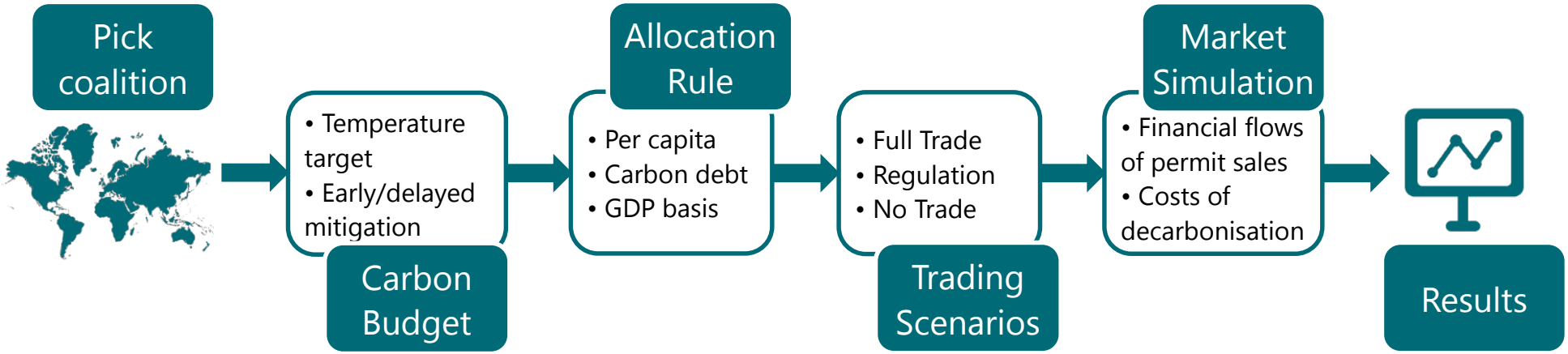
SkyShares$^{\beta}$ – Technical Overview

SkyShares is a tool created by the Center for Global Development to aid in international climate negotiations by computing the scientific and economic implications of a climate deal, under various parameters chosen by the user. SkyShares exists as a Desktop version for review, and as a website which is currently undergoing Beta testing. The simulation tool calculates the financial flows and costs resulting from user-chosen countries participating in a cap-and-trade scheme, where the cap is scientifically determined so as to limit warming to the user's chosen temperature target, and where permits are shared according to the allocation rule chosen by the user.



Advanced parameters

- Choose between 1800 and 1990 to start counting past stocks of emissions
- Switch Business As Usual assumptions (includes RCP 8.5)
- Discount future costs and benefits
- Switch cost curve model
- Toggle GDP data-set
- And more…

Data sources are publicly and freely available

- Emissions: Carbon Dioxide Information Analysis Center
- Population: United Nations, World Population Prospects
- GDP: CEPII database & Massachusetts Institute of Technology's EPPA
- Cost curves generated using integrated assessment models:
  - Global Change Assessment Model (GCAM), Pacific Northwest National Laboratory
  - Emissions Prediction and Policy Analysis (EPPA), MIT
- SkyShares code is released for free

The carbon budget

SkyShares uses the latest scientific evidence to program the relationship between cumulative carbon emissions (all-time) and peak warming relative to pre-industrial levels. The user sets a temperature target, and SkyShares will return the remaining allowable emissions (of CO_2e) in the budget. SkyShares then "spreads" the all-time cumulative emissions budget (a finite quantity) into discrete annual carbon budgets by plotting an idealised emissions pathway. The trajectory is a smooth-capped distribution which increases and decreases exponentially before and after the start of a mitigation scheme. The user can choose to delay the start of the global mitigation regime. SkyShares numerically solves for the required mitigation rate that ensures the planet's emissions trajectory will stay within the confines of the global carbon budget.

The allocation rule

SkyShares offers a variety of algorithms to distribute the yearly carbon budget among the countries the user has chosen to participate in the coalition.

Per capita: Allowances are grandfathered from current emissions shares and converge to per capita entitlements at a date chosen by the user.

Carbon debt: Allowances also converge to equal per capita entitlements, but this takes into account the stock of past emissions. SkyShares computes the carbon owed by each country since 1800 or 1990, and future allowances are adjusted accordingly so that the carbon debt is paid back at the end of the century. The user can choose the repayment schedule for the servicing of that debt (linear, postpone or frontload).

Historical responsibilities: Calculates the share of global emissions that past emitters have been responsible for, and mandates the same rate of mitigation effort in the future. This variant of the carbon debt scenario is more severe in its treatment of past emitters.

GDP basis: Allowances converge to shares of GDP. This scenario distributes allowances to the richest, and is intended to help visualise the distributional implications of the status quo.

Trading scenarios

The market-clearing price of allowances is determined endogenously by matching supply and demand for abatement. SkyShares then maps back the equilibrium price to each country's marginal abatement cost (MAC) curve to determine how much abatement each country provides at the world price. The rest is traded.

Full trade: SkyShares determines the optimal mix of decarbonising at home and of buying allowances on the market so as to minimise costs. There is a "no banking, no borrowing" rule and the market clears every year. This scenario is a cost-minimising one.

No trade: The user can turn trading off, and countries will be forced to meet their abatement target entirely through domestic emissions reduction.

Regulation: The user can act as the central planner and mandate what share of the coalition's abatement target must be decarbonised at home.

SkyShares computes the financial flows and decarbonisation costs of each trading scenario for each country. Whatever scenario is chosen, the coalition will always stay within its carbon budget.