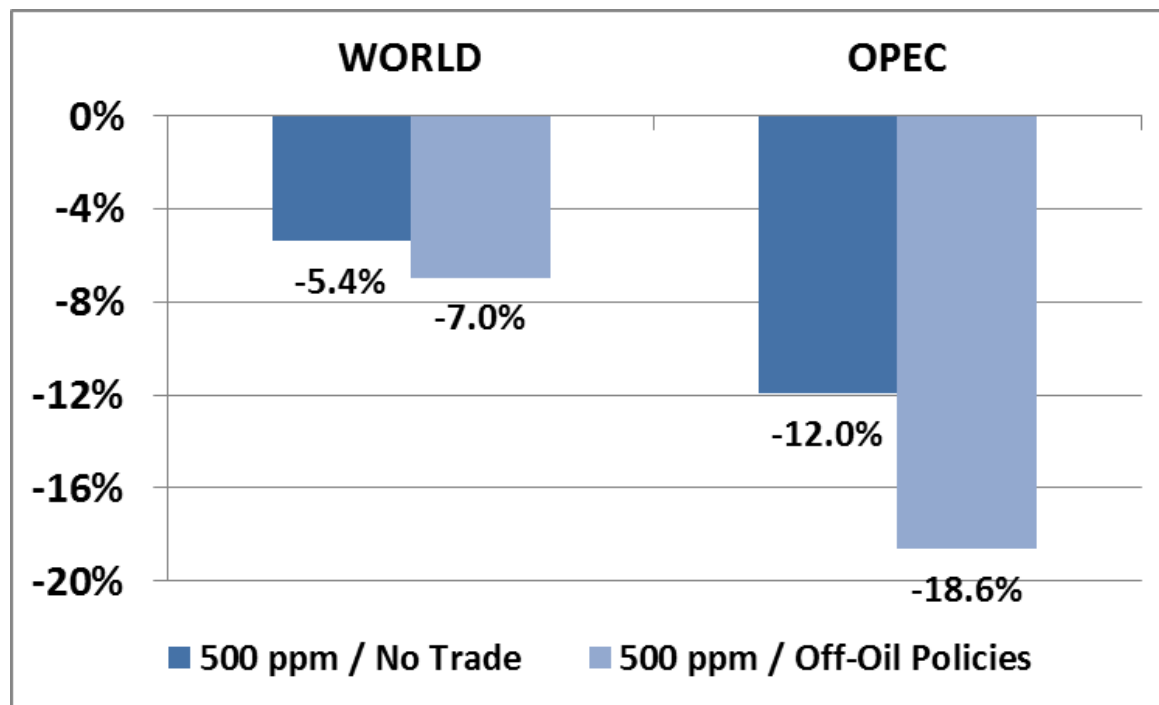


Projected lower oil export revenues per capita are compounded with higher finding, development and operating unit costs



OPEC faces large and disproportionate adverse impacts arising from the implementation of response measures

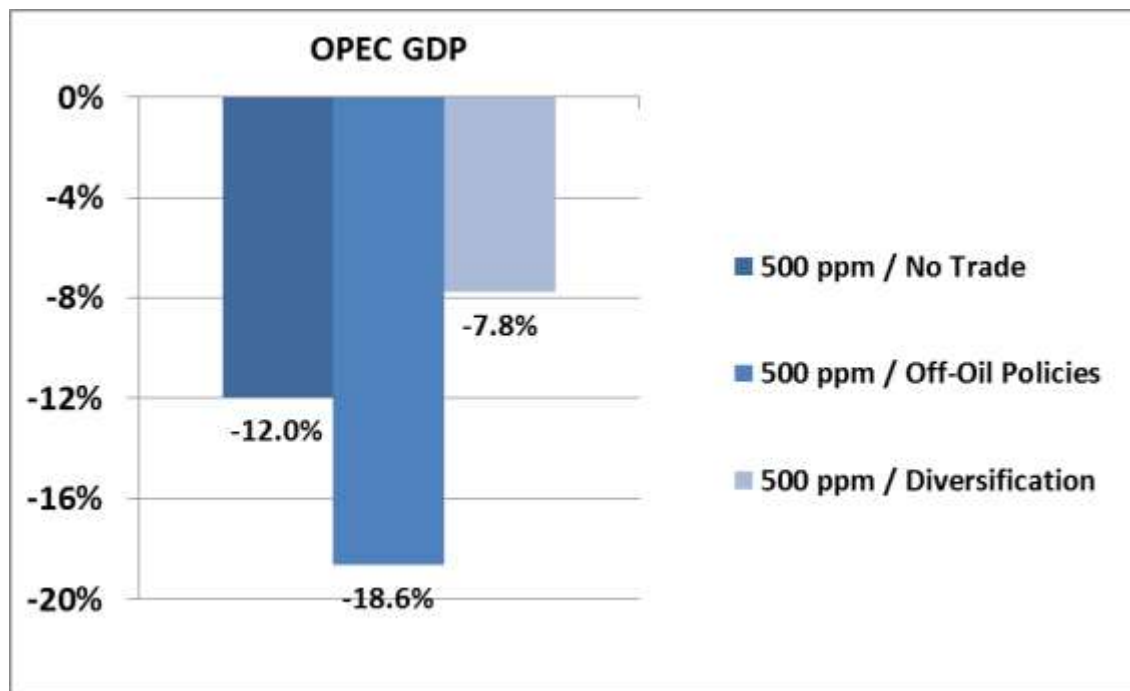
Percentage change in GDP compared to baseline, 2050





Diversification helps reduce the adverse impacts, but only partially

Percentage change in GDP compared to baseline, 2050



The CGE model doesn't assess the transitional dislocation costs, as resources are reallocated across sectors

* The Diversification scenario assumes that technology improvement in chemicals and energy intensive industries in OPEC is more rapid than in the baseline, and that both industries approach productivity levels in North America by 2050.



Conclusions

- The use of appropriate modelling techniques could contribute to assessing the adverse impacts of response measures
- OPEC Member Countries face large and disproportionate adverse impacts of response measures, like the developing countries that are referred to in Article 4, Paragraph 8 of the UNFCCC
- These adverse impacts could be minimised, should the portfolio of mitigation policies by developed countries be selected with a view to achieve their mitigation commitments in a least-cost manner, while minimising the adverse impacts of response measures (win-win-win policies)
- To this end, full implementation of previous decisions in this regard is required, and it is highly beneficial that appropriate methodologies/processes/institutions be established to:
 - Share information about proposed policies and measures and assess their adverse impacts on developing countries
 - Exchange views on ways and means to minimise these adverse impacts
 - Report information on actions to minimise the adverse impacts
 - Share information on the impact of policies in the implementation phase
 - Seek better understanding on adaptation to the adverse impacts of response measures and the required support mechanisms