Snapshot of - MIMOSA

Archive of MIMOSA, version: 1.0

Contents

Reference card - MIMOSA

The reference card is a clearly defined description of model features. The numerous options have been organized into a limited amount of default and model specific (non default) options. In addition some features are described by a short clarifying text.

Legend:

☐ not implemented
☑ **implemented**
☑ **implemented (not default option)**

About

Name and version	MIMOSA 1.0
Model link	https://utrechtuniversity.github.io/mimosa/; https://doi.org/10.1038/s41467-021-22826-5; https://doi.org/10.1038/s41558-023-01636-1; https://www.copernicus-model-atlas.uu.nl/model/MIMOSA
Institution	Utrecht University (UU), The Netherlands, https://www.uu.nl/.
Documentation	MIMOSA documentation is limited and consists of a reference card
Process state	published

Model scope and methods

Model type	☐ Integrated assessment model	☐ CGE
	☐ Energy system model	☑ **CBA-integrated assessment model**
Geographical scope	☑ **Global**	☐ Regional

Objective	Cost-benefit IAM with focus on equity and climate damages	
Solution concept	☐ Partial equilibrium (price elastic demand) ☐ Partial equilibrium (fixed demand)	☐ General equilibrium (closed economy)
Solution horizon	☐ Recursive dynamic (myopic)	☑ **Intertemporal optimization (foresight)**
Solution method	☐ Simulation	☑ **Optimization**
Temporal dimension	Base year:2020, time steps:5, horizon: 2100	
Spatial dimension	Number of regions:26	
	1. CAN,USA,MEX,RCAM,BRA,RSAM,NAF,WAF,EAF,SAF,WEU,CEU,TUR,UKR,STAN,RUS,ME,INDIA,KOR,CHN,SEAS,INDO,JAI *Note: IMAGE regions*	
Time discounting type	☑ **Discount rate exogenous**	☐ Discount rate endogenous
Policies	☐ Emission tax ☑ **Emission pricing** ☐ Cap and trade ☐ Fuel taxes ☐ Fuel subsidies ☐ Feed-in-tariff ☐ Portfolio standard	☐ Capacity targets ☐ Emission standards ☐ Energy efficiency standards ☐ Agricultural producer subsidies ☐ Agricultural consumer subsidies ☐ Land protection ☐ Pricing carbon stocks

Socio-economic drivers

Population	☑ **Yes (exogenous)**	☐ Yes (endogenous)
Population age structure	☐ Yes (exogenous)	☐ Yes (endogenous)
Education level	☐ Yes (exogenous)	☐ Yes (endogenous)
Urbanization rate	☐ Yes (exogenous)	☐ Yes (endogenous)
GDP	☐ Yes (exogenous)	☑ **Yes (endogenous)**
Income distribution	☐ Yes (exogenous)	☐ Yes (endogenous)
Employment rate	☐ Yes (exogenous)	☐ Yes (endogenous)
Labor productivity	☐ Yes (exogenous)	☐ Yes (endogenous)
Total factor productivity	☑ **Yes (exogenous)**	☐ Yes (endogenous)
Autonomous energy efficiency improvements	☐ Yes (exogenous)	☐ Yes (endogenous)

Macro-economy

Economic sector

Industry	☐ Yes (physical) ☐ Yes (economic)	☐ Yes (physical & economic)
Energy	☐ Yes (physical) ☐ Yes (economic)	☐ Yes (physical & economic)
Transportation	☐ Yes (physical) ☐ Yes (economic)	☐ Yes (physical & economic)
Residential and commercial	☐ Yes (physical) ☐ Yes (economic)	☐ Yes (physical & economic)
Agriculture	☐ Yes (physical) ☐ Yes (economic)	☐ Yes (physical & economic)
Forestry	☐ Yes (physical) ☐ Yes (economic)	☐ Yes (physical & economic)

Macro-economy

Trade	☐ Coal ☐ Oil ☐ Gas ☐ Uranium ☐ Electricity	☐ Bioenergy crops ☐ Food crops ☐ Capital ☑ **Emissions permits** ☐ Non-energy goods
Cost measures	☑ **GDP loss** ☑ **Welfare loss** ☑ **Consumption loss**	☑ **Area under MAC** ☐ Energy system cost mark-up
Categorization by group	☐ Income ☐ Urban - rural ☐ Technology adoption ☐ Age	☐ Gender ☐ Education level ☐ Household size
Institutional and political factors	☐ Early retirement of capital allowed ☐ Interest rates differentiated by country/region ☐ Regional risk factors included ☐ Technology costs	differentiated by country/region ☐ Technological change differentiated by country/region ☐ Behavioural change differentiated by country/region ☐ Constraints on cross country financial transfers

Resource use

Coal	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Conventional Oil	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Unconventional Oil	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Conventional Gas	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Unconventional Gas	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Uranium	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Bioenergy	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Water	☐ Yes (fixed)	☐ Yes (supply curve)

☐ Yes (process model)

Raw Materials	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)
Land	☐ Yes (fixed) ☐ Yes (supply curve)	☐ Yes (process model)

Technological change

Energy conversion technologies	☐ No technological change ☐ Exogenous technological change	☐ Endogenous technological change
Energy End-use	☐ No technological change ☐ Exogenous technological change	☐ Endogenous technological change
Material Use	☐ No technological change ☐ Exogenous technological change	☐ Endogenous technological change
Agriculture (tc)	☐ No technological change ☐ Exogenous technological change	☐ Endogenous technological change

Energy

Energy technology substitution

Energy technology choice	☐ No discrete technology choices ☐ Logit choice model ☐ Production function	☐ Linear choice (lowest cost) ☐ Lowest cost with adjustment penalties
Energy technology substitutability	☐ Mostly high substitutability ☐ Mostly low substitutability	☐ Mixed high and low substitutability
Energy technology deployment	☐ Expansion and decline constraints	☐ System integration constraints

Energy

Electricity technologies	☐ Coal w/o CCS ☐ Coal w/ CCS ☐ Gas w/o CCS ☐ Gas w/ CCS ☐ Oil w/o CCS ☐ Oil w/ CCS ☐ Bioenergy w/o CCS ☐ Bioenergy w/ CCS ☐ Geothermal power ☐ Nuclear power	☐ Solar power ☐ Solar power-central PV ☐ Solar power-distributed PV ☐ Solar power-CSP ☐ Wind power ☐ Wind power-onshore ☐ Wind power-offshore ☐ Hydroelectric power ☐ Ocean power
Hydrogen production	☐ Coal to hydrogen w/o CCS ☐ Coal to hydrogen w/ CCS ☐ Natural gas to hydrogen w/o CCS ☐ Natural gas to hydrogen w/ CCS ☐ Oil to hydrogen w/o CCS ☐ Oil to hydrogen w/ CCS	☐ Biomass to hydrogen w/o CCS ☐ Biomass to hydrogen w/ CCS ☐ Nuclear thermochemical hydrogen ☐ Solar thermochemical hydrogen ☐ Electrolysis

Refined liquids	☐ Coal to liquids w/o CCS	☐ Bioliquids w/o CCS
	☐ Coal to liquids w/ CCS	☐ Bioliquids w/ CCS
	☐ Gas to liquids w/o CCS	☐ Oil refining
	☐ Gas to liquids w/ CCS	
Refined gases	☐ Coal to gas w/o CCS	☐ Oil to gas w/ CCS
	☐ Coal to gas w/ CCS	☐ Biomass to gas w/o CCS
	☐ Oil to gas w/o CCS	☐ Biomass to gas w/ CCS
Heat generation	☐ Coal heat	☐ Geothermal heat
	☐ Natural gas heat	☐ Solarthermal heat
	☐ Oil heat	☐ CHP (coupled heat and power)
	☐ Biomass heat	

Grid Infra Structure

Electricity	☐ Yes (aggregate)	☐ Yes (spatially explicit)
Gas	☐ Yes (aggregate)	☐ Yes (spatially explicit)
Heat	☐ Yes (aggregate)	☐ Yes (spatially explicit)
CO2	☐ Yes (aggregate)	☐ Yes (spatially explicit)
Hydrogen	☐ Yes (aggregate)	☐ Yes (spatially explicit)

Energy end-use technologies

Passenger transportation	☐ Passenger trains	☐ Hybrid LDVs
	☐ Buses	☐ Gasoline LDVs
	☐ Light Duty Vehicles (LDVs)	☐ Diesel LDVs
	☐ Electric LDVs	☐ Passenger aircrafts
	☐ Hydrogen LDVs	
Freight transportation	☐ Freight trains	☐ Freight aircrafts
	☐ Heavy duty vehicles	☐ Freight ships
Industry	☐ Steel production	☐ Paper production
	☐ Aluminium production	☐ Plastics production
	☐ Cement production	☐ Pulp production
	☐ Petrochemical production	
Residential and commercial	☐ Space heating	☐ Refrigeration
	☐ Space cooling	☐ Washing
	☐ Cooking	☐ Lighting

Land-use

Land cover	☐ Cropland	☐ Managed forest
	☐ Cropland irrigated	☐ Natural forest
	☐ Cropland food crops	☐ Pasture
	☐ Cropland feed crops	☐ Shrubland
	☐ Cropland energy crops	☐ Built-up area
	☐ Forest	
Agriculture and forestry demands	☐ Agriculture food	☐ Agriculture non-food crops
	☐ Agriculture food crops	☐ Agriculture non-food livestock
	☐ Agriculture food livestock	☐ Agriculture bioenergy
	☐ Agriculture feed	☐ Agriculture residues
	☐ Agriculture feed crops	☐ Forest industrial roundwood
	☐ Agriculture feed livestock	☐ Forest fuelwood
	☐ Agriculture non-food	☐ Forest residues

Agricultural commodities	☐ Wheat	☐ Sugar crops
	☐ Rice	☐ Ruminant meat
	☐ Other coarse grains	☐ Non-ruminant meat and eggs
	☐ Oilseeds	☐ Dairy products

Emission, climate and impacts

Greenhouse gases	☐ CO2 fossil fuels	☐ N2O land use
	☐ CO2 cement	☐ N2O other
	☐ CO2 land use	☐ CFCs
	☐ CH4 energy	☐ HFCs
	☐ CH4 land use	☐ SF6
	☐ CH4 other	☐ PFCs
	☐ N2O energy	☑ **CO2 (total)**
Pollutants	☐ CO energy	☐ SO2 other
	☐ CO land use	☐ BC energy
	☐ CO other	☐ BC land use
	☐ NOx energy	☐ BC other
	☐ NOx land use	☐ OC energy
	☐ NOx other	☐ OC land use
	☐ VOC energy	☐ OC other
	☐ VOC land use	☐ NH3 energy
	☐ VOC other	☐ NH3 land use
	☐ SO2 energy	☐ NH3 other
	☐ SO2 land use	
Climate indicators	☐ Concentration: CO2	☐ Radiative forcing: Kyoto gases
	☐ Concentration: CH4	☐ Radiative forcing: aerosols
	☐ Concentration: N2O	☐ Radiative forcing: land albedo
	☐ Concentration: Kyoto gases	☐ Radiative forcing: AN3A
	☐ Radiative forcing: CO2	☐ Radiative forcing: total
	☐ Radiative forcing: CH4	☑ **Temperature change**
	☐ Radiative forcing: N2O	☐ Sea level rise
	☐ Radiative forcing: F-gases	☐ Ocean acidification
Carbon dioxide removal	☐ Bioenergy with CCS	☐ Soil carbon enhancement
	☐ Reforestation	☐ Direct air capture
	☐ Afforestation	☐ Enhanced weathering
Climate change impacts	☐ Agriculture	☑ **Economic output**
	☐ Energy supply	☐ Built capital
	☐ Energy demand	☐ Inequality
Co-Linkages	☐ Energy security: Fossil fuel imports & exports (region)	☐ Air pollution & health: Health impacts of air Pollution
	☐ Energy access: Household energy consumption	☐ Food access
		☐ Water availability
	☐ Air pollution & health: Source-based aerosol emissions	☐ Biodiversity