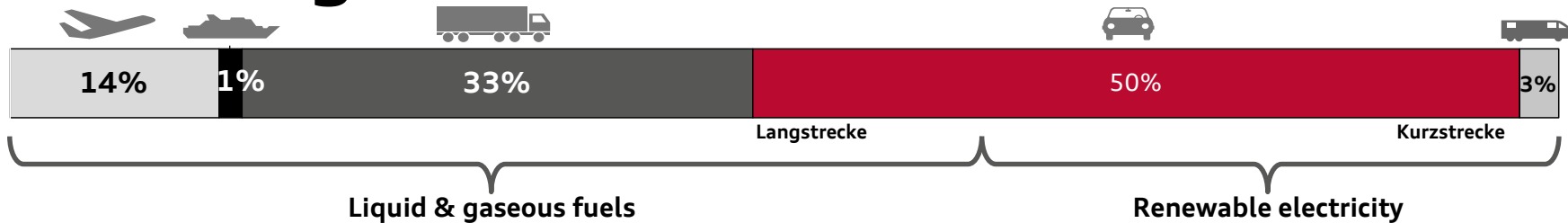


Decarbonization of the transport sector

Dr. Hermann Pengg, EG-X, AUDI AG



Electrification alone is not enough to reach climate goals



Audi e-fuels

Fossil fuels



- > High CO₂-Emissions
- > Other environmental and health issues

Biofuels from crops



- > Limited arable land
- > Food prod. competition
- > Low CO₂ reduction potential

Audi e-fuels

Waste based

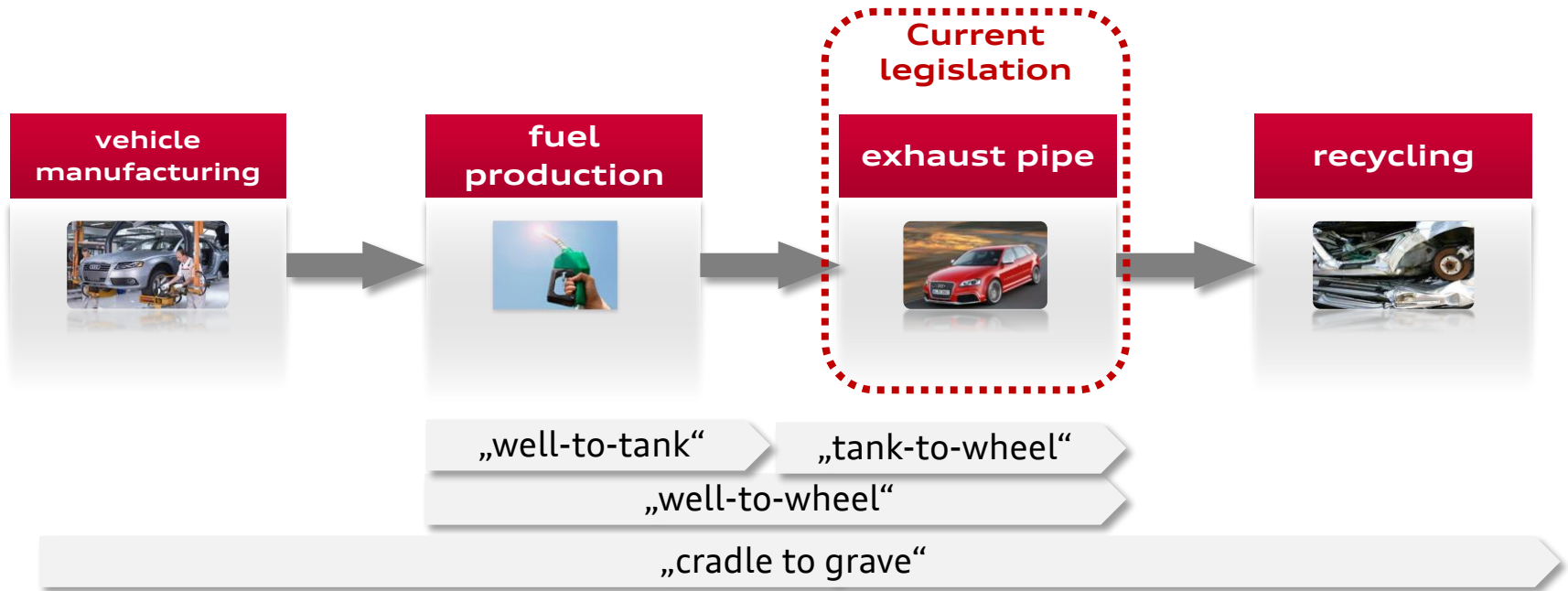


Electricity based

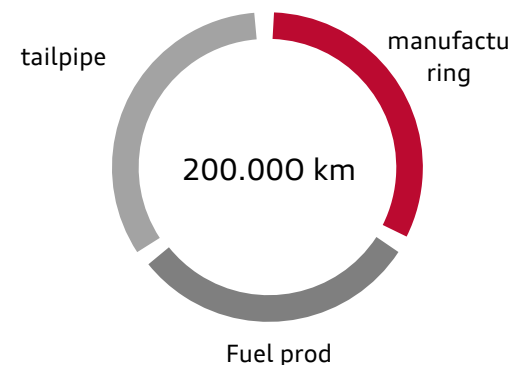
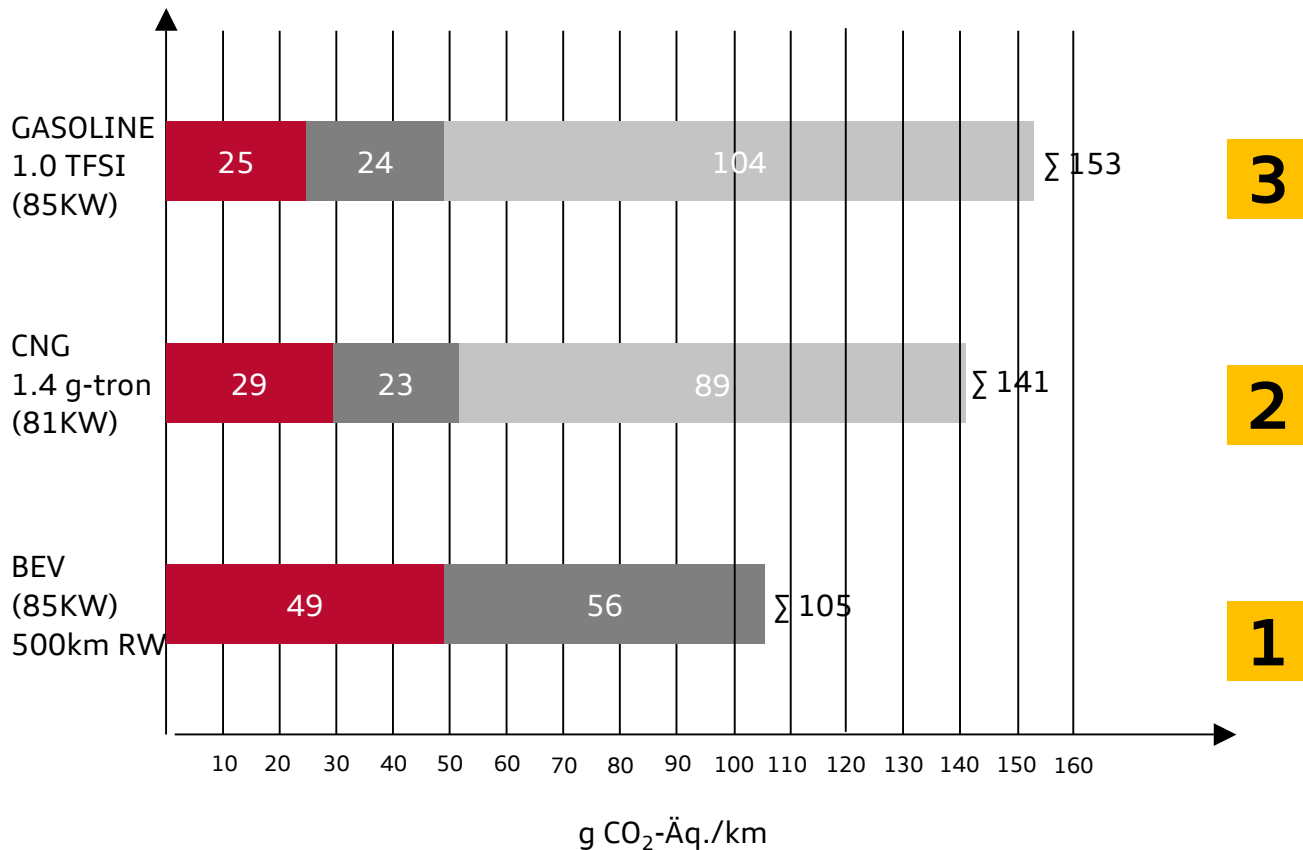


- > **CO₂-Reduction > 70% Well-to-Wheel**
- > **No competition to food production**
- > **100 % infrastructure compatible**

Lifecycle Analysis (LCA): all emissions monitored



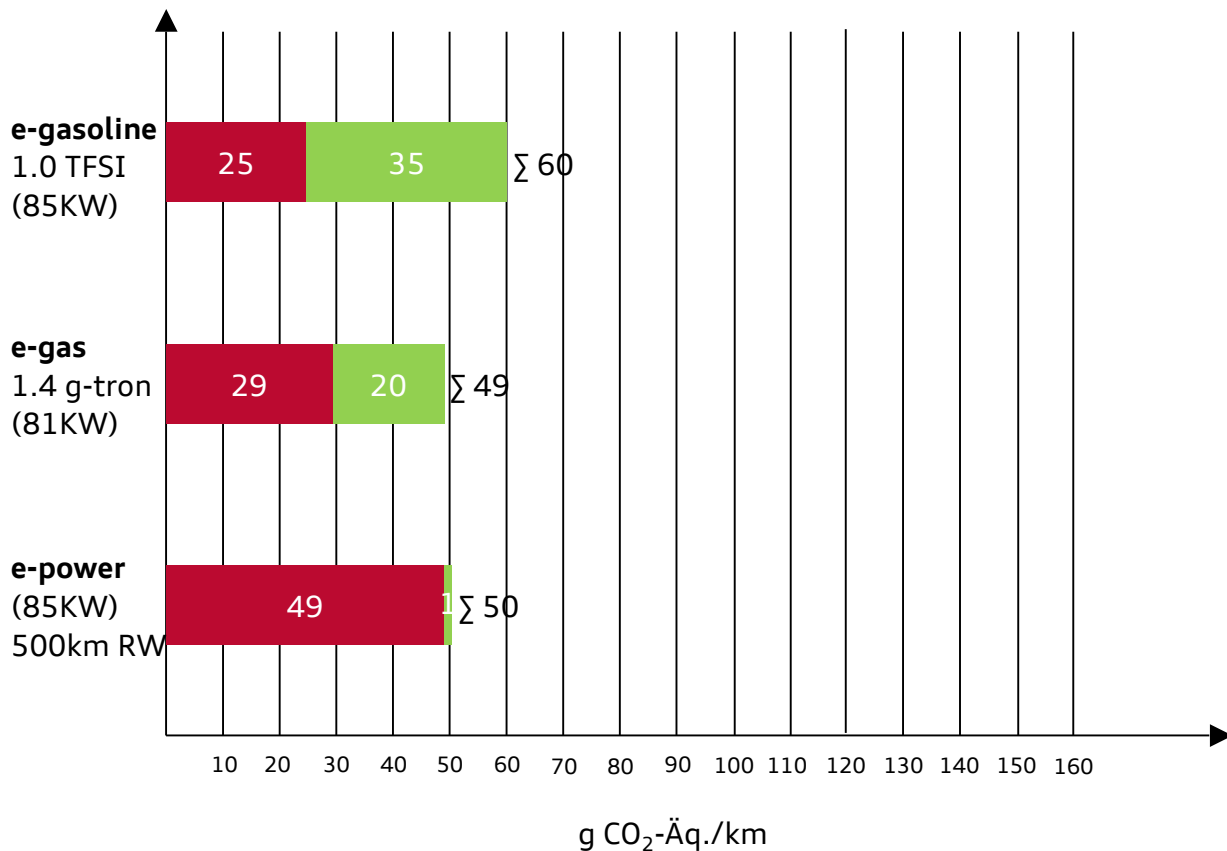
Who wins the „LCA race“?



Assumptions:

- Compact car (A3)
- NEDC
- All cars same range
- Lifetime 200.000 km
- Neglect recycling
- Fossil gasoline & CNG / EU electricity mix

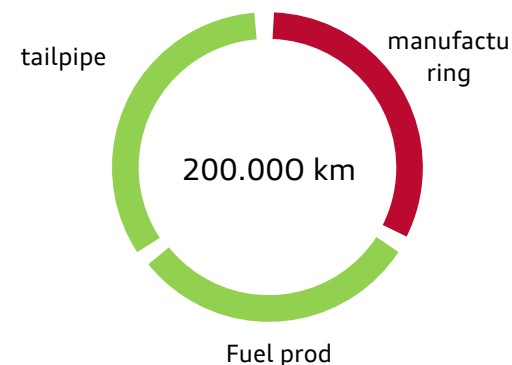
LCA race with green energy



2

1

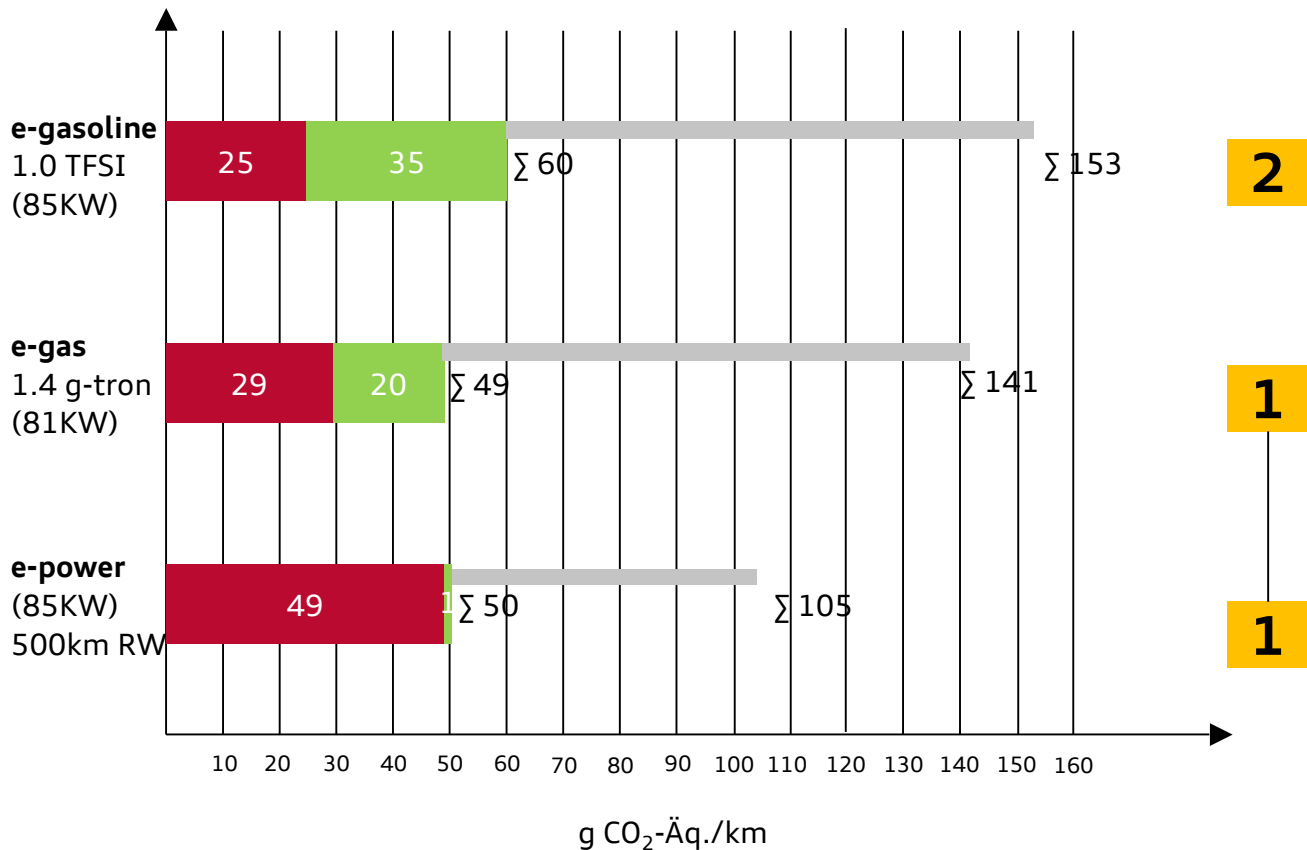
1



Assumptions:

- Compact car (A3)
- NEDC
- All cars same range
- Lifetime 200.000 km
- Neglect recycling
- e-gasoline / e-gas / wind energy

Green energy – not powertrain - determines CO₂



2

1

1



Examples

**Audi e-
diesel®**

**Audi
gasoline®**

**Audi e-
gas®**



A4 Avant g-tron and A5 Sportback g-tron

-80%

CO₂ emissions (wtw)



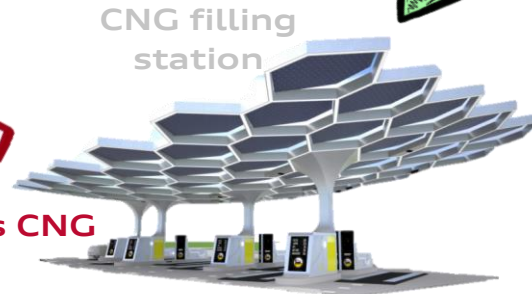
Audi e-gas: minus 80% CO2 !



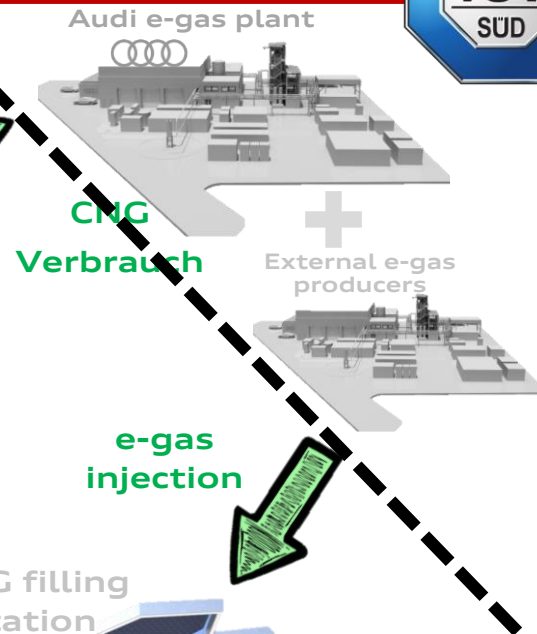
Mileage check



Customer fills CNG

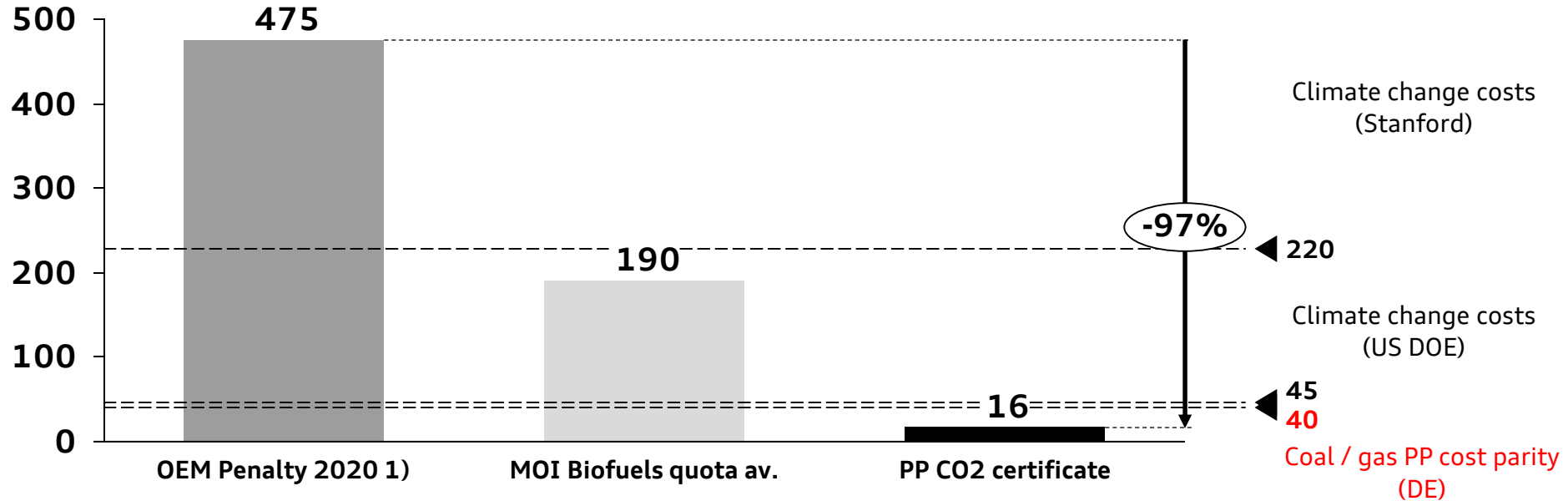


CNG filling station



Burning coal costs 97% less than OEM penalty

€/tonCO2



OEM: automotive
MOI: mineral oil producer
PP: power production

1) OEM will have to pay penalty if electrification is too slow („CO2 gap“ by 2020)

Climate goals in transport can be reached, and ...

- We need a holistic CO₂ assessment: cradle-to-grave lifecycle analysis
- Result: Green energy – not powertrain - determines CO₂
- Electrification of powertrains **PLUS** e-fuels technologies are necessary to decrease transport emissions – cars, trucks, ships, planes - by minus 70% (cradle-to-grave)
- Legislation that includes (at least) well-to-wheel approach would help to promote renewable fuels

Thank you for your attention!



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