

# NISMOD Transport model overview and application

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# Presentation summary

- Transport model overview
- Recent applications
  - Regional assessments:
    - Oxford-Cambridge Arc
    - England's Economic Heartland
- NISMOD visualisation on DAFNI



# NISMOD Transport Model

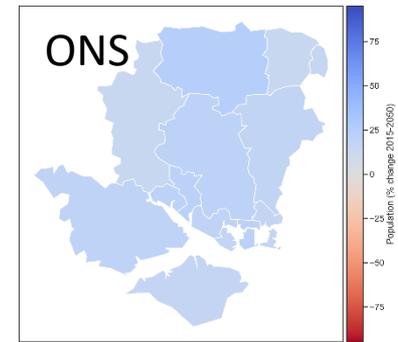
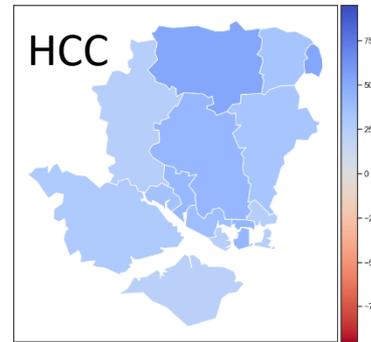


## Road demand and capacity

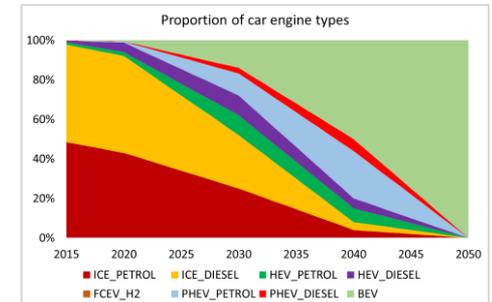
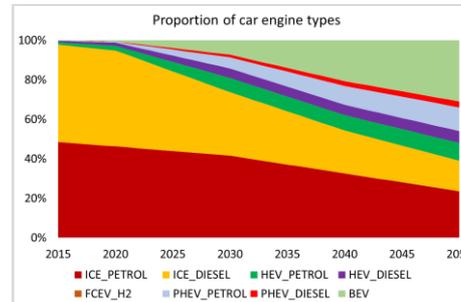
- Major road network (GB) (A-roads and motorways)
- 380 LADs / 7700 TEMPro
- OD Matrix (AADF count data)
- Calibrated with vehicle kilometres, trip length distribution, total number of car trips
- Offline route set generation

## Input variables

- Population



- Changes to the fleet



- Changes to the network
- Congestion charging zones

# NISMOD Transport Model

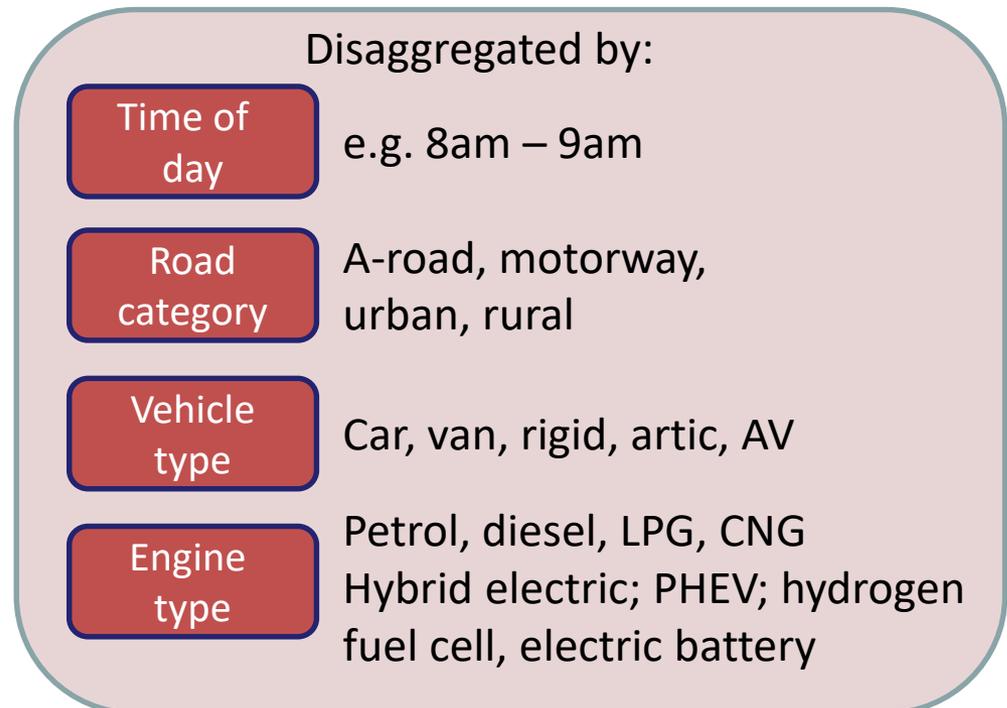
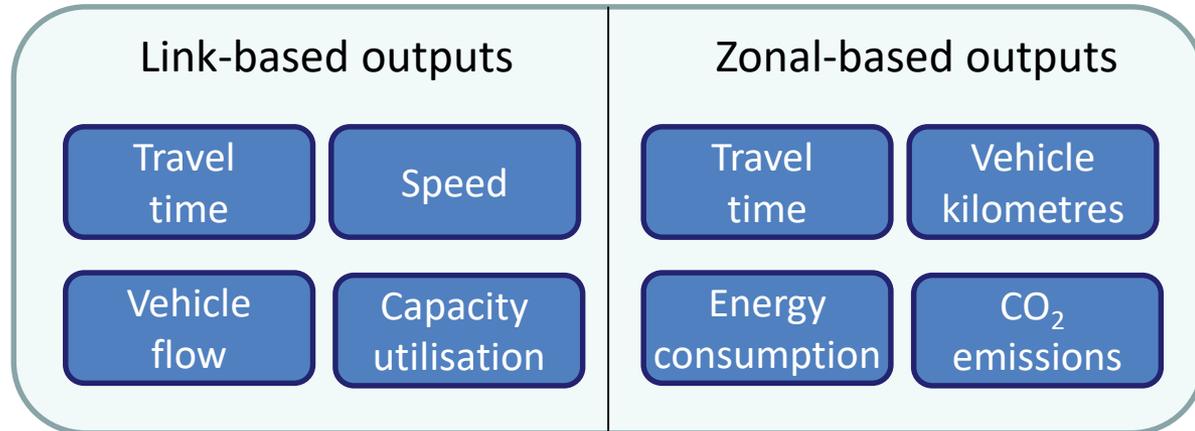


## Road demand and capacity

- Major road network (GB) (A-roads and motorways)
- 380 LADs / 7700 TEMPro
- OD Matrix (AADF count data)
- Calibrated with vehicle kilometres, trip length distribution, total number of car trips
- Offline route set generation

## Railway station demand

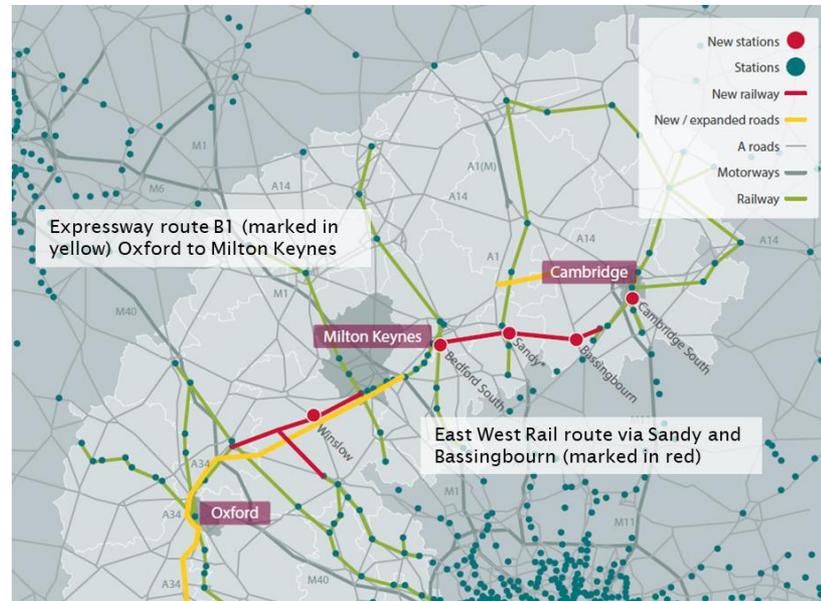
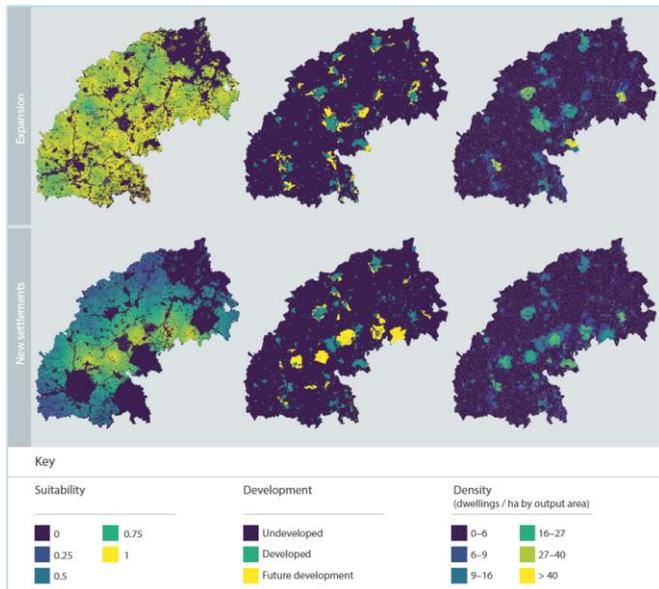
## Airport demand and capacity



# Recent applications: regional assessments

## Oxford-Cambridge Arc

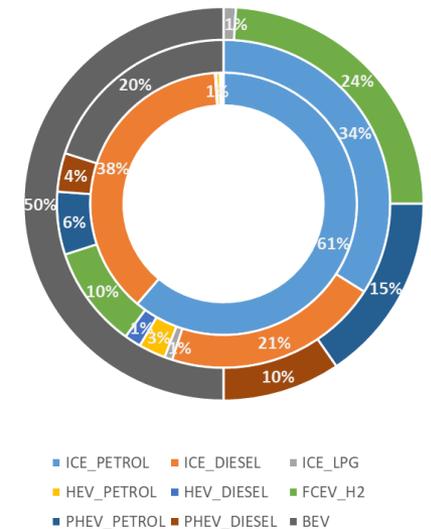
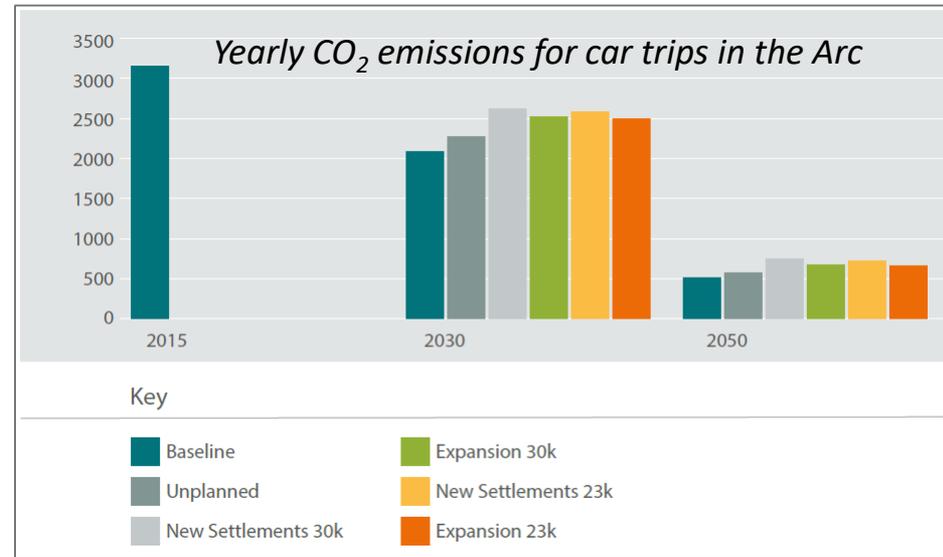
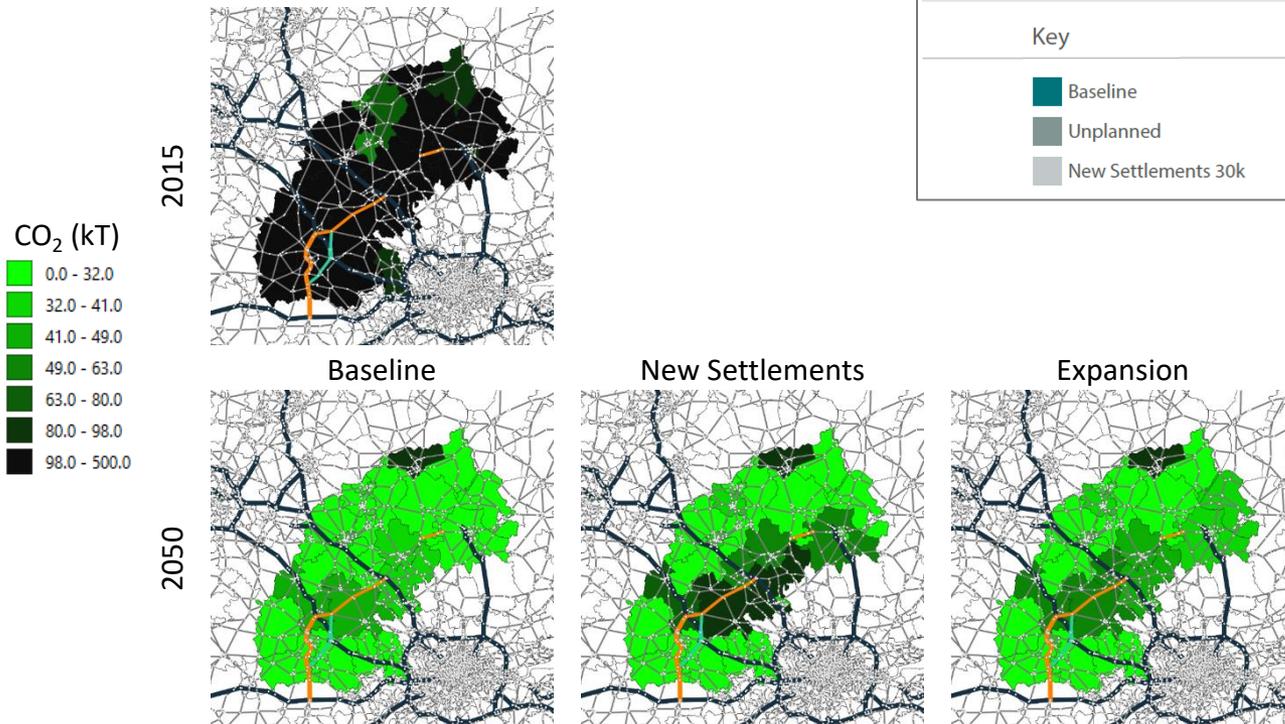
- Multiple growth scenarios, based on alternative approaches to development of new dwellings (23,000 – 30,000 per annum)
- Multi-sector analysis demonstrating all NISMOD capabilities
- Not implicitly strategy-based, although assessed transport options and decarbonisation of domestic heating



# Recent applications: regional assessments

## Selected results for road transport *Vehicle electrification and carbon footprint*

Despite population growth, conversion to electric vehicles would result in a sharp decrease in carbon emissions and other air pollutants by 2050, but would lead to substantial new electricity demand from the transport sector.

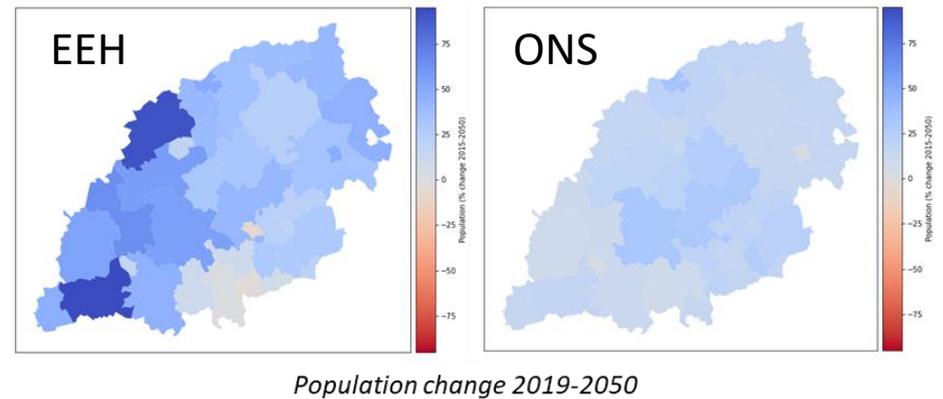


Vehicle electrification scenario with market shares of passenger car engine types (inside: 2015, middle: 2030, outside: 2050)

# Recent applications: regional assessments

## England's Economic Heartland (EEH)

- Single growth scenario, based on planned development to 2050
- Single sector assessment (transport)
- Multiple strategic approaches ('Pathways') to decarbonise transport to meet UK 2050 net-zero emission targets



## Pathways to decarbonisation

All Pathways (except BaU) assume 100% zero-emission vehicles in 2050

- **Business as Usual (BaU)** – pre-Covid 'baseline'
- **Highly Connected (HC)** – ICT and embedded technologies
- **Adapted Fleet (AF)** – rapid technological development
- **Behaviour Shift (BS)** – more intensive use of fewer vehicles, modal shift.

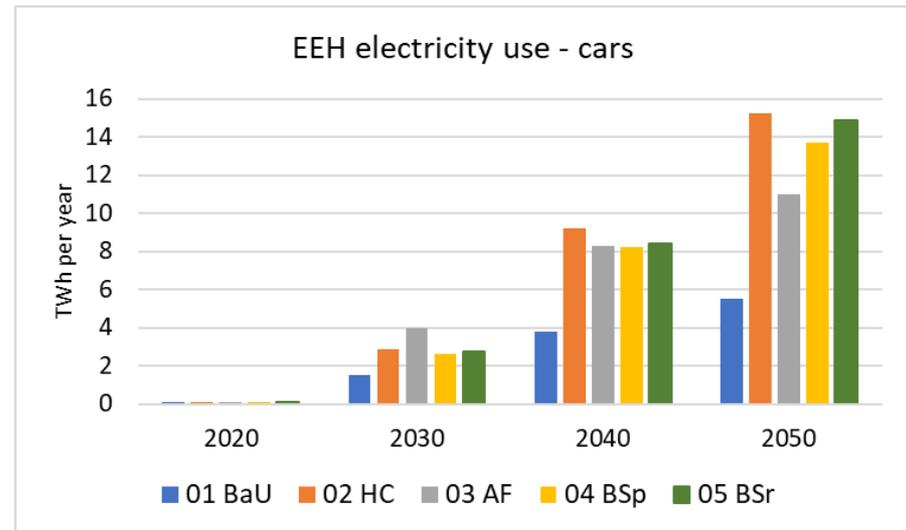
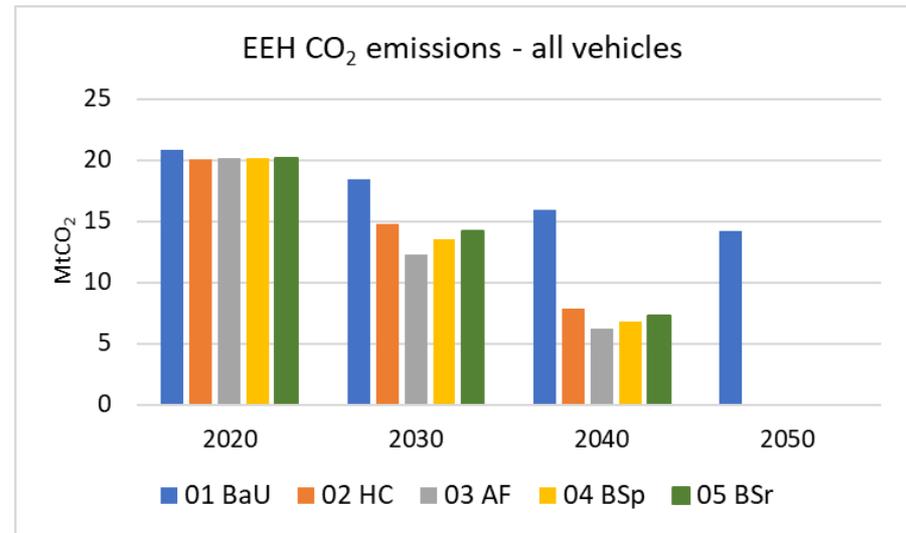
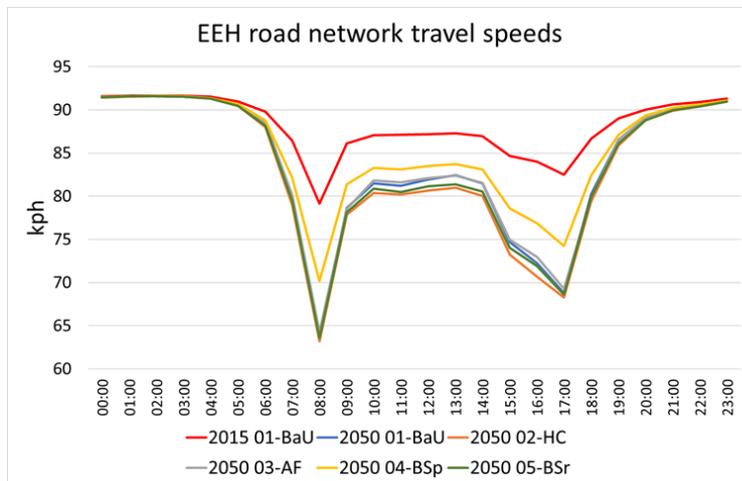
# Recent applications: regional assessments

## Selected results for road transport *Vehicle electrification and carbon footprint*

Carbon emissions drop for all Pathways, but impact of more rapid conversion to electric vehicles is seen for 'Adapted Fleet', where technological improvements help limit electricity demand.

## *Congestion and traffic speeds*

All Pathways have reduced network speeds in 2050, but the road pricing regimes in Behaviour Shift result in less congestion.



# Transport model on DAFNI

## NISMOD model run setup

The screenshot displays the DAFNI Workflow Status page. The workflow consists of the following steps: nismod2-..., decision, energy-2015, adaptor-2015, transport-2015, energy-transport..., publish, and End. The 'transport-2015' step is highlighted, and its details are shown below.

**Step name:** transport-2015

**Model name:** NISMOD - Transport (model v2.3.0 build 2)

**Steps to include data from:** adaptor-2015.

**Parameters:**

Parameter	Value
Transport Sector Model	transport
Model Run	nic_ed_et_tr
Part of SOS Model	true
Use generated scenario	false
Timestep	2015

**Dataslots:**

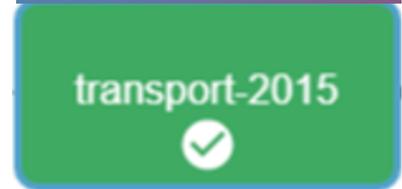
Name	Path to data	Datasets
Scenario Data	scenarios/	NISMOD Scenario data pack
Transport Model Data	transport/	NISMOD Transport data pack
LAD boundaries	lads/	Local Authority Districts (December 2016) Boundaries Local Authority Districts (December 2016) Ultra Generalised Clipped Boundaries in the UK

**Step status: Succeeded**

Status	Number of processes
Failed	0
Pending	0
Running	0
Succeeded	1



IRIDIS  
High  
Performance  
Computing



# Transport model on DAFNI

## EEH analysis on DAFNI

The screenshot displays the DAFNI software interface for EEH analysis. The top navigation bar includes the DAFNI logo and a 'HELP' link. Below the navigation bar, the user is prompted 'what is your input data?' and has selected 'CSV' with the file 'eehCO2Emissions.csv'.

The interface is divided into several panels:

- Geometries:** Allows adding layers to the plot. Options include 'line' and 'point'. A button 'Add new geometry' is present.
- Aesthetics:** Allows mapping columns to visual properties. The 'x' axis is set to 'year', the 'y' axis to 'CAR', 'size' is set to 'Add', and 'color' is set to 'scenario'. A button 'Add new aesthetic' is present.
- Columns:** Allows dragging columns to an aesthetic. The columns 'scenario', 'year', 'CAR', 'ARTIC', and 'RIGID' are listed. Buttons for 'Add new field' and 'Calculate new field' are present. A 'Filter data' section includes a text input field with an example: 'datum.fieldName > 60' (syntax).
- Plot:** A line chart showing 'CAR' (y-axis, 0 to 16,000,000) versus 'year' (x-axis, 2,016 to 2,048). Five scenarios are plotted: 01-BaU (blue), 02-HighlyConnected (orange), 03-AdaptedFleet (red), 04-BehavShiftPolicy (green), and 05-BehavShiftResults (light green). Buttons for 'SAVE PLOT' and 'SAVE TEMPLATE' are visible.
- EEH CO<sub>2</sub> emissions - all vehicles:** A bar chart showing 'MtCO<sub>2</sub>' (y-axis, 0 to 25) for the years 2020, 2030, 2040, and 2050. The legend indicates five scenarios: 01 BaU (blue), 02 HC (orange), 03 AF (grey), 04 BSp (yellow), and 05 BSr (green).

# Transport model on DAFNI

## EEH analysis on DAFNI

The screenshot displays the DAFNI web interface for configuring an EEH analysis. The interface is organized into several panels:

- Header:** DAFNI logo and HELP link.
- Input Fields:** Dropdown menus for file types and names: "what is your input data?" (csv + topojson), "csv file" (eehLinkTravelTimes.csv), "csv id field" (edgeID), "topojson file" (eehNetwork.topojson), and "geometry id field" (EdgeID).
- Geometries:** A panel to add layers to the plot, currently showing "geoshape" and an "Add new geometry" button.
- Aesthetics:** A panel to map columns to visual properties. It shows "shape" mapped to "geo", "color" mapped to "MIDNIGHT", and "detail" mapped to "edgeID". There is an "Add new aesthetic" button.
- Columns:** A panel to drag columns to an aesthetic. It lists "geo", "year", "edgeID", "freeFlow", "MIDNIGHT", and "ONEAM". There are buttons for "Add new field" and "Calculate new field".
- Plot:** A visualization of the network with a color scale for "MIDNIGHT" ranging from 0 (yellow) to 13 (dark blue). It includes "SAVE PLOT" and "SAVE TEMPLATE" buttons.
- Vega-Lite Specification:** A panel showing the JSON specification for the plot, including data source and mark type.

```
{
  "data": {
    "url": "eehLinkTravelTimes.csv",
    "name": "table",
    "format": {
      "type": "csv"
    }
  },
  "mark": {
```

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with thanks to Milan Lovric, Simon Blainey and John Preston  
for their inputs into previous work

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