

ENVISAGE (*)

A TOOL FOR ANALYZING ECONOMY-WIDE CLIMATE CHANGE MITIGATION SCENARIOS

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() The Environmental Impact and Sustainability
Applied General Equilibrium Model*

SECTOR-SPECIFIC VS. CGE APPROACH

- CGE includes interactions across sectors and across countries.
 - Changes in energy prices within a country have impacts on demand by households and industry.
 - US policy has an impact on China and vice versa, etc.
 - CGE captures intra- and inter-industry linkages and international trade.
- CGE approach forces consistency across policies, given resource constraints such as:
 - availability of natural resources,
 - demand as income rises,
 - demographics, economic structure, etc.
- It is not easy to translate mitigation policies into shocks to the CGE model. This is done via:
 - Changes in prices, technologies, taxes/subsidies, elasticities of substitution, changes in demand for electricity etc.).
 - Investment in energy efficiency cannot be properly modelled (only as investment at a sectoral level).
- Sector-specific studies with extensive analysis of investment, transaction costs and benefits provide more detailed information on mitigation options than do CGE models, but generate data and parameters that can be loaded into CGE models.



WHAT KIND OF POLICY OPTIONS CAN BE MODELLED?

- Carbon pricing modelled either as carbon tax or as cap-and-trade emissions trading
- Reform of fuel subsidies, tax rebates for clean energy etc.
- Sectoral price changes likely due to various reasons e.g. increased energy efficiency, new technologies, technology substitution elasticities, etc.
 - Source of sectoral price and technology parameters from sector-specific models



WHAT THE MODEL GENERATES: IMPACT INDICATORS OF THE PROPOSED POLICIES

- GDP impacts
- Sectoral output growth rates, factor rewards
- International trade
- Energy intensity of the economy and trade flows
- Reports emissions of CO₂, methane (CH₄), nitrous oxide (N₂O) and the fluoridated gases as an aggregate (F-gases).
- Income distribution and poverty (Global Income Distribution Dynamics micro-simulation tool)



ENVISAGE – DATA

- Based on Global Trade Analysis Project (GTAP) release 9 benchmarked to 2011 including 57 sectors and 140 countries/regions (including all PMR countries: Brazil, China, Colombia, Costa Rica, Peru)
- Recursive dynamic—2011-2030 (up to 2100)
- Tracks historical macro aggregates to be consistent with the most recent data on investment, GDP and current account etc.
- Long term forecast consistent with demographic UN projections, captures structural change, LT changes in demand etc.



ENVISAGE HAS A CLIMATE CHANGE MODULE (AN INTEGRATED ASSESSMENT MODEL, OR IAM).

- Greenhouse gases from economic activity lead to changes in atmospheric concentrations
- A reduced form atmospheric model converts changes in the stock of atmospheric concentrations into changes in radiative forcing and global mean temperature
- Changes in global mean temperature feedback in the economy through damage functions affecting drivers
- The climate module is largely derived from the MERGE model



CLIMATE MODULE FEATURES

- Dynamic model of country-specific energy technologies
 - Composition of electricity generation: coal, oil & gas, hydro, nuclear, renewable, other
- Climate module
 - Linking of emissions (CO_2 , CH_4 , N_2O , F-gases) to temperature
 - Feedback from temperature to ‘damages’ (e.g. agricultural productivity falls with increasing temperature)

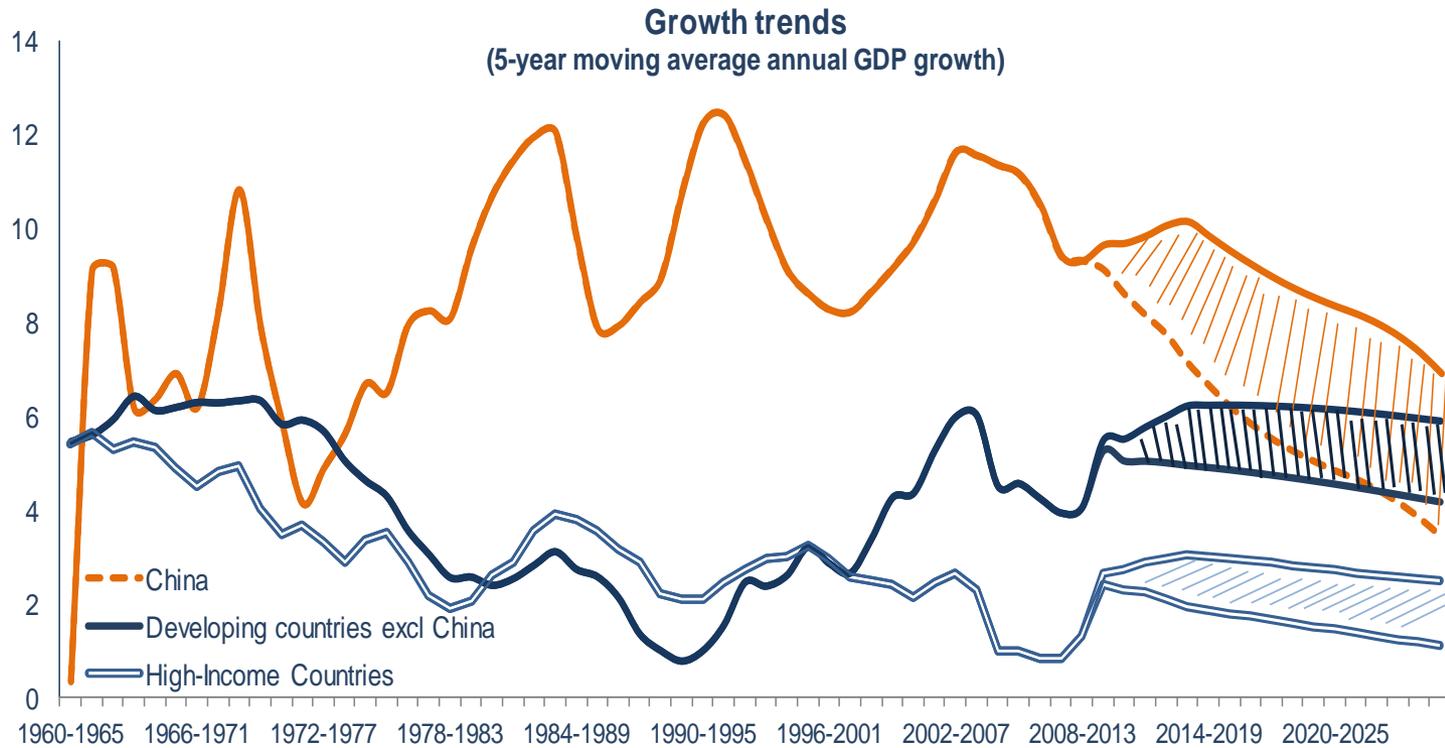


ENVISAGE AS FULL IAM: EXAMPLE

- “China 2030” World Bank & DRC (2013) - simulating a carbon price for China
- Two scenarios: High and Low growth
- Low growth scenario: re-balancing of the growth model (move away from investment and towards domestic consumption)
- Carbon pricing, achieved through trading or taxation, would influence the cost of emissions reduction and structural shifts in the economy.
- Introduction of a carbon price in China, starting in 2015 and phased in over eight years.

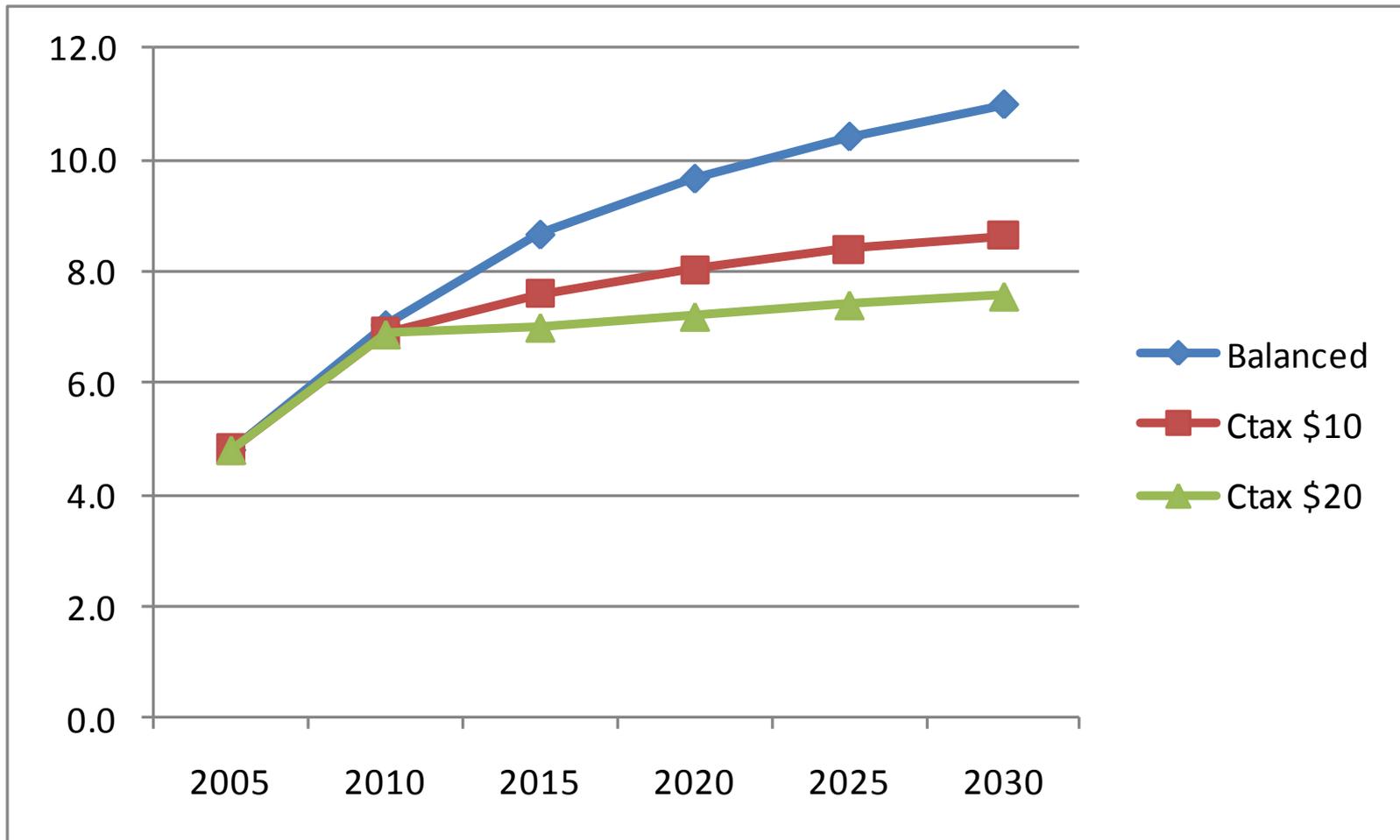


CHINA 2030 GROWTH SCENARIOS



CO₂ EMISSIONS (GT) – CHINA 2030

SCENARIOS



CHINA EXAMPLE: FISCAL AND GROWTH IMPLICATIONS

- GDP slow down in both scenarios is very small (less than 0.5 percentage points wrt. the baseline)
- Carbon revenues in China could be significant: by 2030, fiscal revenues of 1.4 percent of GDP under a carbon price of \$10 a ton and to 2.7 percent of GDP under \$20 a ton.
- If the carbon revenues were recycled to households, each household would receive between RMB 2,126 (\$329) and RMB 2,097 (\$634) a year by 2030, depending on the price and assuming a household size of three.



HOW WE CAN HELP?

- We can run Envisage for all PMR countries.
- We would need your inputs in implementing mitigation policies and results/assumptions from sectoral models into the simulations.
- It would take about 6 months.
- We can link it to the GIDD (Global Income Distribution Dynamics) microsimulation tool with household level data to look at poverty and income distribution implications of policies.

