ELIPTIC
Task 3.4: Conventional Full Evaluation, the test result

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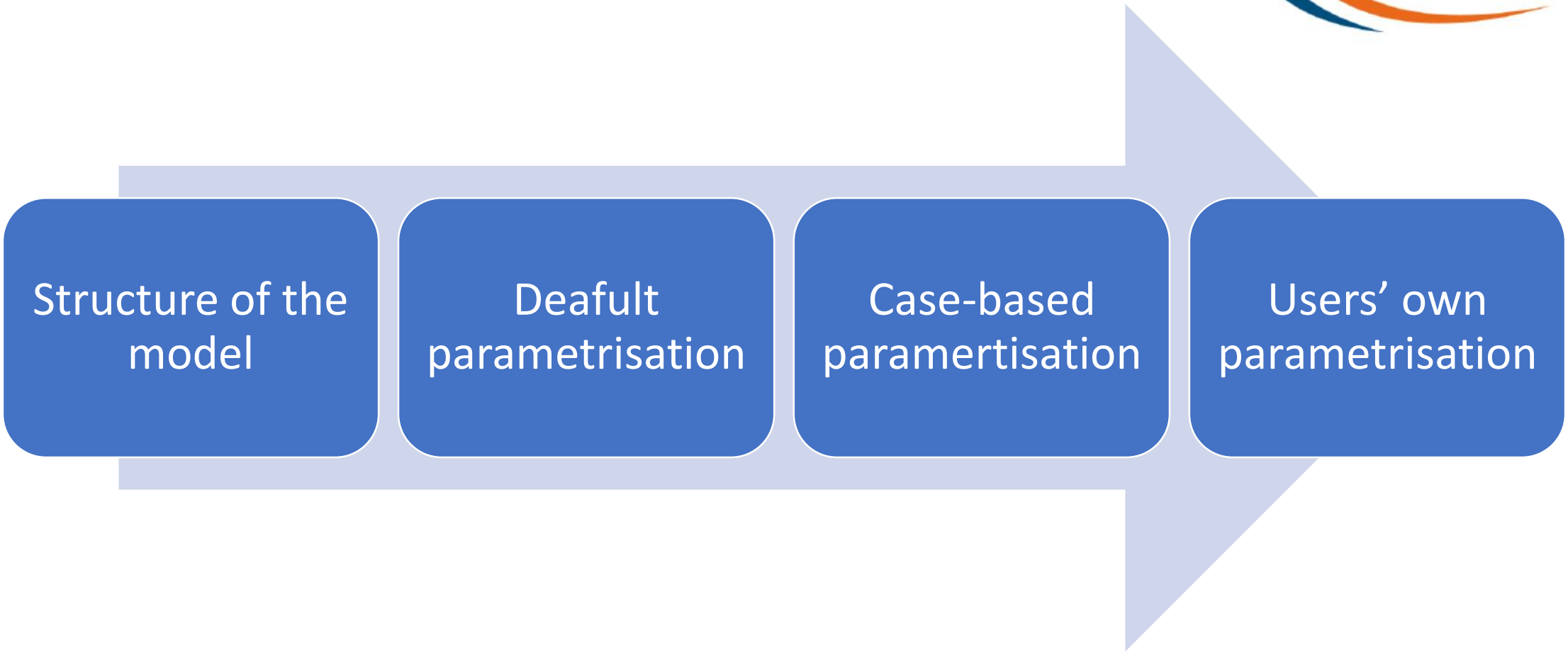
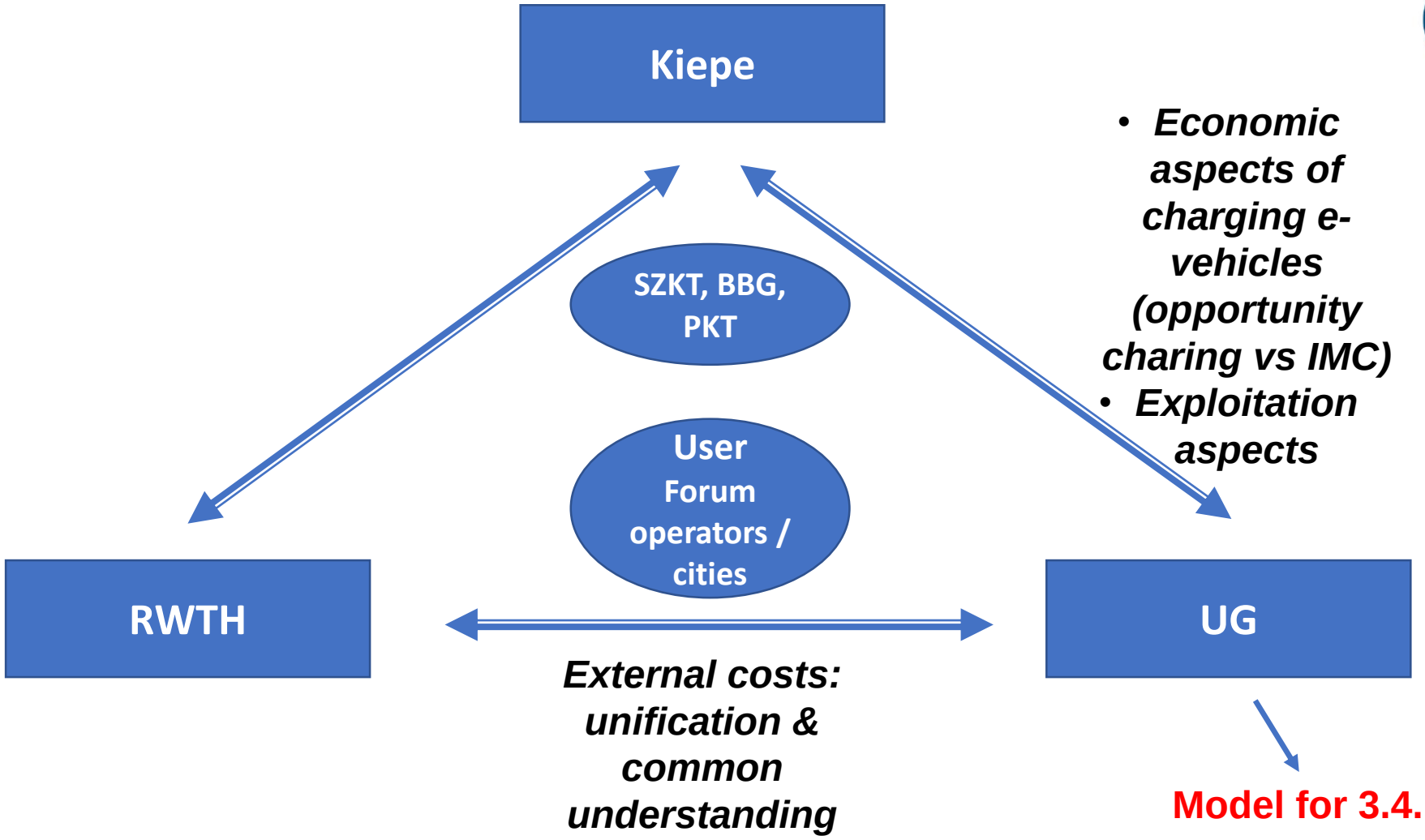
Work structure



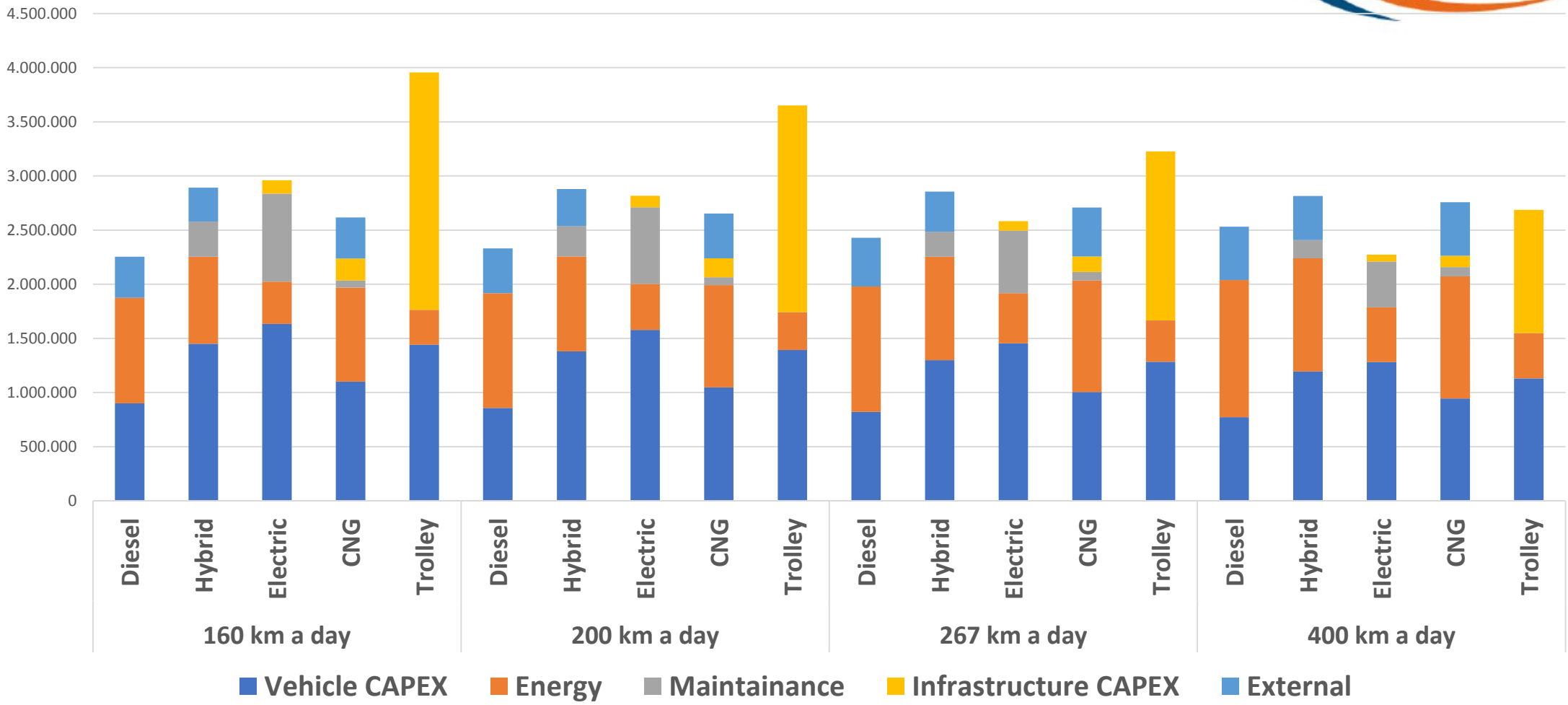
Interactions between WP2, WP 3 and WP 4



- *Economic aspects of charging e-vehicles (opportunity charing vs IMC)*
- *Exploitation aspects*

Current model – output format

Lifecycle cost in PLN depending from daily mileage (EUR in target model)



Main questions to the model

- What is the optimum way to introduce electromobility?
  - (1) Electric small battery + opportunity or
  - (2) Electric big battery + overnight or
  - (3) Electric small battery + overhead charging

  Answer will be given by one model

  - (1) Electric vehicles only or
  - (2) electric vehicles on selected lines and all-week duties?

  Answer will be probably given by comparison of two models

- Under what circumstances?
  - Existing trolleybus network?
  - Green energy available?

  Answer will be given by comparison of two models

Lifetime, mileage and residual value assumptions

- Up to 1 000 000 km mileage of the bus – 10-25 years lifetime
- Residual value – as shown in the table
- 4% discount rate

To be added:
(1) Electric small battery + opportunity
(2) Electric big battery + overnight
(3) Trolleybus: Electric small battery + overhead charging
Electric / oil heating?
as separate modes - instead of Hybrid / CNG

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Lifetime mileage	1000000	1000000	1000000	1000000
Yearly mileage	40000	50000	66667	100000
no of years	25	20	15	10
Daily mileage	160	200	267	400
Residual value				
Diesel	0%	10%	15%	20%
Hybrid	0%	10%	18%	25%
Electric	10%	15%	25%	35%
CNG	0%	10%	15%	20%
Trolley	10%	15%	25%	35%
Discount rate	4%			

Vehicle CAPEX

- According to the Polish market research
- Will be updated using Europe-wide study

	EUR	PLN
Diesel	209 302	900 000
Hybrid	337 209	1 450 000
Electric	395 349	1 700 000
CNG	255 814	1 100 000
Trolley	348 837	1 500 000

To be added:
Higher number of vehicles needed in some cases
Higher number of employees added in some cases

Energy

- According to the Polish market research
- Will be updated using Europe-wide study

	Usage / 100 km	Unitary price PLN	Price per 100 km PLN	Unitary price EUR	Price per 100 km EUR
Diesel	40	3,75	150,00	0,87	34,88
Hybrid	33	3,75	123,75	0,87	28,78
Electric	150	0,40	60,00	0,09	13,95
CNG	50	2,67	133,74	0,62	31,10
Trolley	165	0,30	49,50	0,07	11,51

To be added:
Lower consumption for trolley
Separate price per kWh and power available

Maintenance

- Current approach – differences against Diesel only – may be amended

- Electric – ca. 11 500 EUR / year assumed for battery exchange – for example 172 kEUR for the 15 years period (one exchange after 15 years)

	EUR / 10 000 km	EUR / year
Diesel	0	0
Hybrid	0	4 651
Electric	0	11 628
CNG	233	0
Trolley	0	0

To be added:
Lower cost / 100 000 km for Electric / Trolley (no oil, filters)
Separate price per kWh and power available – to differentiate slow, overhead and opportunity charging properly

Infrastructure CAPEX

- Ca. 160 kEUR assumed per opportunity charger – 25 years lifetime (?), 5 buses a charger
- Ca. 11.5 kEUR assumed per night charger – 25 years lifetime, 1 bus a charger
- Overhead construction for trolley and depot upgrade for CNG assumed
- Infrastructure OPEX omitted (except trolley)

To be added:

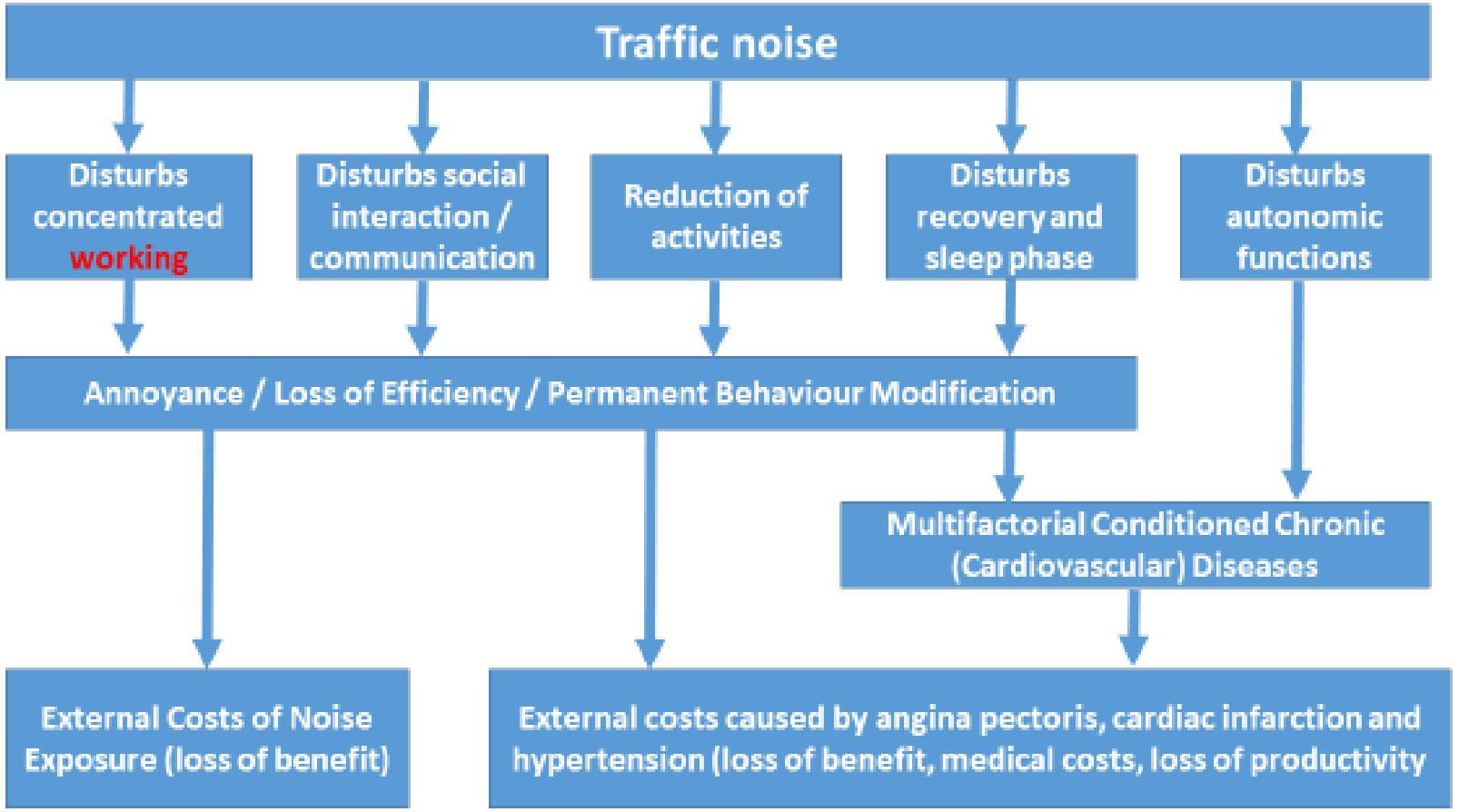
….

External costs

- Different Energy-mix possible (example based on 100% green Energy)
- Problems with Euro norms – emission/km recalculation
- Input will be reviewed basing on current studies
- More than one output graphs for one model possible – including and excluding emission (urban vs. countrywide point of view)

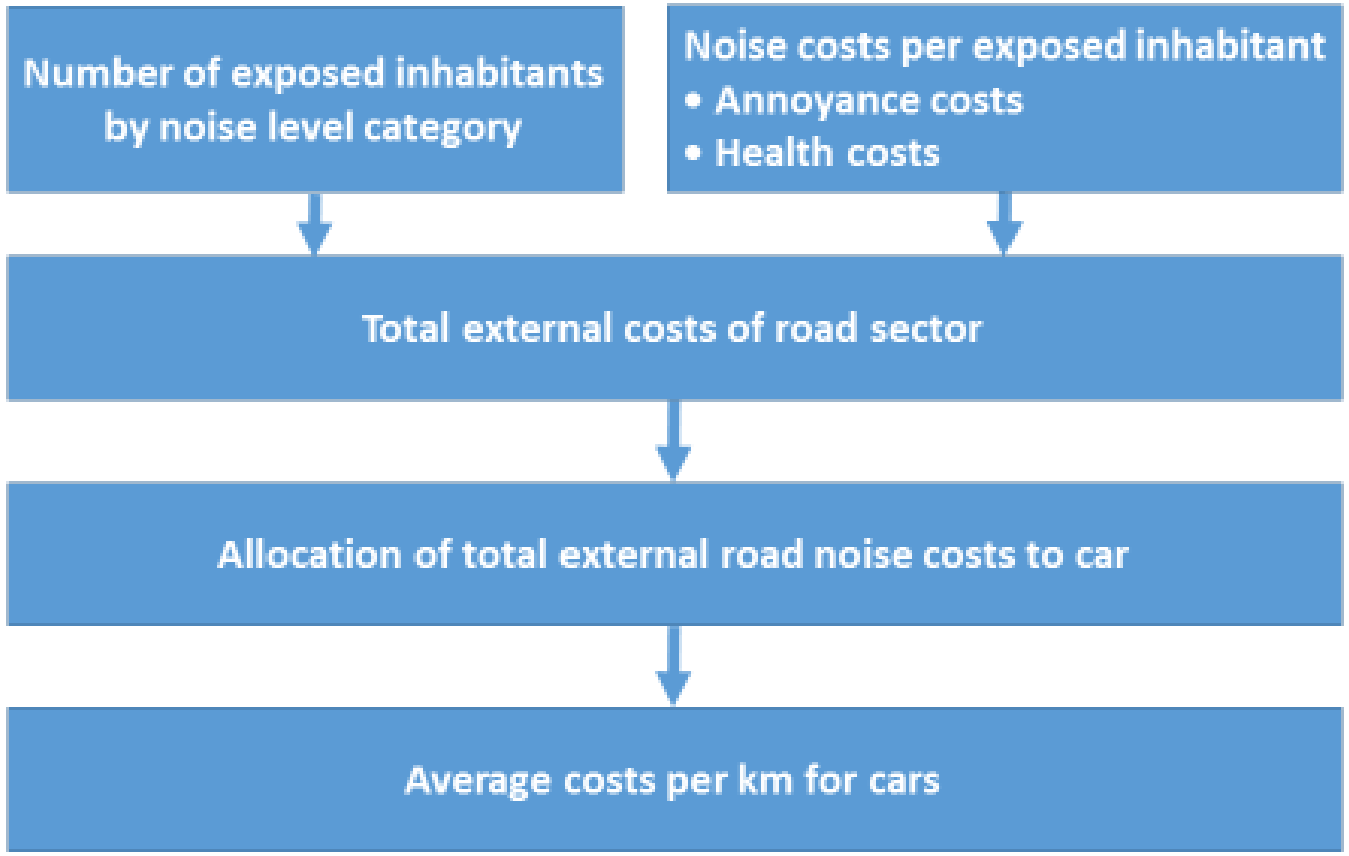
To be added:
Fully new study
Different perspectives (?)
Automatic generation of outputs for different Energy-mixes (?)

Noise effects and related costs



Source: The True Costs of Automobility: External Costs of Cars Overview on existing estimates in EU-27

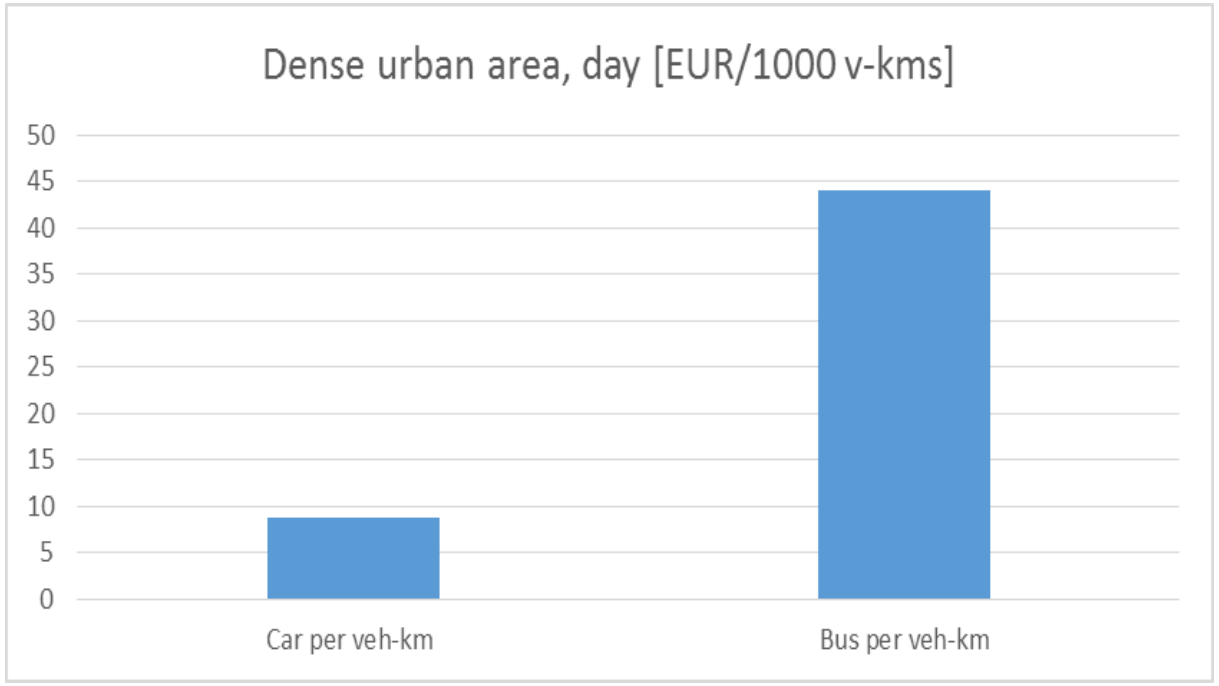
Methodology of Calculating Noise Costs



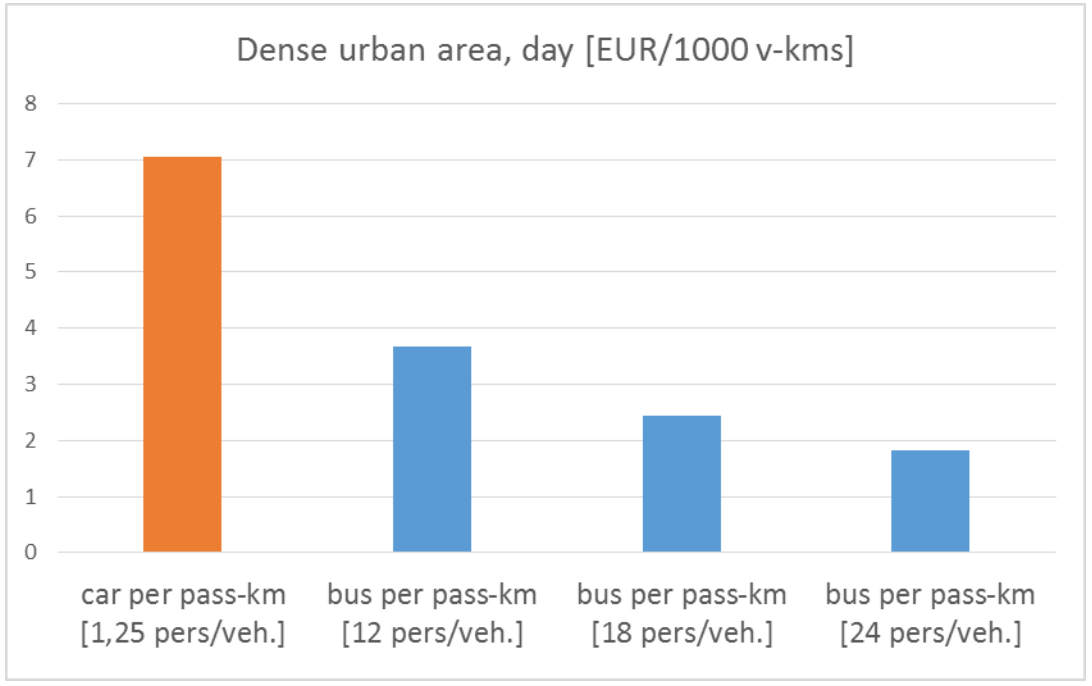
Source: The True Costs of Automobility: External Costs of Cars Overview on existing estimates in EU-27

Assumptions are important!

Marginal noise cost calculation per vehicle-km



Marginal noise cost calculation per passenger-km



Source: self-study based on „Update of the Handbook on External Costs of Transport Final Report"

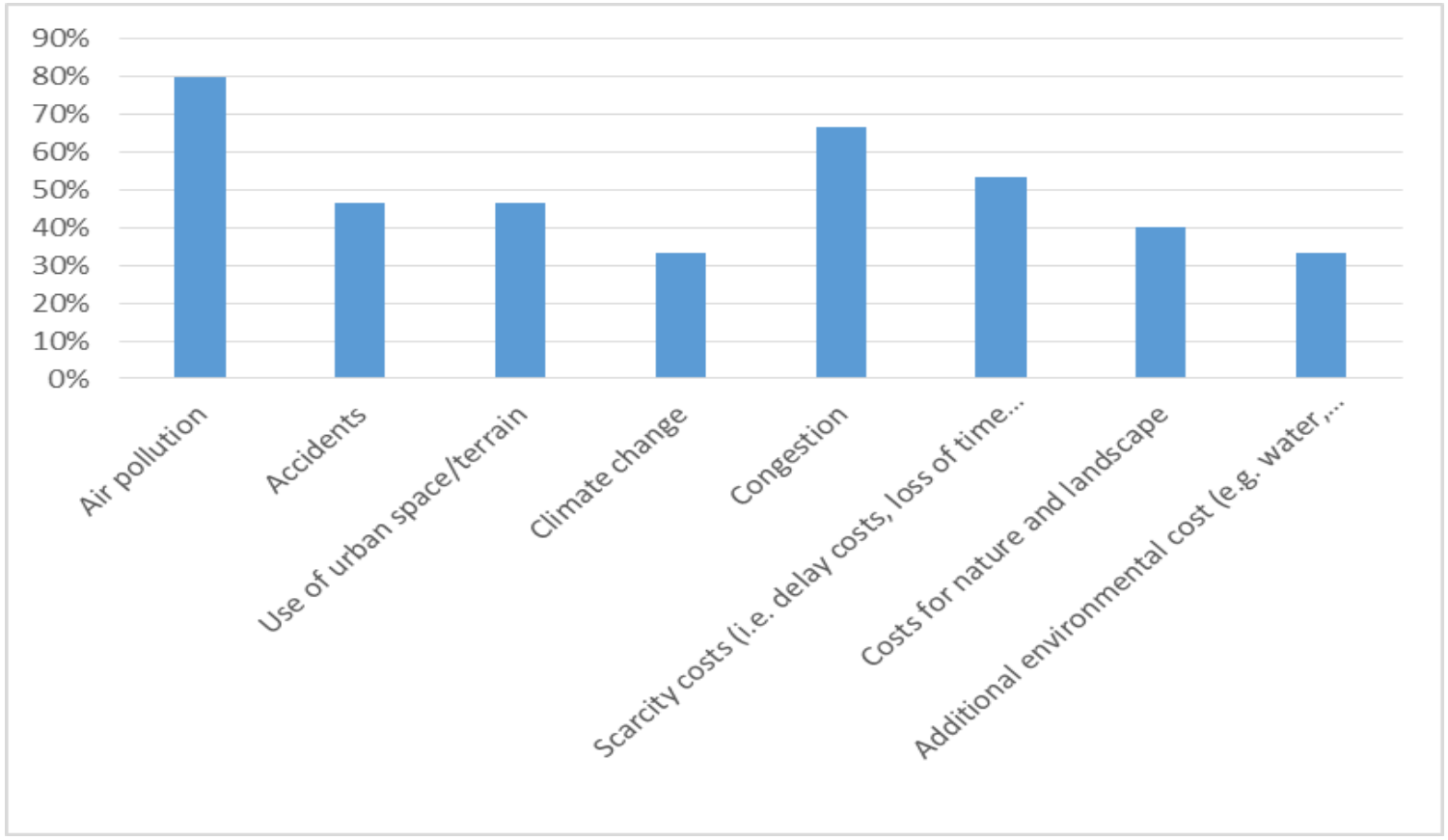
Marginal noise costs differences between European countries

Marginal noise costs lower than average [<90%]	Bulgaria, Romania, Latvia, Lithuania, Croatia Poland, Estonia, Hungary ,Slovakia, Czech Republic Portugal, Malta, Slovenia
Average marginal noise costs +/- 10%	Greece, Cyprus, Spain, Italy, France
Marginal noise costs higher than average [>110%]	United Kingdom, Finland, Germany, Belgium, Sweden, Austria, Denmark, Ireland, Netherlands, Luxembourg

Source: Update of the Handbook on External Costs of Transport Final Report

Results of the questionnaire research among User Forum Members, 05.2017

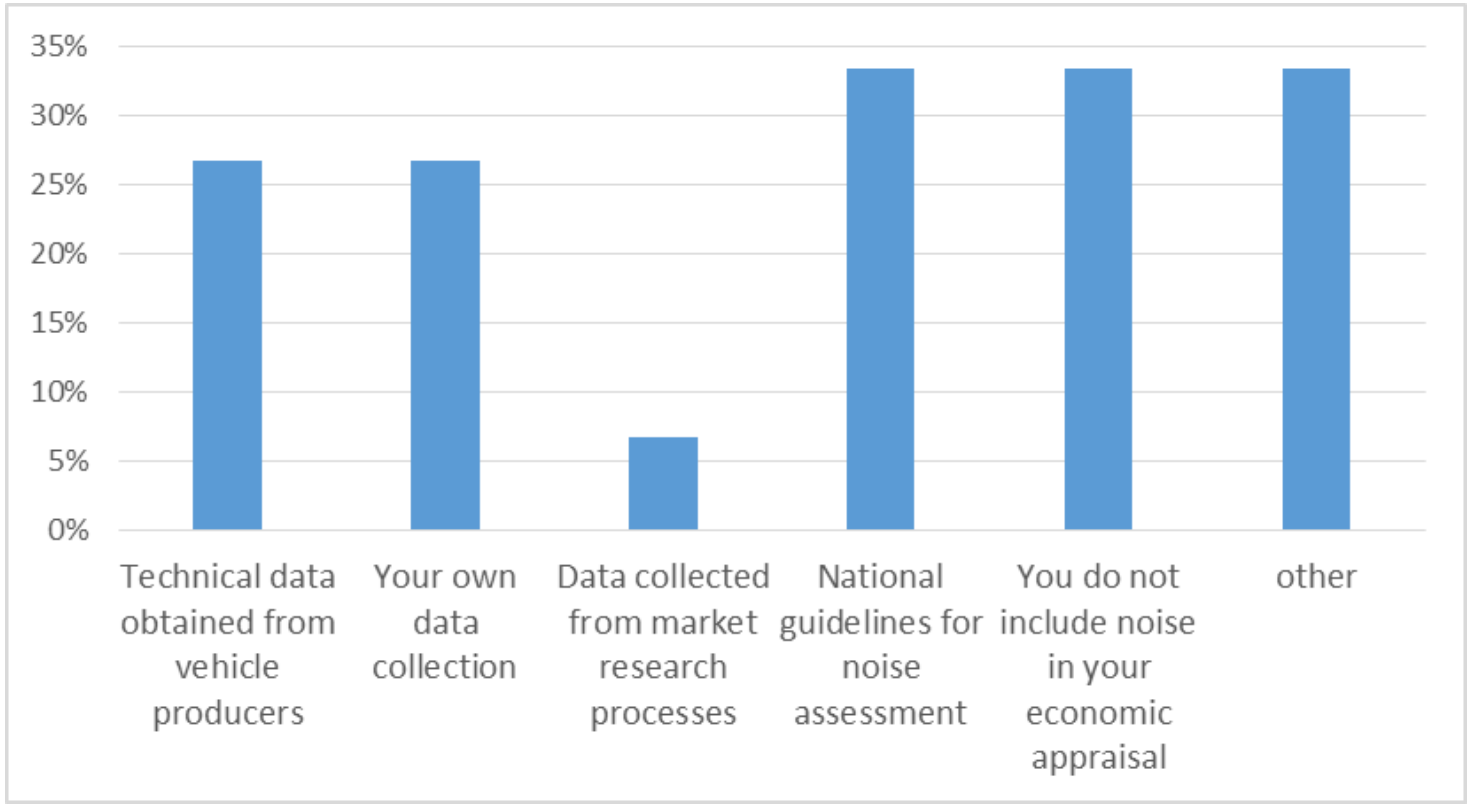
External costs taken into account in feasibility studies



[n=15, ELIPTIC questionnaire, May 2017]

Results of the questionnaire research among User Forum Members, 05.2017

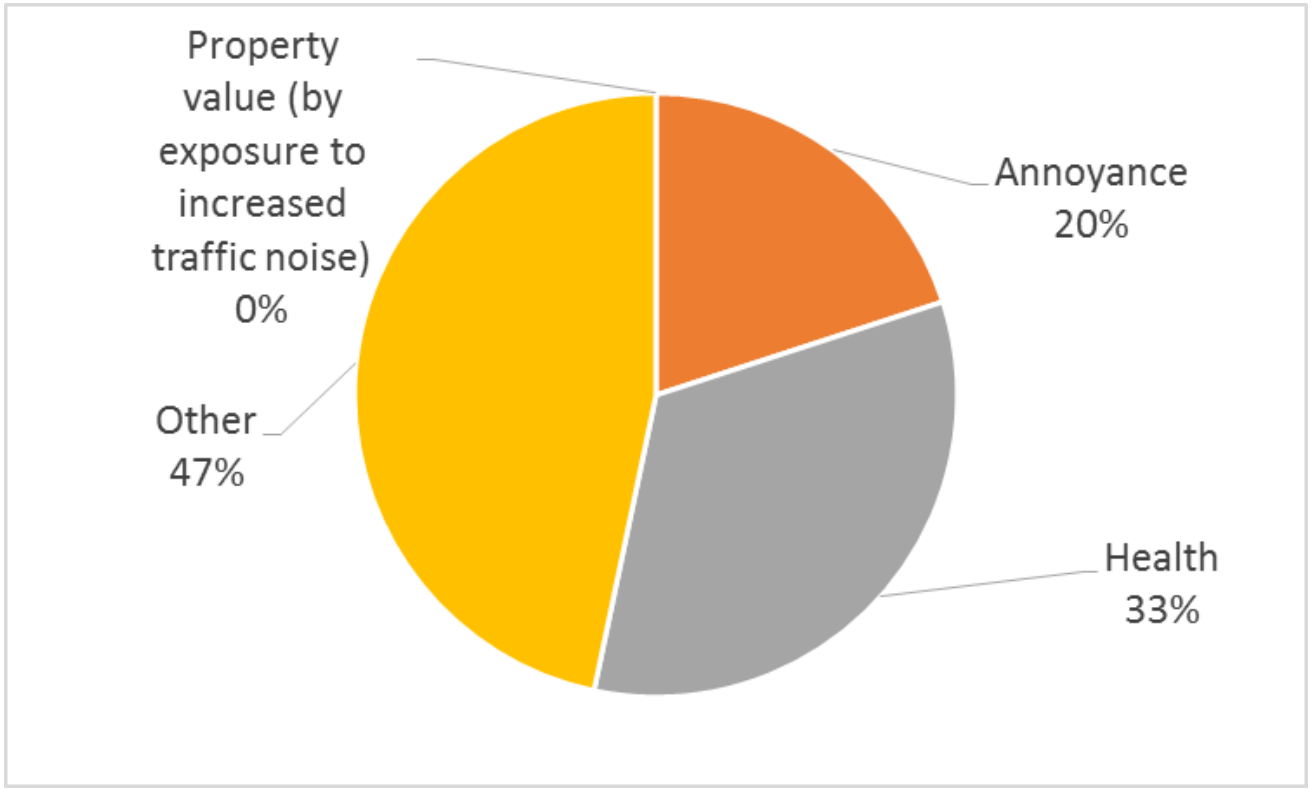
How do you include noise as a cost category in economic appraisal of public transport projects?



[n=15, ELIPTIC questionnaire, May 2017]

Results of the questionnaire research among User Forum Members, 05.2017

If you take noise into account in your appraisal, what type of specific impact do you evaluate?



[n=15, ELIPTIC questionnaire, May 2017]

Results of the questionnaire research among User Forum Members, 05.2017

How do you include lack of local emissions in the economic appraisal of public transport projects?

- „Lack of local emissions is not factored into the appraisal but assessed as part of the environmental impact”
- Following national /EU level rules guidelines: 4
- Recalculation CO2 reduction impact
- Included in air quality aspects

[n=15, ELIPTIC questionnaire, May 2017]

Results of the questionnaire research among User Forum Members, 05.2017

How do you include costs of health in economic appraisal of public transport projects?

- online tool that standardises impacts and benefits for financial quantification evaluation of the entire transport system;
- included in noise-reduction plans;
- number of hospitalizations and costs
- recalculated into reduced CO2 emissions.
- using European and local standards to calculate equivalent money value for local reduction in health problems
- not taken into account: 8

[n=15, ELIPTIC questionnaire, May 2017]

Further actions

- Costs of drivers?
- A need of increased numer of e-buses to replace diesel fleet (i.e. Eindhoven);
- Battery lifetime and type (a risk of technological development);
- Unification of noise approach;
- Hybrid trolleybus vs. classic trolleybus (lower costs of infrastructure vs. higher costs of batteries in the LCC of the vehicle);
- Diversification of electric buses (stronger battery vs. Smaller battery + higher capital costs).