The prospects of alternative automotive systems and fuels in Austria till 2050

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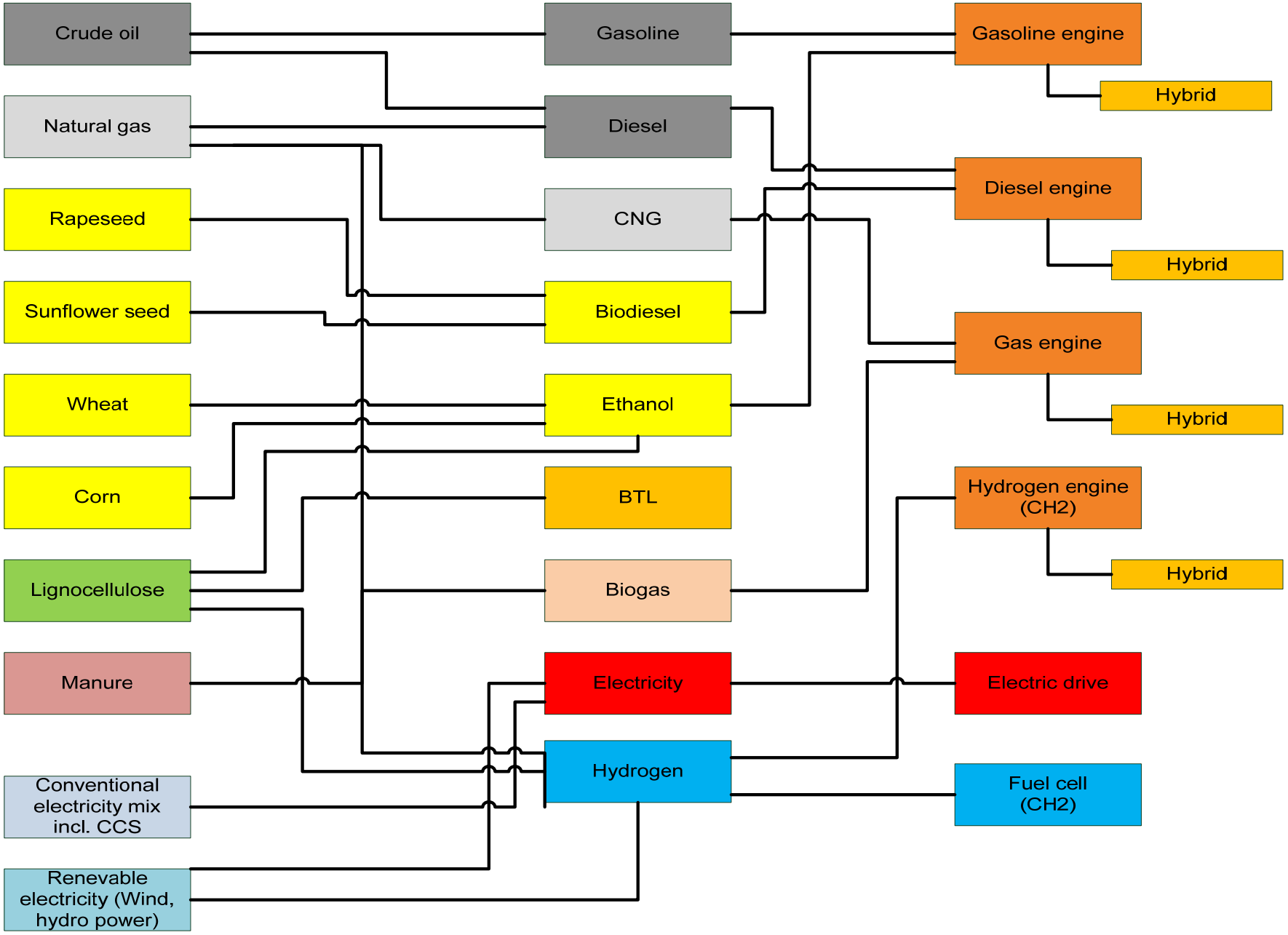
Introduction

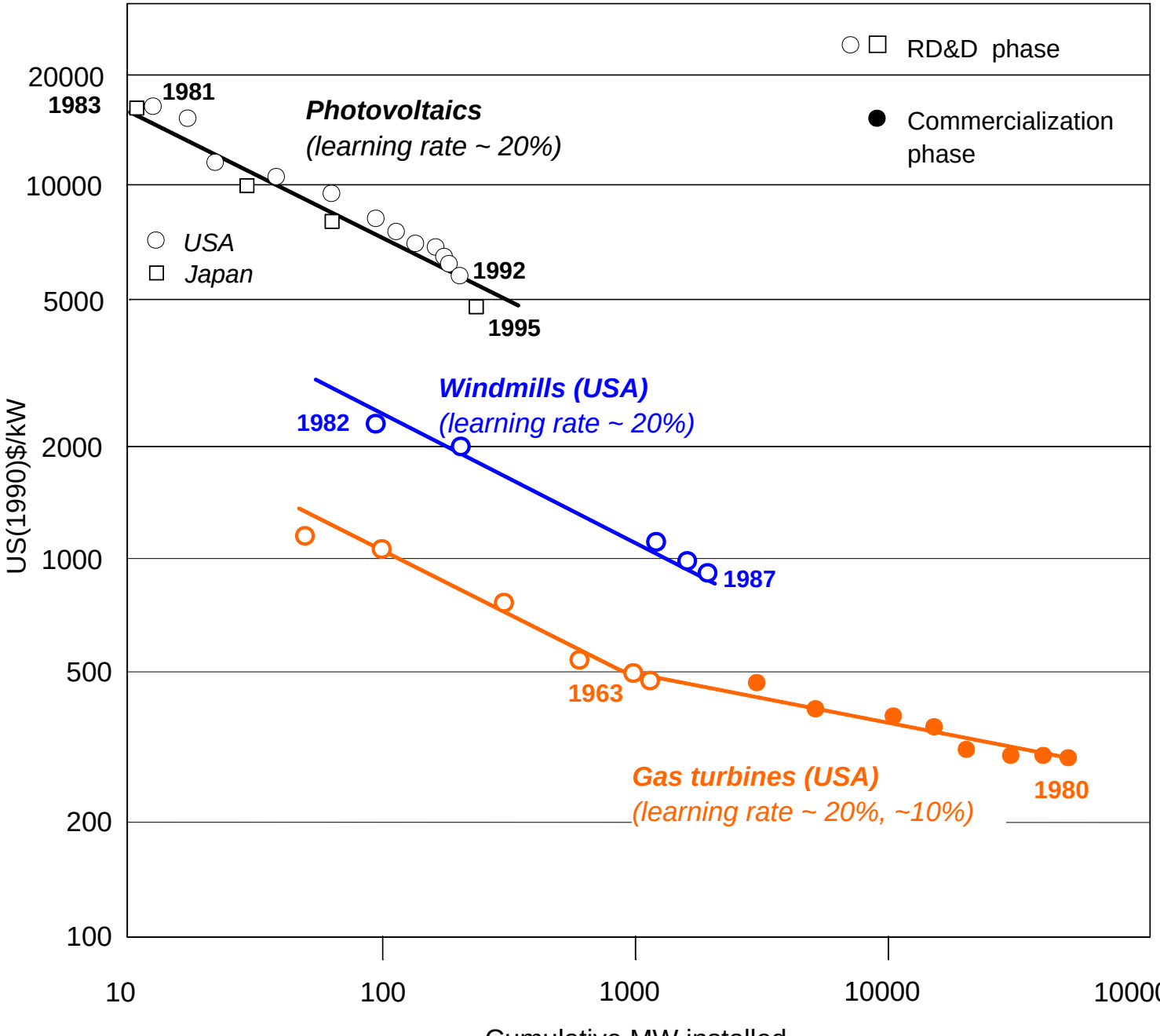


Core objective

- The core objective of this work is to analyse if and under which policy and/or market conditions, to what extent and when alternative automotive technologies and fuels will become economically attractive in Austria in the long run and may contribute significantly to providing the service individual mobility.

  To meet this objective in scenarios the impact of the following key parameters is investigated:
- Possible trends in the energy price level
- Changes in demand for mobility
- Technical efficiency increases and cost reduction of specific technologies;
- Changes in policy framework conditions (taxes, subsidies, etc.).

Technology learning curves



$$C(x) = a \cdot x^{-b}$$

C(x): Specific cost
x: Cumulative capacity
b: Learning index
a: Specific cost of the first unit

$$p = 2^{-b}$$

p: progress ratio

Economic analysis

The analysed alternative automotive systems are in a different stage of development, so that total vehicle costs could be divided in two parts:

$$IC(x(t)) = IC_{CON}(x(t)) + IC_{INNOV}(x(t))$$

Where:
IC^{CON}: Investment costs for the conventional part of vehicle (no learning effect)
IC^{INNOV}: Investment costs for the innovative part of vehicle (learning rate 20%).

The total transport costs are dependent on the fuel cost and investment costs for vehicles:

$$TC = FC + IC_{sp}$$

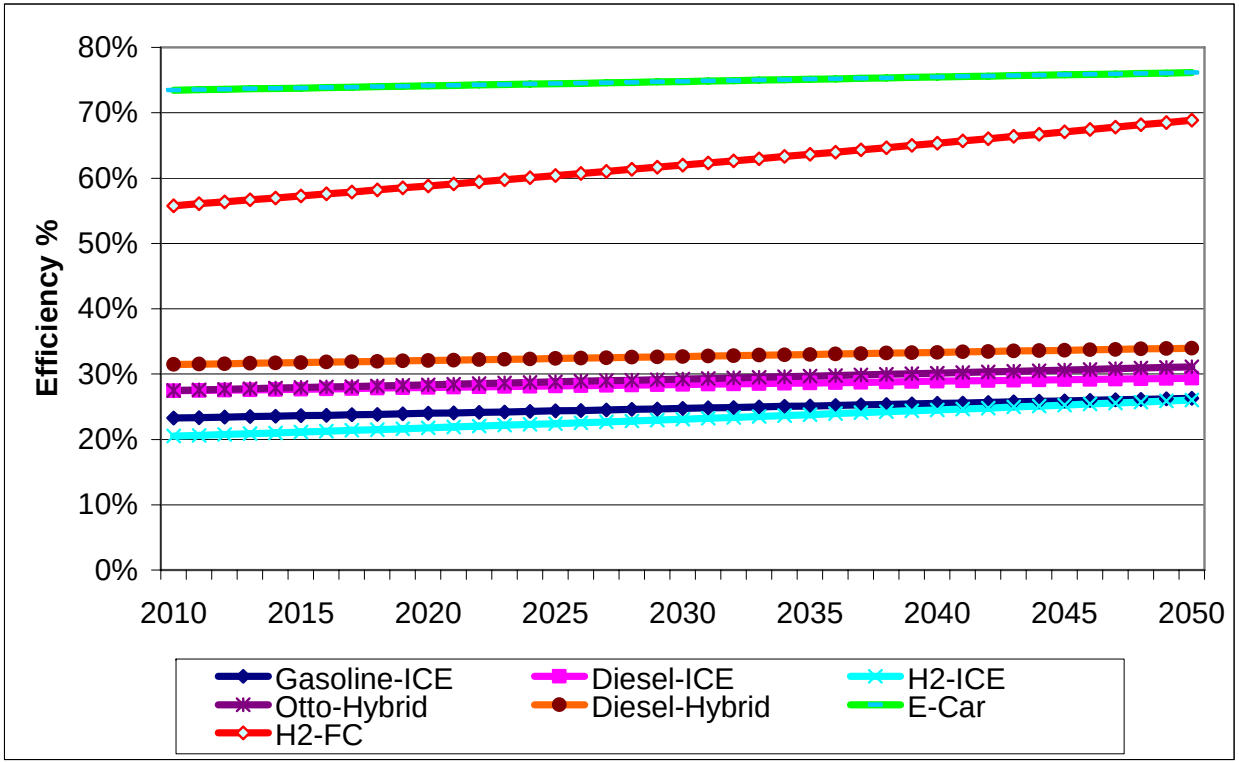
Where:
TC: Transport cost (EUR/km)
FC: Fuel cost (EUR/km)
IC_{sp}: Specific investment costs for vehicle (EUR/km)

Economic analysis

The fuel cost per passenger kilometre is calculated as follows:

$$FC = EC \cdot FP$$

Where:
EC: Energy consumption (kWh/km)
FP: Fuel price at the refuelling station (EUR/kWh)



Assumptions on the development of efficiency of the analysed vehicles 2010-2050 (Source: AVL)

Economic analysis

The total annual specific investment costs for vehicles are calculated as follows:

$$IC_{sp} = (\alpha \cdot (IC + NOVA) \cdot (1 + VAT)) / D_{km}$$

Where:
α: Capital recovery factor (-)
ICsp: Specific investment costs for vehicle (EUR/km)
NOVA: Tax on acquisition (EUR)
VAT : Value added tax
Dkm: The annual number of kilometres driven (km)

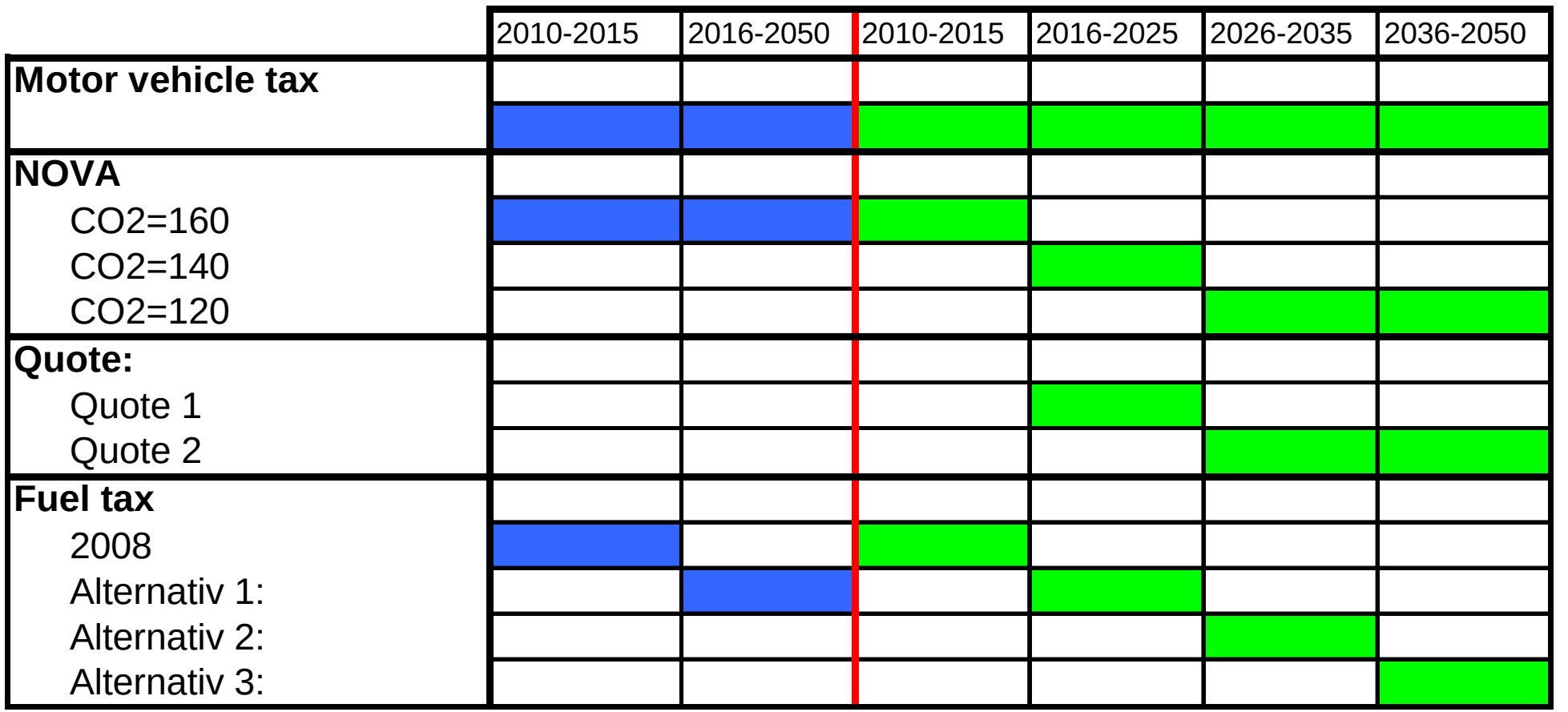
Scenarios

1.BAU-Scenario:

Low oil price and business as usual policy

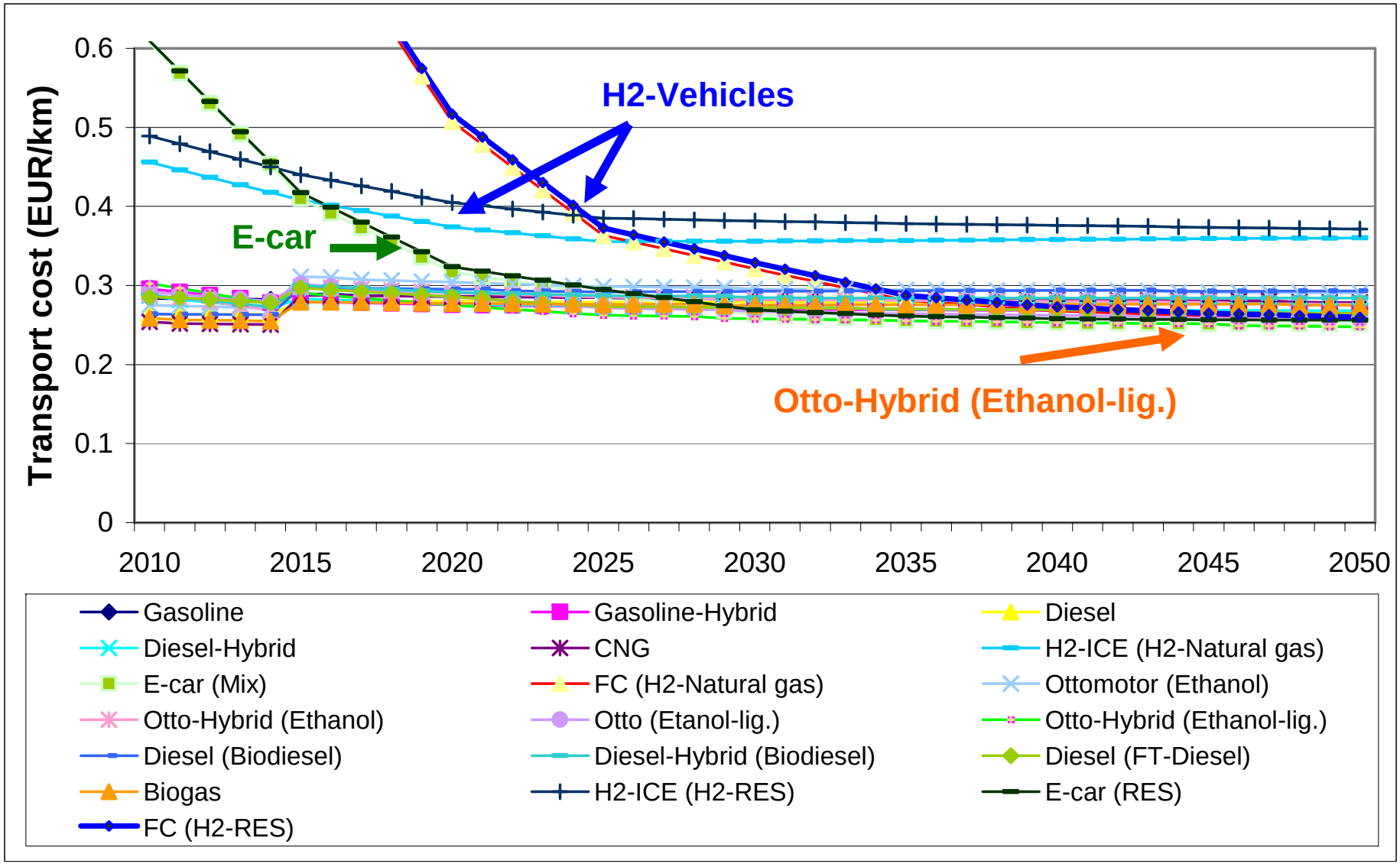
2. Policy-Scenario:

High oil price and more active policy



BAU-Scenario :

Low oil price and business as usual policy



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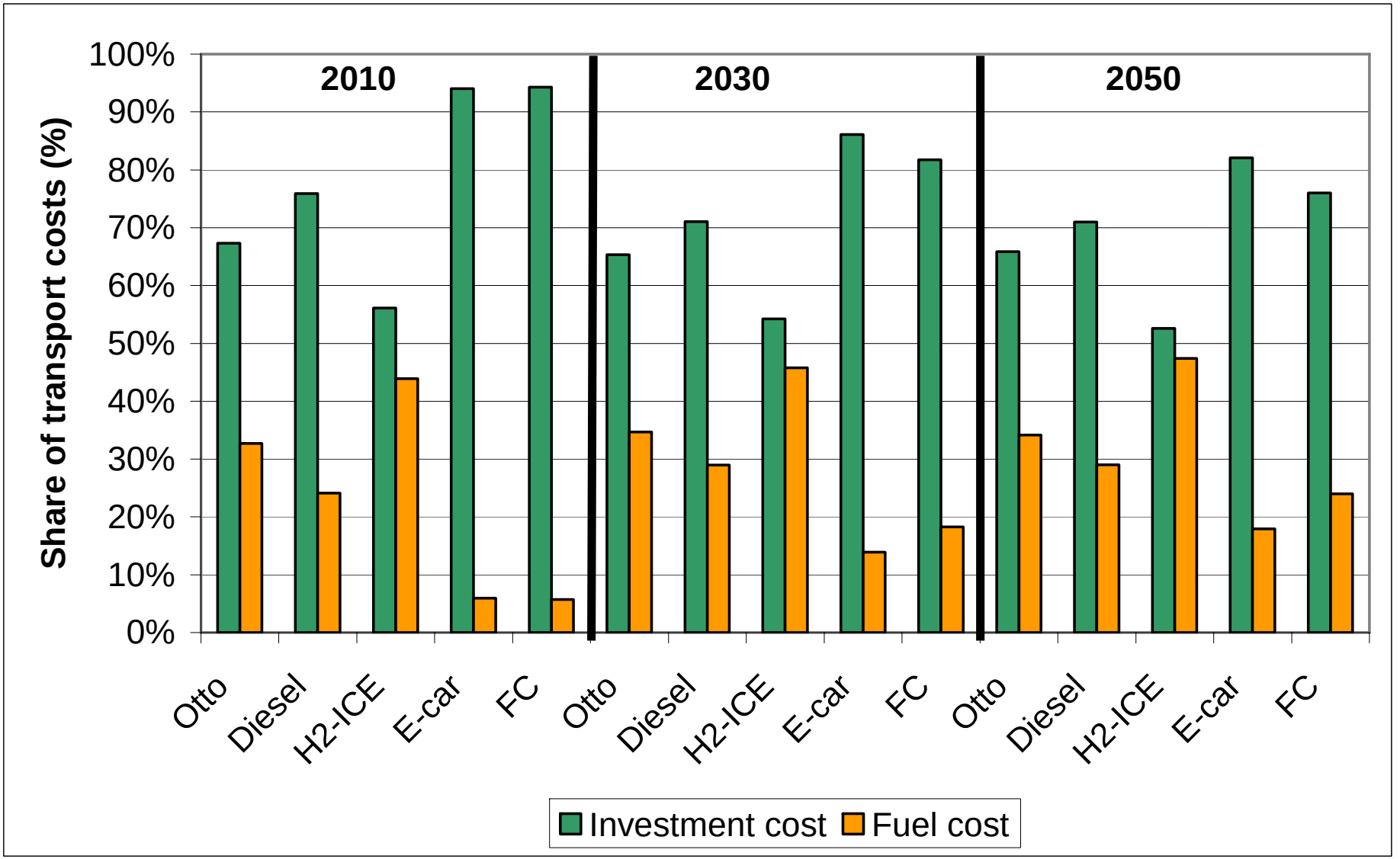
Low oil price and business as usual policy



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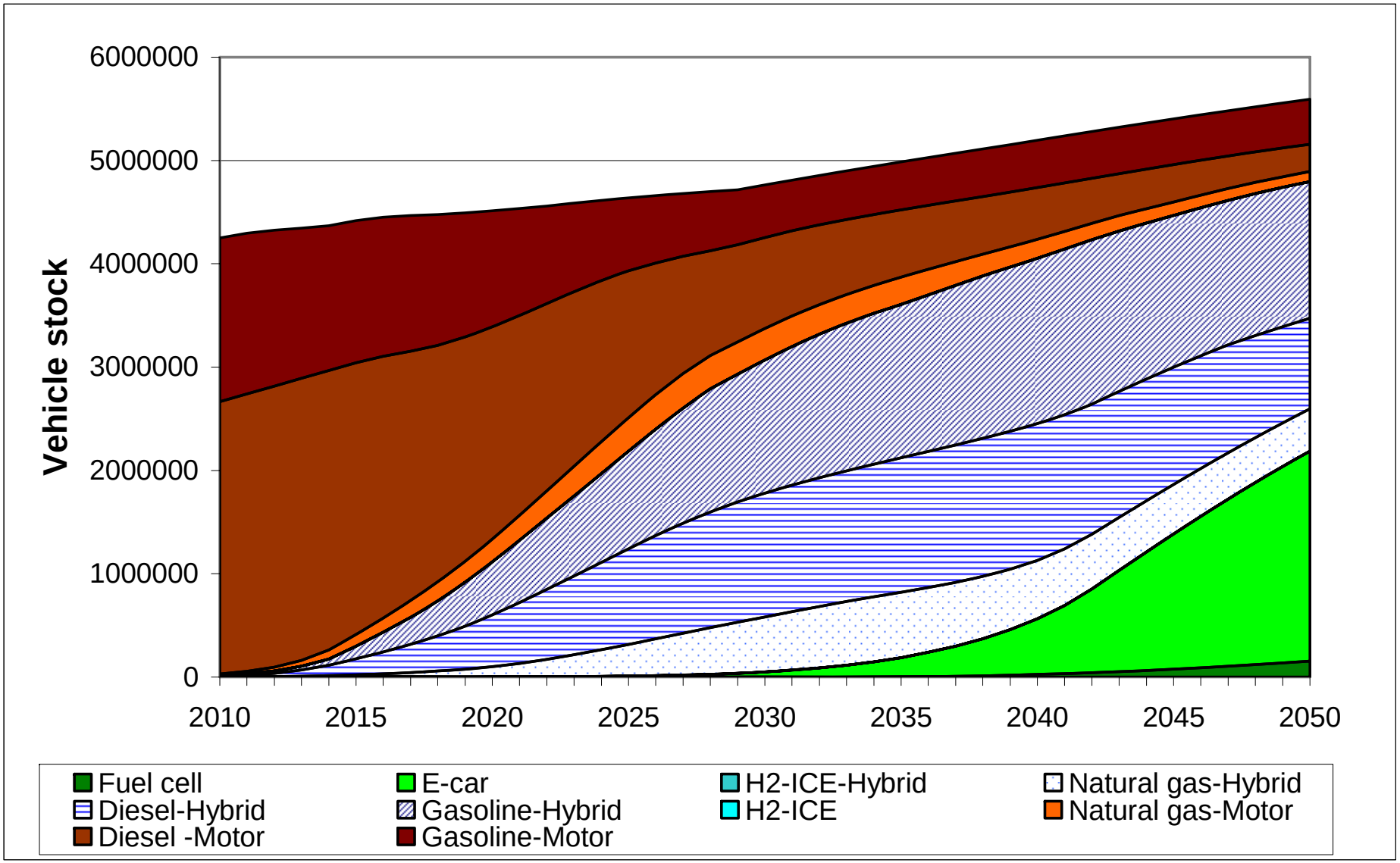

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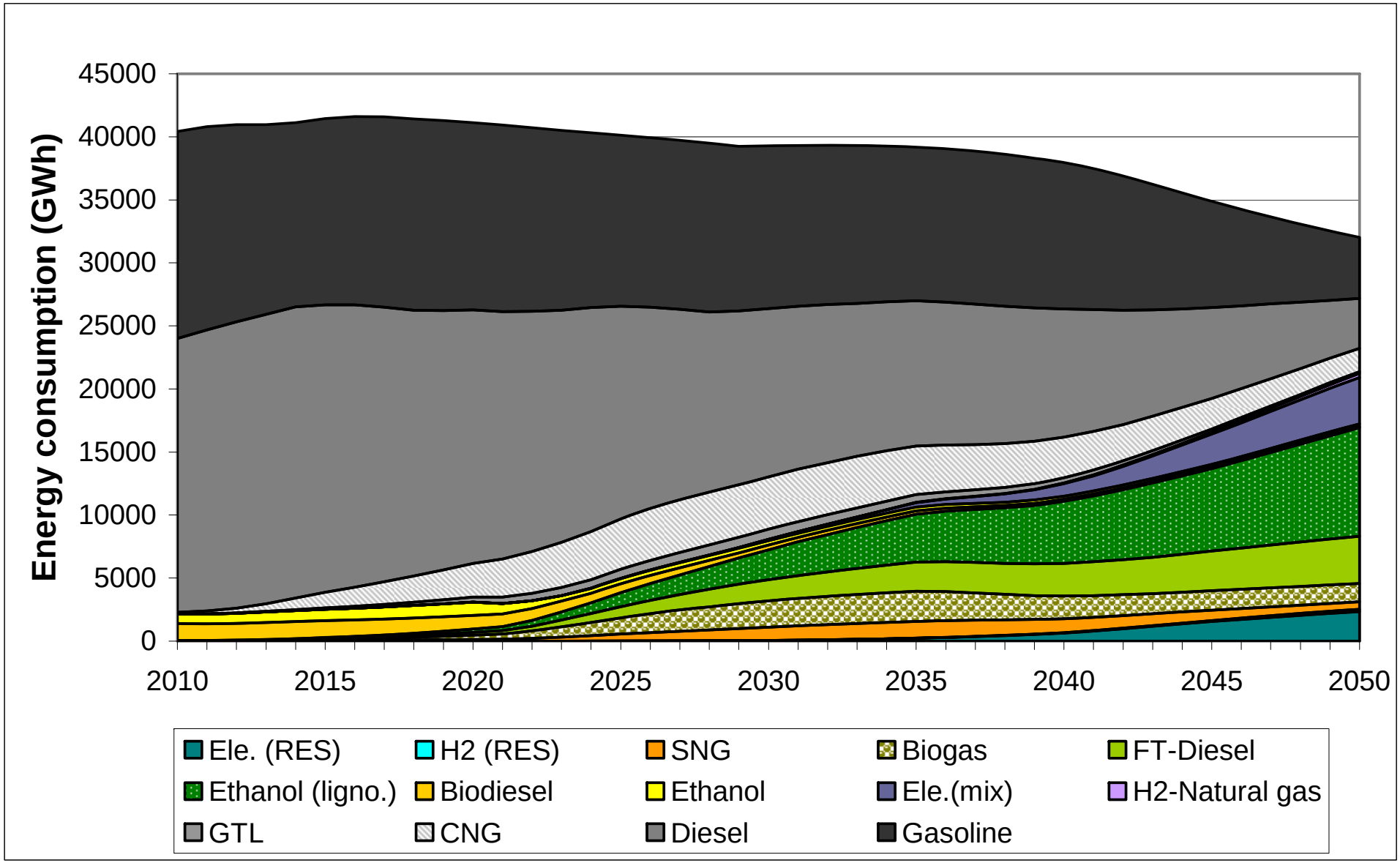

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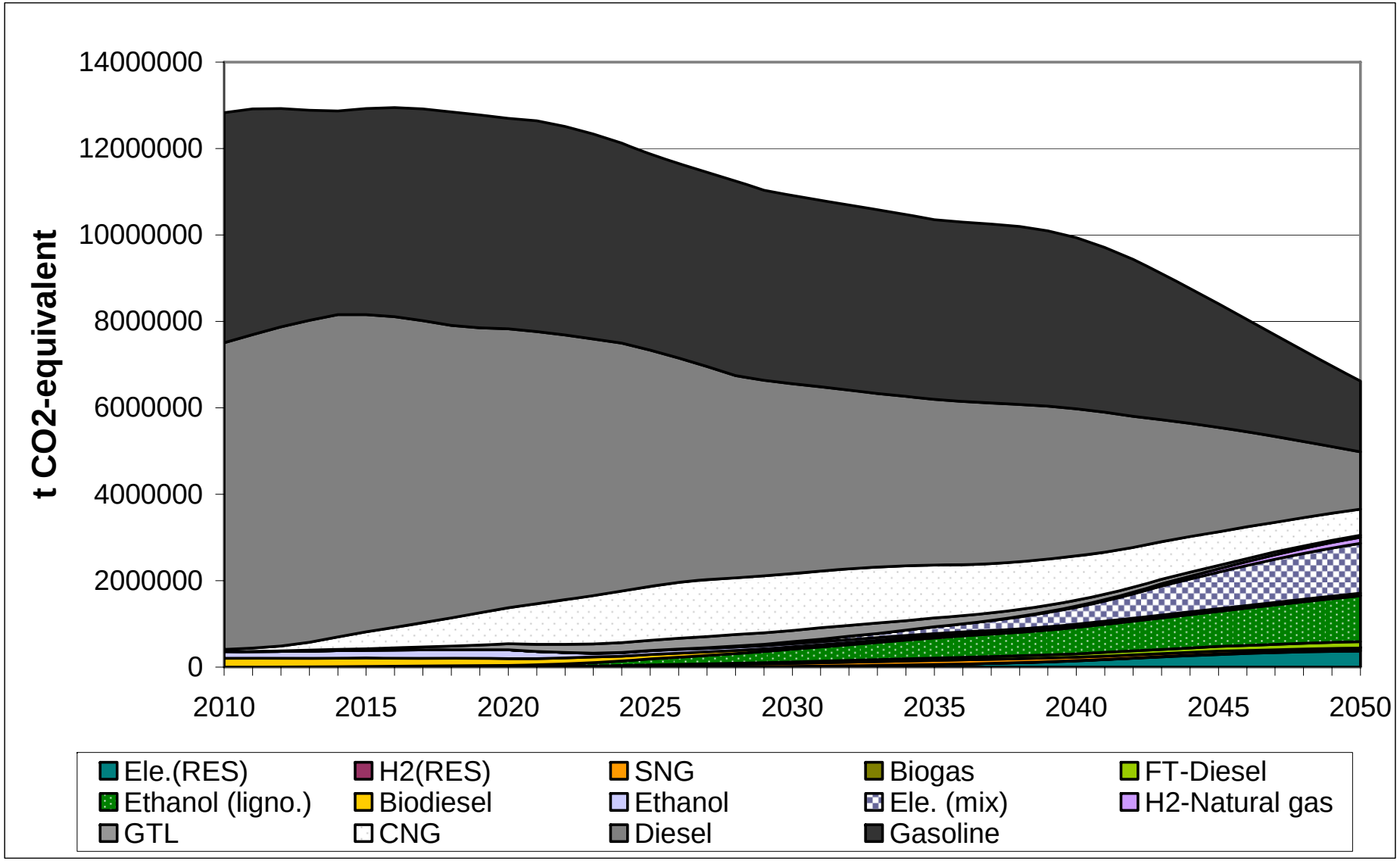
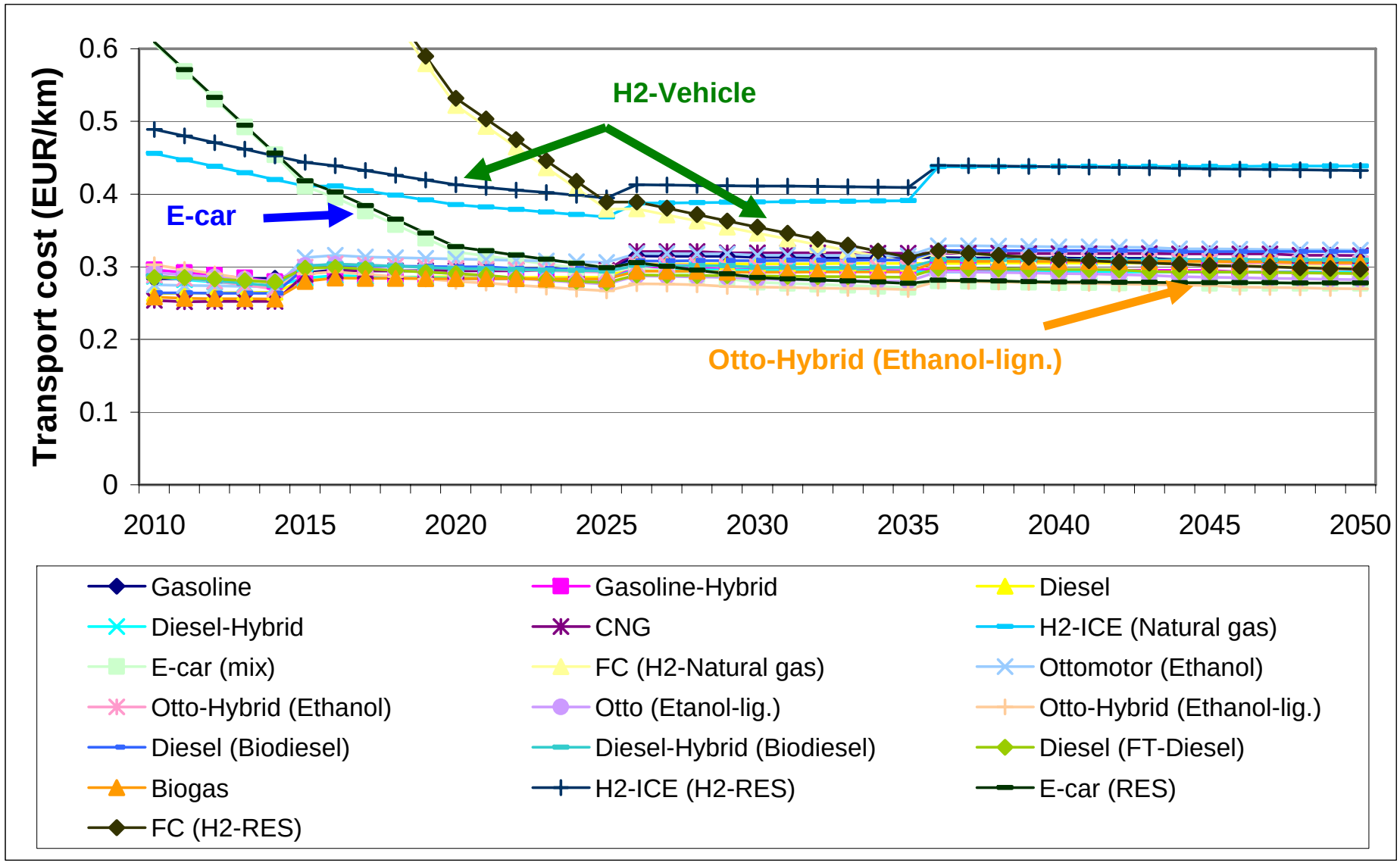


Policy-Scenario: High oil price and more active policy



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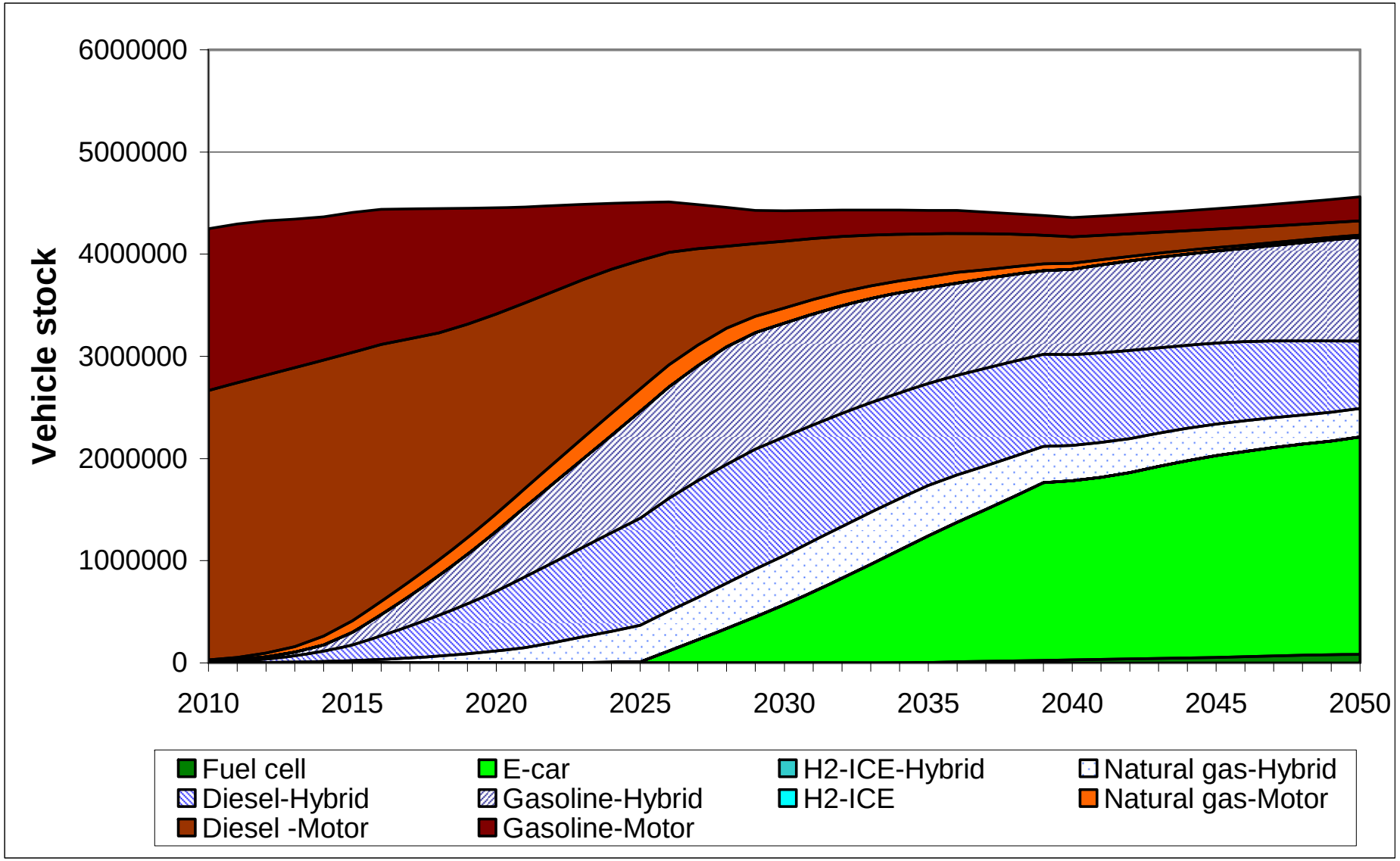

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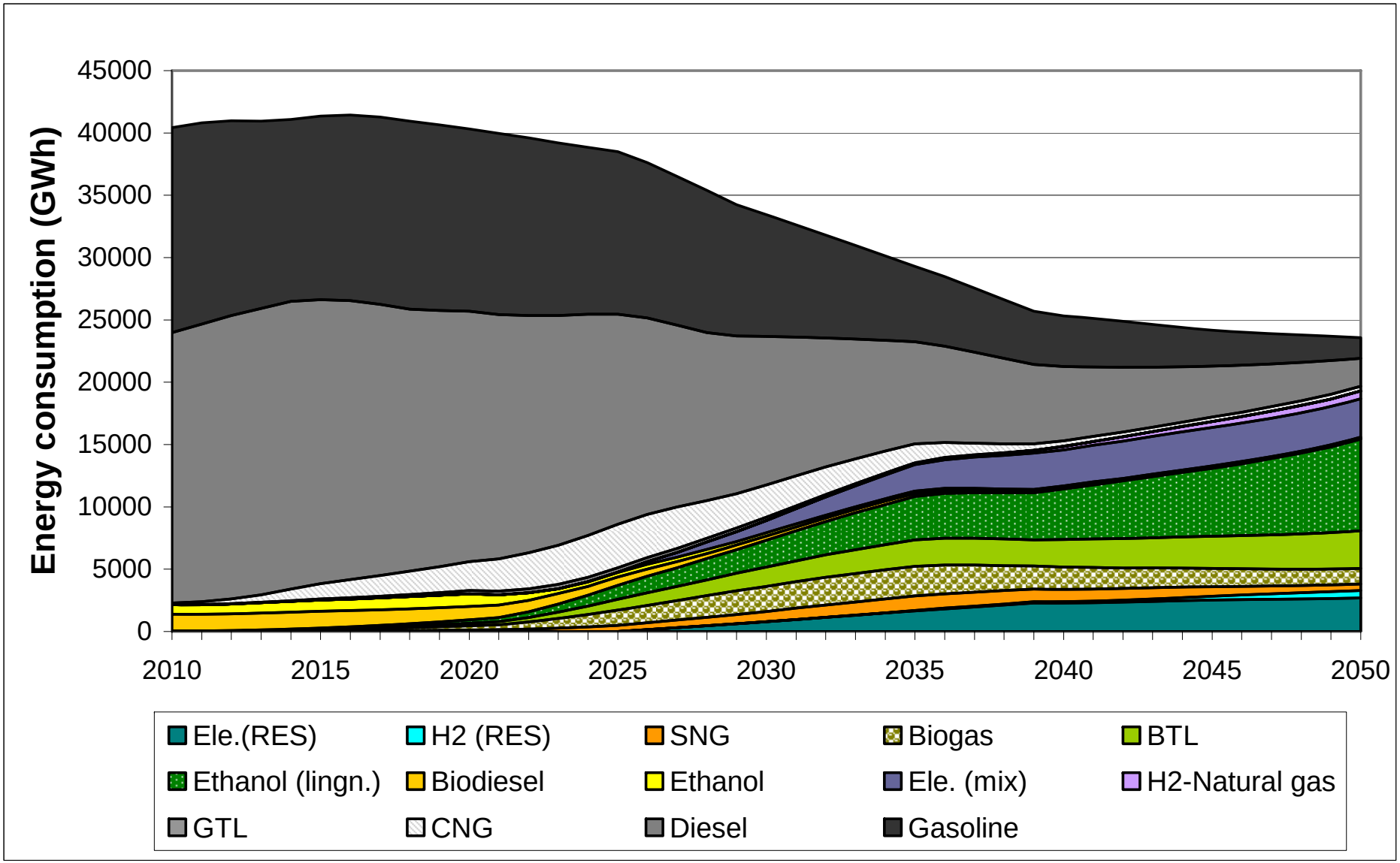

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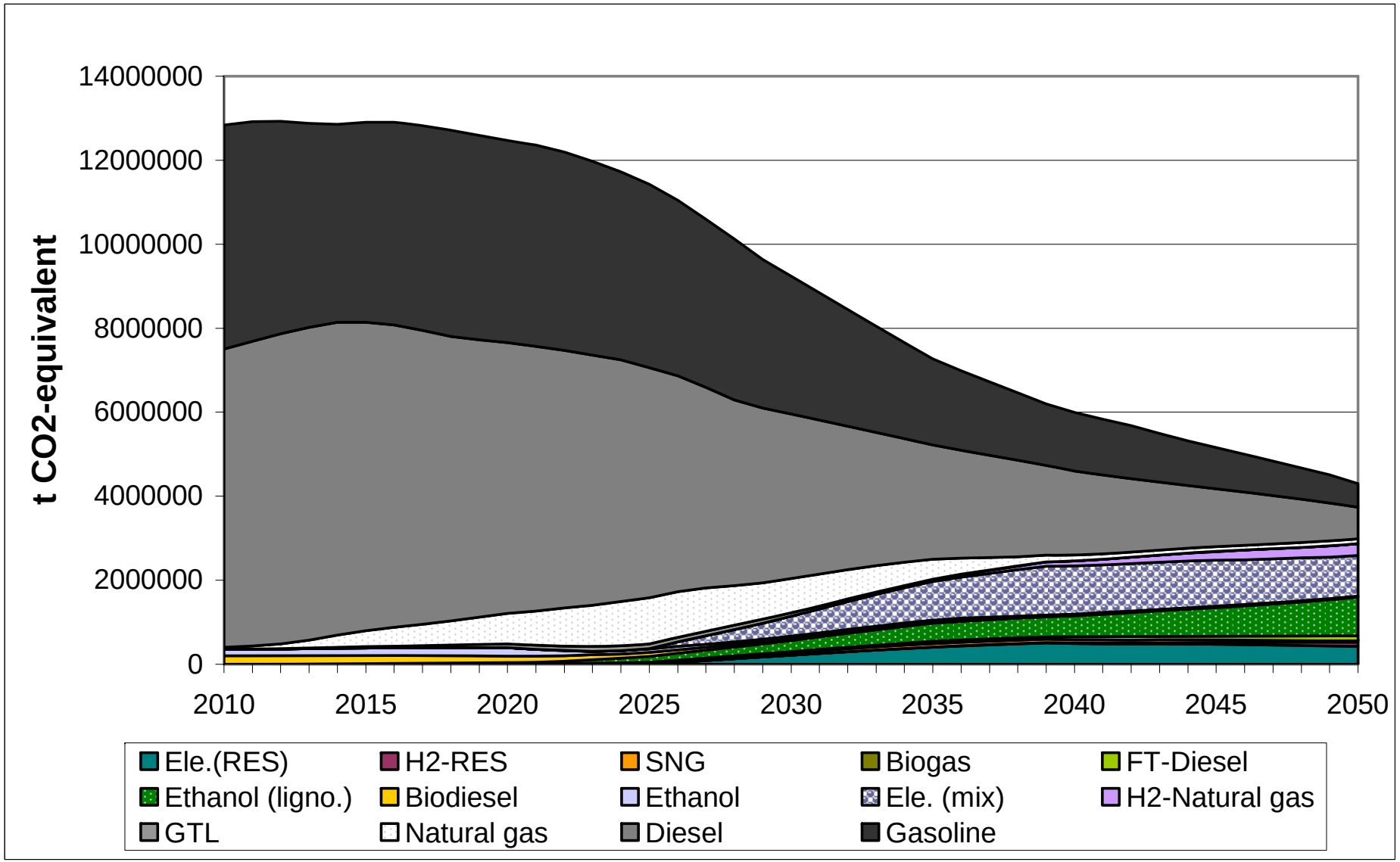

Conclusions

The major conclusions of this analysis are:

- In the BAU-scenario with fuel prices increasing only moderately the stock of vehicles is increasing continuously and the major effect is strong “hybridisation” of vehicles.
- In the scenario with high oil price and ambition introduction of “green” policies the total stock of vehicles is stagnating or even slightly decreasing and electric cars gain significant market shares already from 2030.
- A major characteristic of both scenarios is significant increase of manifold of propulsion systems and fuels.
- The higher decrease in energy consumption and vehicles stock can be achieved only if appropriate policies are implemented.

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Thank you for attention!