NISMOD Transport model
overview and application

DAFNI Roadshow – focus on Transport Research

24th March 2021

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Presentation summary

- The ITRC approach using NISMOD

- Transport model overview

- Recent applications
    Regional assessments:
    – Oxford-Cambridge Arc
    – England's Economic Heartland

- NISMOD visualisation on DAFNI

The ITRC approach
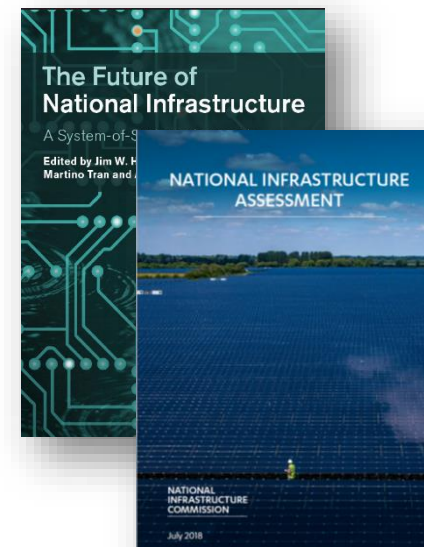## Scenario-based assessment of future infrastructure options

From 2011 the EPSRC-funded Infrastructure Transitions Research Consortium (ITRC) led by the University of Oxford has developed:

- The NISMOD national system-of-systems model (energy-transport-digital-water-waste) for long-term infrastructure planning in Britain

- National modelling of climate risks to infrastructure networks

- MISTRAL's multi-scale approach

- Assessment of the Oxford-Cambridge Arc
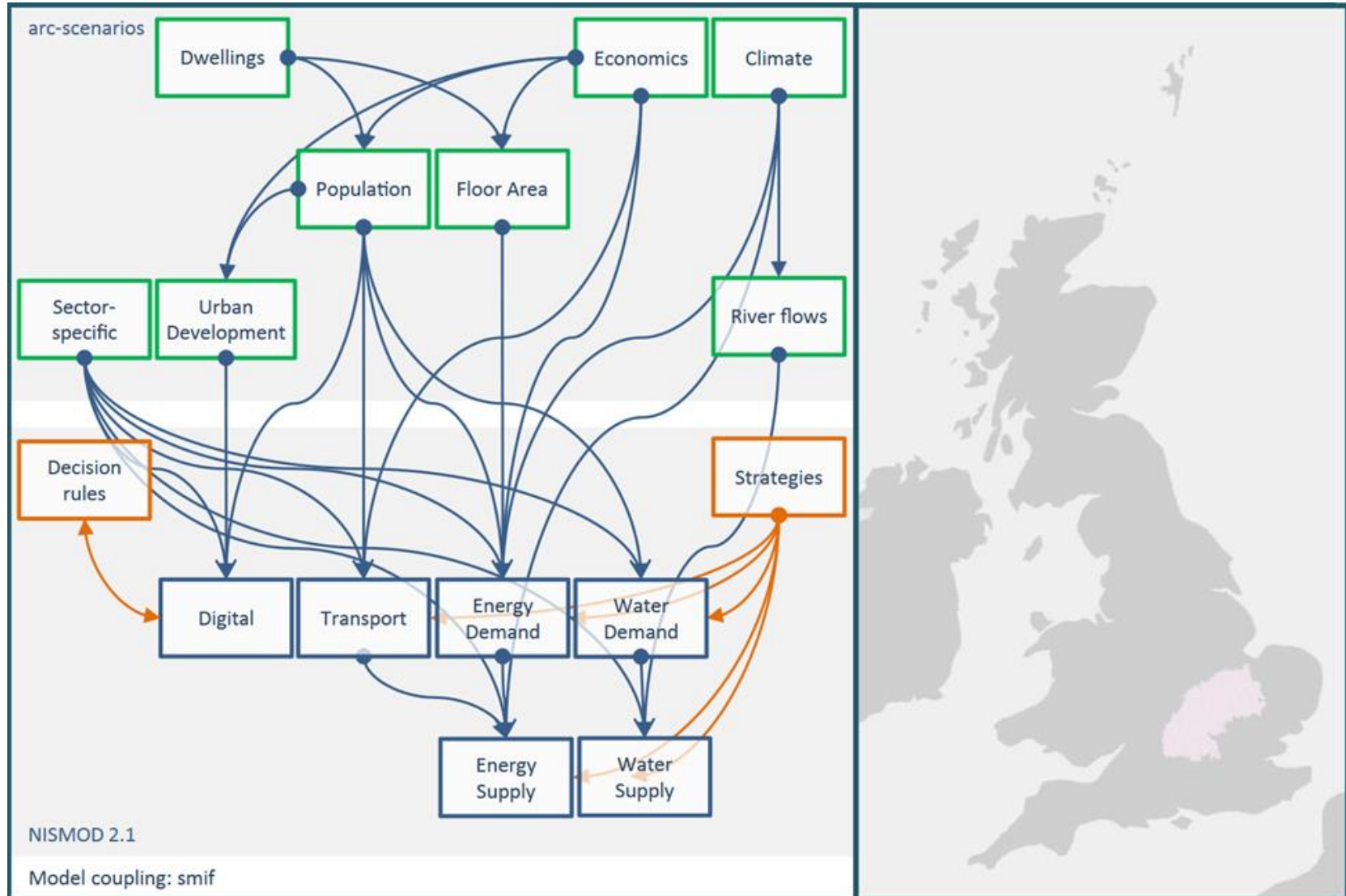
More information available at www.itrc.org.uk

ITRC's data and open source codes are being migrated to DAFNI: the Data and Analytics Facility for National Infrastructure

ITRC's NISMOD

Scenario-based assessment of future infrastructure options
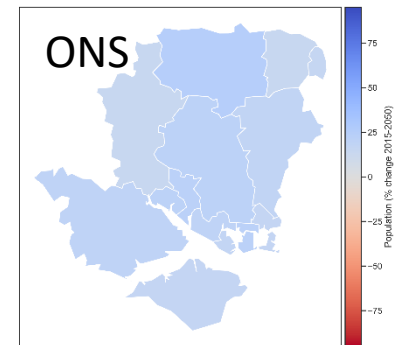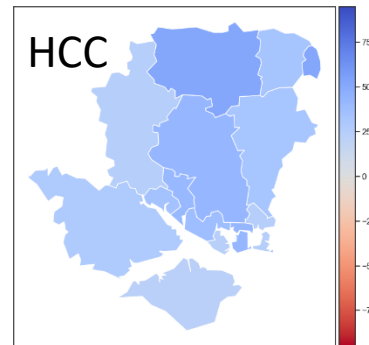
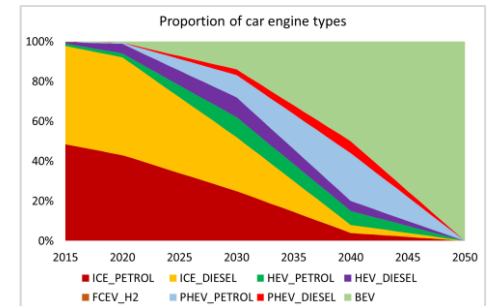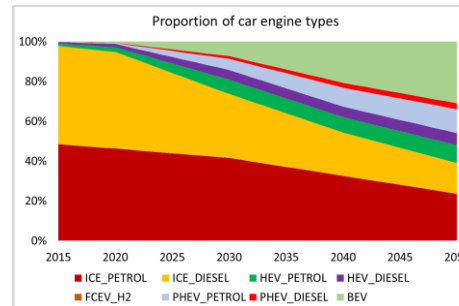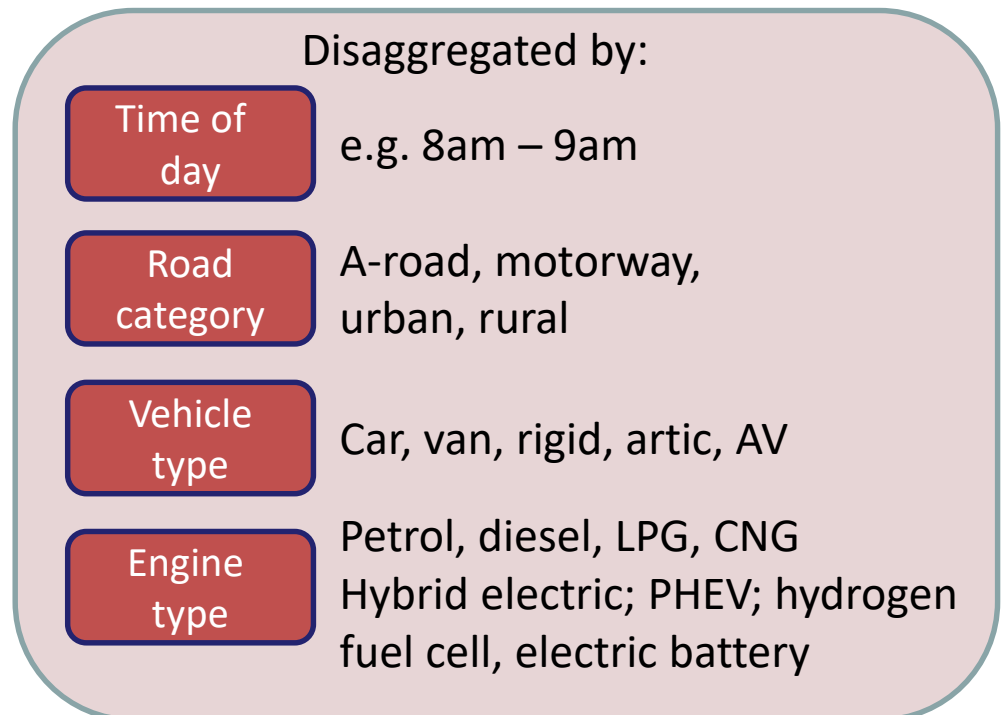# NISMOD Transport Model

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
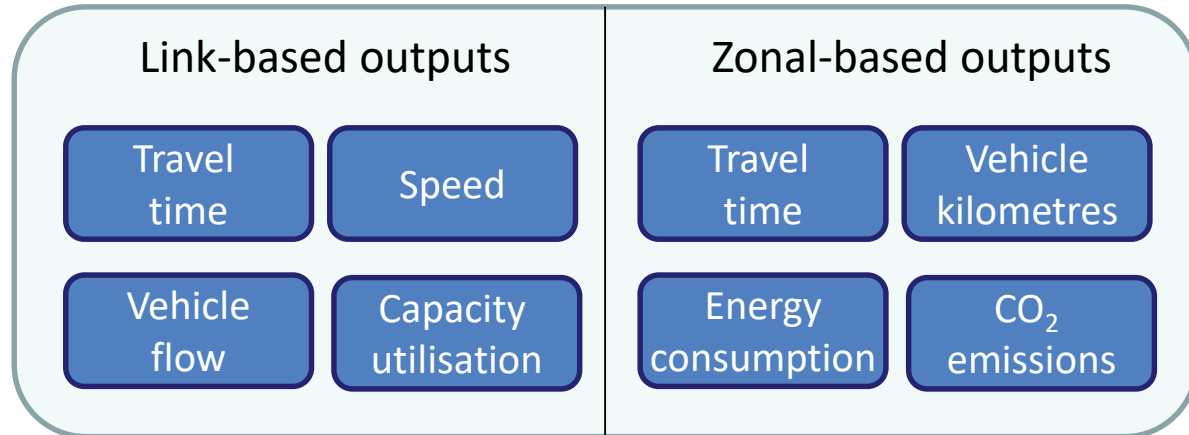
ITRC *mistral*

Road demand and capacity

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Railway station demand

Airport demand and capacity

Link-based outputs		Zonal-based outputs	
Travel time	Speed	Travel time	Vehicle kilometres
Vehicle flow	Capacity utilisation	Energy consumption	CO_2 emissions

Disaggregated by:

Time of day	e.g. 8am – 9am
Road category	A-road, motorway, urban, rural
Vehicle type	Car, van, rigid, artic, AV
Engine type	Petrol, diesel, LPG, CNG Hybrid electric; PHEV; hydrogen fuel cell, electric battery

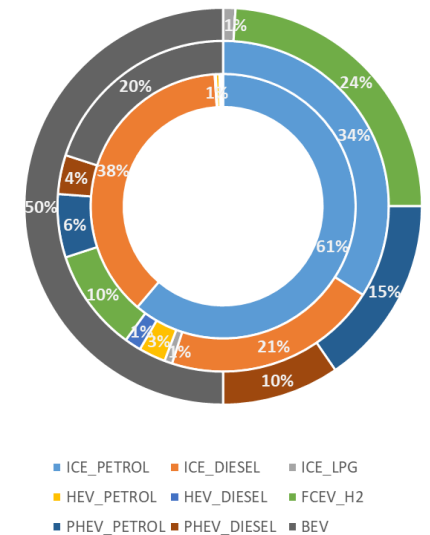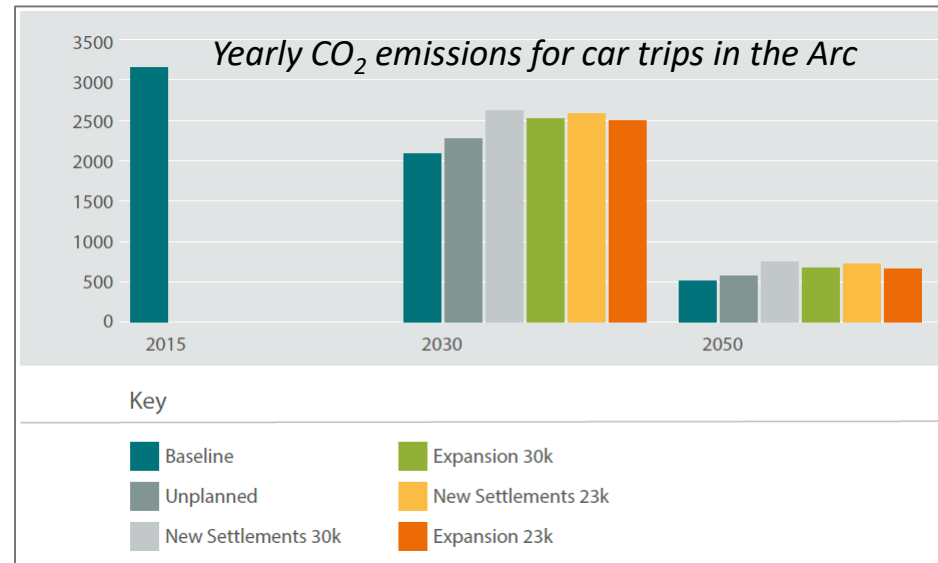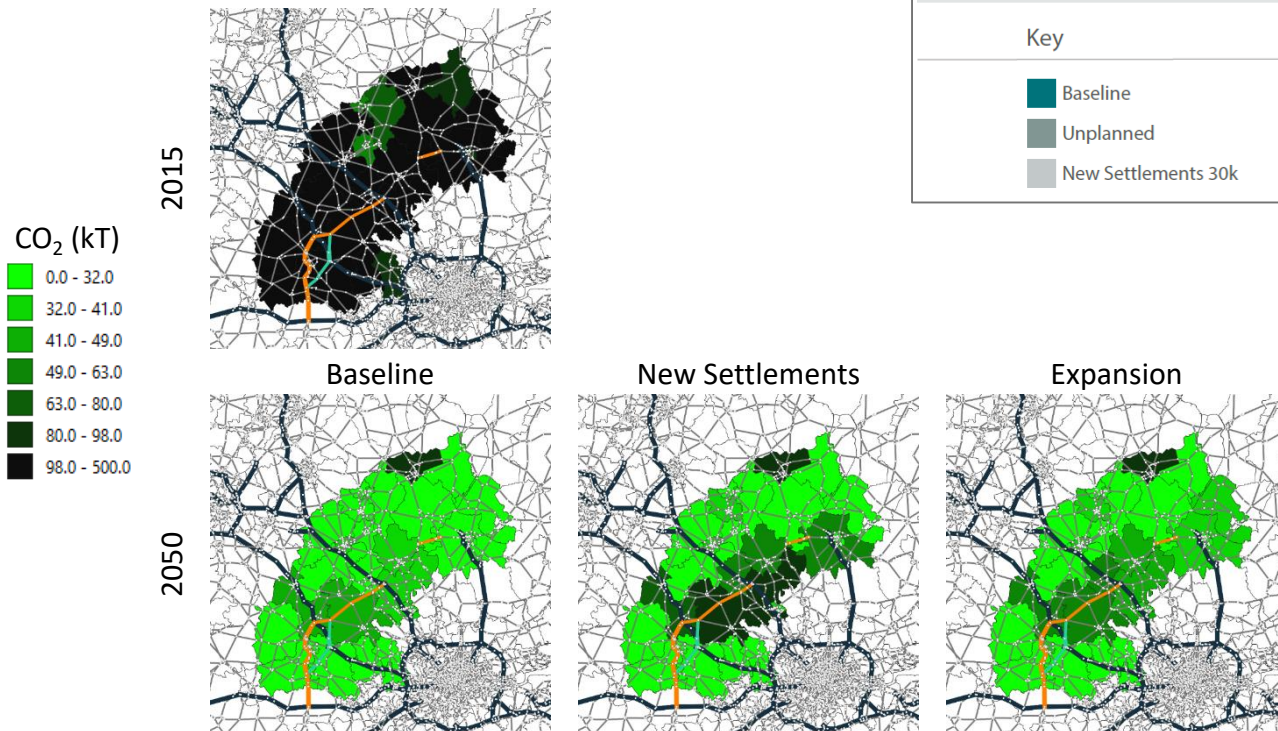# Recent applications: regional assessments

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
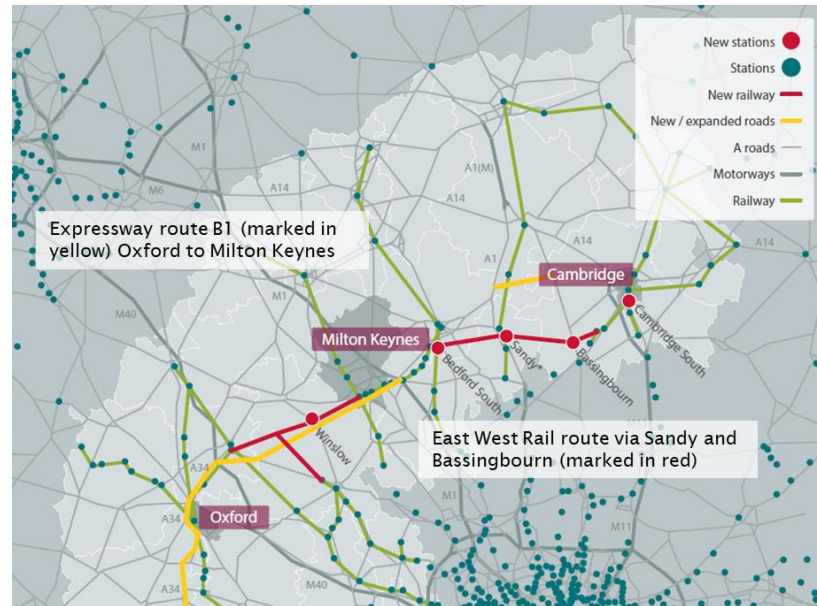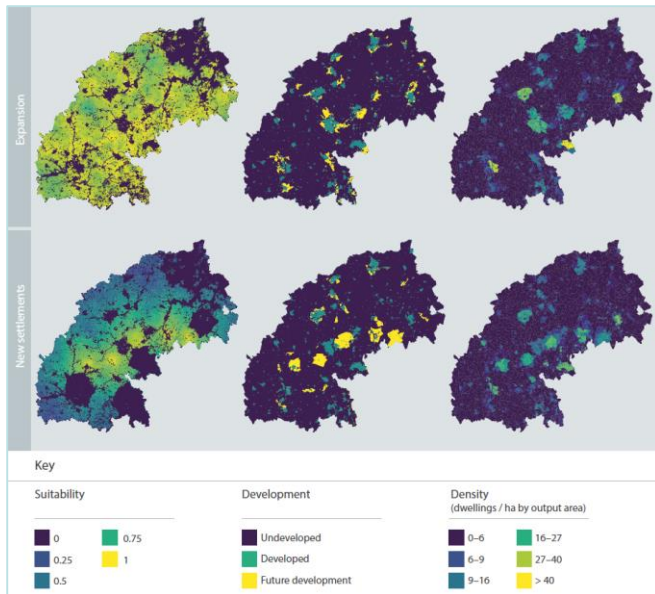
itrc.org.uk/casestudies/itrc-infrastructure-analysis-oxcam-arc/

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)

Population change 2019-2050

- Multiple strategic approaches ('Pathways') to decarbonise transport to meet UK 2050 net-zero emission targets
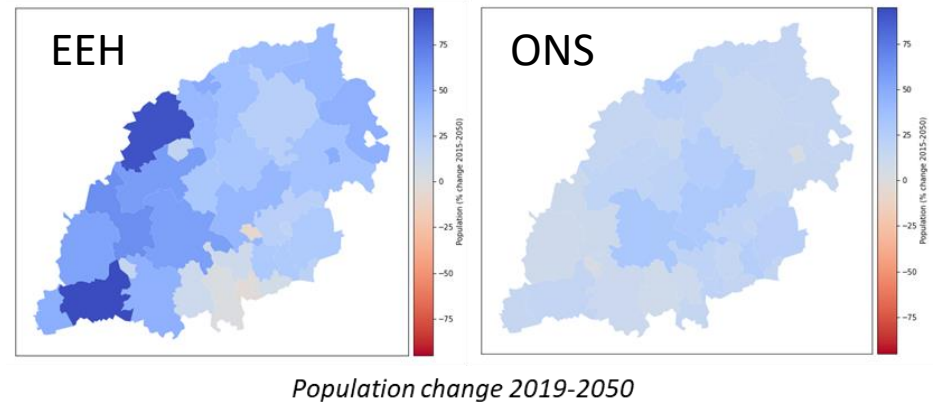
Pathways to decarbonisation

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.

EEH CO_2 emissions - all vehicles

EEH road network travel speeds

EEH electricity use - cars
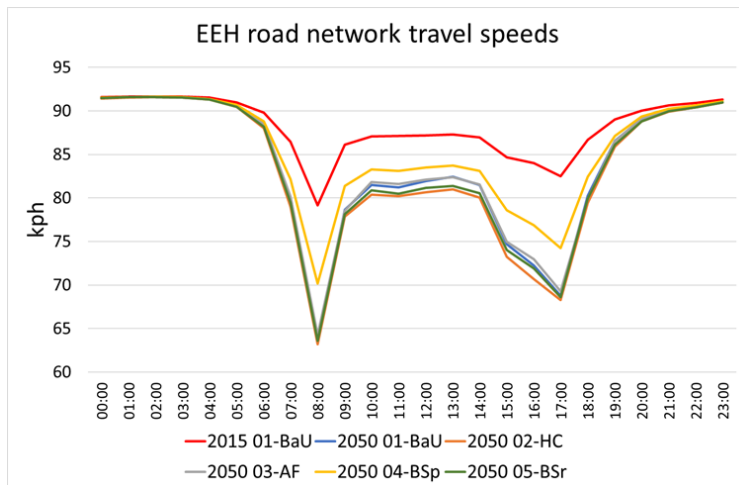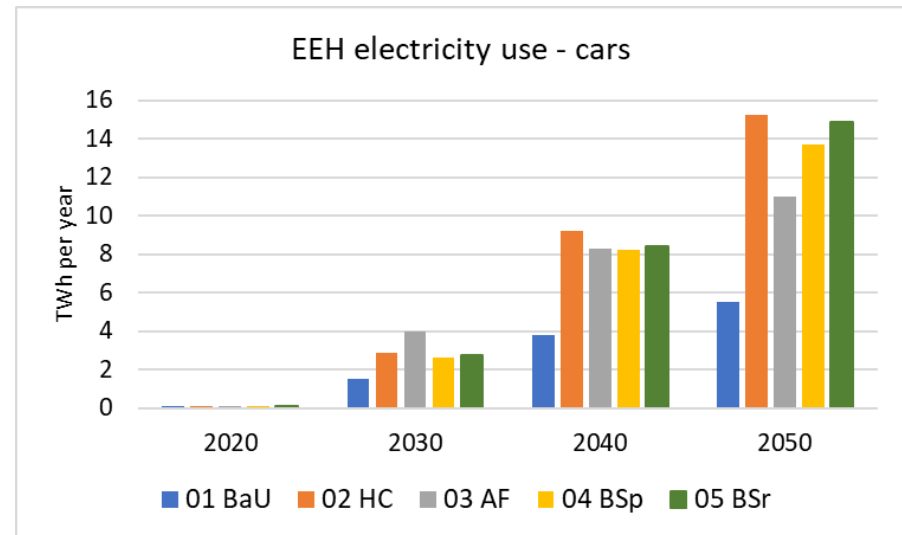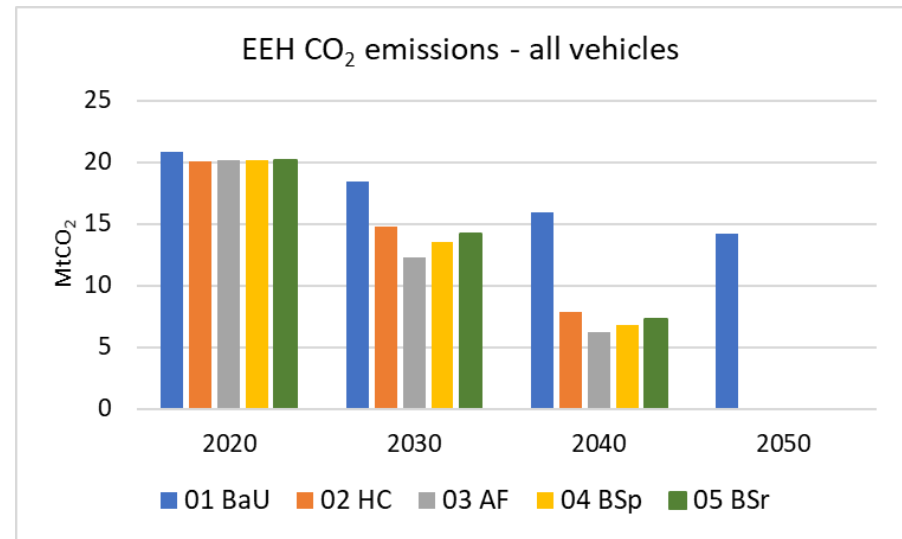
Transport model on DAFNI

NISMOD model run setup

Transport model on DAFNI

EEH analysis on DAFNI

Transport model on DAFNI

EEH analysis on DAFNI

UNIVERSITY OF
Southampton

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with thanks to Milan Lovric, Simon Blainey and John Preston
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