Sustainability of transportation in a circular world – where do composites fit in?

Dr Kevin Lindsey
“for a complex challenge there is always a simple solution and that solution is nearly always wrong. what you need to solve a complex challenge is a complex solution and that takes time”.

James George EMF 2020 / H. L. Mencken
Life Cycle Analysis

Weight saving reduces total energy usage materials and manufacturing burden

After Hall and Lutsey, 2018
Life cycle analysis

- Weight saving leads to energy saving
- Reducing emissions rather than net zero
- Going electric will help if renewable
- Light weighting to reduce battery pack size (acceleration) rather than range.
What does the future look like?

The future is led by analysis, circular in nature and made by robots.
Complexity

Not just materials, but also business models

Re-use and remanufacture
Impacts of the circular economy

• Design for re-manufacture / distributed manufacturing
• Design for extended use
• Integrated vs modular design
• Recycling is the last resort (design for the inner loops)
• New business models (leasing / Riversimple)
What do materials need to do?

- Can be productionised at a suitable cost
- Survive -45°C to +85°C operational
- Paint oven not required? (up to 200°C for 30 minutes)
- Can be readily dismantled/recycled
- Corrosion resistant to EU Specification and dirt road requirements (including CaCO₃)

What about strength / stiffness?

- Primary structural strength?
- Balance of energy usage / strength / cost
A single solution?

A single material – e.g. bio based or PET
Put together a complete solution
A complete supply chain
Can we use what we have in a better way

- Using an existing materials
- Reduce secondary processes,
- Natural fibres, reducing variability?
- Design for variability
- Sensors to define what we have
- Variable manufacturing processes to give a consistent product
• Making the most of what we have?
  − What do we need to do to use what we have?
  − A change in design / manufacturing / end users

• Having a single, complete solution that is good enough

• A focus on energy usage / life cycle analysis
  − But not too much of a focus!
  − Total energy = cost

• Driven by legislation, driven by customers
Transportation - where will the balance be?
Thank you

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