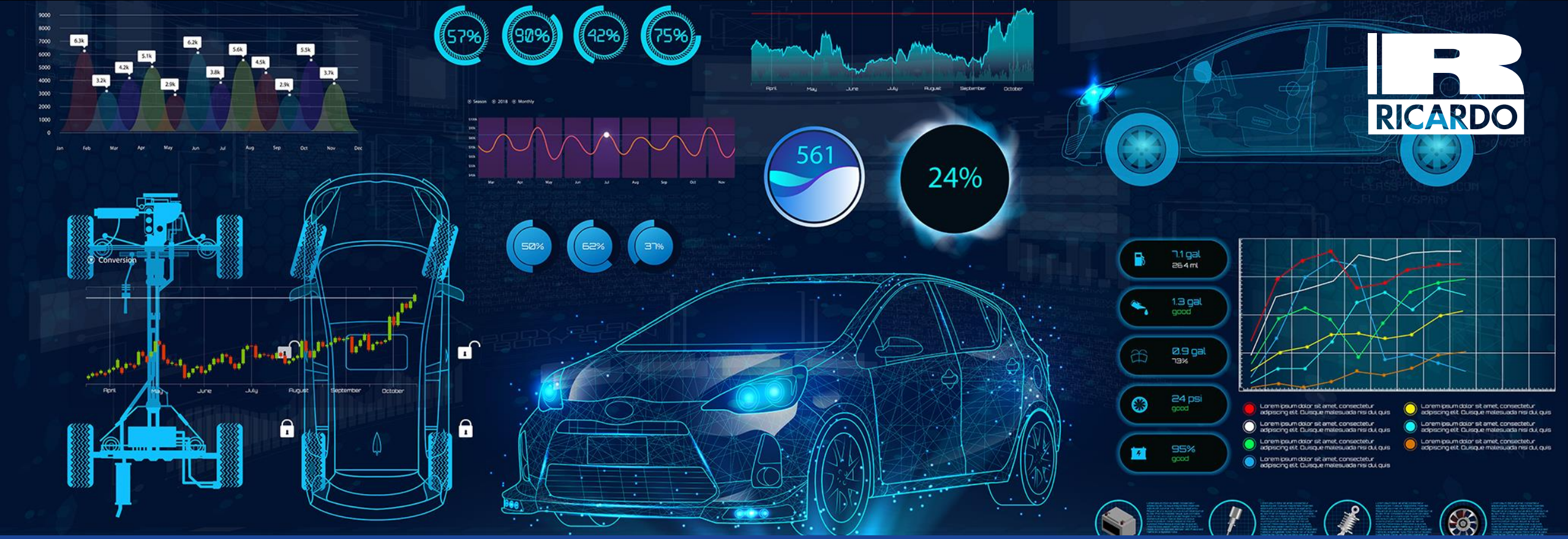

Ricardo: The importance of including Capital Goods for Renewable Electricity in LCA

UNECE IWG A-LCA, 17th Meeting, 26 Sep 2024

Nikolas Hill (Ricardo)

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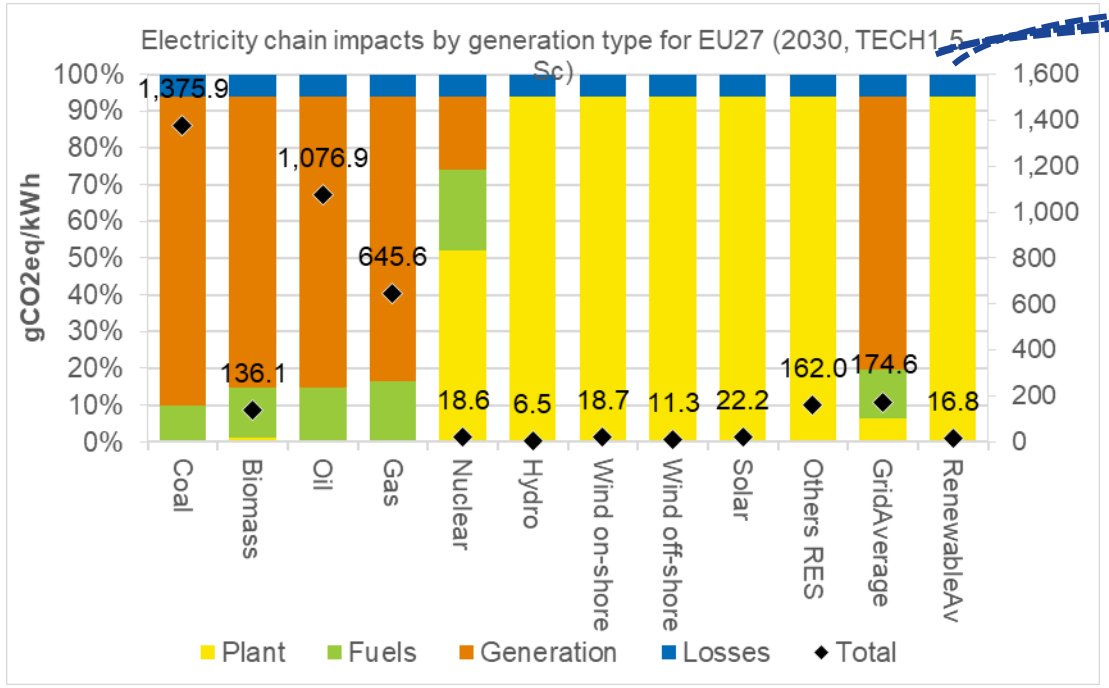
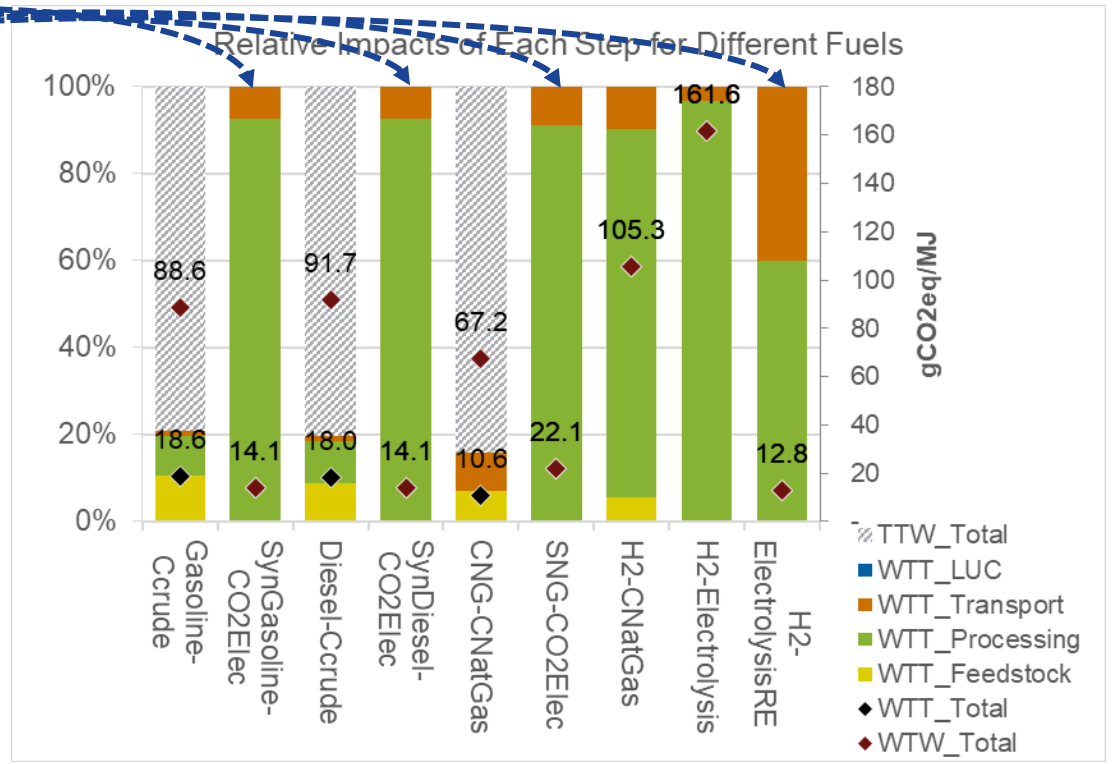
WTT impacts from vehicles operating on renewable hydrogen and e-fuels produced from renewable electricity are responsible for 20-45% of total WTW impacts



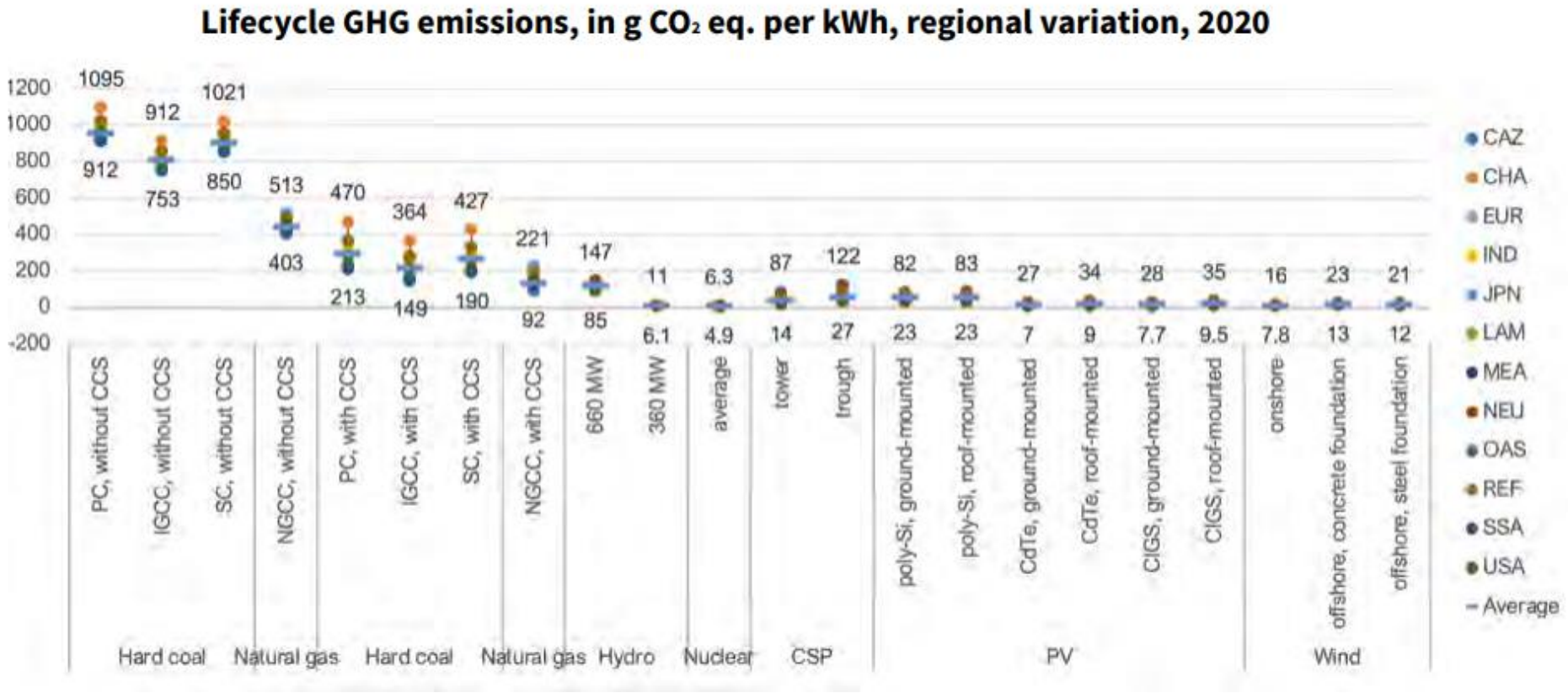


- Impacts from nuclear and renewable electricity generation are entirely resulting from capital goods (i.e. generation equipment) - also in the 'losses'
- These are relatively small compared to conventional generation types but more important for production or e-fuel and green H2
- Impacts derived from renewable electricity capital goods are responsible for significant impacts for production of green H2 (~12% vs WTW impacts for H_2 from natural gas) and liquid e-fuels (~20% vs WTW impacts for conventional gasoline/diesel)
- Impacts magnified further with differences in vehicle powertrains

Source: Ricardo analysis conducted as input to projects for DG CLIMA (2020) and the European Parliament (2023): https://www.europarl.europa.eu/thinktank/en/document/IPOL_STU(2023)733112

Impacts from generation equipment are also included in UNECE reporting on integrated life-cycle assessment of electricity sources, with similar results as for Ricardo's analyses

Figure 37 **Lifecycle greenhouse gas emissions' regional variations for year 2020. Variability is explained by several factors: electricity mix (all regions), methane leakage rates (fossil fuels), load factors (renewables). Nuclear power is modelled as a global average except for back-end.**

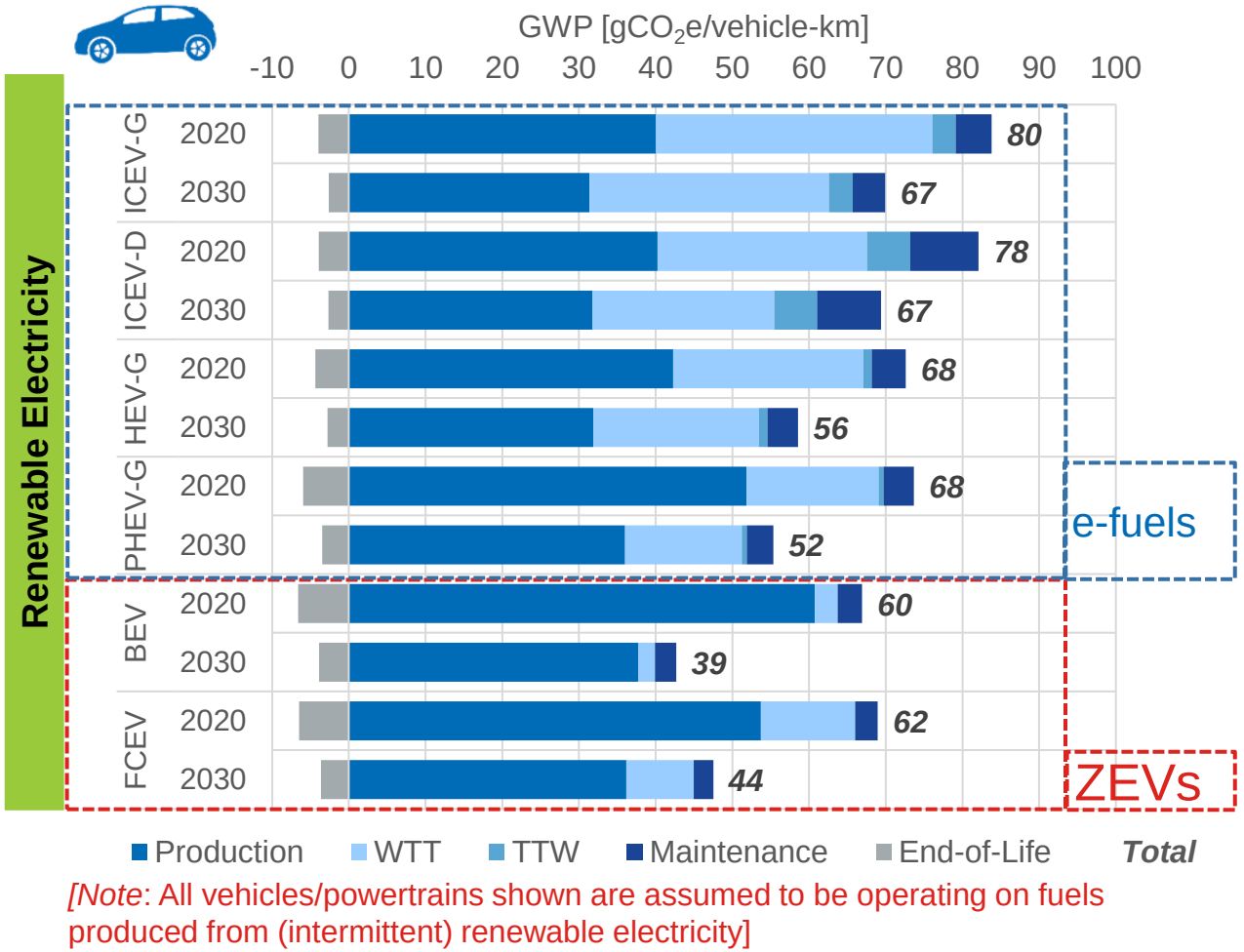


- Best practice in LCA of different electricity production chains includes accounting for production of generation equipment
- Such impacts are already included in LCI datasets widely used in automotive and other LCA studies for electricity use, e.g. from Econinvent, Sphera in Europe

Source: Carbon neutrality in the UNECE region :

Ricardo analysis shows WTT GWP impacts from vehicles operating on renewable hydrogen and e-fuels produced from renewable electricity are responsible for 20-45% of total lifecycle impacts

Lower Medium Car, WeightedAv (Tech1.5 Scenario)



[Note: All vehicles/powertrains shown are assumed to be operating on fuels produced from (intermittent) renewable electricity]

- WTT GWP impacts for production and distribution of e-fuels are mainly due to the embedded emissions from electricity generation equipment (e.g. solar PV cell manufacturing) – i.e. aka ‘capital goods’
- GWP impacts from capital goods are responsible for:
  - 20% of total lifecycle impacts for FCEVs using ‘green’ (renewable) hydrogen; and
  - 45% of total lifecycle impacts for ICEVs/HEVs powered by 100% liquid e-fuels
    - This is similar to the share for vehicle production
- These fuel/powertrain options are being investigated for deployment alongside other electric powertrains:
  - It is important capital goods are therefore included for renewable electricity production for objective and fair comparisons

Source: Ricardo analysis conducted as input to projects for DG CLIMA (2020) and the European Parliament (2023): https://www.europarl.europa.eu/thinktank/en/document/IPOL_STU(2023)733112

Thank you

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