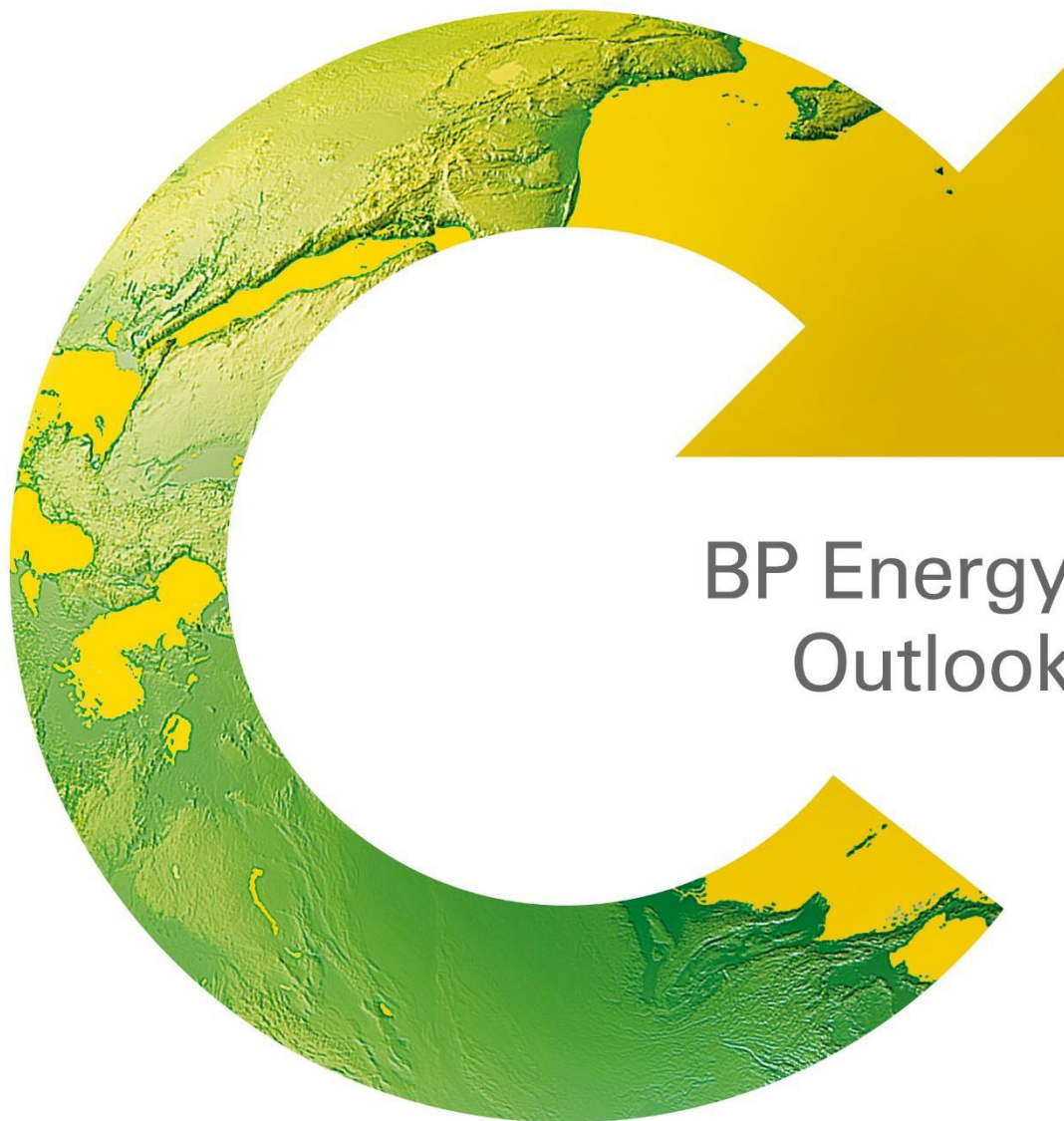




Modelling disruptions in mobility... a **BP** perspective

4 themes for today's discussion

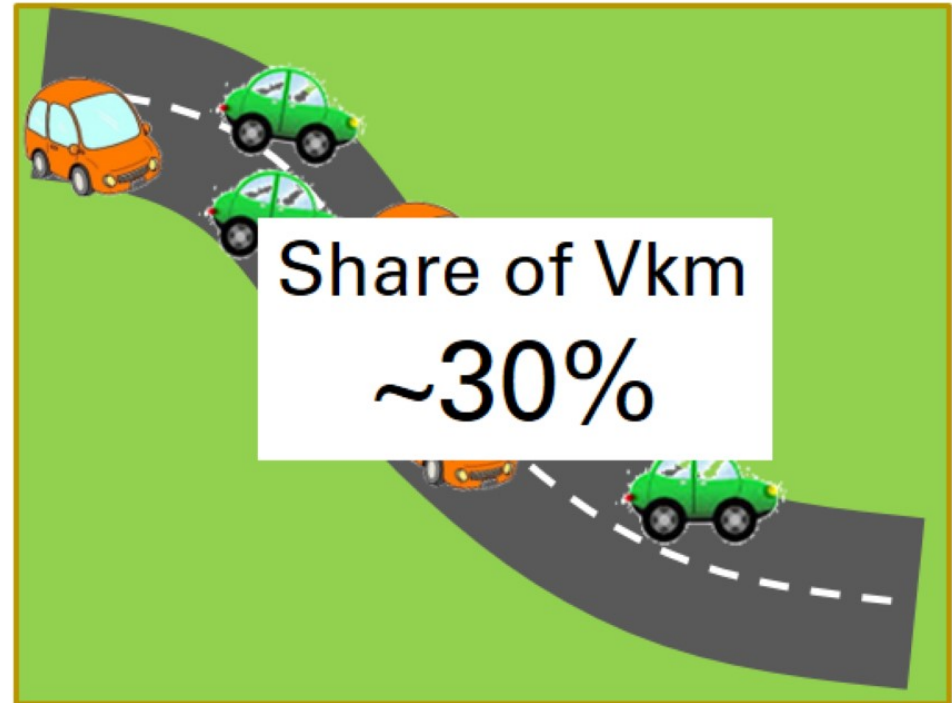
1. What have we published on this topic, and what are we pursuing for our internal needs ?
2. What has this meant in terms of model development ?
3. What have we learnt so far, and what are we doing at the current time ?
4. What insights re assumptions and model “pivot points” can we offer ?



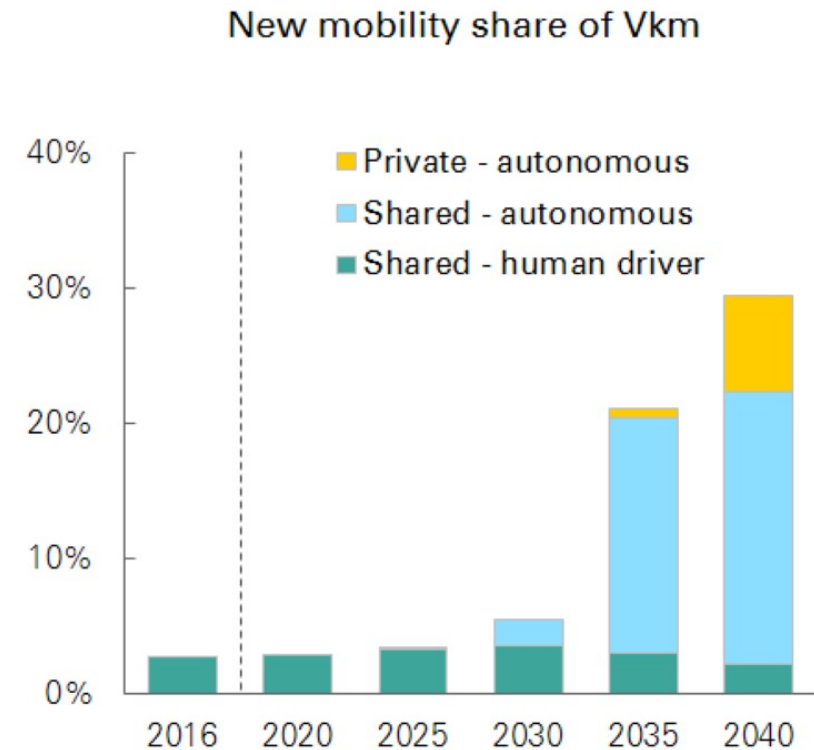
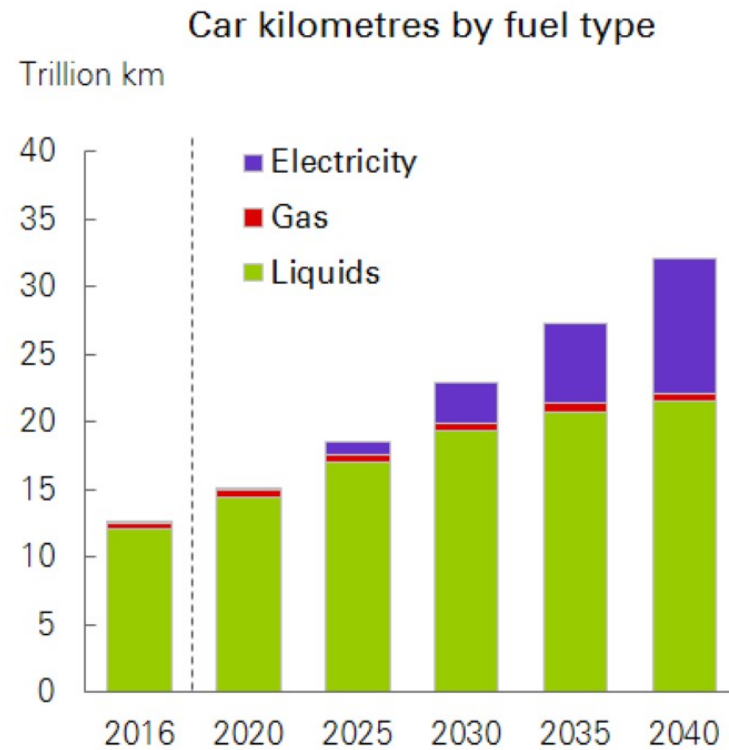
BP Energy Outlook | 2018 edition

BP energy economics
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Penetration of Electric Cars...

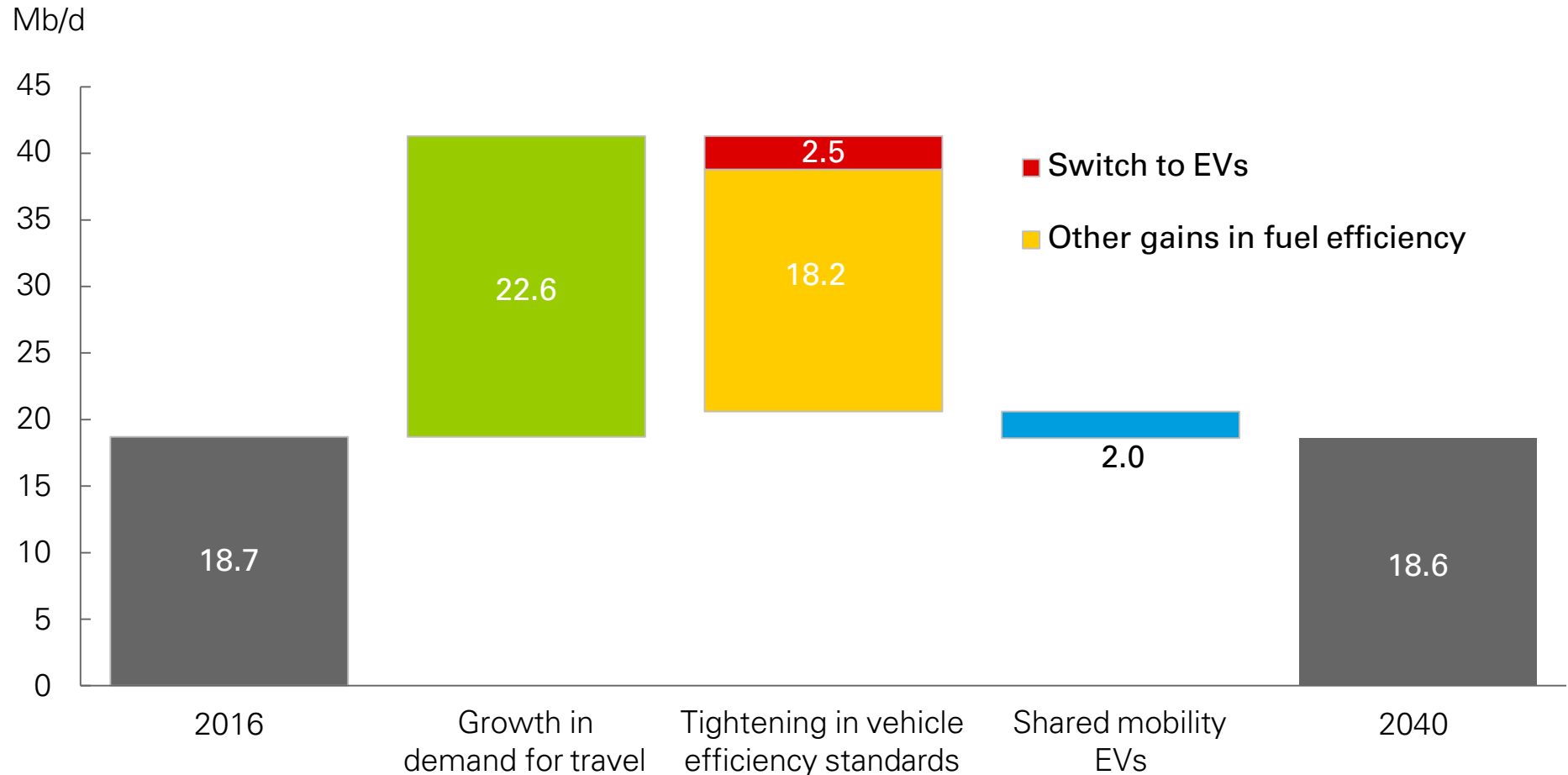


Impact of Autonomous Technology



... Liquid fuel use in cars is broadly flat

Changes in liquids demand from cars: 2016-2040



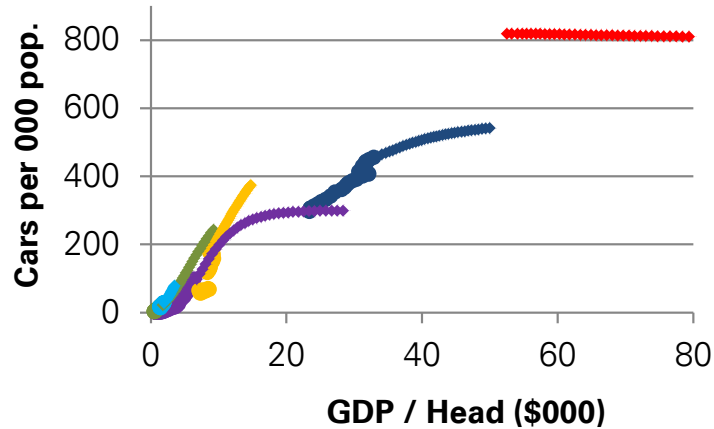
4 themes for today's discussion



2. What has this meant in terms of model development ?

**For EO18 we have used a
combination of approaches**

Growth of Vehicle Fleet



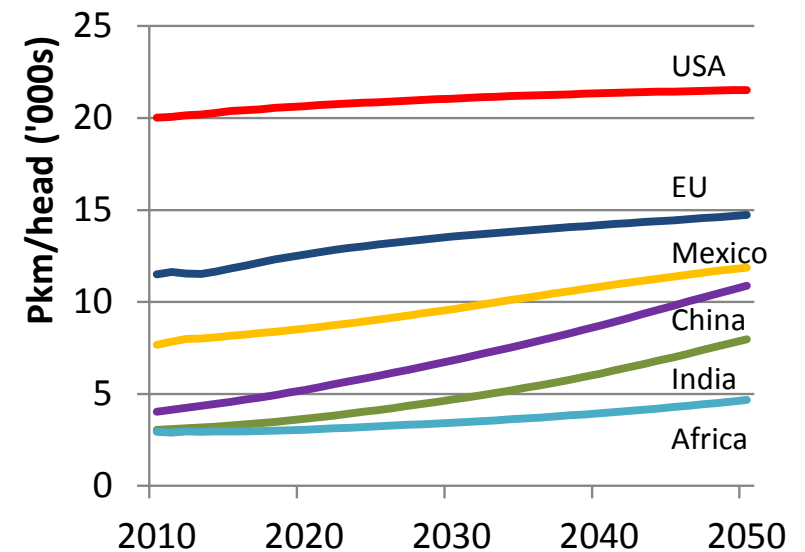
● USA (LDVs) ● Europe ● China ● Mexico ● India ● Africa

Demand 2050 model

“Old £”

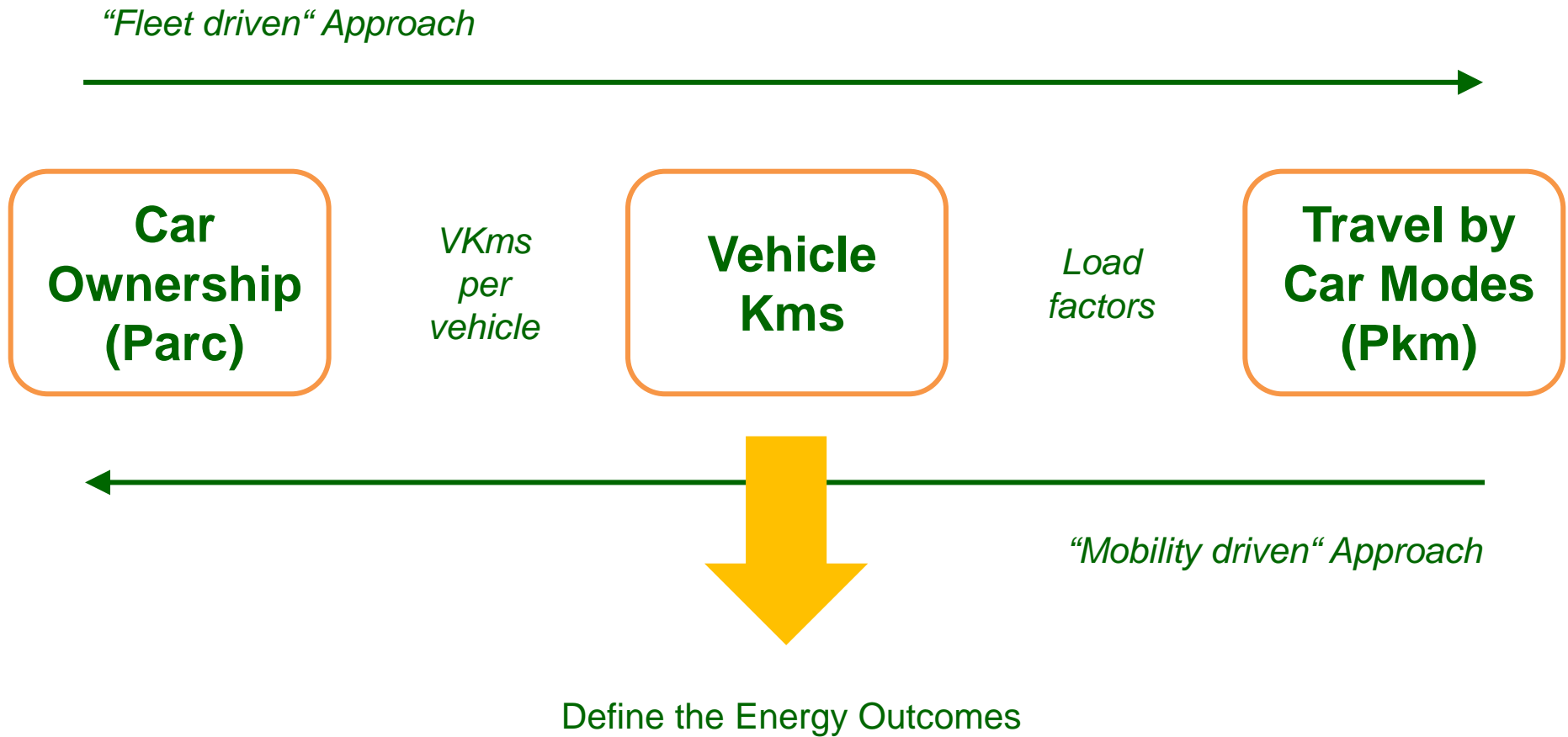
Mobility 2050 Model

“New £”



PKm Growth

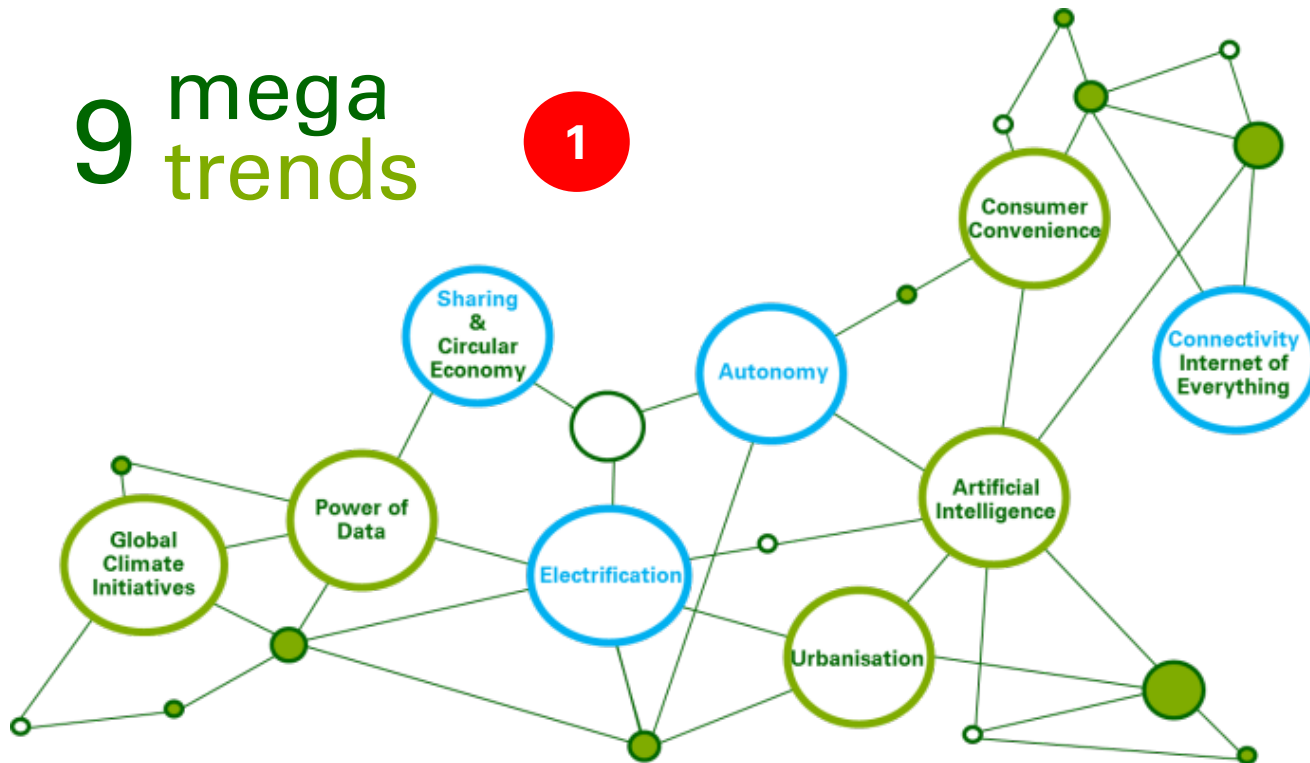
Vehicle Km are the key pivot



Our thinking has 3 foundations

9 mega trends

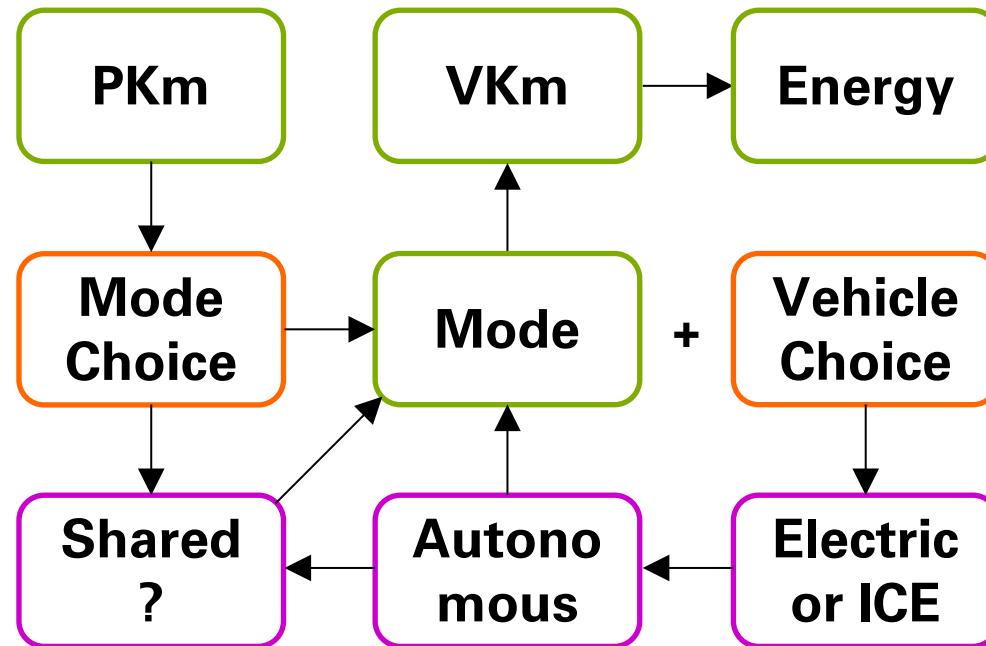
1



Our thinking has 3 foundations

2

What drives
consumer choice
on Mode of
Travel, and
Vehicles ?



Our thinking has 3 foundations

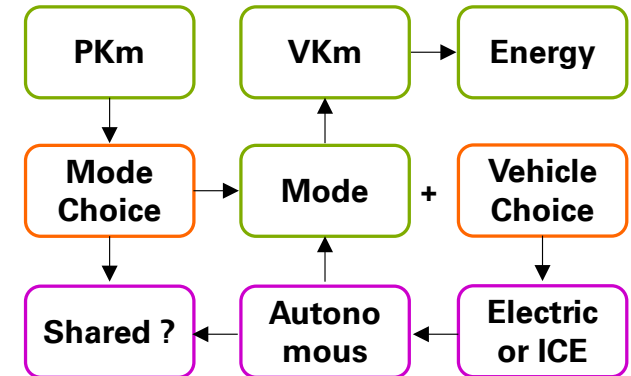
With a need to
assess Cost vs
“Convenience”...

3



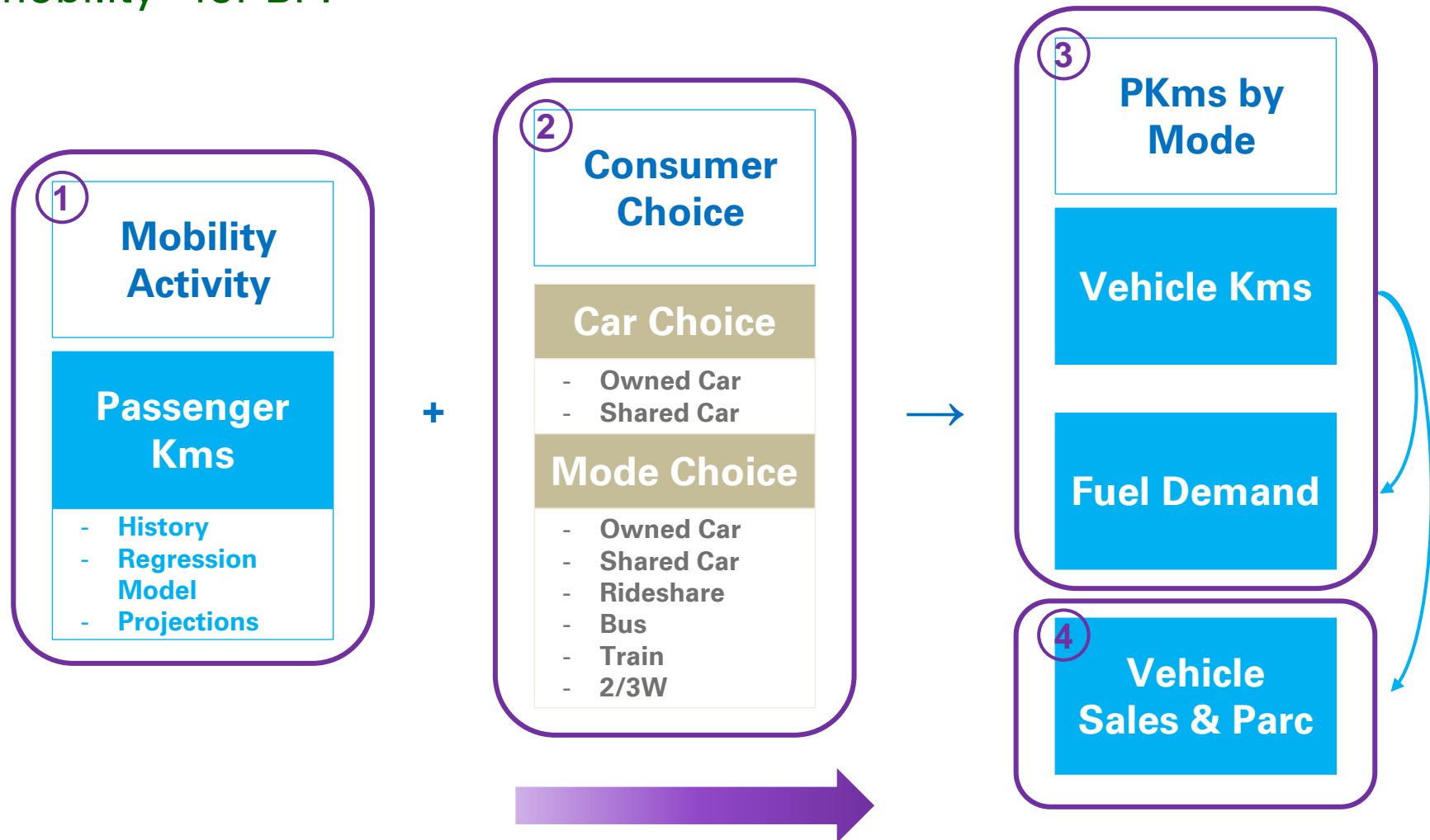
Our thinking has 3 foundations

9 mega trends



Choice modelling ...
on Vehicles, and
Modes

Mobility 2050 uses two consumer choice models to estimate mode share & quantify the impact & dimensions of “new mobility” for BP.



Diffusion curves for adoption of Sharing & AV technology

4 themes for today's discussion

3. What have we learnt so far, and what are we doing at the current time ?

Initial learnings & current programme

- For now much of the “old” paradigm remains valid, but we are absolutely convinced about the need to reflect “new” mobility into our approach to long term modelling for transportation energy. A clear challenge is to manage the evolution within our modelling.
- Personal mobility expands the modelling scope, requiring more detail & mode switch interactions to be considered. There is a complexity trade-off; the scale of changes could be very significant, particularly over the long term, for energy demand.
- New mobility requires thinking beyond techno-economic choices. It clearly involves behavioural-economic choices – but the evidence for the strength of some changes is still building – as such this inevitably requires scenario & sensitivity tools within the modelling framework.
- We built a new model, that is sizeable & complex, and we are happy with what we achieved with it, but we need to still be open to adapting our approach, and we will actively monitor alternative ones...

Initial learnings & current programme

- Phase 2 – we are clearly moving on from the initial development, into model iteration & continuous improvement
- We are currently taking on board the challenge to integrate our two models into a single model
- We are clearly wanting to test & improve the key assumptions, as well as widen our data sources & capture

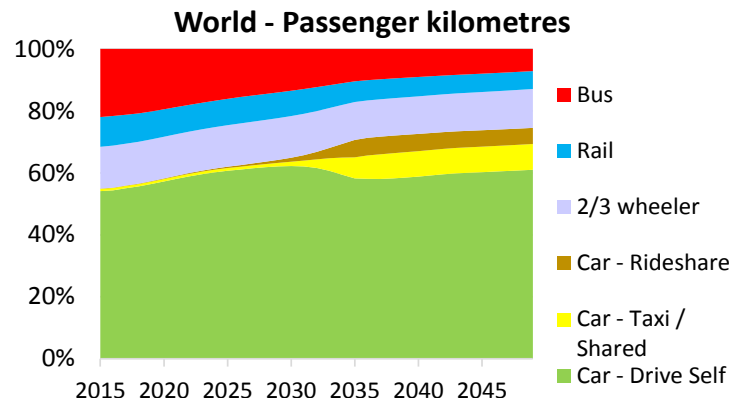
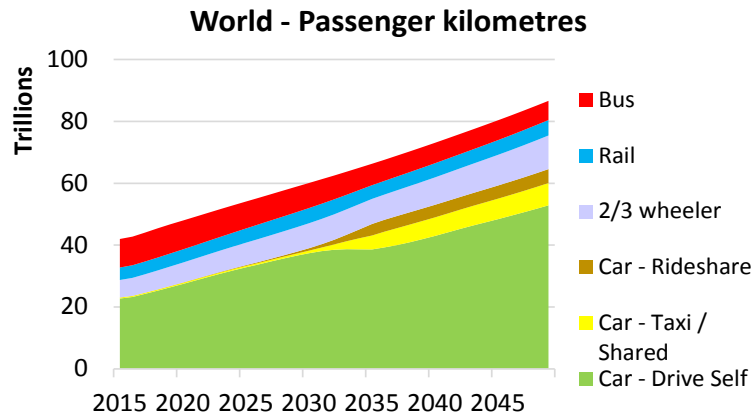
4 themes for today's discussion

4. What insights re assumptions and model “pivot points” can we offer ?

Insights on Assumptions & Pivot Points

- Consumer vs Regulatory-driven world ? There is no certainty, we believe that there is a need to consider & model both kinds of outcome for some time.
- Vehicle ownership is better understood than personal mobility – our experience is that the latter requires understanding of more factors, with more detail so it is necessary to be prepared to develop / research the necessary inputs & assumptions, particularly for a global model, that covers the entire range of settings / energy demands.
- Our initial focus has been on the movement of people as opposed to the movement of goods, but we recognise need to go there too, it is likely to require another development project...
- (The various aspects of) Consumer choice, and technology adoption are key areas... We believe the value of time is critical, and shapes the outcomes... Moreover, there is a need to think carefully about the diffusion parameters, what AV might entail, and when will the market be ready for it ?

Some takeaways from our analysis...



- **Autonomous driving** may be a stronger vector for change than powertrain electrification...
- **Autonomy supports electrification** particularly for Shared Car-based Transportation modes...
- The future **regulatory ecosystem** (for AVs, in Cities, on highways etc.) is **emerging** but not certain...
- For now, **technology development is leading**, and Consumer Adoption is likely to lag... uncertainties lie in timing and pace of the take off...
- The **convenience of personal, owned cars** may be more enduring than some suggest...