Electric vehicle batteries

What environmental risks do the batteries add to electric vehicles and how can we handle them?
Electrification
– a shift in the life cycle environmental impact of cars

- Use phase decreases in importance
- The production phase increases in importance, largely because of the battery

Example medium sized car, 180000km life

*Graphics based on LCA results from Ellingsen et al 2016 - The size and range effect: lifecycle greenhouse gas emissions of electric vehicles*
Battery production impact

- We often talk about battery emissions in terms of kg CO2/kWh battery

- Example on previous slide has an impact of 131 kg CO2/kWh battery with a 24,4 kWh battery

Unfortunately reality is not as simple as one answer...
Battery production impact

- A review of available LCAs in 2016 showed highly varying results
Battery production impact

- Conclusion from previous slide?

- There are reasonable variation in the results due to
  - Different production location (i.e. electricity mix in production)

- We need to work hard to get better data
  - From actual production
  - Updated

- The data is good enough to support general conclusions
Where do the emissions occur?

- **Mining**: 20% CO2 emissions
  - Uncertain division between mining and post processing
- **Material processing**: 20% CO2 emissions
- **Manufacturing**: 50% CO2 emissions
  - Cell material: 40-70%
  - Cell manufacturing: 30-70%
  - Other manufacturing and assembly: 0.5-5%
  → Cells contribute almost all of the manufacturing impact
- **Use**: 10% CO2 emissions
- **End of life**:
Exemplifying improvement potential

- Cells contribute up to 70% - mainly due to use of fossil based electricity
- By only targeting this stage and its electricity the reduction potential is significant!

Graphics based on LCA results from Ellingsen et al 2013 – Life cycle assessment of a lithium-ion battery vehicle pack
Moving forward

- Realizing energy efficiency and fossil-free electricity in the **high energy** stages of the production.

- Increasing the recycling, and also the processing value of the output
  - Avoided CO2 emissions
  - Material security for large scale adoption

- Batteries have a high processing value and production impact – when we have made them we should use them effectively and for as long as possible!