UK OEM Consensus Passenger Car Technology Roadmap

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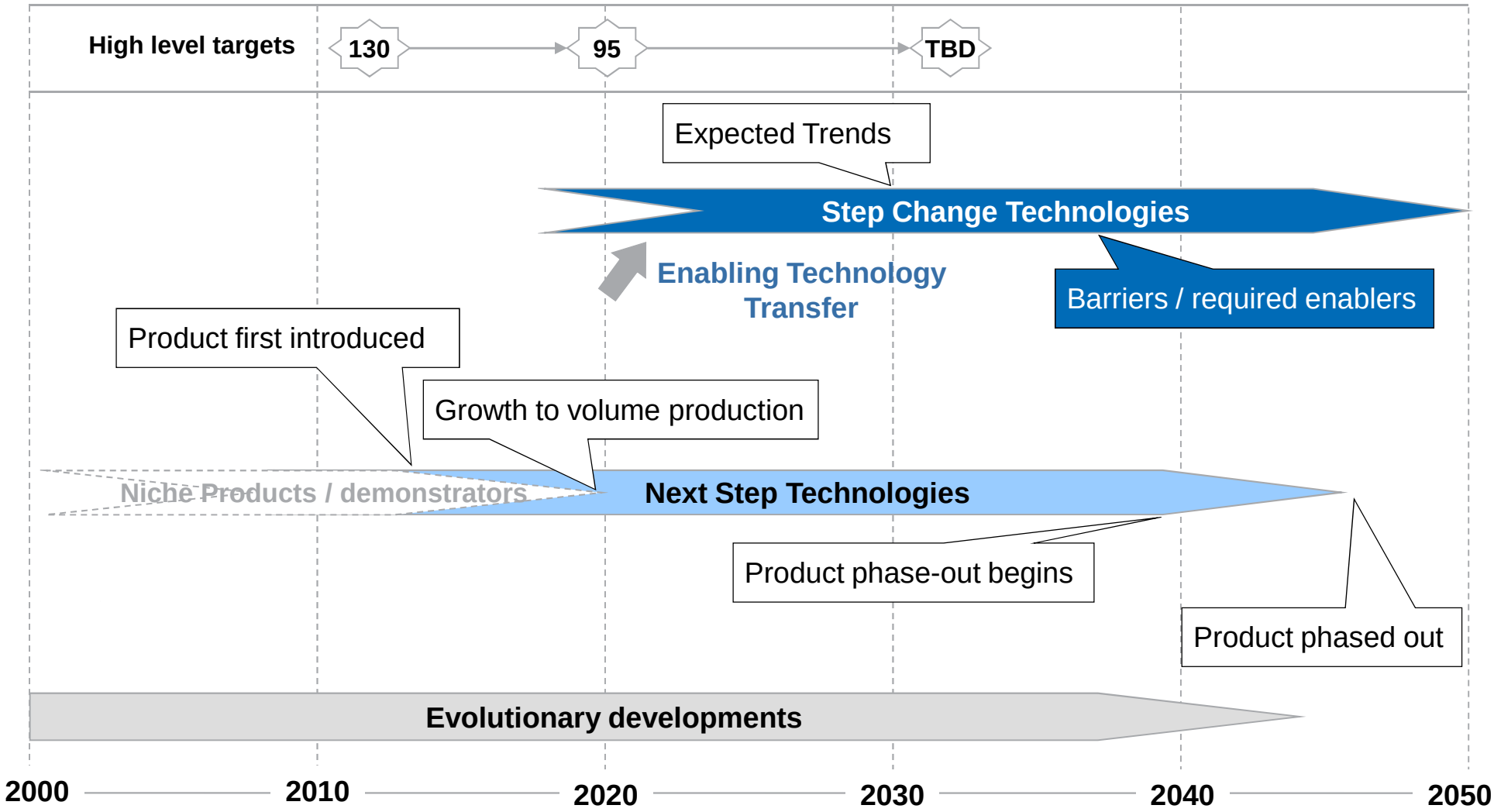
Individual manufacturers will prioritise certain technologies to fit with brand values, but OEMs share a common view of a high level Technology Roadmap

- NAIGT initiative revealed that UK Passenger Car OEM's and associated Stakeholders have developed similar views on the potential rollout of low CO_2 technologies
- Recognition that a commonly agreed "OEM Consensus Roadmap" may be of assistance to the UK in prioritising its R&D investments in meeting CO_2 challenges

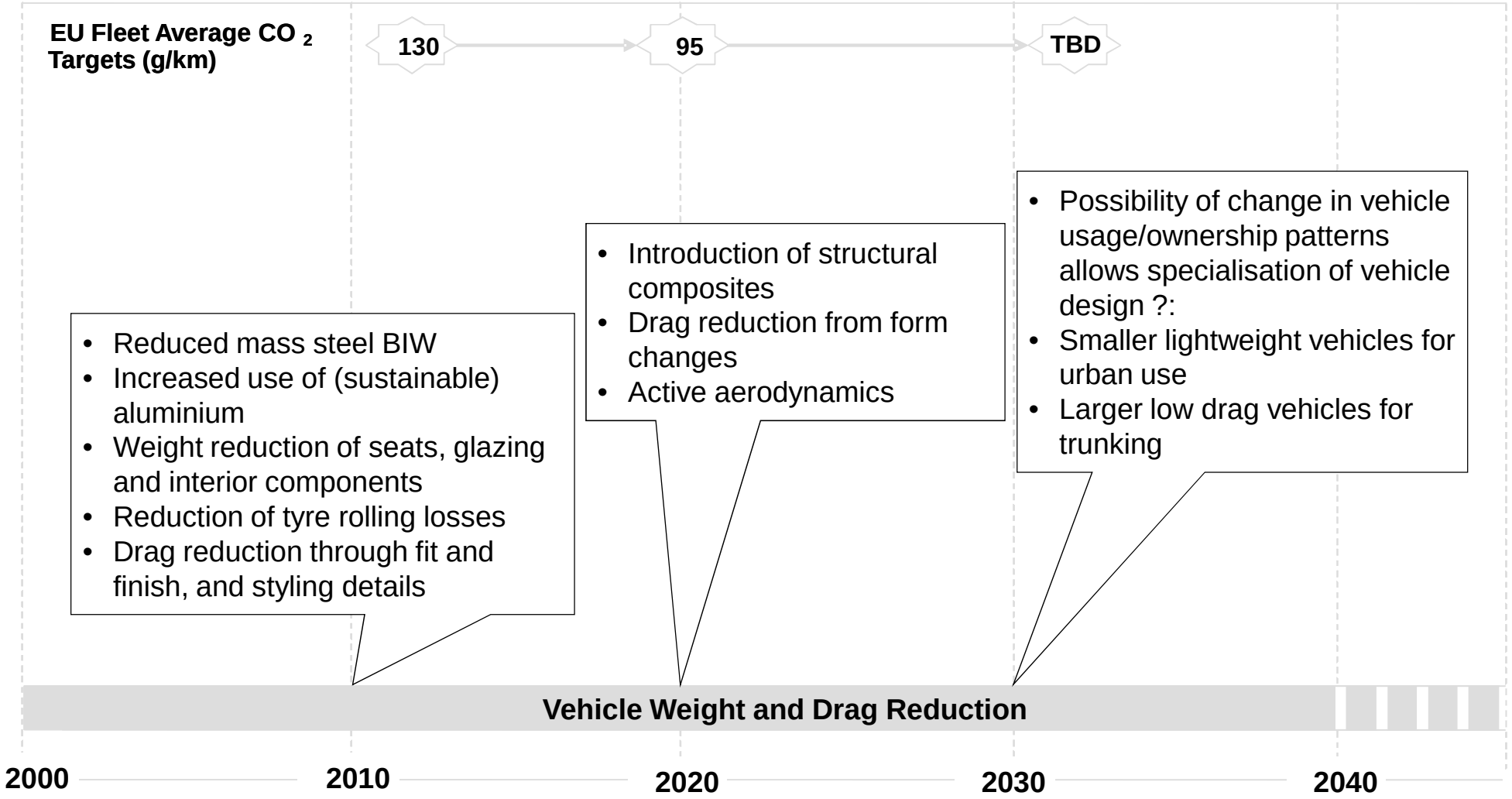
Key Points related to the OEM Consensus Roadmap

- OEMs share a common product technology roadmap and recognise the same technical and commercial barriers.
- Individual manufacturers will implement technologies which best address their own brand values and market sectors.
- In the near to medium term, improvement of conventional powertrains and transmissions can have a significant impact on fleet average CO_2 by providing moderate benefits for a large proportion of the fleet.
- In the medium to longer term it is anticipated that a technology shift to alternative powertrains and transmissions will be required to achieve the CO_2 reduction targets from transport. Supported by alternative fuel delivery including grid electricity and hydrogen.
- Both electrification and fuel cell vehicle technologies rely on the concurrent development of a "clean and sustainable" supply of energy

Key for following slides

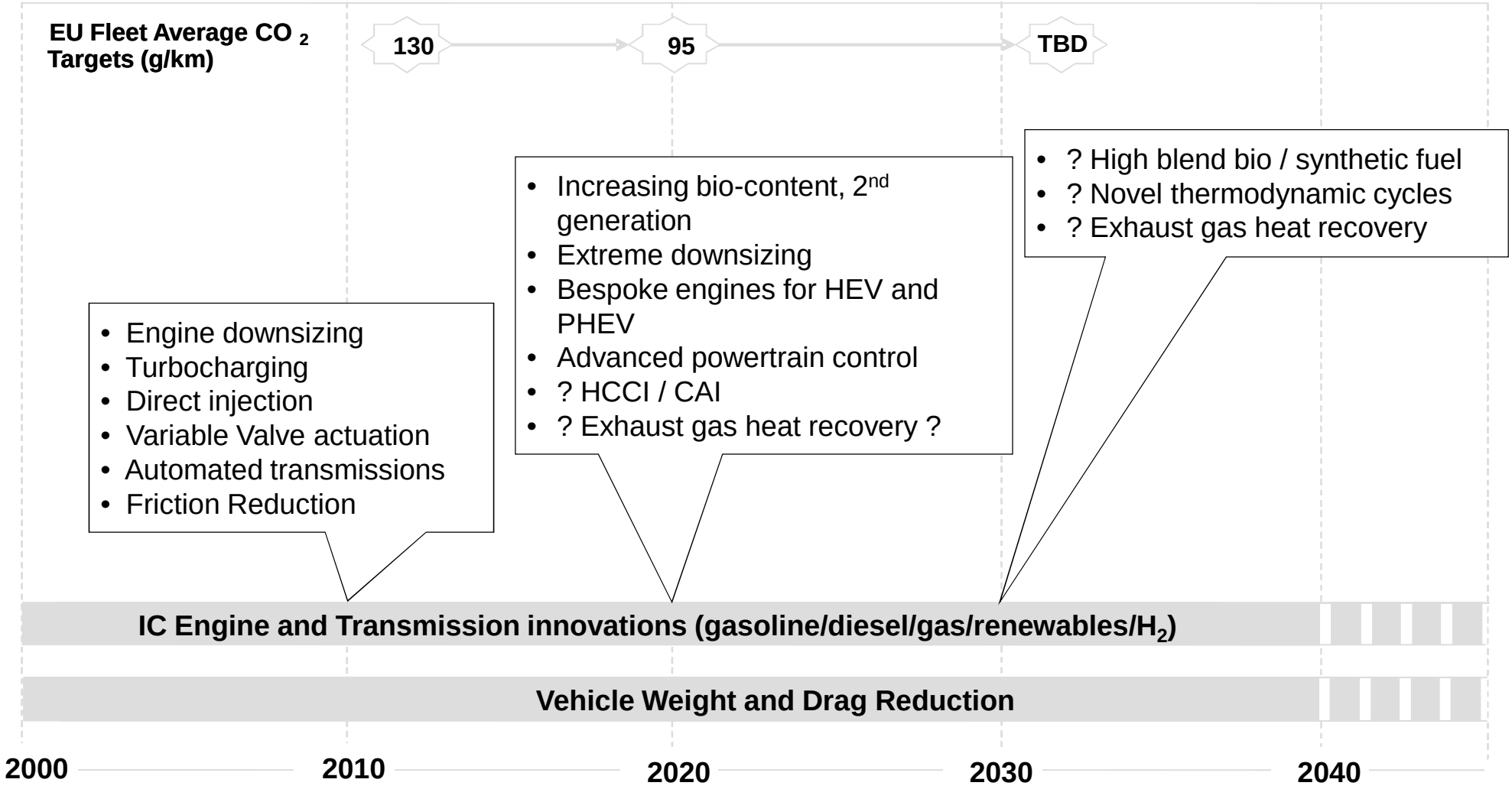


Vehicle weight and drag reduction will continue to evolve within the constraints of the owners requirements for functionality



Source: An Independent Report on the Future of the Automotive Industry in the UK – New Automotive Innovation & Growth Team (NAIGT)

IC engines and transmissions will develop to become lighter, more efficient and to meet the specific needs of hybrid and plug-in applications



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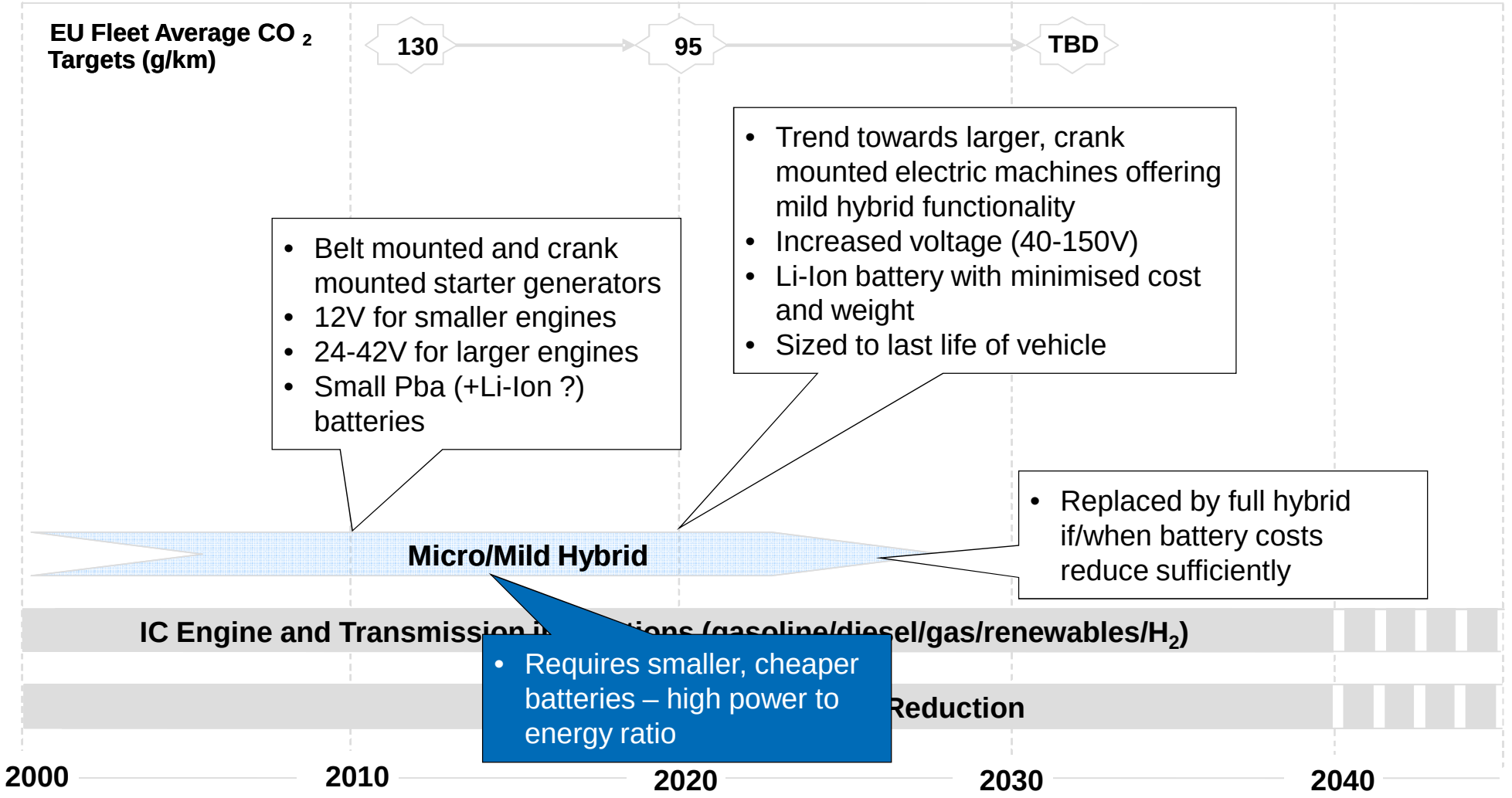
Whilst battery and electric machine costs remain high, cost effective solutions for urban and semi-urban vehicles will be attractive



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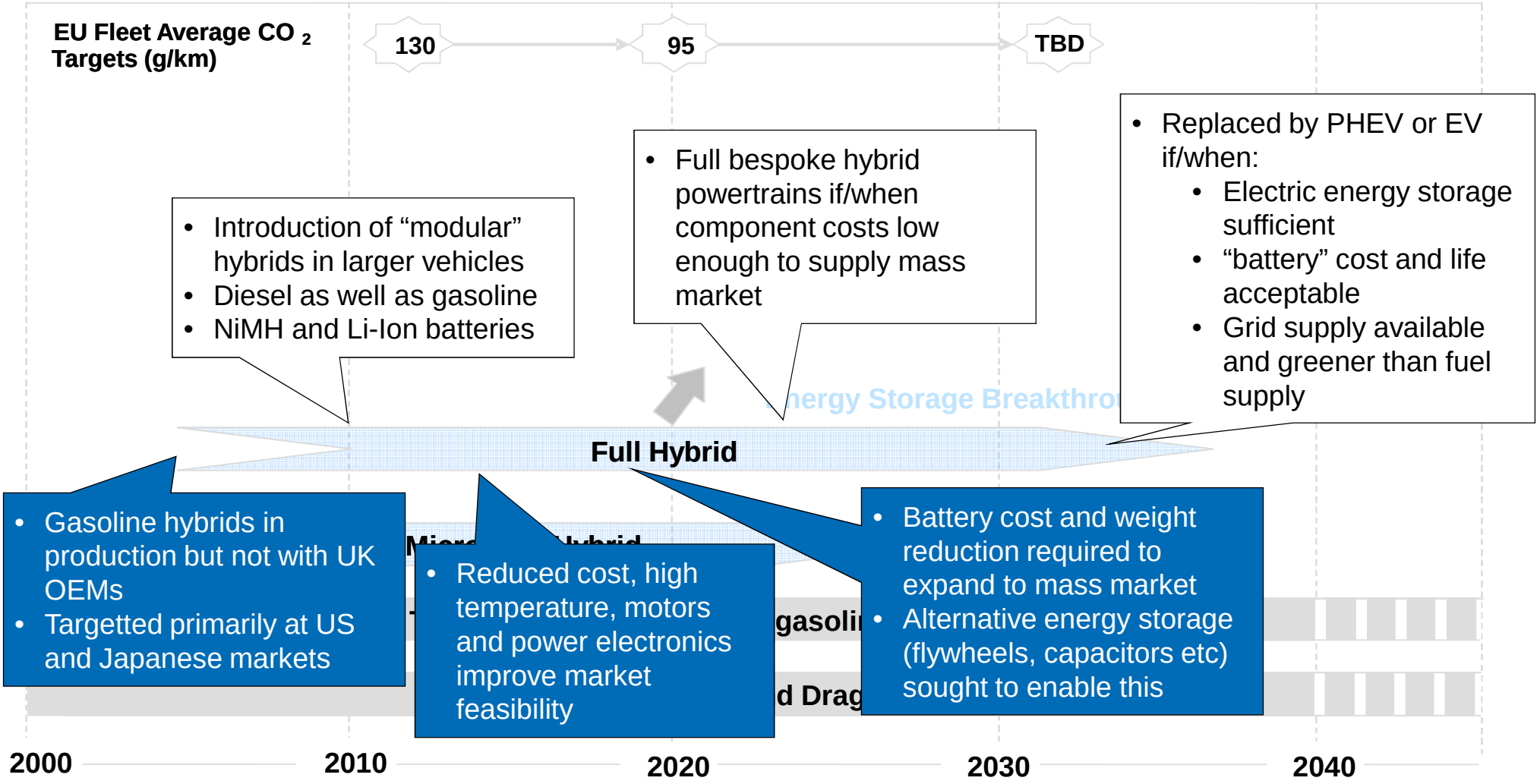
As battery costs and capabilities improve, migration from niche market to mass market for full hybrids may become possible



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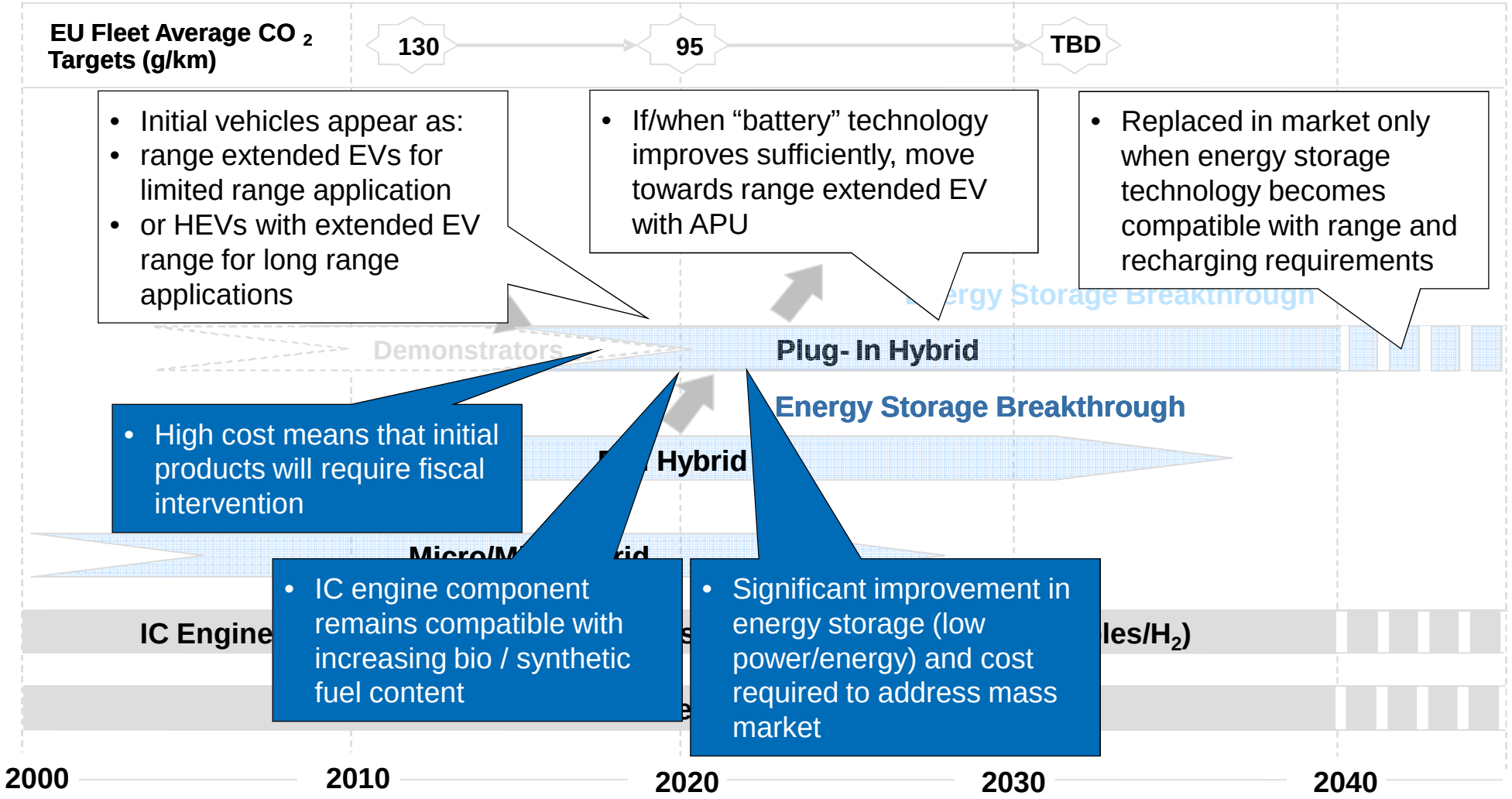
Transition to Plug-In Hybrids requires significant reduction in battery weight & cost to enable acceptable range, needs charging infrastructure & green electricity



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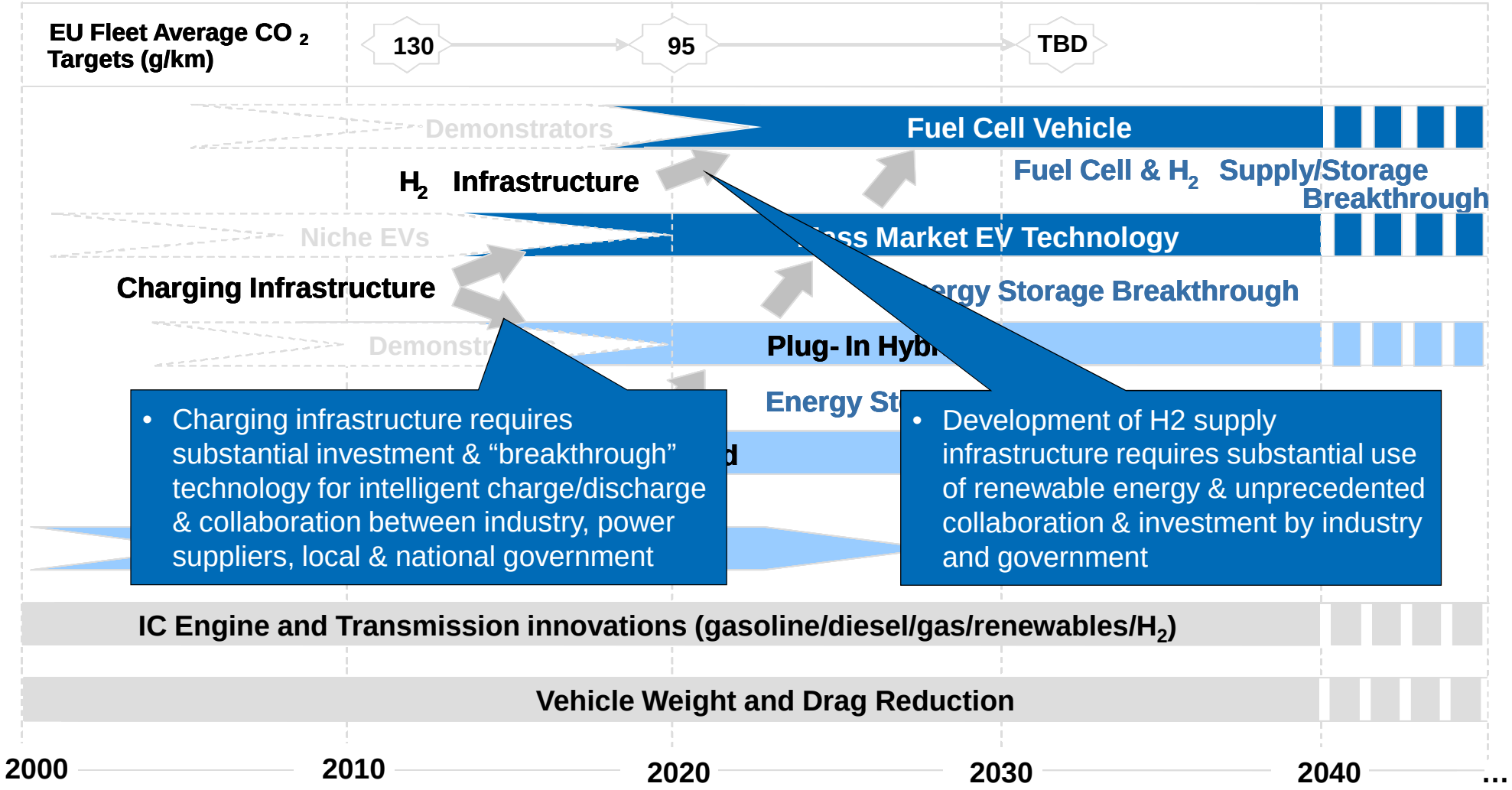
Significant improvements in energy distribution & infrastructure required for substantial electrification of transport whether battery or hydrogen fuel cell powered



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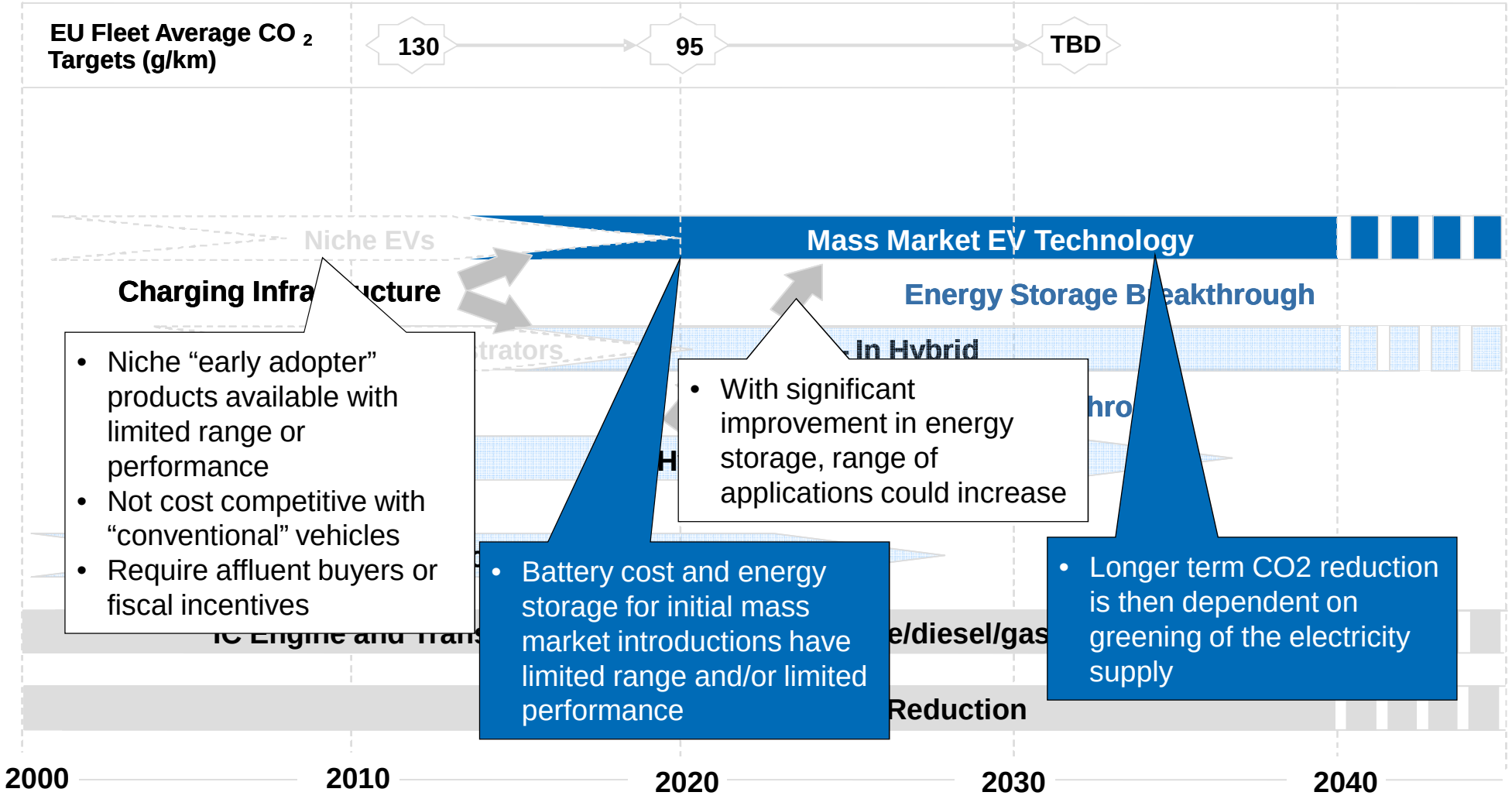
Significant improvement in energy storage and cost of batteries required for electrification of transport – Near term EVs will have a role in limited range commuting



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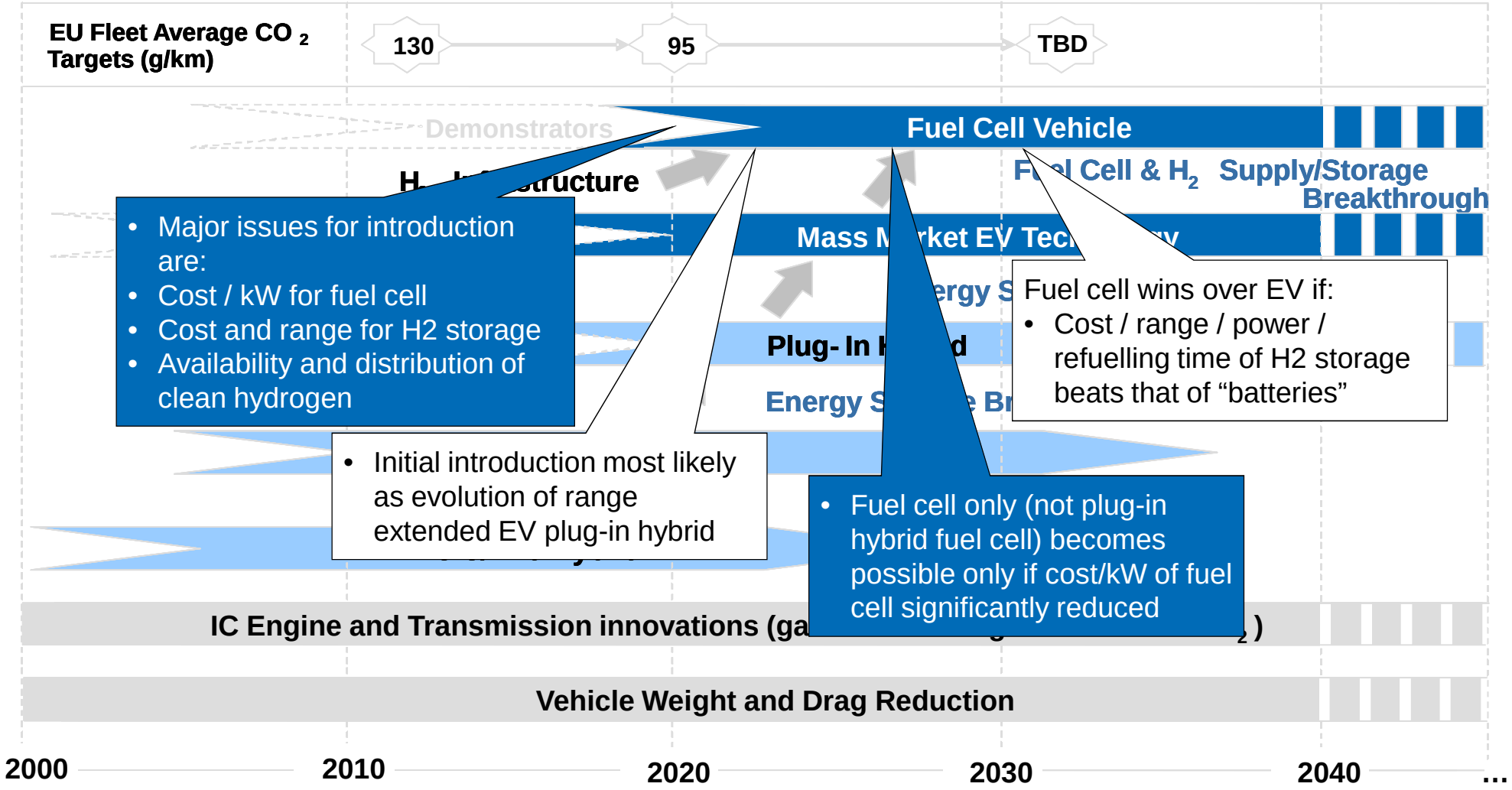
Long term future will depend on the relative development rates of renewable H_2 vs. electricity, and fuel cells & hydrogen storage vs. "batteries"



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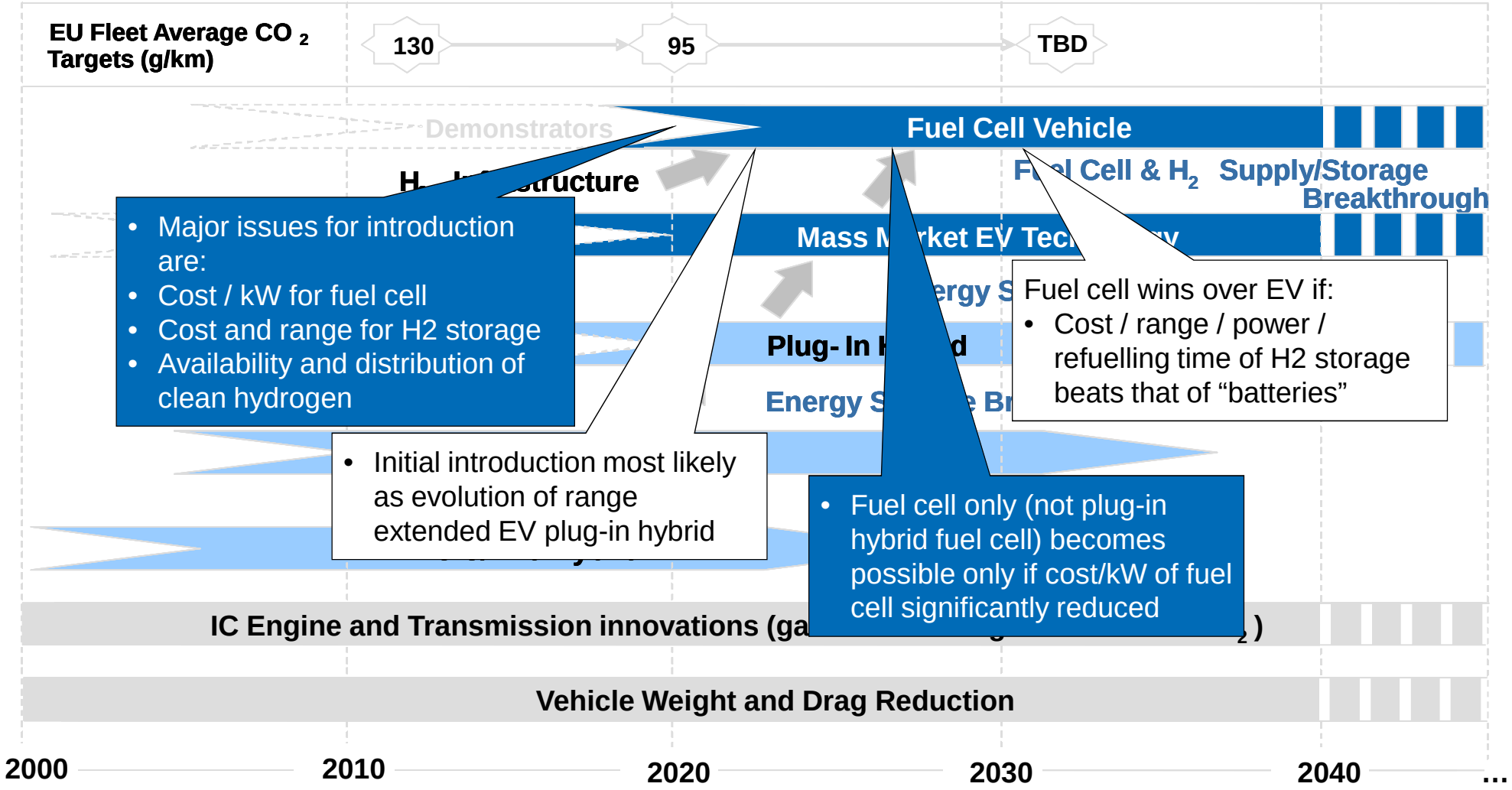

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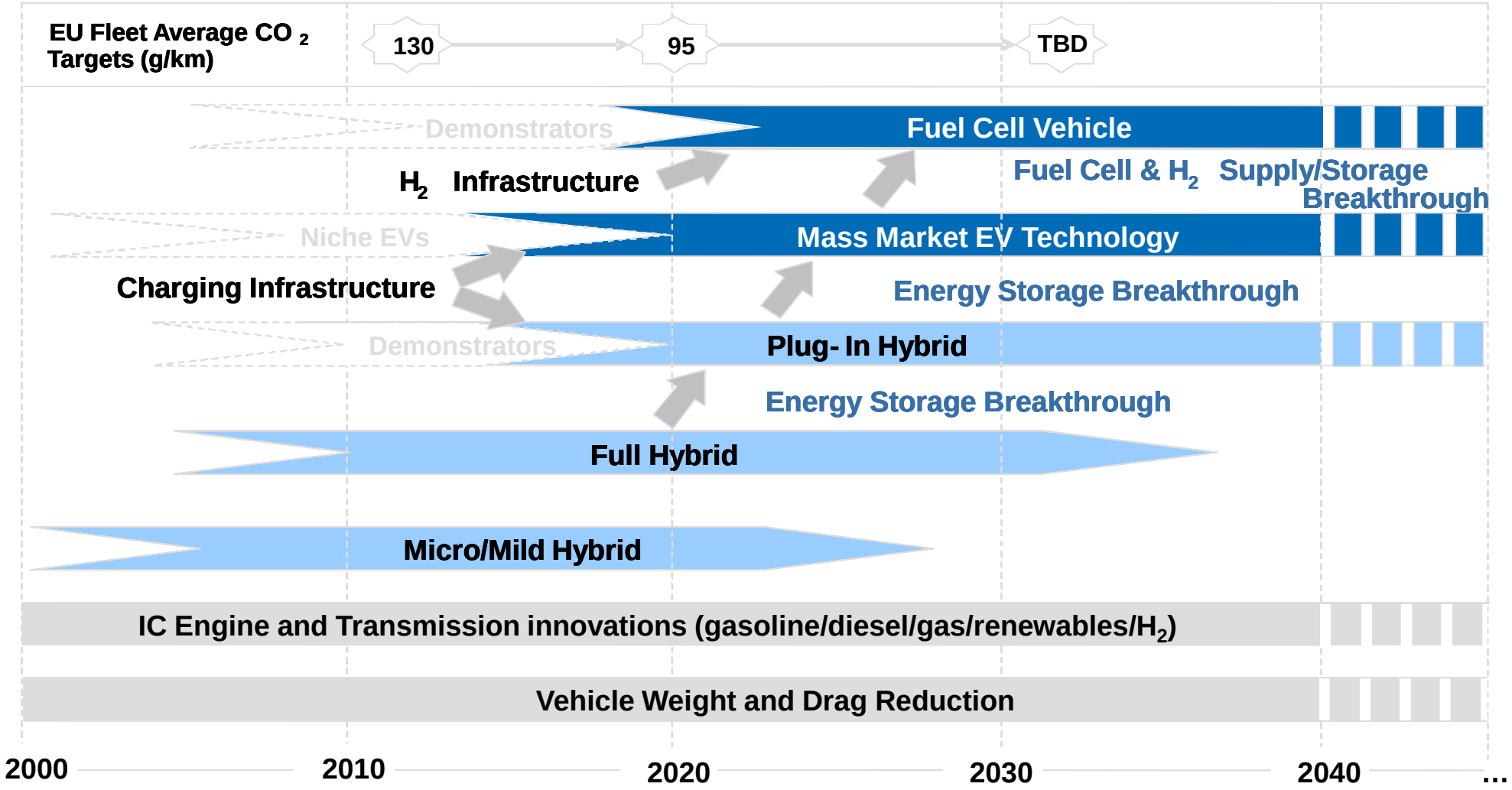

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Conclusions

- **All OEMS share a common product technology roadmap** and recognise the same technical and commercial barriers.
- **Individual manufacturers will implement technologies which best address their own brand values** and market sectors.
- In the **near to medium term, improvement of conventional powertrains and transmissions can have a significant impact on fleet average CO_2** by providing moderate benefits for a large proportion of the fleet
- Introduction of increasing levels of **hybridisation / electrification is highly dependent on the availability of battery, motor and power electronics** technology with high power density, high energy density, and low cost
  - And the economic acceptability of this solution in the marketplace
- Widespread uptake of **electric vehicle technology is critically dependent on availability of batteries with low cost and high energy density**,
  - along with the **availability of an infrastructure to deliver clean electricity** to point of use
- Whether the long term future will be based around **fuel cells or electric vehicles is entirely dependent on the relative pace of progress** of
  - cost effectiveness, package size, weight and refuelling time of fuel cell + hydrogen storage (+ battery ?) vs battery
  - Availability and distribution infrastructure for clean hydrogen vs clean electricity