

Snapshot of - NICE

Archive of NICE, version: 2020

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Reference card - NICE

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 NICE 2020

Model link	https://www.pnas.org/doi/10.1073/pnas.1513967112 ; https://github.com/myoungbrun/replication_Young-Brun_et_al_2025/blob/main/src/MimiNICE2020_module.jl ; https://www.pnas.org/doi/10.1073/pnas.2505239122 ; https://www.pnas.org/doi/10.1073/pnas.2529652122
Institution	Centre d'Économie de la Sorbonne, University Paris 1 Panthéon Sorbonne (CES), France, https://ces.panthéonsorbonne.fr/ , Paris School of Economics (PSE), France, https://www.parisschoolofeconomics.eu/ , Macroeconomics Department, Halle Institute for Economic Research, University of Leipzig (IWH), Germany, https://www.iwh-halle.de/ , Institute for Theoretical Economics, University of Leipzig (Institute for Theoretical Economics), Germany, https://www.wifa.uni-leipzig.de/institut-fuer-theoretische-volkswirtschaftslehre. , World Bank Group (World Bank), United States, https://www.worldbank.org/ext/en/home. , School of Public and International Affairs, Princeton University (SPIA), United States, https://spia.princeton.edu/ , Potsdam Institute for Climate Impact Research (PIK), Germany, https://www.pik-potsdam.de/en. , Economics of Climate Change Department, Technische Universität Berlin (TUB), Germany, https://www.tu.berlin/en/climatecon. , Centre International de Recherche sur l'Environnement et le Développement (CNRS, Agro ParisTech, Ponts ParisTech, EHESS, CIRAD) (CIRED), France, https://www.centre-cired.fr/ .
Documentation	NICE documentation is limited and consists of a reference card
Process state	published

Model scope and methods

Model type	<input type="checkbox"/> Integrated assessment model <input type="checkbox"/> Energy system model	<input type="checkbox"/> CGE <input checked="" type="checkbox"/> CBA-integrated assessment model
Geographical scope	<input checked="" type="checkbox"/> Global	<input type="checkbox"/> Regional
Solution concept	<input type="checkbox"/> Partial equilibrium (price elastic demand) <input type="checkbox"/> Partial equilibrium (fixed	demand) <input checked="" type="checkbox"/> General equilibrium (closed economy)
Solution horizon	<input type="checkbox"/> Recursive dynamic (myopic)	<input checked="" type="checkbox"/> Intertemporal optimization (foresight)

Solution method Simulation **Optimization****Temporal dimension**

Base year:2020, time steps:yearly, horizon: 2100

Spatial dimension

Number of regions:179

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)

Other socio economic driver

Exogenous autonomous technical progress on the

carbon intensity of GDP

Macro-economy

Economic sector

Industry

Yes (physical)

Yes (physical & economic)

Yes (economic)

Energy

Yes (physical)

Yes (physical & economic)

Yes (economic)

Transportation

Yes (physical)

Yes (physical & economic)

Yes (economic)

Residential and commercial

Yes (physical)

Yes (physical & economic)

Yes (economic)

Agriculture

Yes (physical)

Yes (physical & economic)

Yes (economic)

Forestry

Yes (physical)

Yes (physical & economic)

Yes (economic)

Macro-economy

Trade

Coal

Bioenergy crops

Oil

Food crops

Gas

Capital

Uranium

Emissions permits

Electricity

Non-energy goods

Cost measures

GDP loss

Consumption loss

Welfare 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

- | | |
|---|--|
| <input type="checkbox"/> Bioenergy w/o CCS | <input type="checkbox"/> Solar power-CSP |
| <input type="checkbox"/> Bioenergy w/ CCS | <input type="checkbox"/> Wind power |
| <input type="checkbox"/> Geothermal power | <input type="checkbox"/> Wind power-onshore |
| <input type="checkbox"/> Nuclear power | <input type="checkbox"/> Wind power-offshore |
| <input type="checkbox"/> Solar power | <input type="checkbox"/> Hydroelectric power |
| <input type="checkbox"/> Solar power-central PV | <input type="checkbox"/> Ocean power |
| <input type="checkbox"/> Solar power-distributed PV | |

Hydrogen production

- | | |
|--|--|
| <input type="checkbox"/> Coal to hydrogen w/o CCS | <input type="checkbox"/> Biomass to hydrogen w/o CCS |
| <input type="checkbox"/> Coal to hydrogen w/ CCS | <input type="checkbox"/> Biomass to hydrogen w/ CCS |
| <input type="checkbox"/> Natural gas to hydrogen w/o CCS | <input type="checkbox"/> Nuclear thermochemical hydrogen |
| <input type="checkbox"/> Natural gas to hydrogen w/ CCS | <input type="checkbox"/> Solar thermochemical hydrogen |
| <input type="checkbox"/> Oil to hydrogen w/o CCS | <input type="checkbox"/> Electrolysis |
| <input type="checkbox"/> Oil to hydrogen w/ CCS | |

Refined liquids

- | | |
|--|---|
| <input type="checkbox"/> Coal to liquids w/o CCS | <input type="checkbox"/> Bioliquids w/o CCS |
| <input type="checkbox"/> Coal to liquids w/ CCS | <input type="checkbox"/> Bioliquids w/ CCS |
| <input type="checkbox"/> Gas to liquids w/o CCS | <input type="checkbox"/> Oil refining |
| <input type="checkbox"/> Gas to liquids w/ CCS | |

Refined gases

- | | |
|--|---|
| <input type="checkbox"/> Coal to gas w/o CCS | <input type="checkbox"/> Oil to gas w/ CCS |
| <input type="checkbox"/> Coal to gas w/ CCS | <input type="checkbox"/> Biomass to gas w/o CCS |
| <input type="checkbox"/> Oil to gas w/o CCS | <input type="checkbox"/> Biomass to gas w/ CCS |

Heat generation

- | | |
|---|---|
| <input type="checkbox"/> Coal heat | <input type="checkbox"/> Geothermal heat |
| <input type="checkbox"/> Natural gas heat | <input type="checkbox"/> Solarthermal heat |
| <input type="checkbox"/> Oil heat | <input type="checkbox"/> CHP (coupled heat and power) |
| <input type="checkbox"/> Biomass heat | |

Grid Infra Structure**Electricity**

- | | |
|--|---|
| <input type="checkbox"/> Yes (aggregate) | <input type="checkbox"/> Yes (spatially explicit) |
|--|---|

Gas

- | | |
|--|---|
| <input type="checkbox"/> Yes (aggregate) | <input type="checkbox"/> Yes (spatially explicit) |
|--|---|

Heat

- | | |
|--|---|
| <input type="checkbox"/> Yes (aggregate) | <input type="checkbox"/> Yes (spatially explicit) |
|--|---|

CO2

- | | |
|--|---|
| <input type="checkbox"/> Yes (aggregate) | <input type="checkbox"/> Yes (spatially explicit) |
|--|---|

Hydrogen

- | | |
|--|---|
| <input type="checkbox"/> Yes (aggregate) | <input type="checkbox"/> Yes (spatially explicit) |
|--|---|

Energy end-use technologies

Passenger transportation

- Passenger trains
- Buses
- Light Duty Vehicles (LDVs)
- Electric LDVs
- Hydrogen LDVs
- Hybrid LDVs
- Gasoline LDVs
- Diesel LDVs
- Passenger aircrafts

Freight transportation

- Freight trains
- Heavy duty vehicles
- Freight aircrafts
- Freight ships

Industry

- Steel production
- Aluminium production
- Cement production
- Petrochemical production
- Paper production
- Plastics production
- Pulp production

Residential and commercial

- Space heating
- Space cooling
- Cooking
- Refrigeration
- Washing
- Lighting

Land-use

Land cover

- Cropland
- Cropland irrigated
- Cropland food crops
- Cropland feed crops
- Cropland energy crops
- Forest
- Managed forest
- Natural forest
- Pasture
- Shrubland
- Built-up area

Agriculture and forestry demands

- Agriculture food
- Agriculture food crops
- Agriculture food livestock
- Agriculture feed
- Agriculture feed crops
- Agriculture feed livestock
- Agriculture non-food
- Agriculture non-food crops
- Agriculture non-food livestock
- Agriculture bioenergy
- Agriculture residues
- Forest industrial roundwood
- Forest fuelwood
- Forest residues

Agricultural commodities

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

Emission, climate and impacts

Greenhouse gases

CO2 fossil fuels

- CO2 cement
- CO2 land use
- CH4 energy
- CH4 land use
- CH4 other
- N2O energy

- N2O land use
- N2O other
- CFCs
- HFCs
- SF6
- PFCs

Note: Only CO₂ from fossil fuels is accounted for in NICE. However the model is coupled with FAIR v2.0 Mini which can account for other gases.

Pollutants

- CO energy
- CO land use
- CO other
- NO_x energy
- NO_x land use
- NO_x 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

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