

# The Future of Freight: Technology competition for the low-carbon transport transition in Switzerland

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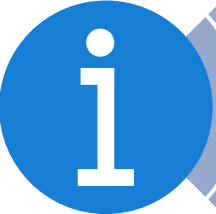
# Motivation



A shift to low-carbon transport technologies is required to meet Swiss climate targets



Seek an understanding of the road-freight transport transition to low- or zero-emission vehicles in Switzerland



Use this understanding to inform Swiss policy-makers



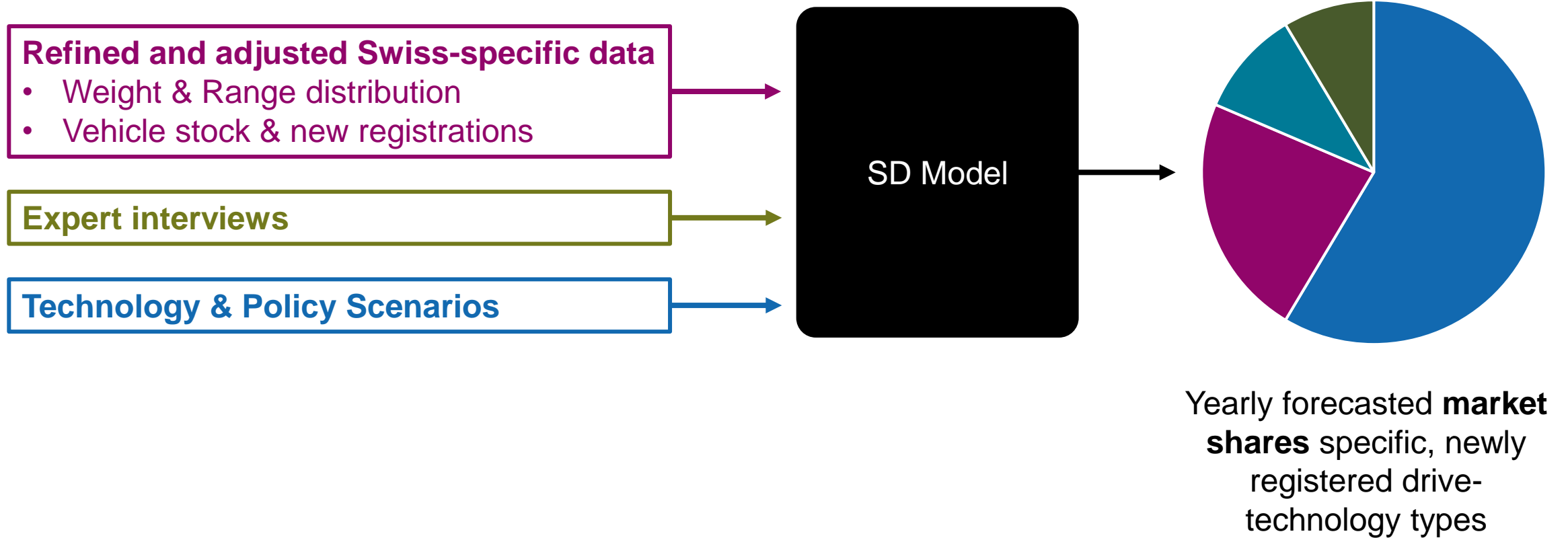
Sources:  
<https://fuelcellworks.com/news/coop-puts-more-hydrogen-trucks-on-the-roads/>  
<https://www.greencarcongress.com/2019/06/20190620-eactros.html>

What are the key drivers of commercial vehicle drive-technology competition in Switzerland?

How do different policy scenarios affect the outcome of this competition?

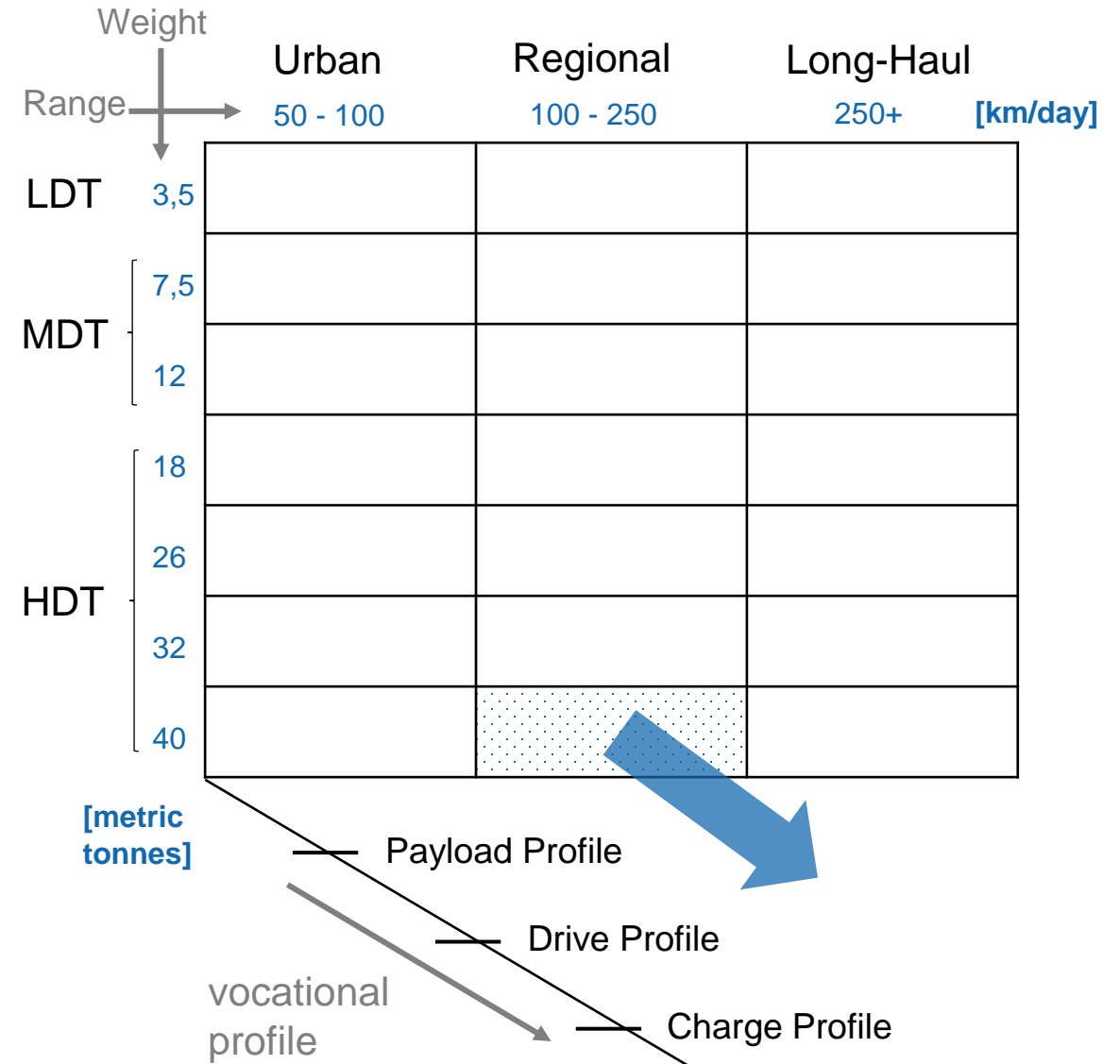
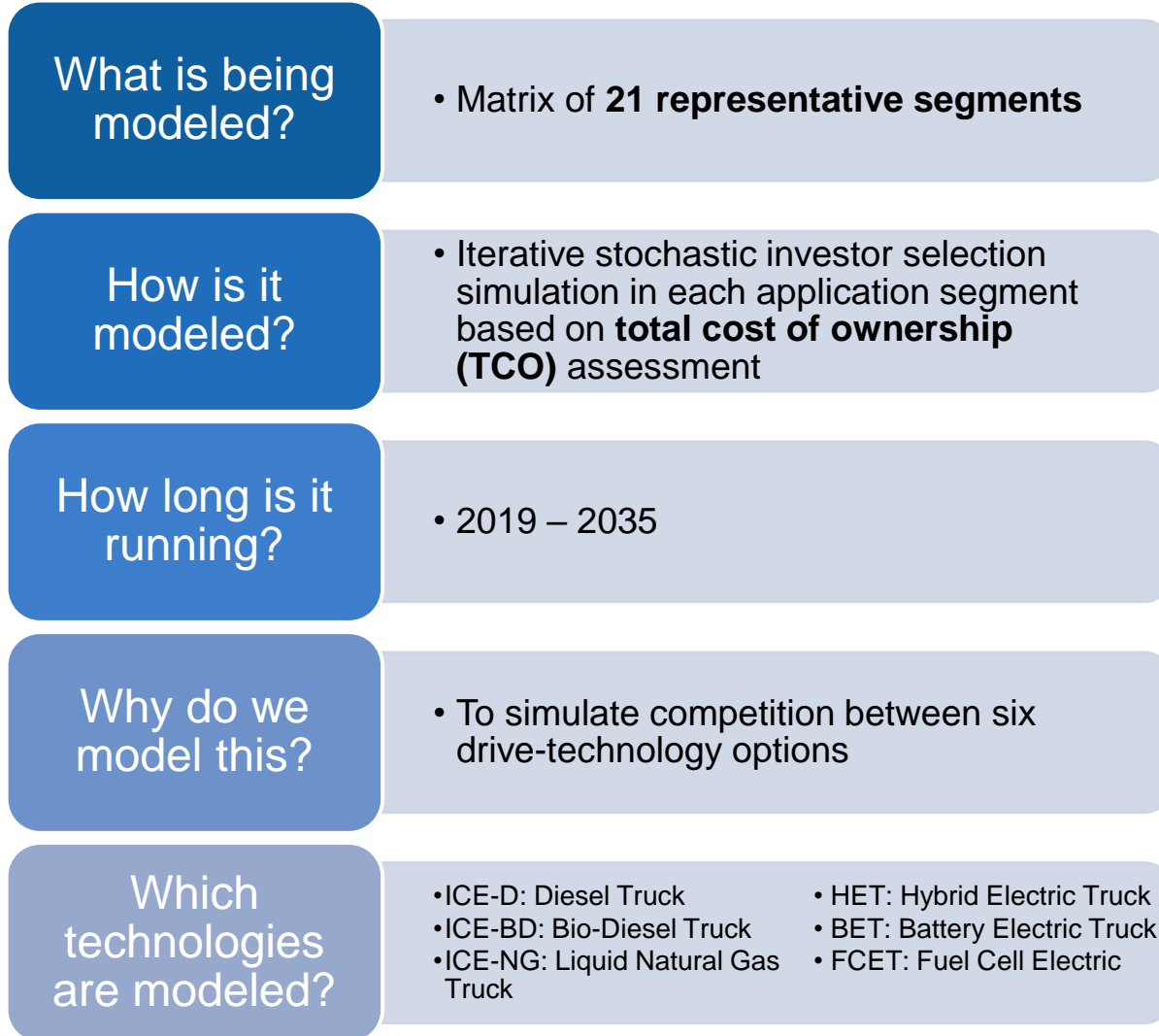
# Model Overview

## Model Inputs & Output



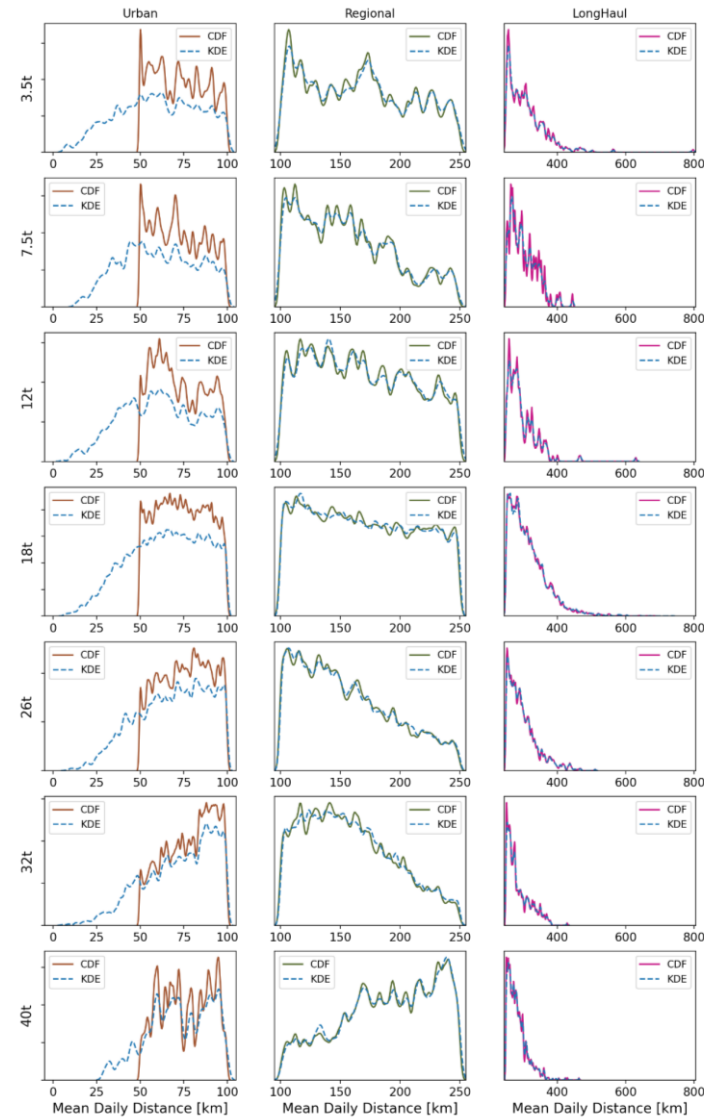
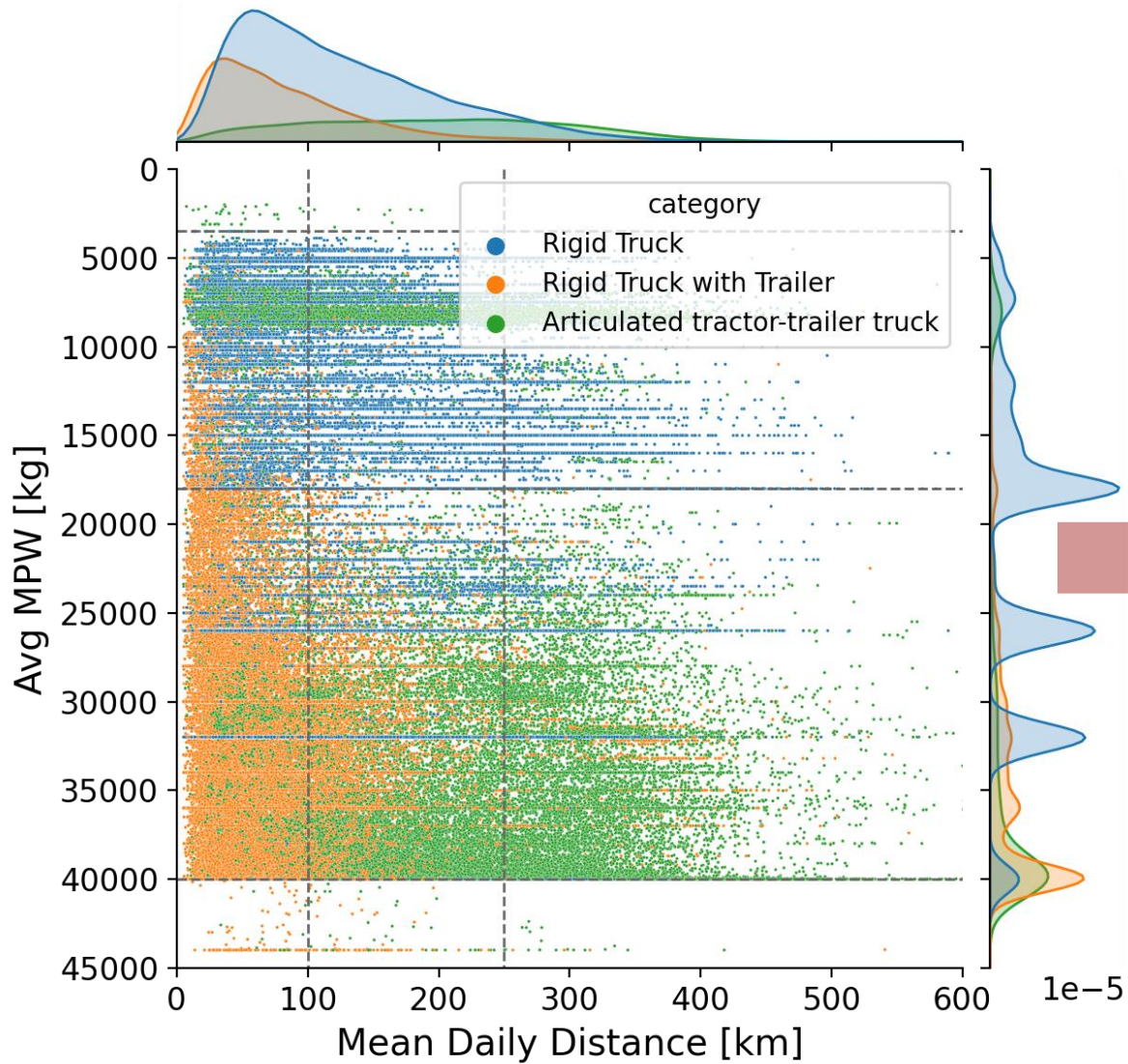
# Model Overview

## Application Space



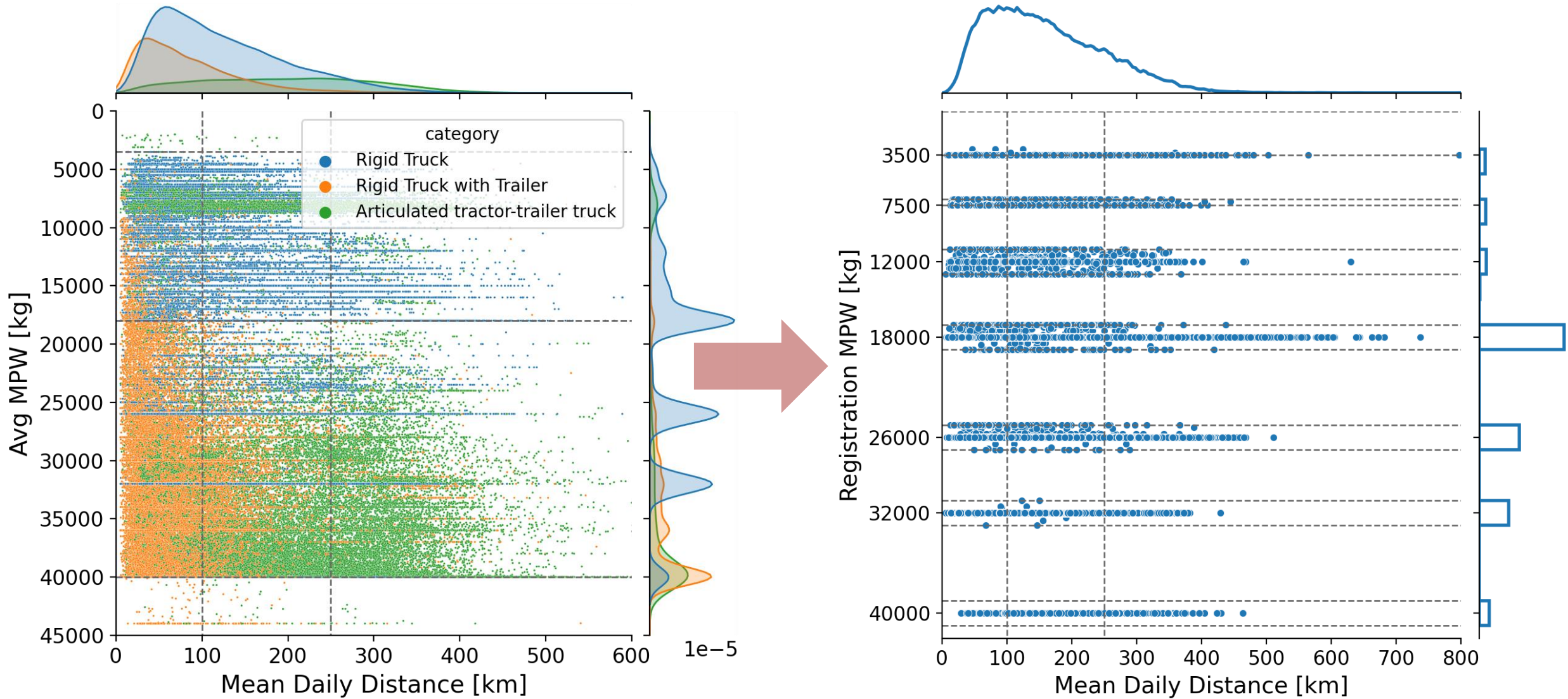
# Model Inputs

## LSVA data analysis results: Range distribution



# Model Inputs

## LSVA data analysis results: New vehicle registration



# Model Inputs

## Expert Interviews

Organization	Expertise	Interviewee's role(s)
Private company / Cooperative	Fleet operation	CEO
	Fleet operation	Project manager
	Fleet operation	CEO
	Fleet operation	Head of transports
	Logistics	Head of last mile delivery & services Global sustainability manager
	Logistics	Senior project manager sustainability Project manager supply chain & logistics
	Logistics	Head of logistics
	Fueling infrastructure	Member of the Board of Directors
	Hydrogen solutions	Project manager
	Hydrogen solutions	Senior technical advisor
	Insurance	Head of fleet and warranty insurance, member of the management
Private agency	Charging Infrastructure	Business area manager, member of the management
Association	Hydrogen solutions	President
Public agency	Freight traffic	Project manager

### Motivation

To inform, understand, and validate the model, it is crucial to understand how the swiss transport sector works.

Most important investment decision criterias:

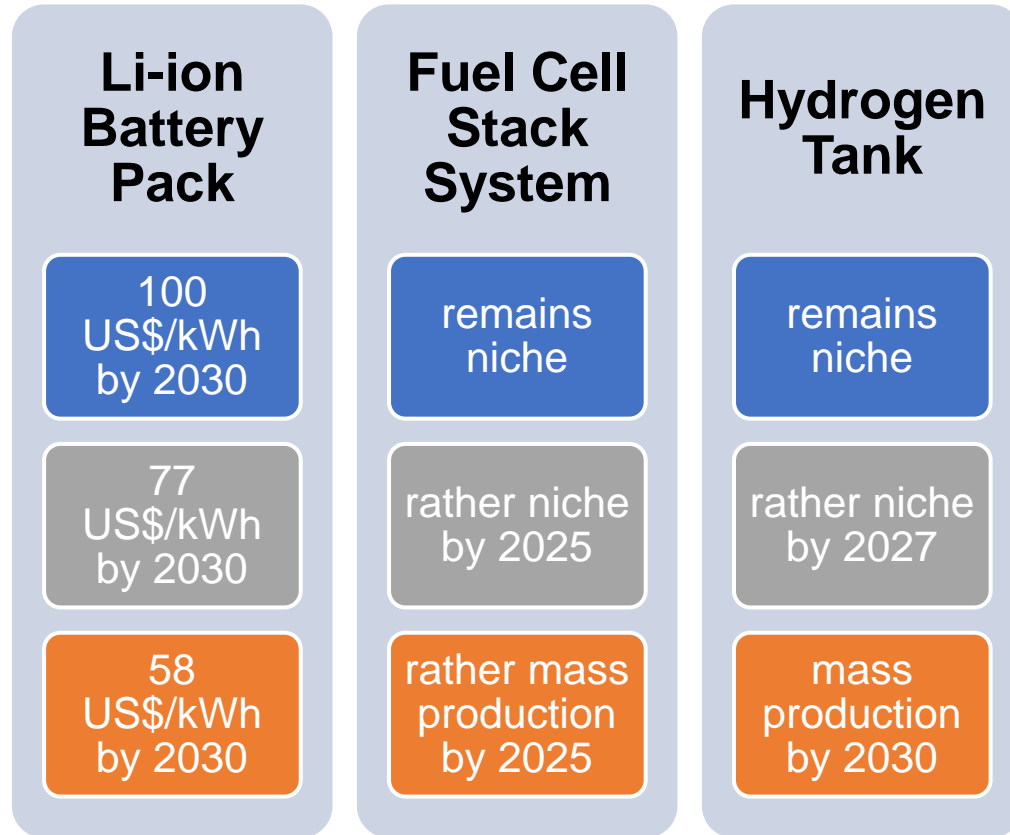
- **Payload**
- **Toll fees**
- **Flexibility**

We have questions, not only answers!

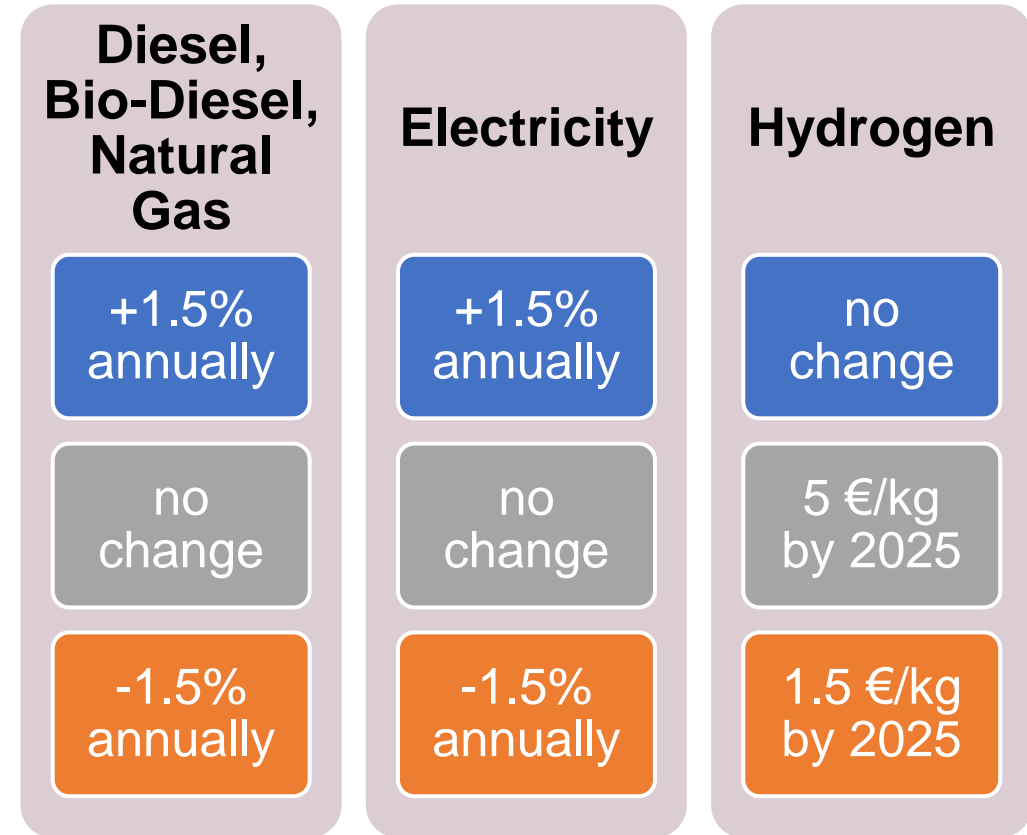


# Model Inputs

## Technology Scenarios



## Fuel Scenarios



# Model Inputs

## Policy Scenarios

### LSVA Toll

ZEV pay full  
LSVA Toll

Modified  
introduction of  
LSVA for ZEV

ZEV are  
exempted from  
LSVA Toll

### Battery payload penalty

BETs are  
penalized

No penalty

$LSVA = weight * tariff * distance$

Applies for all freight vehicles with **GVW > 3.5t**



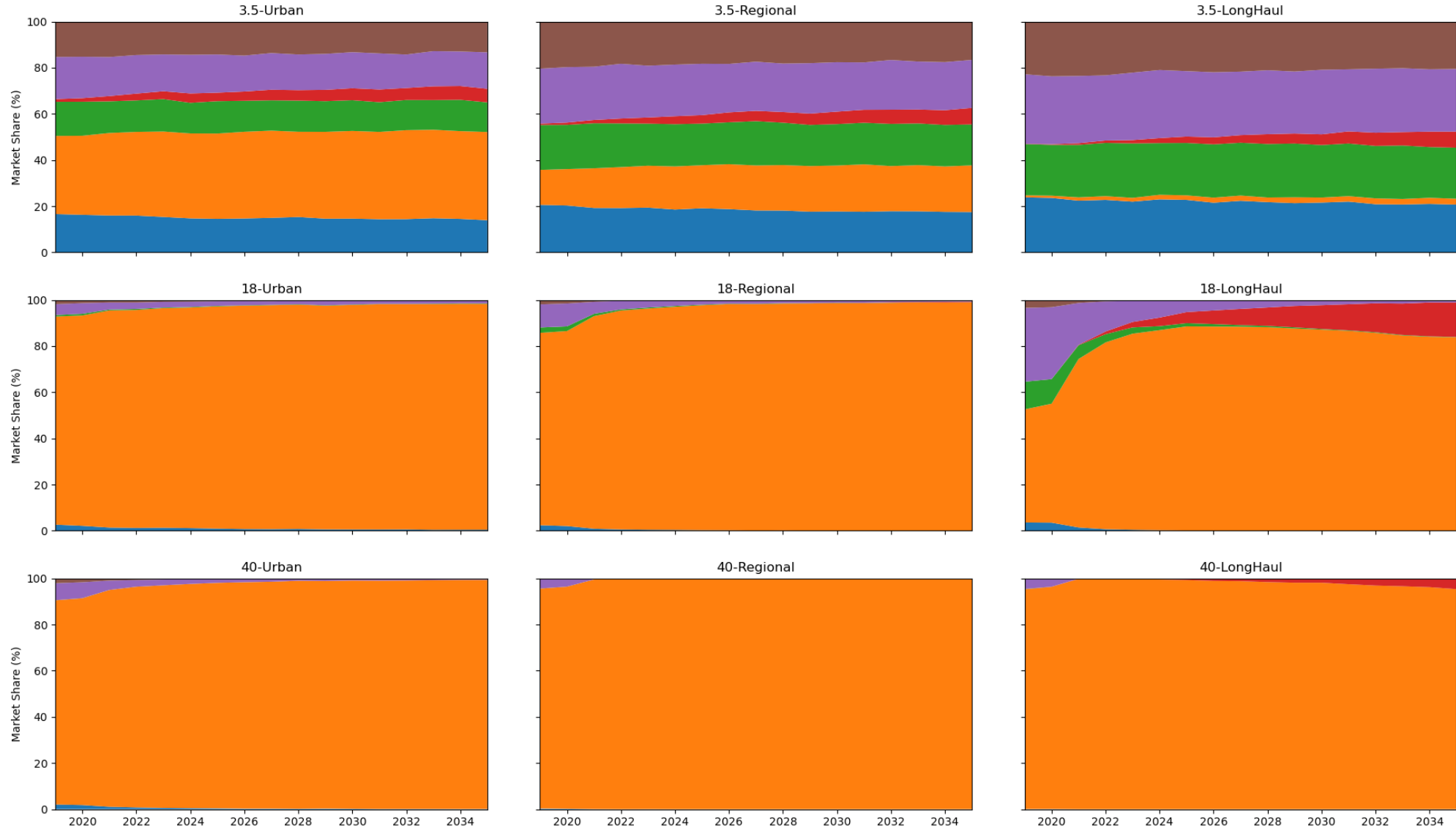
	ICE-D	BET
Penalty	<p>MPW: 18t Payload: 8t</p>	<p>MPW: 18t Payload: 6t</p>
No Penalty	<p>MPW: 18t Payload: 8t</p>	<p>MPW: 20t Payload: 8t</p>

# Results

# Model Results

## Base Case Scenario

Battery	FC Stack	Hydrogen Tank	Diesel	Electricity	Hydrogen	Toll	BET Penalty
Reference	Reference	Reference	Reference	Reference	Reference	ZEV exempted	True

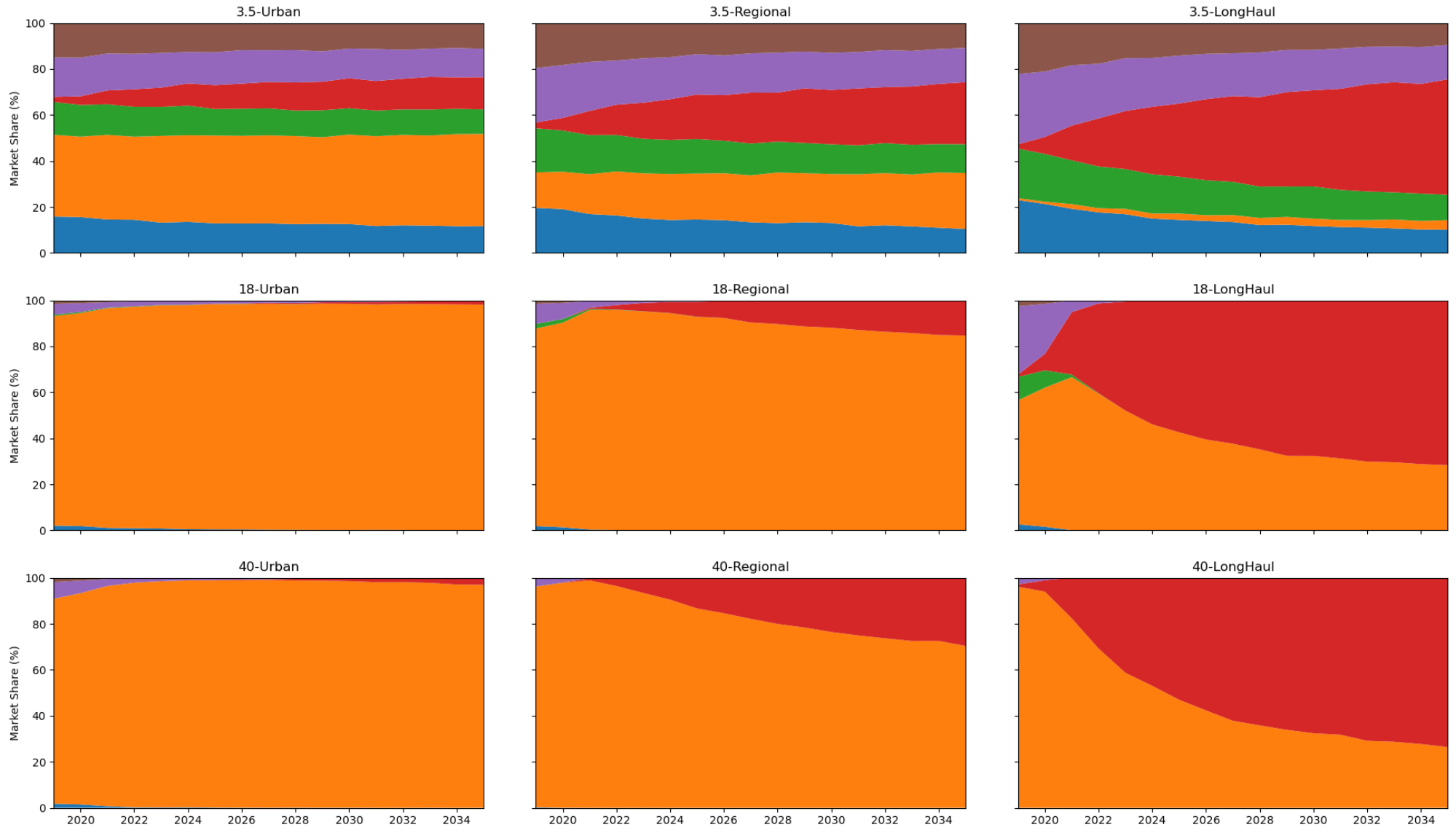


# ZEV Scenarios

# Model Results

## ZEV Best Case Scenario

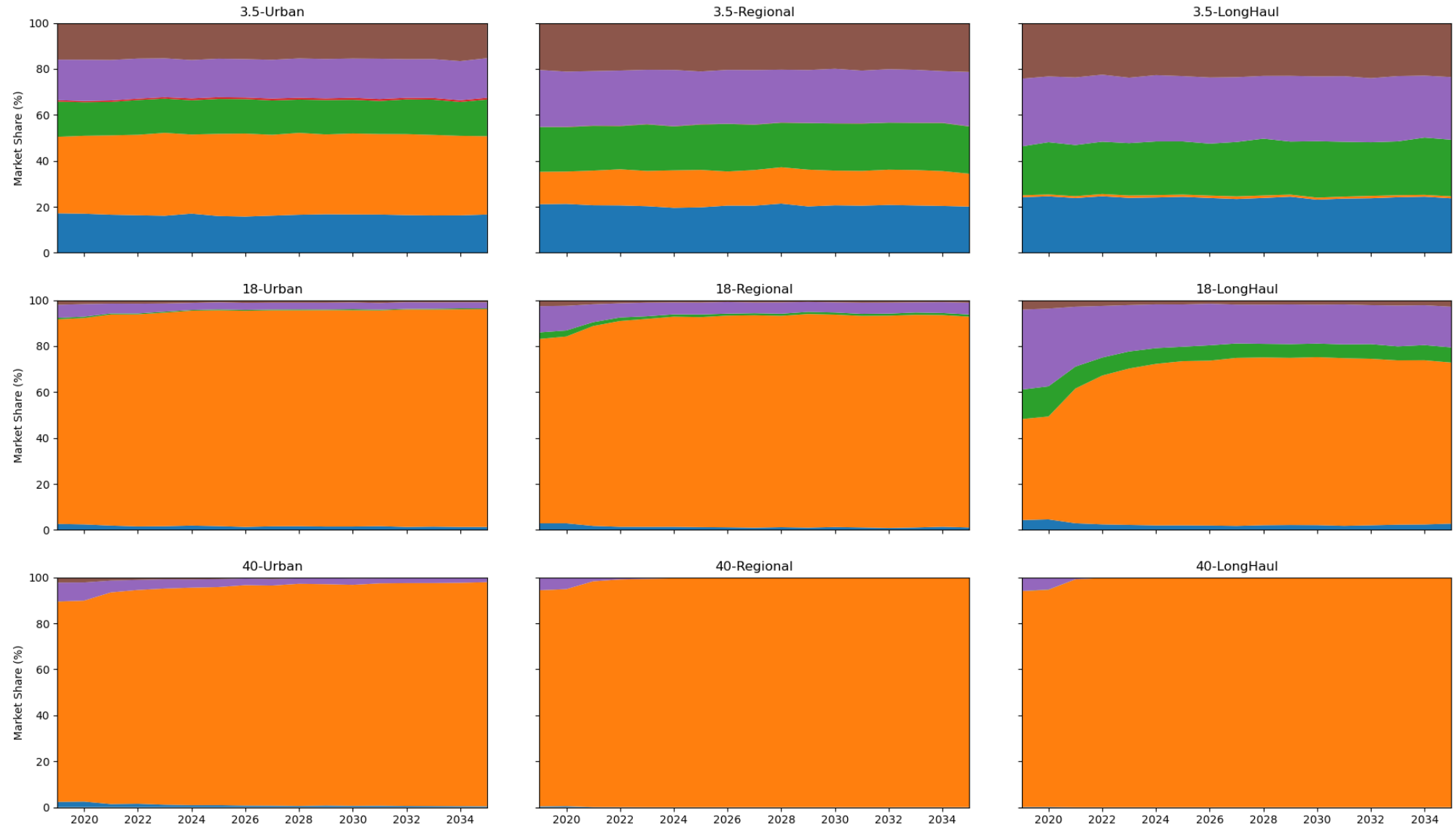
Battery	FC Stack	Hydrogen Tank	Diesel	Electricity	Hydrogen	Toll	BET Penalty
Low	Low	Low	High	Low	Low	ZEV exempted	True



# Model Results

## ZEV Worst Case Scenario

Battery	FC Stack	Hydrogen Tank	Diesel	Electricity	Hydrogen	Toll	BET Penalty
High	High	High	Low	High	High	ZEV exempted	True



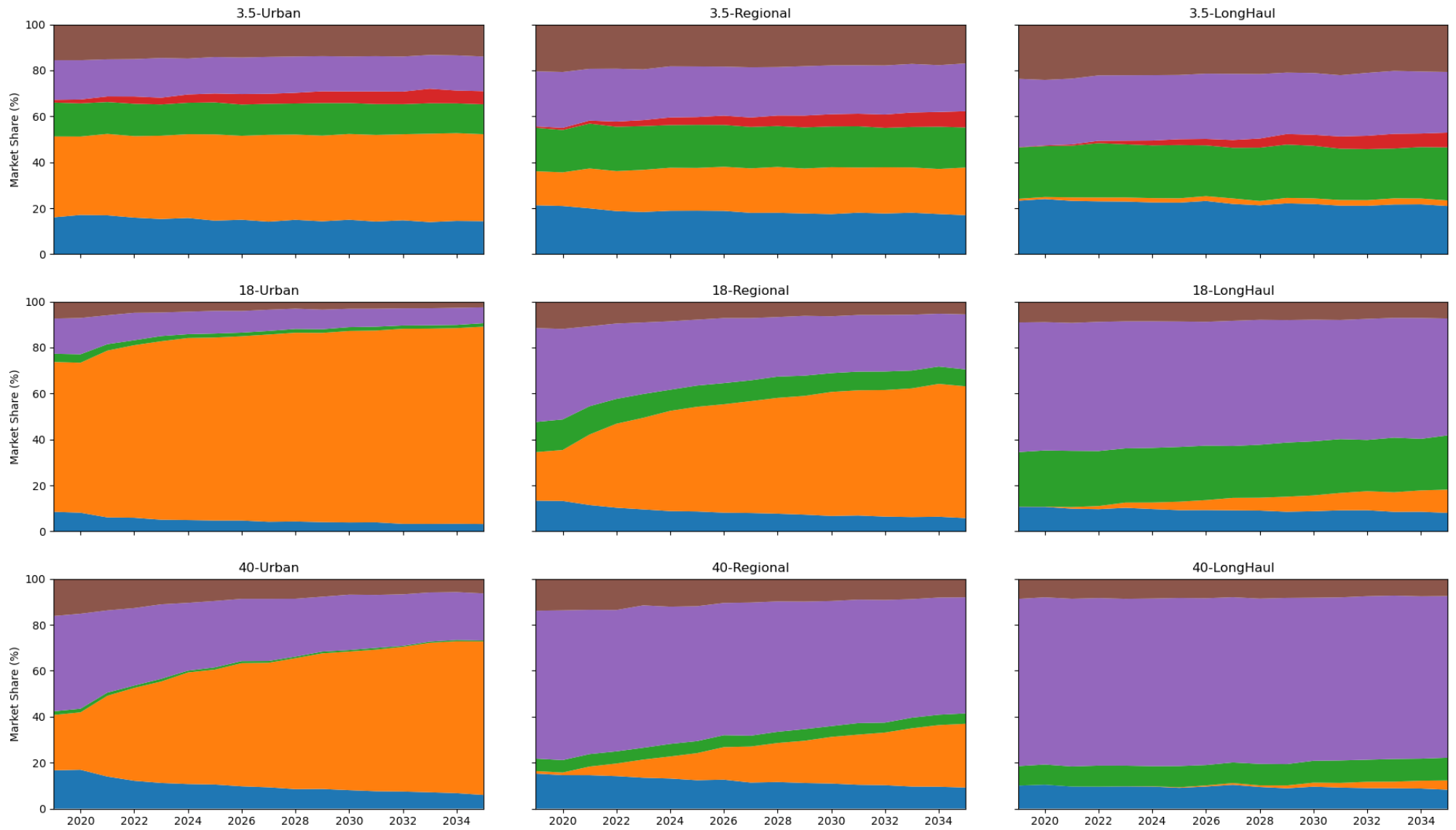
# Policy Scenarios



# Model Results

## ZEV Base Case Scenario & Full LSVA Toll

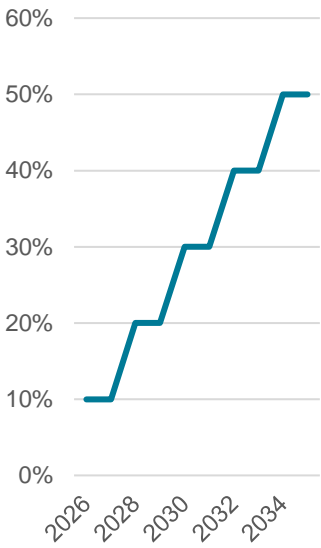
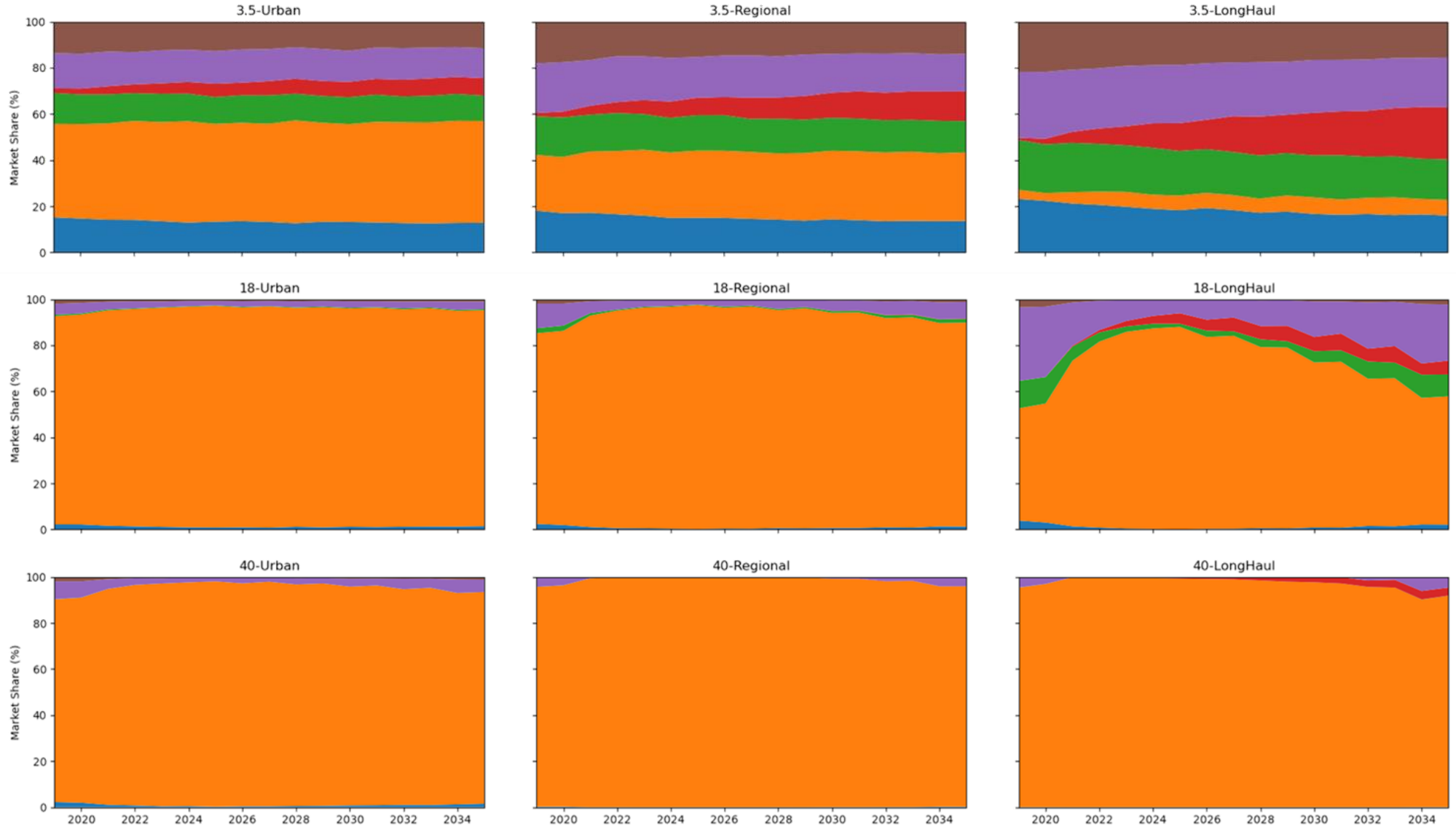
Battery	FC Stack	Hydrogen Tank	Diesel	Electricity	Hydrogen	Toll	BET Penalty
Reference	Reference	Reference	Reference	Reference	Reference	ZEV full Tariff	True



# Model Results

## ZEV Base Case Scenario, modified LSVA Toll for ZEV

Battery	FC Stack	Hydrogen Tank	Diesel	Electricity	Hydrogen	Toll	BET Penalty
Reference	Reference	Reference	Reference	Reference	Reference	modified	True



# Summary & Conclusion



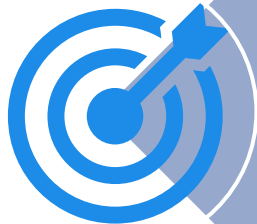
## LSVA data research & expert interviews

- Drive patterns of commercial vehicles in **Switzerland**
- Detailed understanding of **investment decisions** from fleet operators



## Modeling efforts

- **BET** are likely to **outcompete** alternative technologies
- **FCET** have some advantages when **payload loss** is penalized



## Policy measures

- The government has strong measures to avoid **technological lock-in**
- Implementing them too early could **destroy** the development **trajectory**



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