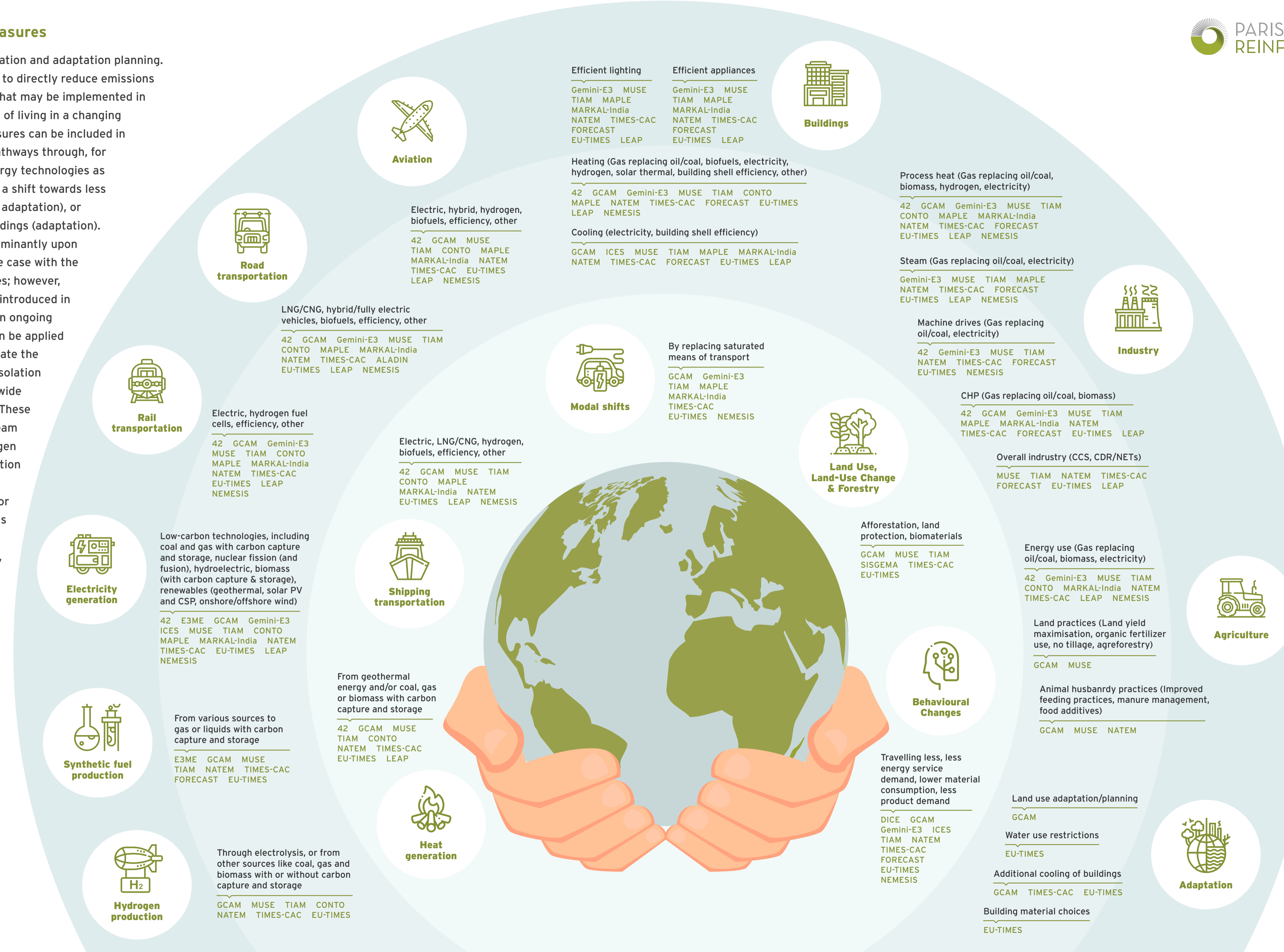


## Mitigation and adaptation measures

Models produce outputs to inform mitigation and adaptation planning. Mitigation concerns measures that look to directly reduce emissions whereas adaptation considers measures that may be implemented in order to maintain established standards of living in a changing climate. Mitigation and adaptation measures can be included in all models' simulations of low-carbon pathways through, for example, the inclusion of renewable energy technologies as alternatives for fossil fuels (mitigation), a shift towards less land use-intensive diets (mitigation and adaptation), or increasing cooling requirements for buildings (adaptation). Models have historically focussed predominantly upon mitigation measures, and this is also the case with the PARIS REINFORCE modelling capabilities; however, adaptation capabilities are being steadily introduced in line with their increasing relevance given ongoing climate change. Mitigation measures can be applied into a range of sectors; one can investigate the effects of interventions into sectors in isolation or as part of a broad-ranging economy-wide strategy, like the European Green Deal. These can include clean technologies in upstream technologies (e.g. blue and green hydrogen production), heat and electricity generation (e.g. renewables) and storage, new transportation alternatives (e.g. hybrid or electric vehicles, biofuels, etc.), buildings technologies (e.g. new appliances and energy efficiency), industrial innovation, or new technologies in agriculture and land use (e.g. animal husbandry, integrated manure management, and reimbursements for holding carbon stocks). Specific adaptation measures can also be implemented for some sectors, particularly relating to the management of land use, water systems, and urban environments (e.g. consequences of afforestation levels on land-use change).



**Aviation**

Electric, hybrid, hydrogen, biofuels, efficiency, other

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**Road transportation**

LNG/CNG, hybrid/fully electric vehicles, biofuels, efficiency, other

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**Rail transportation**

Electric, hydrogen fuel cells, efficiency, other

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**Electricity generation**

Low-carbon technologies, including coal and gas with carbon capture and storage, nuclear fission (and fusion), hydroelectric, biomass (with carbon capture & storage), renewables (geothermal, solar PV and CSP, onshore/offshore wind)

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**Synthetic fuel production**

From various sources to gas or liquids with carbon capture and storage

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**Hydrogen production**

Through electrolysis, or from other sources like coal, gas and biomass with or without carbon capture and storage

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**Shipping transportation**

Electric, LNG/CNG, hydrogen, biofuels, efficiency, other

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**Heat generation**

From geothermal energy and/or coal, gas or biomass with carbon capture and storage

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**Heat generation**

**Modal shifts**

By replacing saturated means of transport

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**Efficient lighting**

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**Efficient appliances**

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**Buildings**

Heating (Gas replacing oil/coal, biofuels, electricity, hydrogen, solar thermal, building shell efficiency, other)

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Cooling (electricity, building shell efficiency)

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**Land Use, Land-Use Change & Forestry**

Afforestation, land protection, biomaterials

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**Behavioural Changes**

Travelling less, less energy service demand, lower material consumption, less product demand

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**Industry**

Process heat (Gas replacing oil/coal, biomass, hydrogen, electricity)

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Steam (Gas replacing oil/coal, electricity)

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Machine drives (Gas replacing oil/coal, electricity)

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**Agriculture**

Land practices (Land yield maximisation, organic fertilizer use, no tillage, agroforestry)

GCAM MUSE

Animal husbandry practices (Improved feeding practices, manure management, food additives)

GCAM MUSE NATEM

**Adaptation**

Land use adaptation/planning

GCAM

Water use restrictions

EU-TIMES

Additional cooling of buildings

GCAM TIMES-CAC EU-TIMES

Building material choices

EU-TIMES

**CHP (Gas replacing oil/coal, biomass)**

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**Overall industry (CCS, CDR/NETs)**

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**Energy use (Gas replacing oil/coal, biomass, electricity)**

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