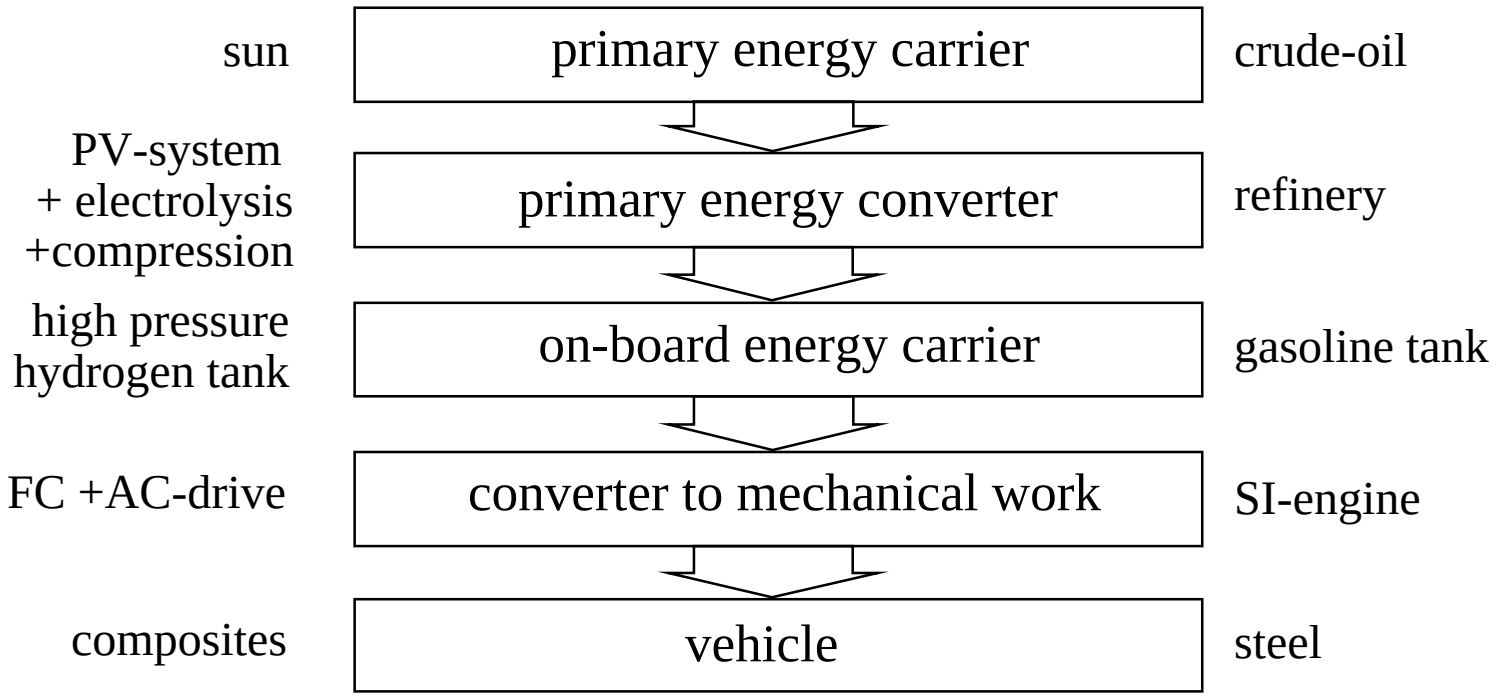
Control Oriented Modelling of Fuel-Cell Based Vehicles

Lino Guzzella, Swiss Federal Instiute of Technology (ETH), Zurich

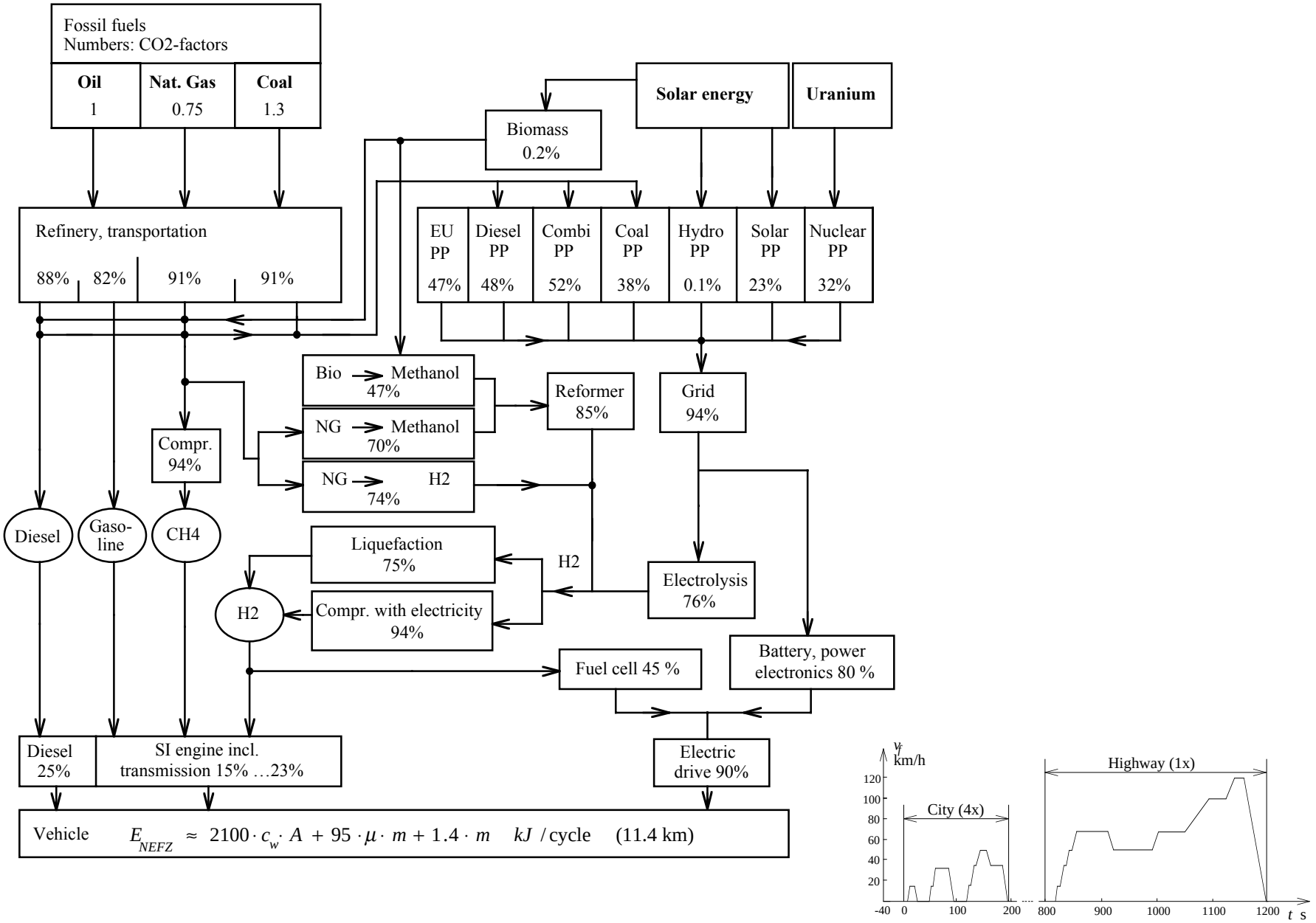
Acknowledgements to Alois Amstutz (ETH) and Felix Büchi (PSI)

- Fuel economy potential of FC based vehicles
- Some remarks on the electrochemistry of FC
- Modeling and control of FC systems ("stacks")
- Modeling and control of FC based powertrains

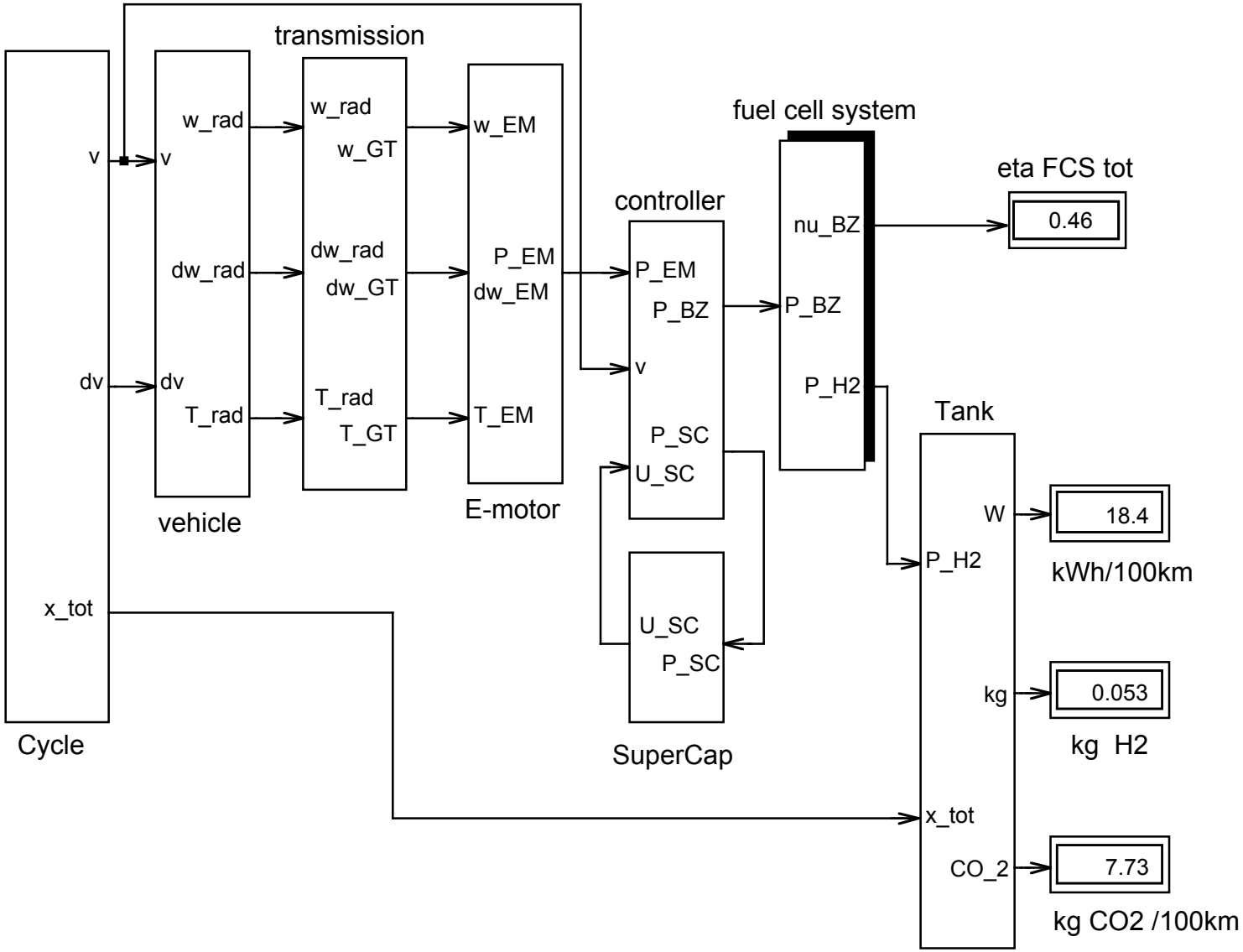
Fuel Economy Potential of FCV



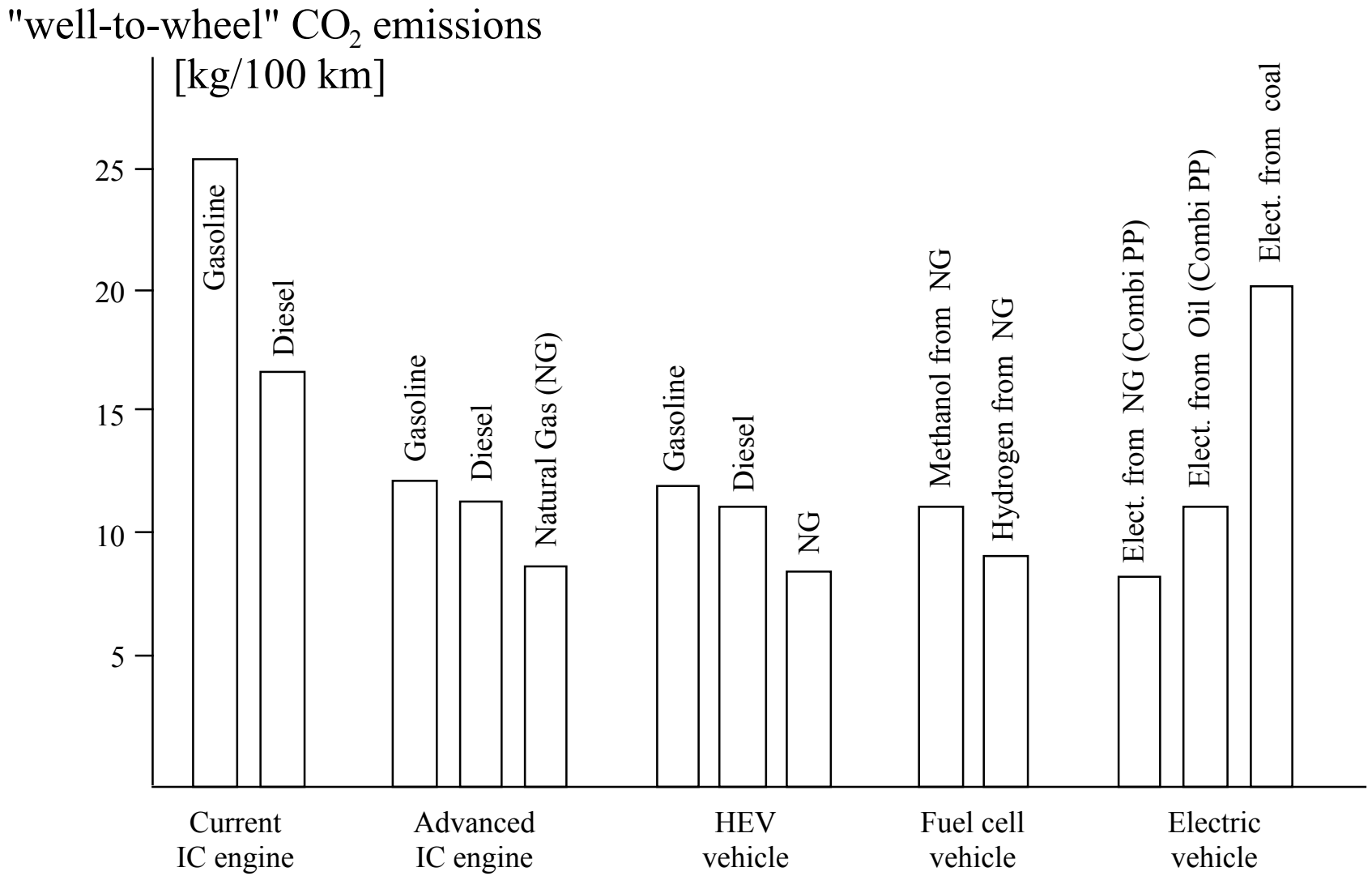
Fuel Economy Potential of FCV



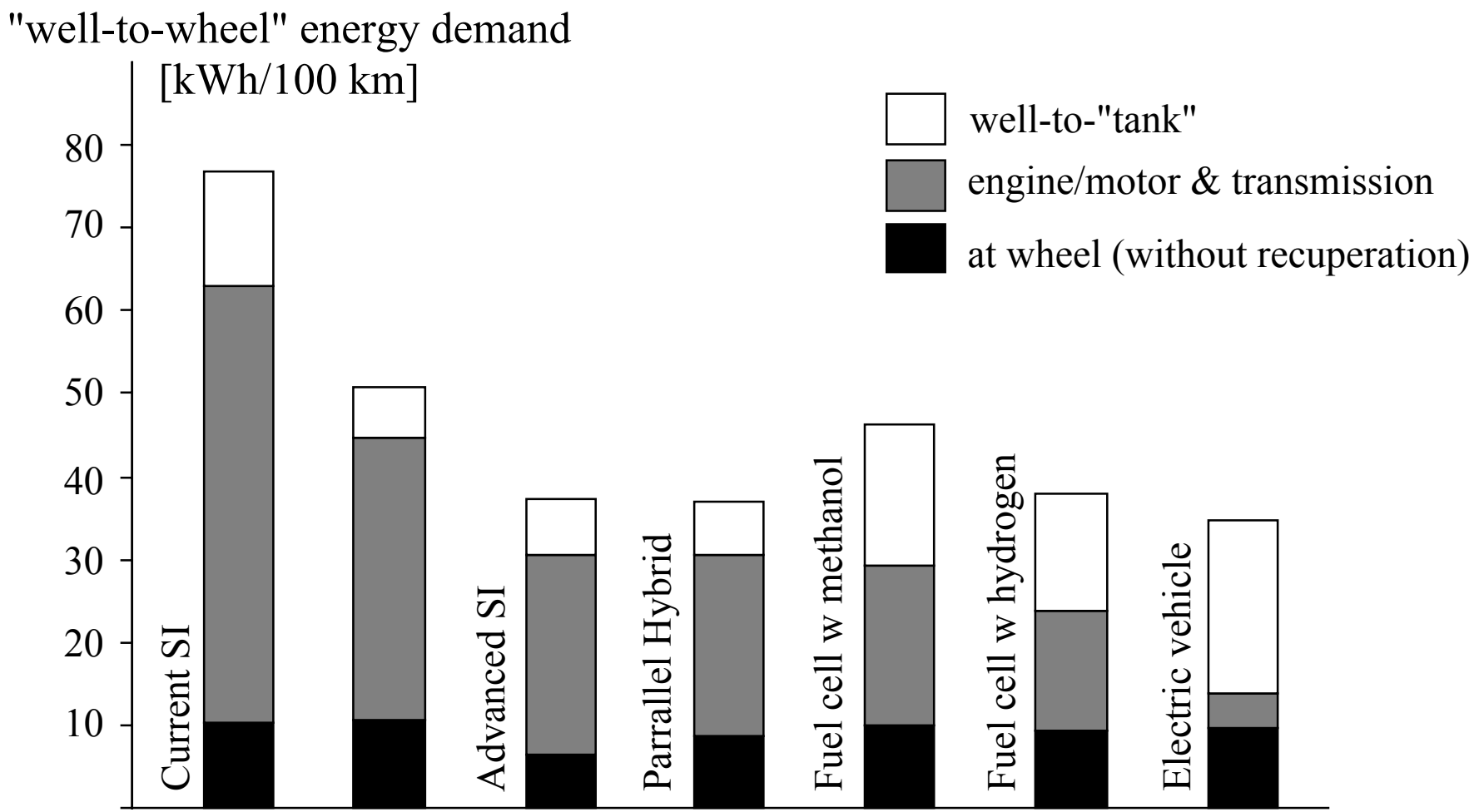
Fuel Economy Potential of FCV



Fuel Economy Potential of FCV

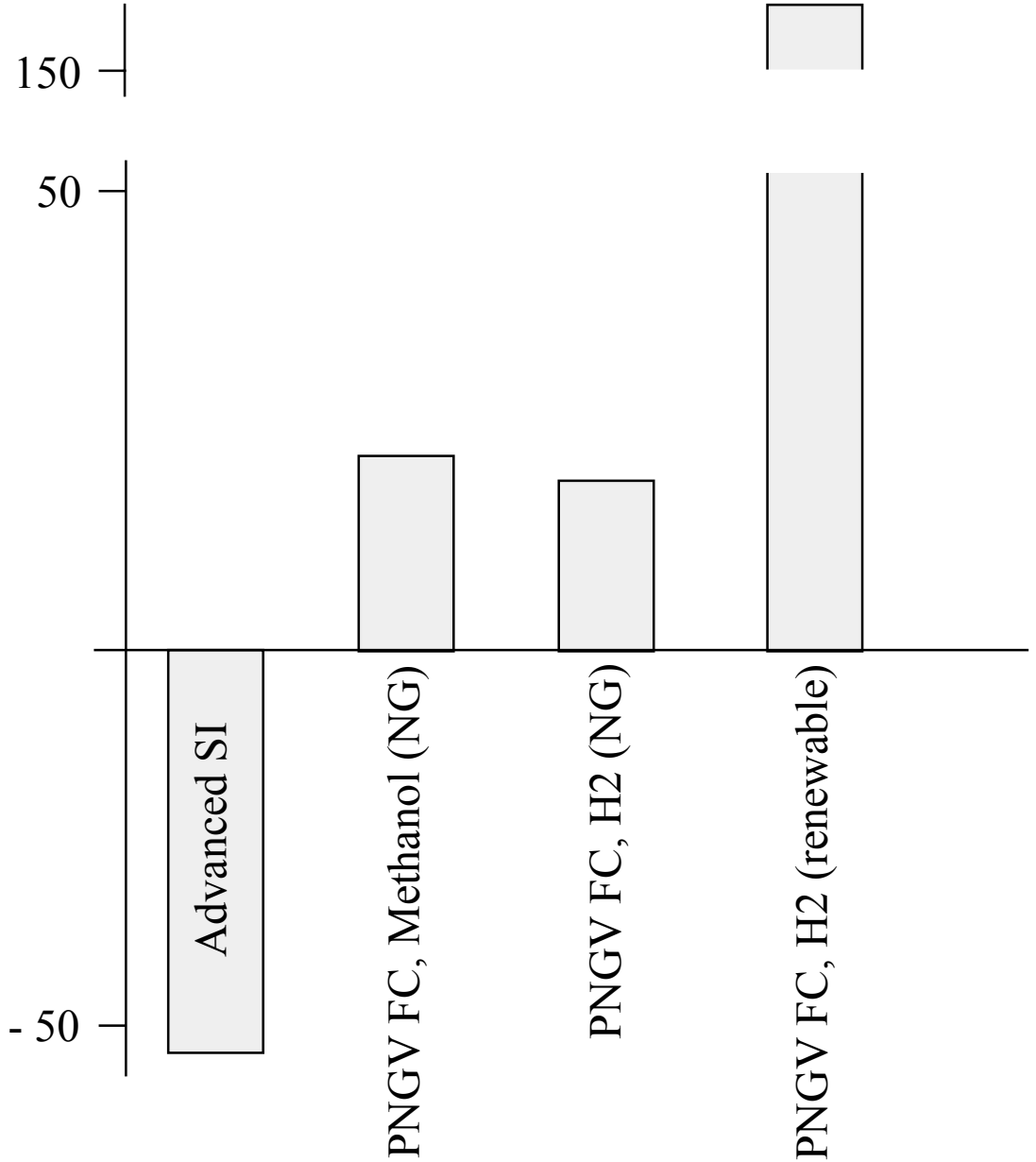


Fuel Economy Potential of FCV



Fuel Economy Potential of FCV

Total CO_2 -avoidance costs
(US $ / ton CO_2 not emitted)



European compact car
German taxation (≈3.5 US $/gallon)

PNGV-FC target 50 US US $/kW
(complete powertrain)

Actual powertrains in the order
of 20 US $/kW

Source: "Umweltbundesamt" , May 1999
(German EPA)

Fuel Economy Potential of FCV

Summary

- FC-V have a fuel-economy potential, especially if sustainable ("CO_2-neutral") primary energy sources are available (in which case the "tank-to-wheel" efficiency is decisive)
- However, this potential should not be overestimated and the necessary infrastructure will need much time to become operational
- Major other advantages are "zero" local pollutant emission, noise, riding comfort, ……
- Major problems:
  - costs (FC, power train, …)
  - fuel (infrastructure, safety, …)