Snapshot of - COFFEE-TEA

Archive of COFFEE-TEA, version: v1

Contents

Reference card - COFFEE-TEA

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	COFFEE-TEA v1
Institution	COPPE/UFRJ (Cenergia), Brazil, http://www.cenergialab.coppe.ufrj.br/.
Documentation	COFFEE-TEA documentation consists of a referencecard and detailed model documentation
Process state	published

Model scope and methods

Model documentation: Model scope and methods - COFFEE-TEA

Model type	☑ **Integrated assessment model** ☐ Energy system model	☐ CGE ☐ CBA-integrated assessment model
Geographical scope	☑ **Global**	☐ Regional
Objective	The models were developed at COPPE/UFRJ, Brazil, for assessing climate, land, energy and environmental policies, providing relevant information to experts and decision-makers about the possible development strategies and repercussions of long term climate scenarios.	
Solution concept	☐ Partial equilibrium (price elastic demand) ☐ Partial equilibrium (fixed demand) ☑ **General equilibrium (closed economy)**	

Note: The COFFEE model is Partial Equilibrium. The TEA model is General Equilibrium.

Solution horizon	☐ Recursive dynamic (myopic)	☑ **Intertemporal optimization (foresight)**

Note: The COFFEE model is Intertemporal Optimization. The TEA model is Recursive Dynamic.

Solution method

☐ Simulation

☐ Optimization

☑ The COFFEE model is solved through Linear Programming (LP). The TEA model is formulated as a mixed complementary problem (MCP) and is solved through Mathematical Programming System for General Equilibrium -- MPSGE within GAMS using the PATH solver.

Temporal dimension

Base year:2010, time steps:5 year, horizon: 2100

Spatial dimension

Number of regions:18

1. AFR Africa
2. AUS Australia and New Zealand
3. BRA Brazil
4. CAM Central America
5. CAN Canada
6. CAS Caspian Region
7. CHN China
8. EEU Europe
9. IND India
10. JPN Japan
11. KOR South Korea
12. MEA Middle East
13. RAS Rest of Asia and Oceania
14. RUS Russia
15. SAF South Africa
16. SAM South America
17. USA United States
18. WEU Rest of Europe

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

Model documentation: Socio-economic drivers - COFFEE-TEA

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

Model documentation: Macro-economy - COFFEE-TEA

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)**
Other economic sector	☑ **Manufactures**	☑ **other**

Macro-economy

Trade	☑ **Coal** ☑ **Oil** ☑ **Gas** ☐ Uranium ☑ **Electricity** ☑ **Bioenergy crops** ☑ **Food crops** ☐ Capital ☑ **Emissions permits** ☑ **Non-energy goods**	☑ **Bioenergy products** ☑ **Chemical Products** ☑ **Consumer Goods Industries** ☑ **Diesel** ☑ **Livestock products** ☑ **Manufactures** ☑ **Ferrous and non ferrous metals** ☑ **Refined Liquid Fuels** ☑ **Services**
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

Model documentation: Energy - COFFEE-TEA

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

Model documentation: Land-use - COFFEE-TEA

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

Model documentation: Emissions - COFFEE-TEA, Climate - COFFEE-TEA, Non-climate sustainability dimension - COFFEE-TEA

Greenhouse gases	☑ **CO2 fossil fuels**	☑ **CH4 energy**
	☑ **CO2 cement**	☑ **CH4 land use**
	☑ **CO2 land use**	☑ **CH4 other**

- ☑ **N2O energy**
- ☑ **N2O land use**
- ☑ **N2O other**
- ☐ CFCs
- ☐ HFCs
- ☐ SF6
- ☐ PFCs

Pollutants

- ☐ CO energy
- ☐ CO land use
- ☐ CO other
- ☐ NOx energy
- ☐ NOx land use
- ☐ NOx other
- ☐ VOC energy
- ☐ VOC land use
- ☐ VOC other
- ☑ **SO2 energy**
- ☑ **SO2 land use**
- ☐ SO2 other
- ☐ BC energy
- ☐ BC land use
- ☐ BC other
- ☐ OC energy
- ☐ OC land use
- ☐ OC other
- ☐ NH3 energy
- ☐ NH3 land use
- ☐ NH3 other

Climate indicators

- ☐ Concentration: CO2
- ☐ Concentration: CH4
- ☐ Concentration: N2O
- ☐ Concentration: Kyoto gases
- ☐ Radiative forcing: CO2
- ☐ Radiative forcing: CH4
- ☐ Radiative forcing: N2O
- ☐ Radiative forcing: F-gases
- ☐ Radiative forcing: Kyoto gases
- ☐ Radiative forcing: aerosols
- ☐ Radiative forcing: land albedo
- ☐ Radiative forcing: AN3A
- ☐ Radiative forcing: total
- ☐ Temperature change
- ☐ Sea level rise
- ☐ Ocean acidification

Carbon dioxide removal

- ☑ **Bioenergy with CCS**
- ☑ **Reforestation**
- ☑ **Afforestation**
- ☐ Soil carbon enhancement
- ☑ **Direct air capture**
- ☐ Enhanced weathering

Climate change impacts

- ☐ Agriculture
- ☐ Energy supply
- ☐ Energy demand
- ☐ Economic output
- ☐ Built capital
- ☐ Inequality

Co-Linkages

- ☑ **Energy security: Fossil fuel imports & exports (region)**
- ☑ **Energy access: Household energy consumption**
- ☐ Air pollution & health: Source-based aerosol emissions
- ☐ Air pollution & health: Health impacts of air Pollution
- ☐ Food access
- ☐ Water availability
- ☐ Biodiversity

Model Documentation - COFFEE-TEA

⚠ ***Note:*** *The documentation of is* and is not yet 'published'!

Corresponding documentation

Previous versions

No previous version available

Model information

Model link	
Institution	
Solution concept	
Solution method	
Anticipation	

Introduction

This wiki page provides detailled information on the COFFEE-TEA models. The COFFEE-TEA is an integrated assessment model framework that consists of two models -- the energy and land-use model COFFEE, and the Computable General Economic (CGE) model TEA. The models were developed at COPPE/UFRJ, Brazil, for assessing climate, land, energy and environmental policies, providing relevant information to experts and decision-makers about the possible development strategies and repercussions of long term climate scenarios. The models can run on a stand-alone basis or linked through a soft-link process, providing long-term (up to 2100) assessments of the interaction between the energy and land-use systems and the economy.

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