



eLCAr

Vehicle consumption estimation for the LCA of BEVs

First eLCAr Workshop – Working Group 2

ETH Zurich 12.6.2012

A. Del Duce



Materials Science & Technology

LCA of vehicles

Problem-shifting



Electricity production



Car disposal

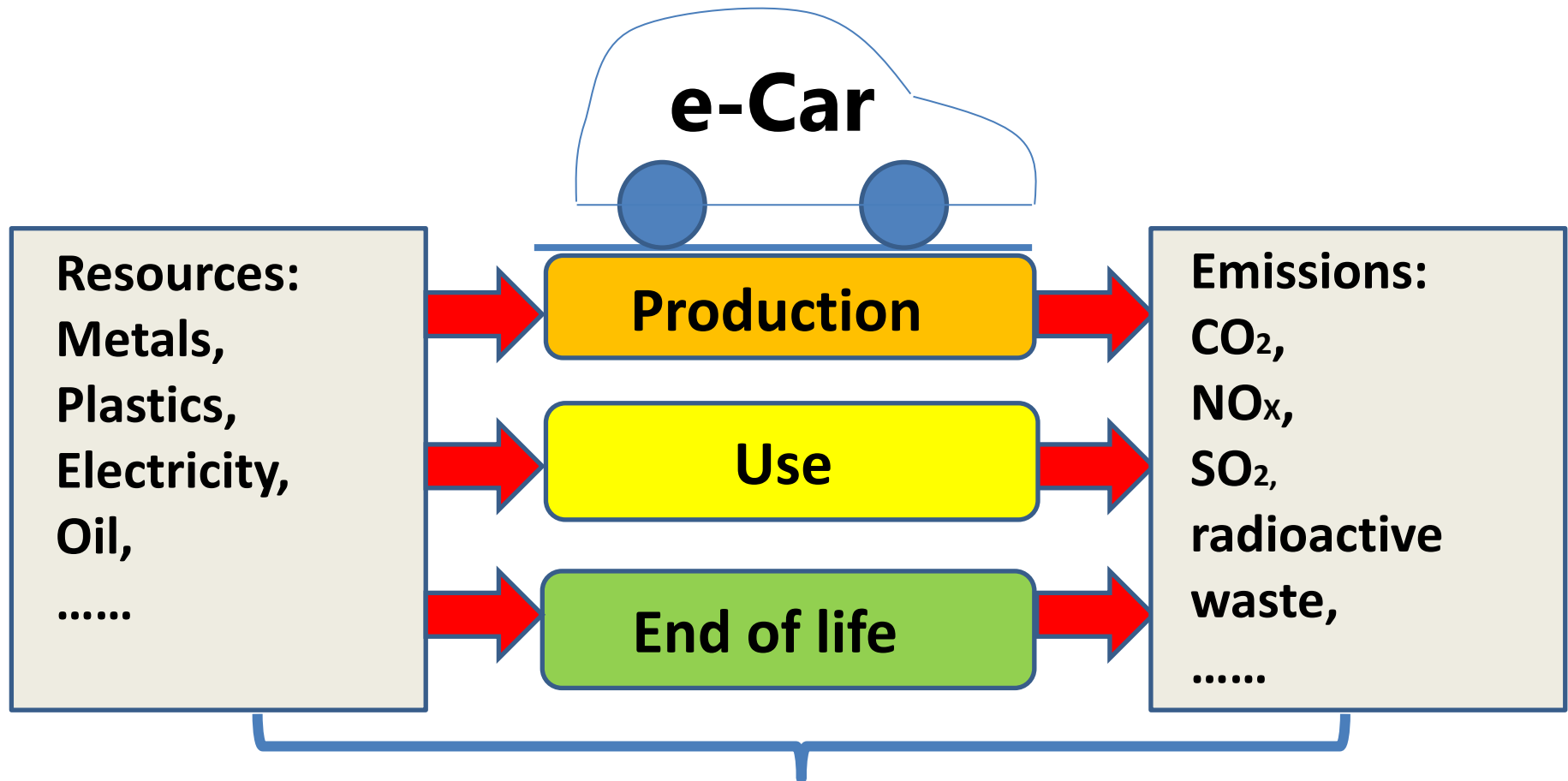
Materials production



Mining



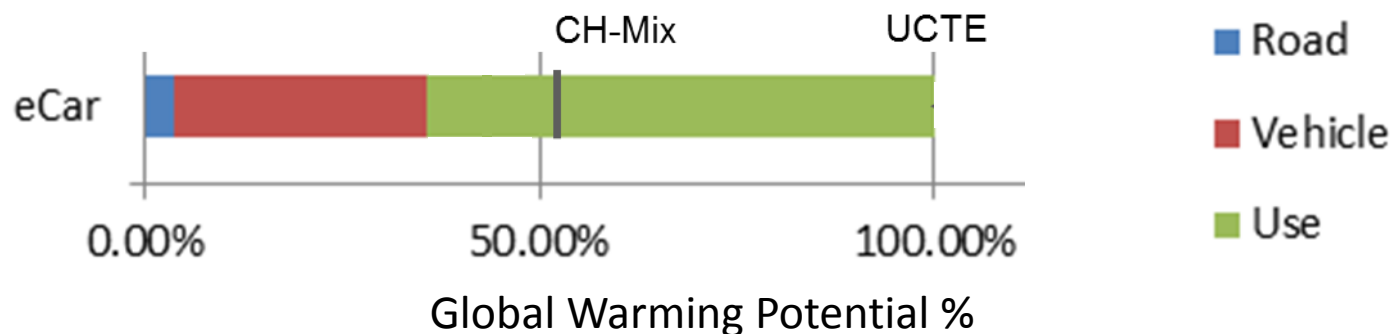
LCA of vehicles



Impact factors: Global warming,
Resource consumption, Toxicity, etc.

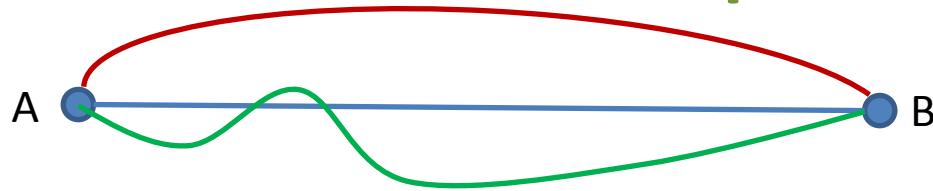
The use phase of BEVs

Main contribution in BEVs' use phase:
electricity for battery charging due to vehicle consumption



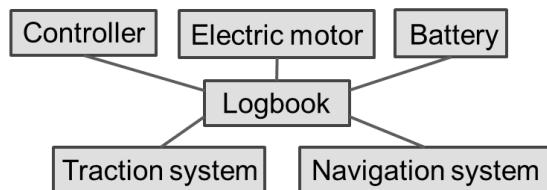
The use phase can have a dominant influence on the impact of a BEV, consumption needs to be evaluated carefully!

Real-world consumption



Evaluation methods

- Fleet measurements (300 e-smart, 600 e-Mini):



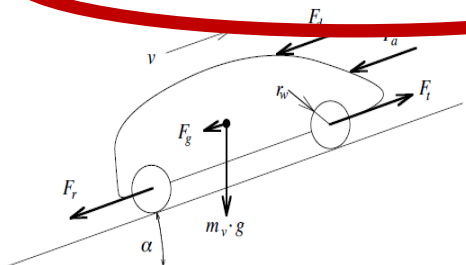
- Can incorporate a large variety of driving situations!
- Slow and expensive, difficult to get hold of data. vehicle specific.

Chassis Dynamometer Measurements:



- Allow to measure very specific data of the vehicle.
- Slow and expensive, vehicle and testing situation specific.

Theoretical calculations:



- Fast and relatively cheap, can be performed for a number of different vehicles/situations.
- Lack of information, difficulty of modelling the dynamics of some components.

Aim: define an effective calculation methodology and framework to increase comparability of LCA studies!

Real world consumption: Driving

Driving cycles?

ICE vs BEV driving?

correction factors?



Regenerative braking?

geographical factors?

Temperature dependence

**Impact on vehicle
performance?**

Use of heating?



Use of cooling?

Climatic zones?

**Different technologies/ use
in ICEs vs BEVs?**

Other auxiliaries

Safety?

Lights?

windscreen wipers?



Radio?

Navigation system?

Gaming?

Procedure and corrections

- 1) Assessment of electric energy required to sustain a specific motion defined through a driving cycle
- ↓
- 2) Real world correction : possible correction to obtain from the driving cycle assessed energy, one more consistent with real world values.
- ↓
- 3) Regenerative braking correction
- ↓
- 4) Temperature correction (only due to influence on vehicle performance)
- ↓
- 5) Temperature correction (heating, cooling)
- ↓
- 6) Other auxiliaries correction
- ↓
- Real-world consumption: contribution of 1) and all corrections

Conclusions

- Aim of the working group: present a framework for consumption calculations and discuss the main parameters influencing the procedure.
- Main areas of discussion:
 - Influence of driving
 - Influence of temperature (including heating and cooling)
 - Other auxiliaries