



INSTITUT FÜR ENERGIE-  
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# Large scale electric mobility and its challenges in Germany

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Fahrverbot

## Verpennt und verpestet

Das Stuttgarter Urteil für Fahrverbote kommt genau richtig: Politik und Industrie in Deutschland müssen endlich begreifen, dass die Zeit für Verbrennungsmotoren abläuft.

### Klimabilanz 2016: Verkehr und kühle Witterung lassen Emissionen steigen

Fast 4 Millionen Tonnen mehr Treibhausgase als 2015 – Verkehrssektor sogar über dem Niveau von 1990



### Streit um Elektromobil: Deutschlands naiver Glaube an den

**Autogott**

SPIEGEL ONLINE - 18.08.2017

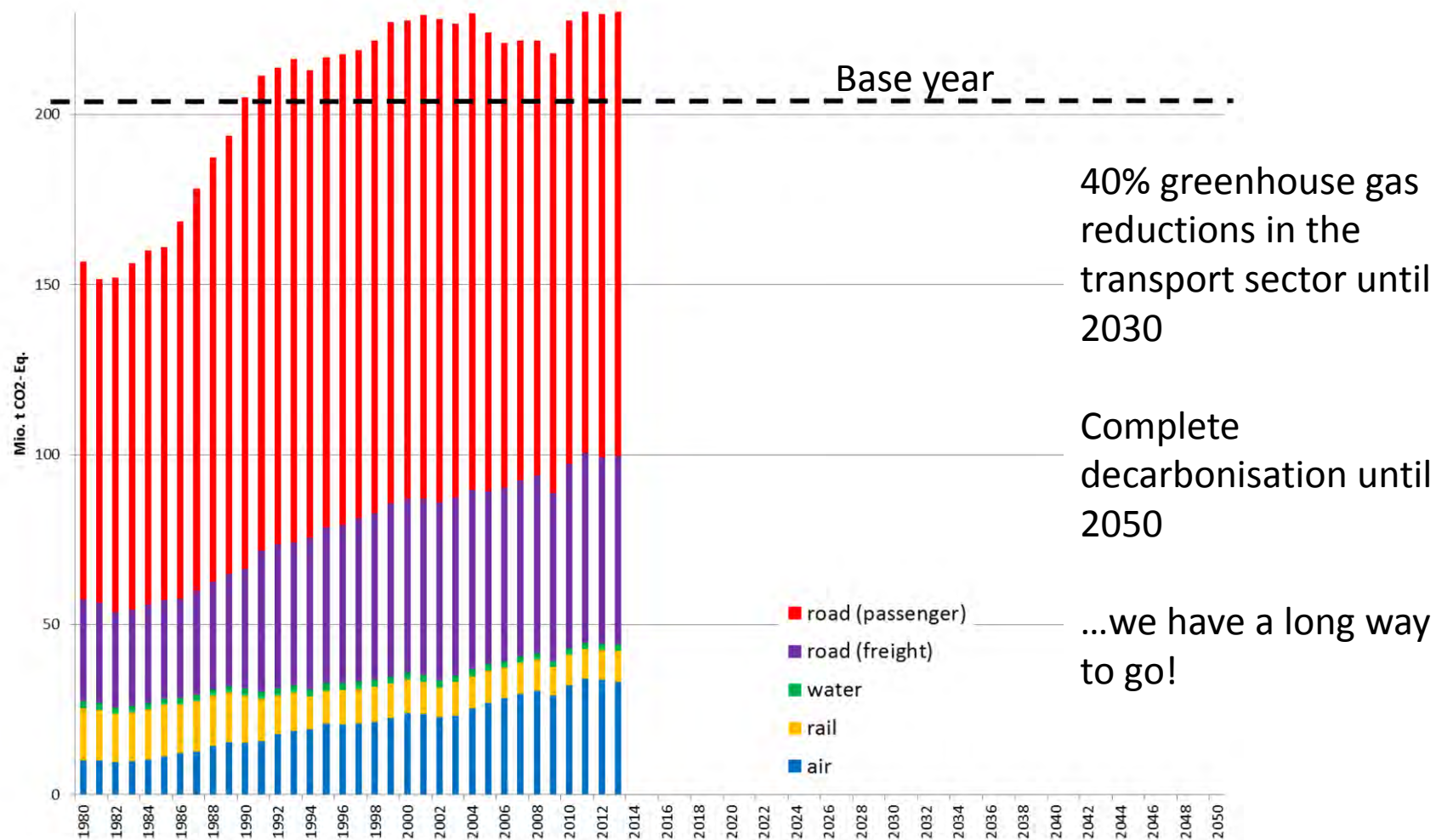


### **Ökobilanz: Der große Schwindel mit den Elektroautos**

SPIEGEL ONLINE - 20.08.2017

Nach dem Dieselskandal fordern Politiker den schnellen Umstieg auf Elektroautos. Modelle sind nicht alltagstauglich - und schon gar nicht umweltfreundlich. *Von Christa...*  
**mehr...**

# Germany's goals for the transport sector

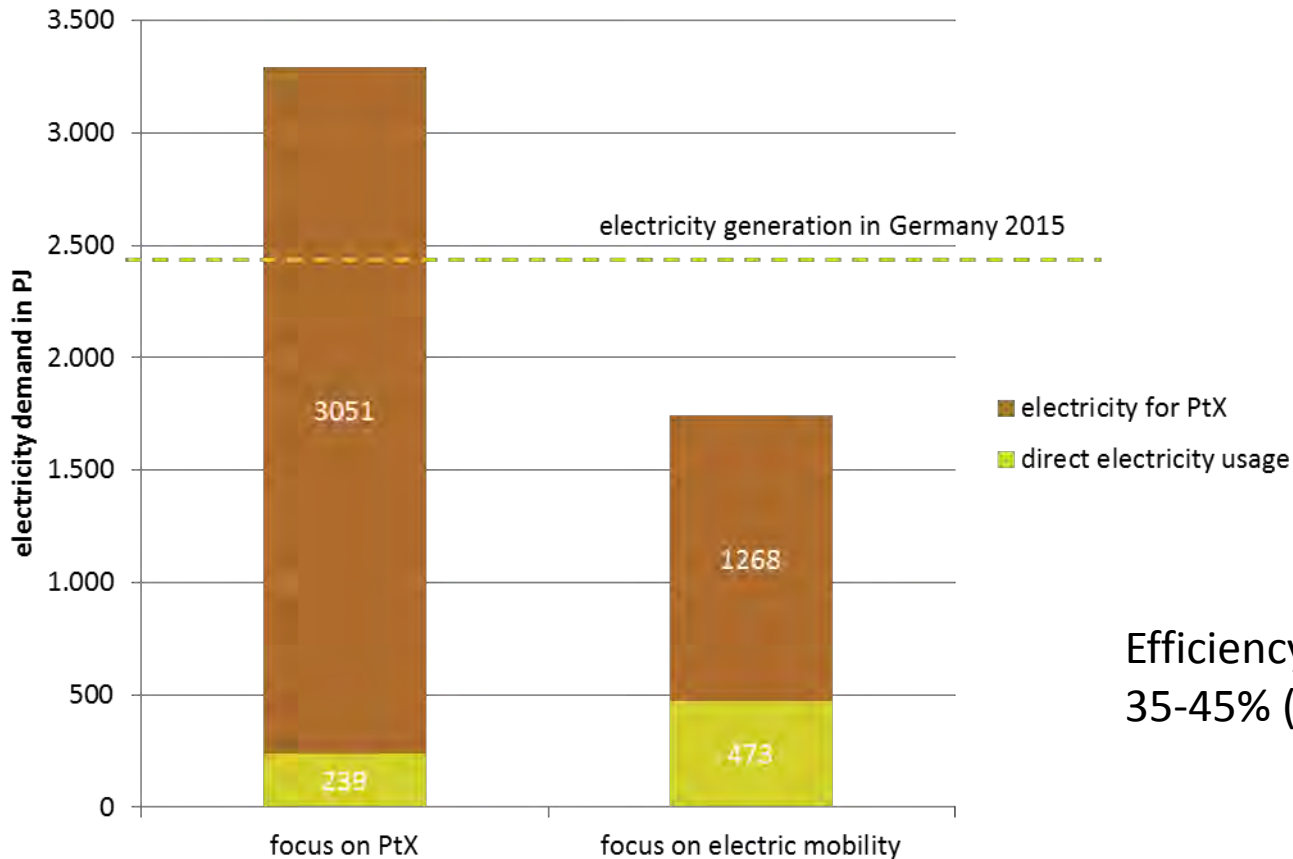


## Electric mobility in Germany

- Backcasting scenarios for the project RENEWBILITY III show possible pathways until 2050
- Complete decarbonisation of the transport sector
  - Renewable electricity, synthetic fuels (imported and from renewable electricity) and 5% sustainable biofuels
  - Improved vehicle technologies
  - Reduced transport demand
  - Modal shift

# Energy usage in the scenarios in 2050

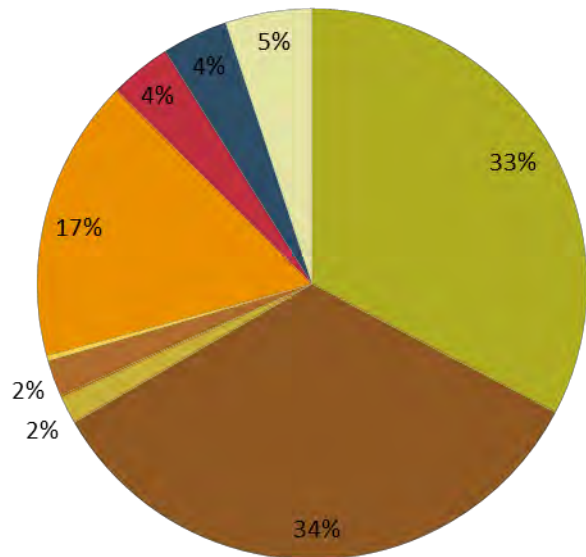
## Impact of PtX on the electricity demand is significant



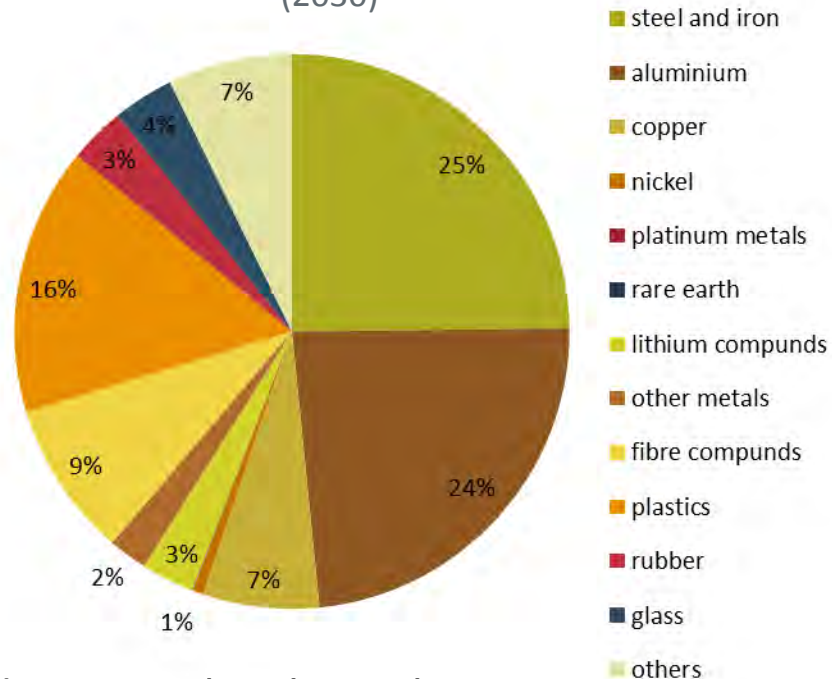
Efficiency of PtL:  
35-45% (depending on CO2 supply)

# Material usage of an electric car

Petrol car with lightweighting  
(2030)



Battery electric car with lightweighting  
(2030)

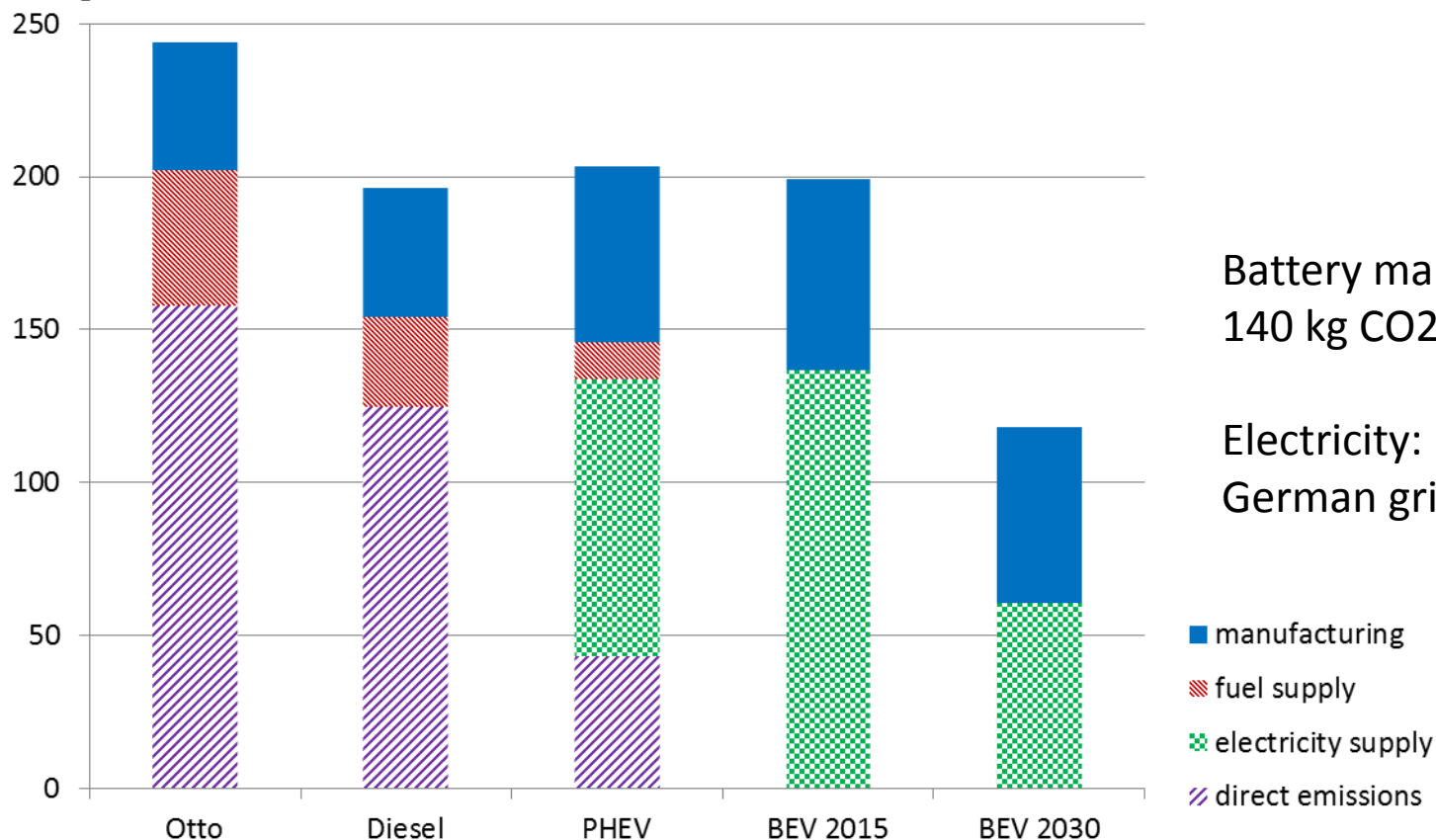


- Different car materialization due to technology changes
  - Increasing demand for special materials needed for electric mobility
- Impacts on emissions from material use and resource demand

# Greenhouse gas emissions from cars

## Global warming potential

[g CO<sub>2</sub>-Eq. / km]



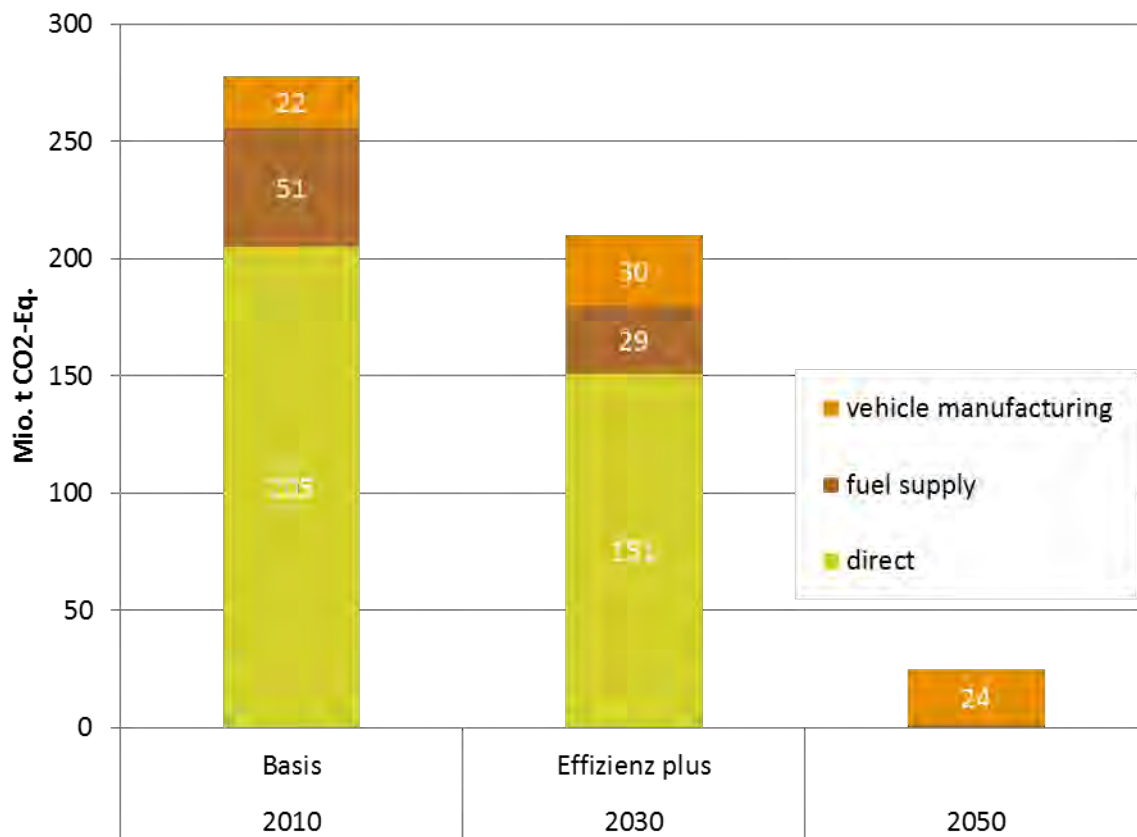
Battery manufacturing:  
140 kg CO<sub>2</sub>-Eq. / kWh

Electricity:  
German grid mix

- manufacturing
- fuel supply
- electricity supply
- direct emissions

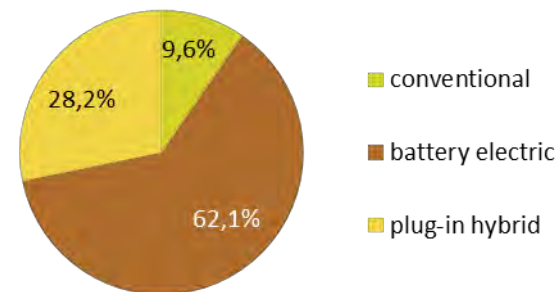
# Scenario results

## Greenhouse gas emissions from transport



Car registrations 2010:  
2,9 mio. (conventional cars)

Car registrations 2050:  
2,0 mio.

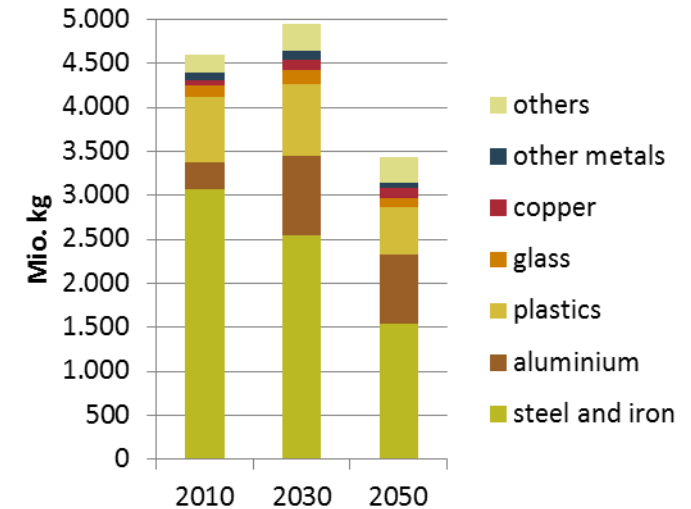
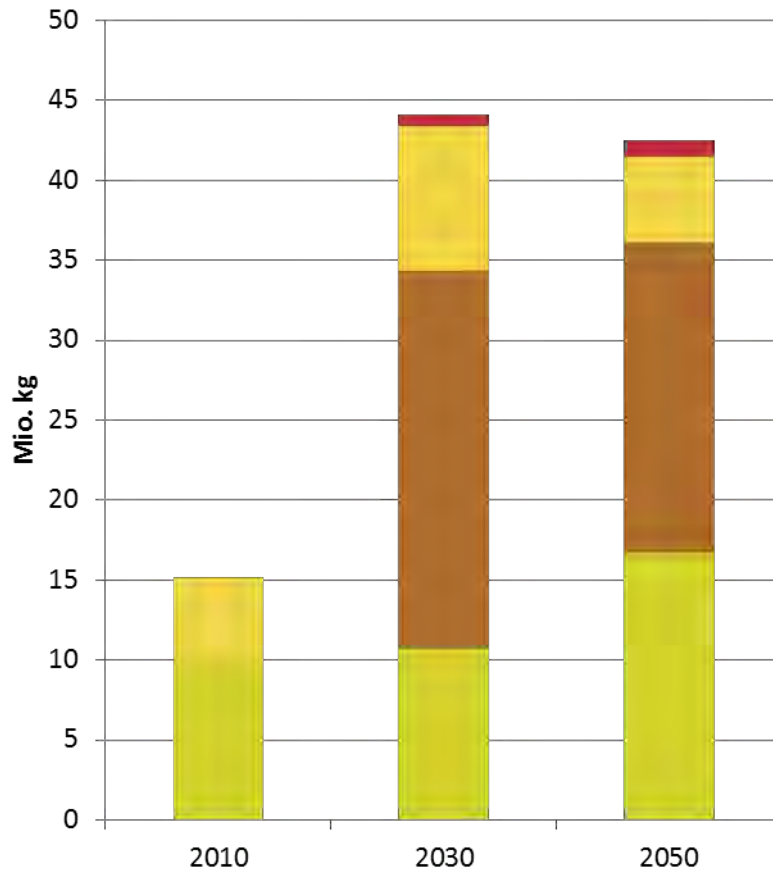




# Scenario results



## Material demand for vehicle manufacturing



Significant increase in lithium, nickel and rare earths

## Direct use of electricity in transport is favorable

- Shift from direct emissions to pre-chains
  - Electric cars need different materials and have higher impacts from car manufacturing than conventional cars
  - Using renewable energy these emissions are more than outweighed by the use phase
- Increasing demand for critical materials like lithium, nickel or rare earth may lead to supply problems especially if other countries have a similar development
  - High uncertainty in resource availability and impacts of future resource extraction
  - Open question: Material demand for PtX supply