



Energy Options for Transport

Energy Research Partnership
Report launch, 21st April 2016

Key messages

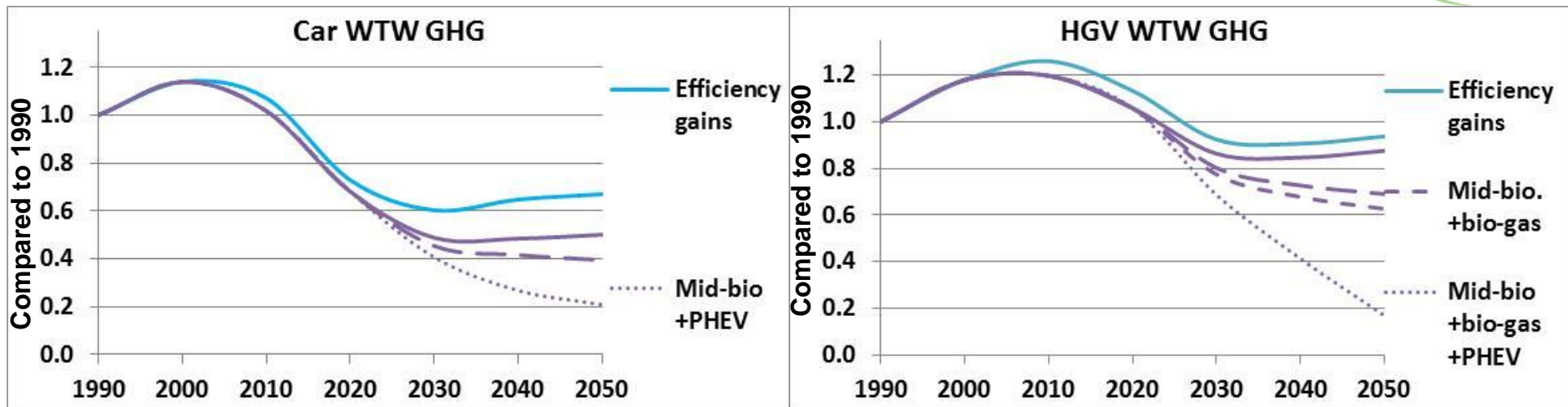


- **Range of options can cut road GHG emissions**
 - *Impacts will depend upon technology mix and timings*
- **Decisions must weigh up strategic considerations**
 - **Interactions with wider energy sector:**
 - *alternative uses of limited low-carbon energy resources*
 - *primary energy consumption and security of supply*
 - **Transport options offer different balances of:**
 - *effort of deployment*
 - *confidence of performance*
- **Steps can be taken to**
 - *aid deployment and ensure performance*
 - *manage implications*

Scenarios for road transport

- **Three scenarios considered:**
 - *ICEVs with carbon-based fuels*
 - *BEVs with low-carbon electricity*
 - *FCEVs with hydrogen*
- **Scenarios are not exhaustive, and are used to:**
 - *consider potential for ~80% GHG cuts (well-to-wheel)*
 - *highlight implications, and steps needed for delivery*

Scenario 1: ICEV Evolution



- **Key points:**

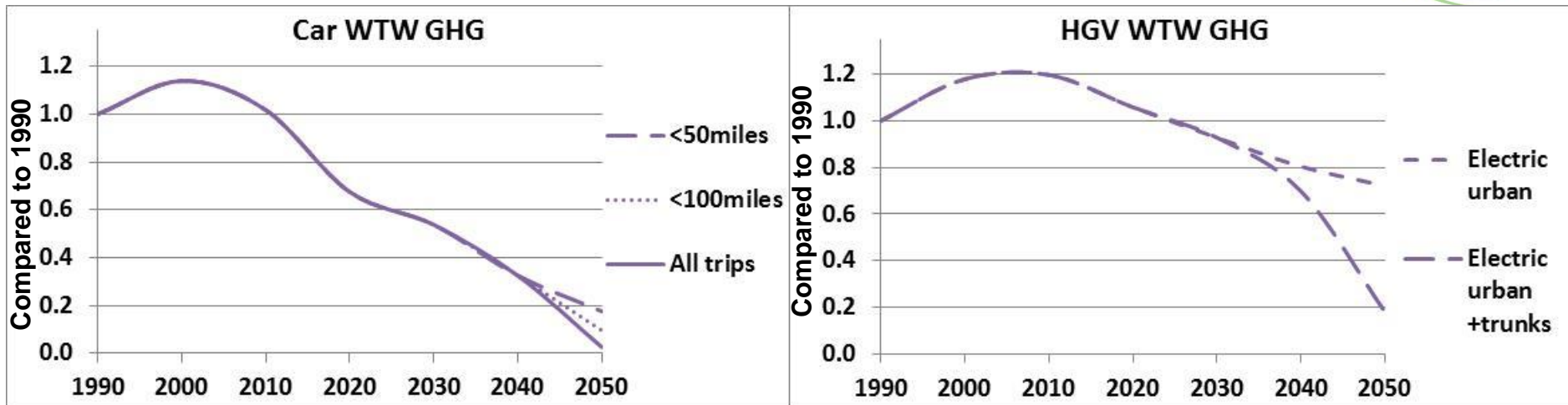
- *reduce energy consumption*
- *use liquid bio/synthetic fuels*
- *use biogas used for HGVs*
- *use electricity (PHEVs) to meet remaining demand*

ICEVs: Steps required



- **Research**
 - *New low-carbon drop-in liquid fuels especially for HGVs*
- **Regulations & Incentives**
 - *Regulations to drive ICEV improvements*
 - *Incentives for advanced biofuels (& bio-gas) production*
 - *Incentives for optimal PHEV operation*
- **Infrastructure decisions**
 - *Modify for high-blend fuels, and optimise fuel selection*

Scenario 2: Electric Transition



- **Key points:**

- *potential depends upon segmentation of demand:*
- *trip length is used for cars*
- *road type is used for freight*

Electric: Steps required



- **Research**

- *Improved battery performance (range or charging time)*
- *Network trials, with third-party leadership where needed*

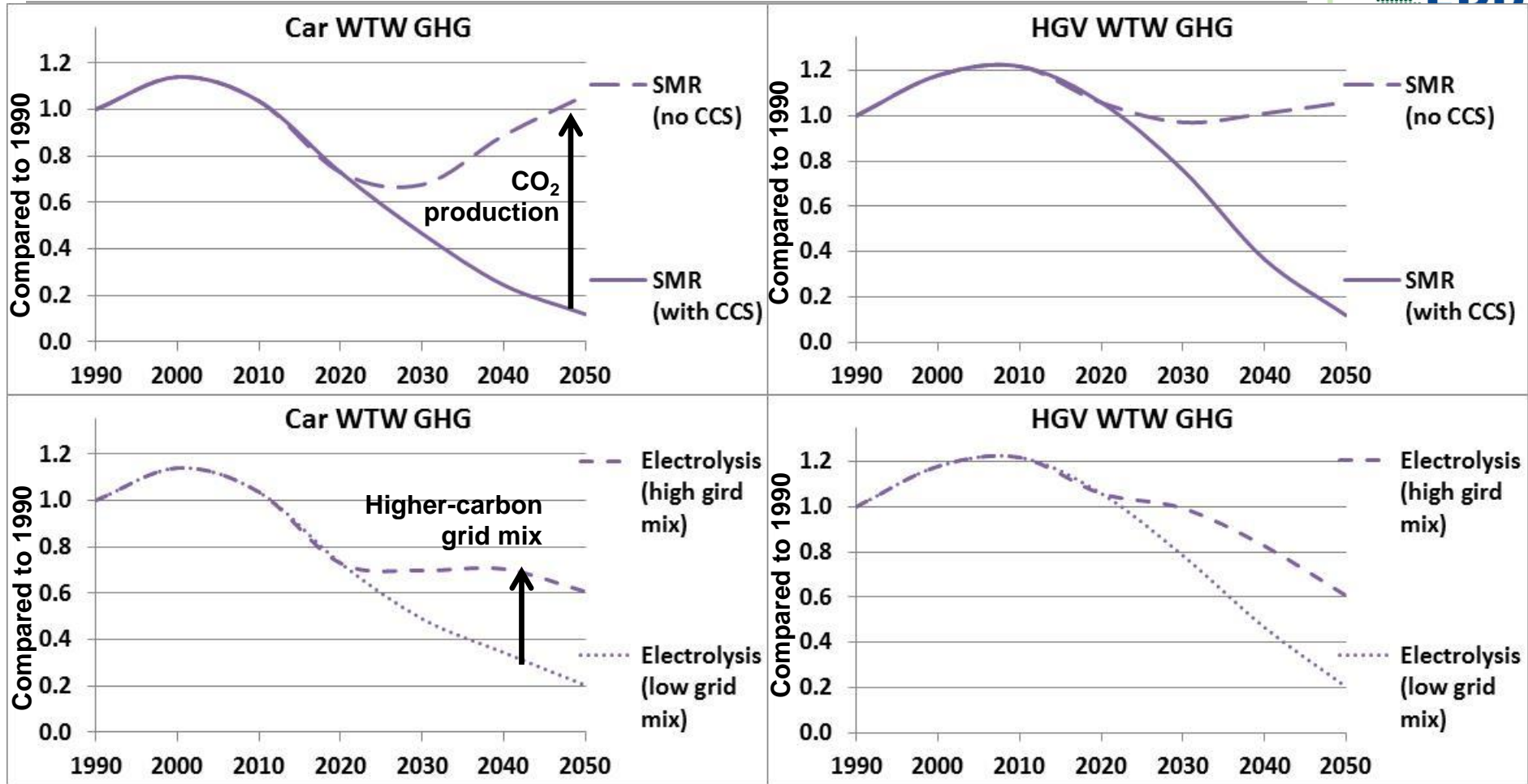
- **Regulations & Incentives**

- *Innovations for smaller freight operators' logistics*

- **Infrastructure decisions**

- *Further grid decarbonisation*
- *Higher generation capacity*

Scenario 3: Hydrogen Transition



• Key points:

- *No demand segmentation needed*
- *Two main production methods (SMR & electrolysis)*

Hydrogen: Steps required



- **Infrastructure decisions (SMR)**
 - *Centralised SMR facilities*
 - *Repurposed low-pressure gas distribution networks*
- **Infrastructure decisions (electrolysis)**
 - *Further grid decarbonisation*
 - *Higher generation capacity*

All options: Steps required

- **Research required:**
 - *Light-weight materials with reduced embedded impacts*
 - *Customers' perceptions of light-weight vehicles*
 - *Impacts on demand due to automation*
- **Infrastructure decisions:**
 - *Provide coverage of existing and emerging fuels*
 - *CO₂ pipelines & storage for range of energy options*

Strategic considerations

Energy system interactions:

- **Wider decarbonisation**

- *sectors' GHG ambitions need to balance for UK target*
- *multiple possible uses for limited resources*

- **Energy consumption**

- *new consumption profiles affect network operation*
- *increased consumption changes supply chains*
- *reliance upon fewer energy vectors for more of UK's critical sectors could affect security of supply*

Strategic considerations

Weigh up deployment and performance:

- **Effort of deployment**
 - *ICEVs require less new infrastructure than EVs or FCEVs*
- **Performance (GHG)**
 - *harder to ensure for ICEVs (need regulations to drive technological gains)*
 - *easier to ensure for EVs and FCEVs (by focussing on upstream energy production)*
- **Co-benefits**
 - *Reduced air and noise pollution with EVs and FCEVs*
 - *Resilience from dual-fuel operation with PHEVs*

Strategic considerations

Questions of timings and costs:

- **Timings of infrastructure deployment**

- *Some infrastructure needed for multiple scenarios (e.g. electrical for BEVs and ICEVs/PHEVs)*
- *Earlier deployment could offer efficiencies with other projects, or later deployment could smooth workloads*

- **Costs of options**

- *Vehicles' TCO expected to converge by ~2030*
- *But upfront costs affect customer decisions*
- *Must be workable & affordable (perhaps not least-cost)*
- *Customer decisions could set direction for infrastructure*
- *Distribution of costs will be a policy judgement*



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