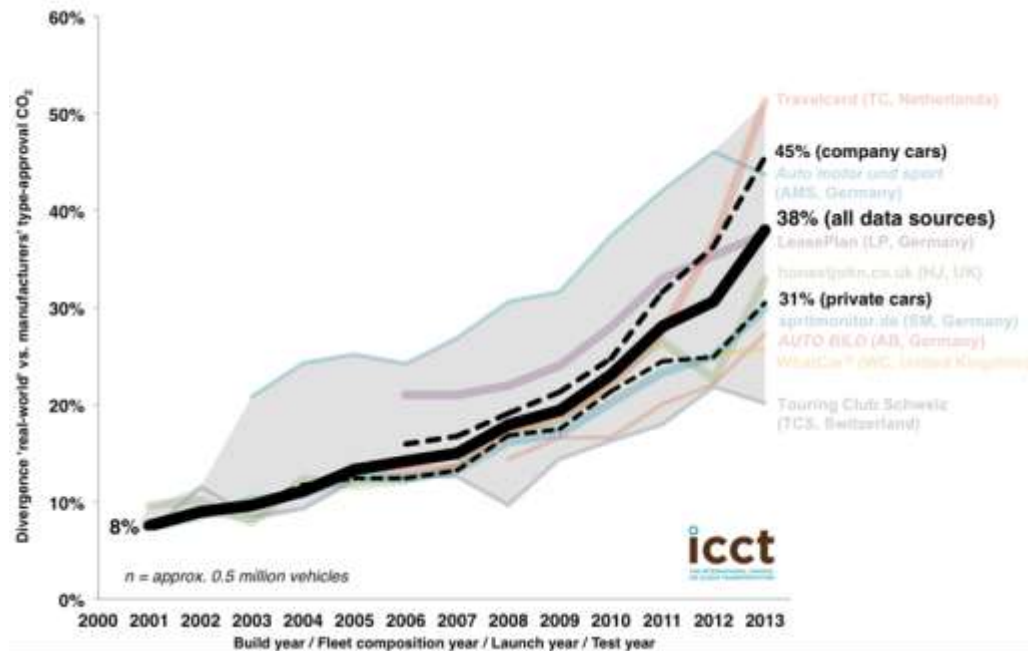
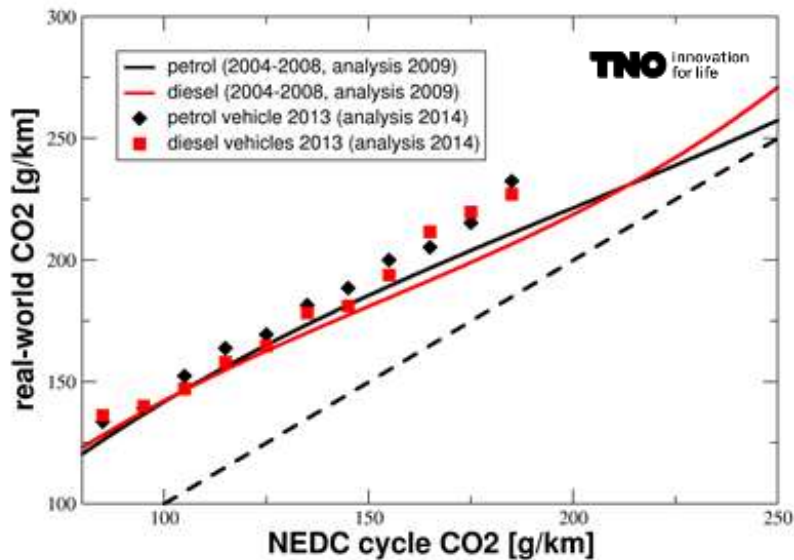




Supporting analysis on real-world light-duty vehicle CO₂ emissions

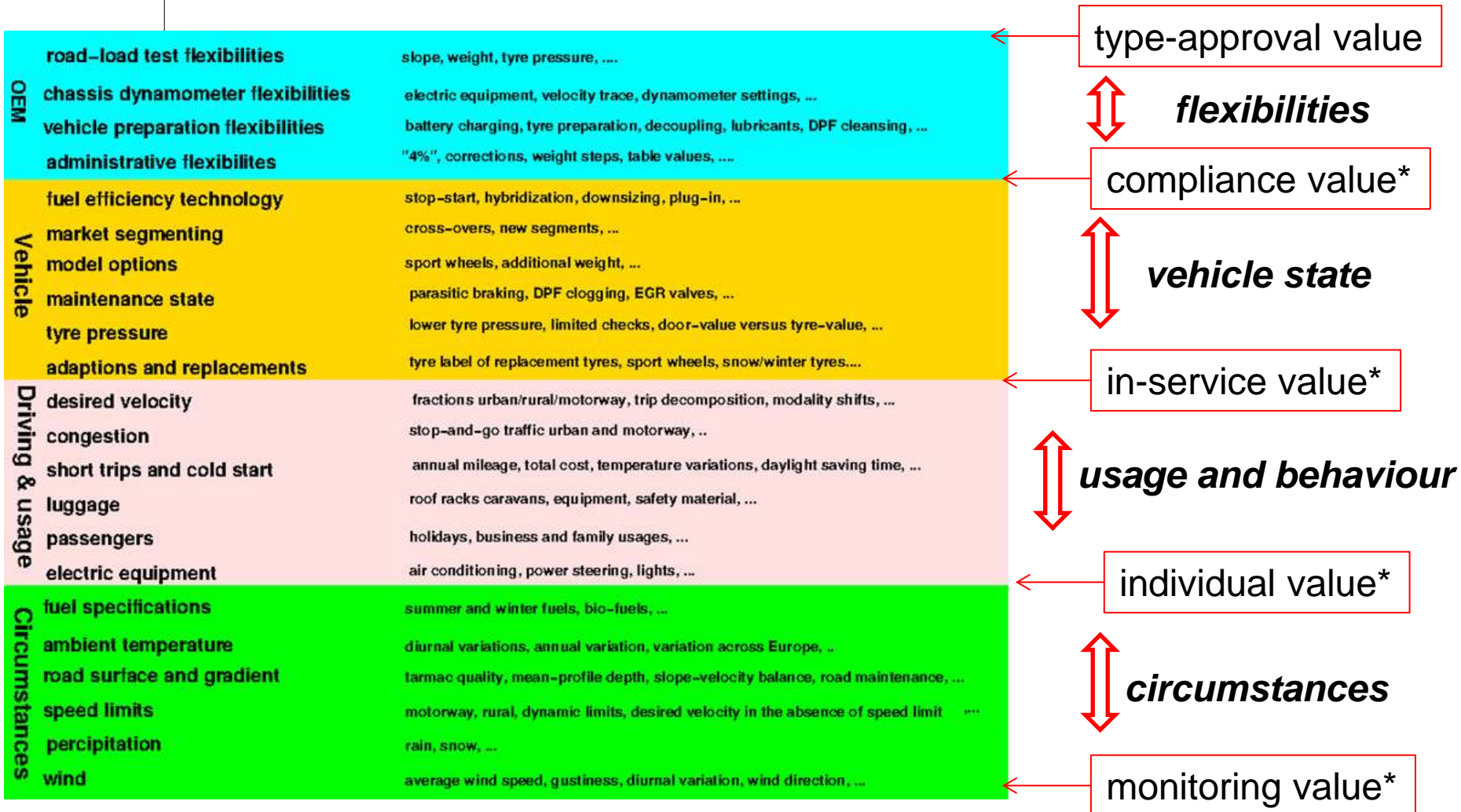
Carried out by TNO and ICCT

Richard T.M. Smokers & Norbert E. Ligterink





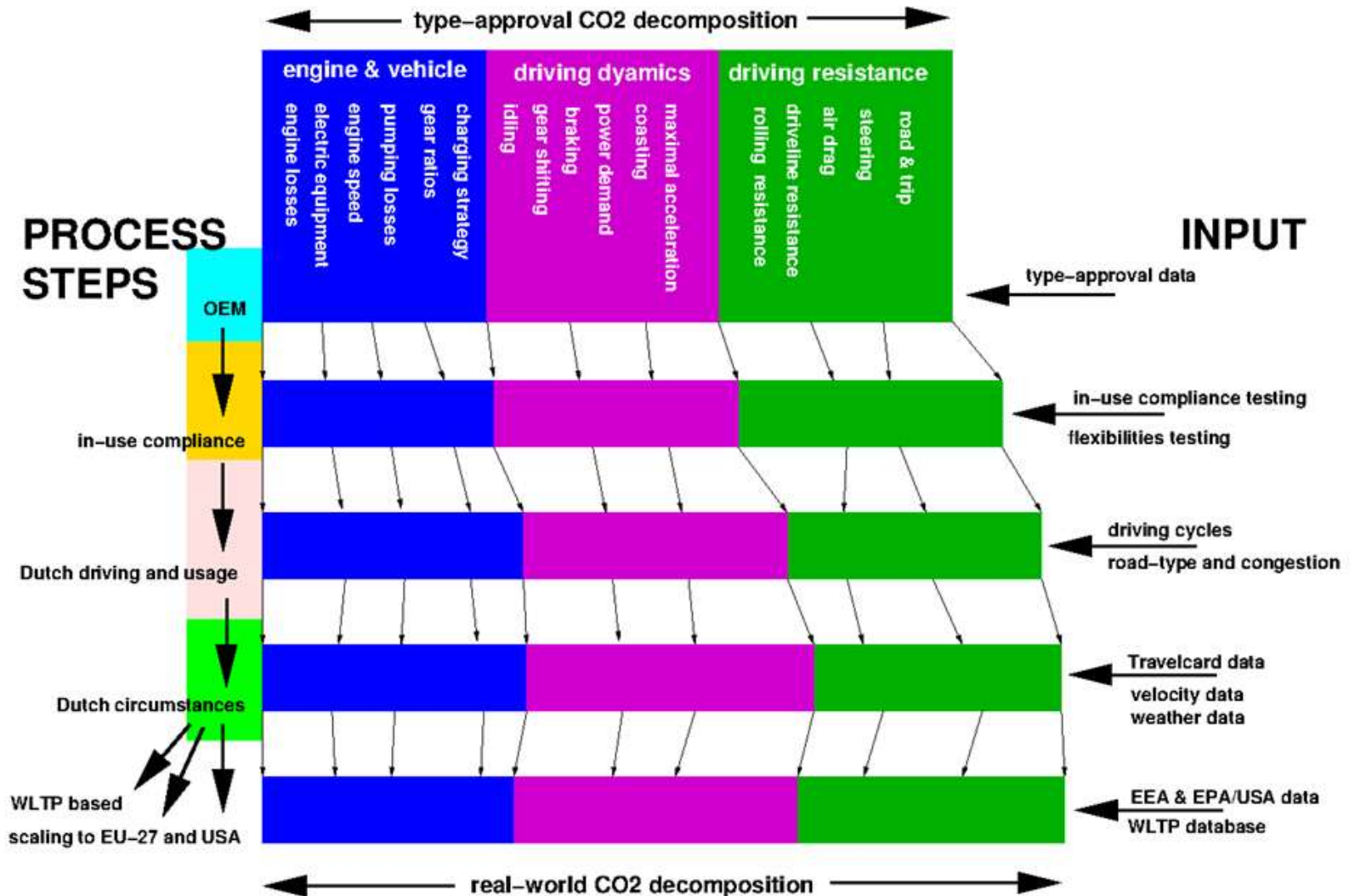
Many effects make up the total gap



*large amount of testing and monitoring results available at TNO

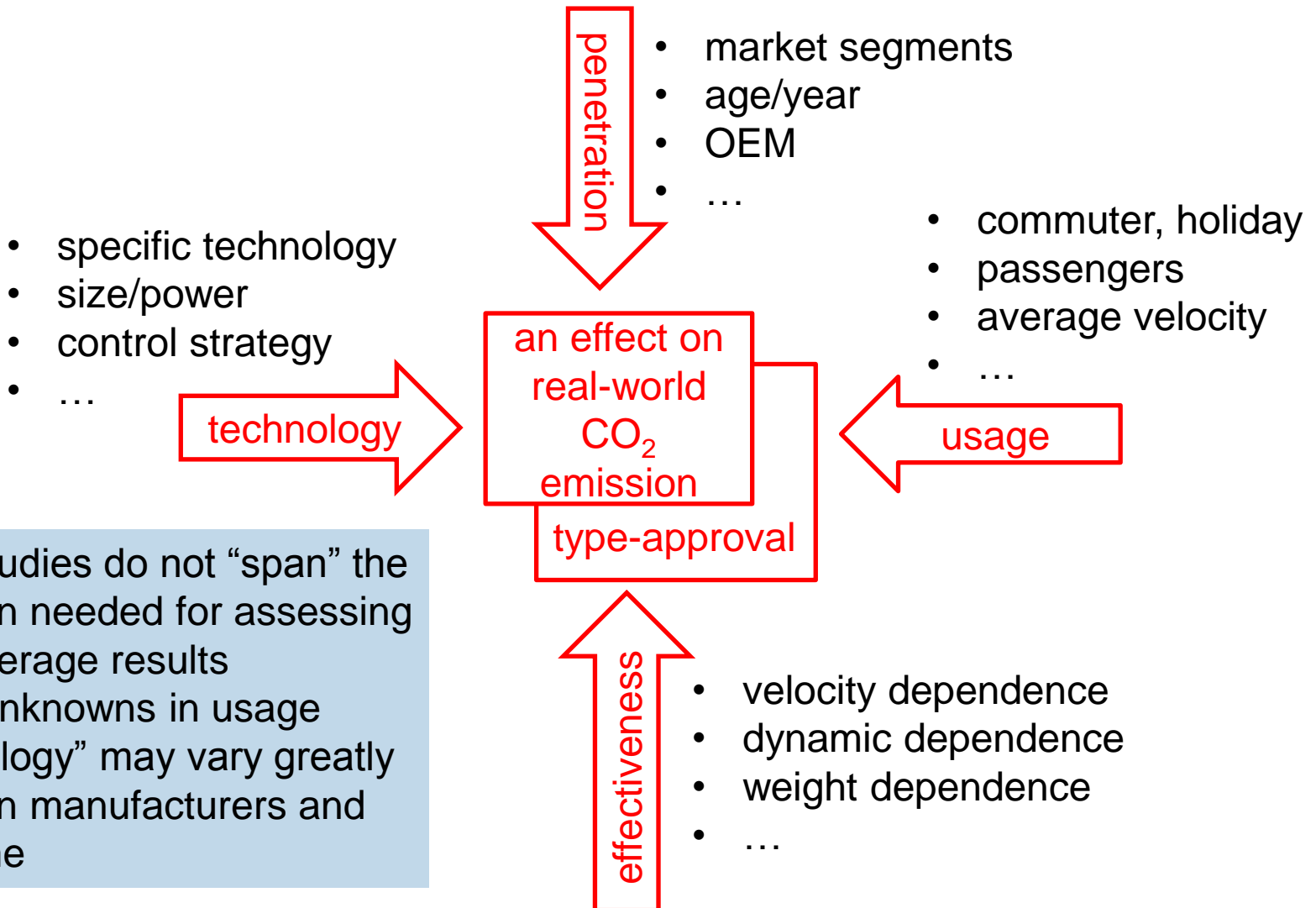


Modelling on the basis of conservation of energy *by decomposition and assigning*





From an individual vehicle on a specific test to fleet average results for average usage: *a tenuous link*



- most studies do not “span” the variation needed for assessing fleet average results
- many unknowns in usage
- “technology” may vary greatly between manufacturers and with time



What we will not do:

- › **Predict the CO₂ type-approval value of a (individual) vehicle model based on its characteristics**
 - *The engineering intelligence of the OEM is taken “as is”, the analysis is on de “delta” between TA and RW*
- › **Base total impact of all identified measures on simple weighted sum of magnitude x likelihood/penetration**
 - *For most effects there is no sound basis for likelihood/penetration at fleet level*
 - *Typically combining the estimates of many small effects leads to an overestimation of the total effect*
- › **Assume a fixed effect of a certain aspect**
 - *Effects depend on usage, behaviour, etc..*
 - *Furthermore, different effects may interact and partly cancel each other. This must be incorporated.*



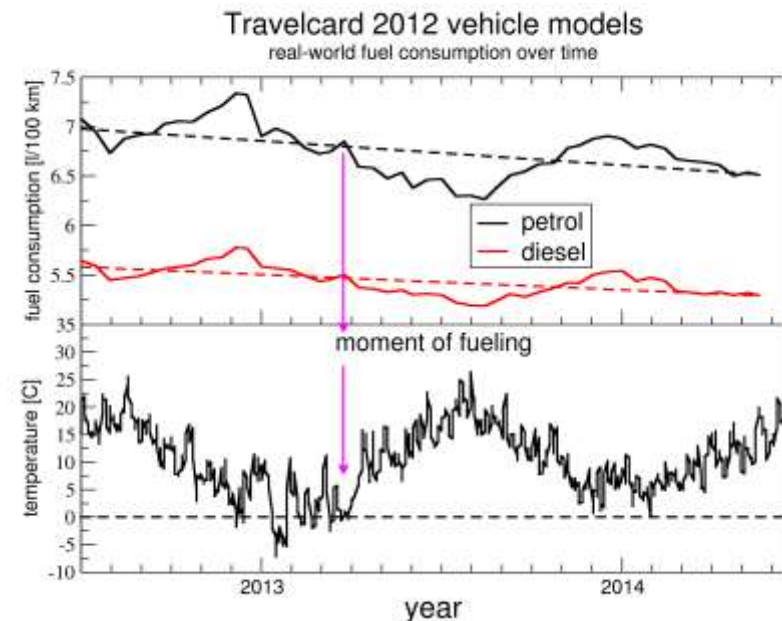
What we will do:

Decompose the total fuel consumption into (non-overlapping) parts (generic groups: rolling resistance, air drag, losses ...)

- specific fuel consumption (“cylinder pressure”) as “ideal efficiency”
- Willans lines (RPM x torque) like approach

Group effects into “stages” for which validation data is available

- › weight specific
- › age specific
- › temperature specific
- › test cycle specific
- › vehicle model specific
- › congestion specific
- › use specific
 - › e.g. holiday travel
- ›





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