

UK – India Seminar

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Platform Efficiency : Body materials and oil independence

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Purpose of this talk

- To show you that 'Platform Efficiency' is as important as 'Prime Mover Efficiency' for oil independence
- Efficient Platforms mean smaller CNG efficient internal combustion engines OR less battery mass and cost for same range

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But many factors

- National Focus / Advantage
- Timing / Surprise
- Fundamentals / Physics, Economics

Materials and Brands



CAR = VEHICLE PLATFORM + PRIME MOVER

FUNDAMENTAL = Mass and Acceleration

Mass = materials

Acceleration = brand choice

This vehiclechanges everything

- o Toyota 1/X
carbon fibre intensive
concept
420kg
500cc petrol engine
150 mpg 50 km/l



Cost down manufacture .. *Economics* Axon

- o Vertically integrated **LOW RISK** manufacturing plant from precursor to carbon fibre to parts manufacture
- o Shared facility with fibre producers and multi-OEM consortium 120bnYen investment
- o One plant Japan, one Europe, one USA

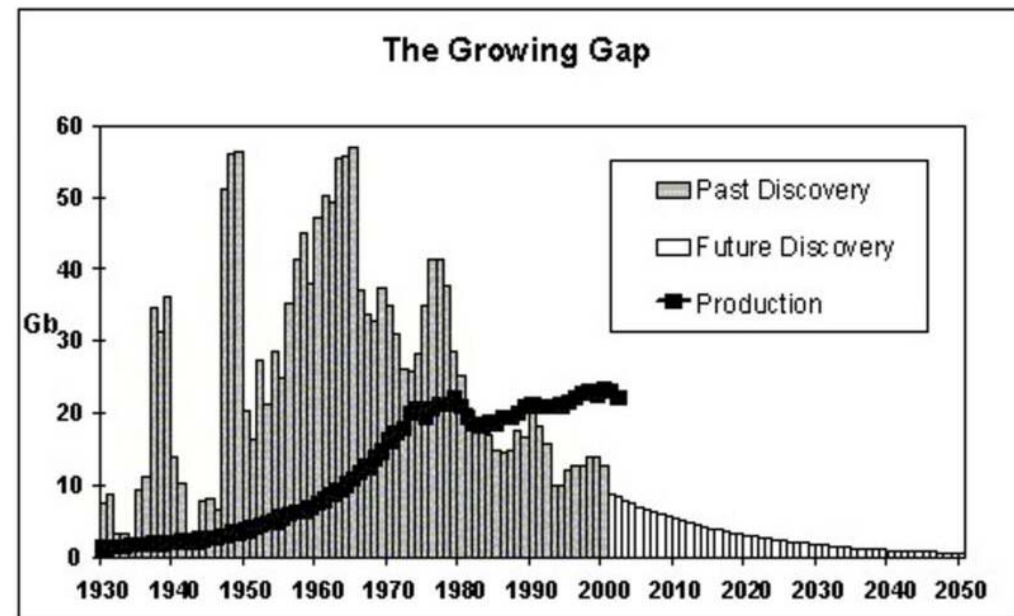


BMW + SGL in USA

Steel to Carbon : Oil strategy

- Aircraft Industry now Carbon fibre led
- Tokyo University projection/simulation 100% of car production carbon by 2020
- A 2020 strategy for Japan given the prospect of 'peak oil'

Timing



Steel to Carbon : Blue Skies

- Globally very little 'Blue Skies' effort to produce low cost carbon fibre
- UK succeeded with recycled CF
- US Oak Ridge Lab target \$1/lb CF from wood pulp precursor and microwave carbonisation
- POTENTIAL for Blue Skies UK
- India project

Steel to Carbon : that's us too



Lightweight Vehicles
for Low Carbon Futures

Steel to Carbon : that's us too

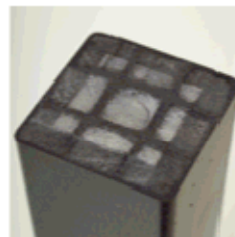
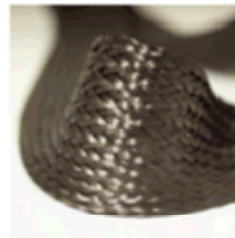


- Axon** – 500cc petrol engine
- plug in hybrid
 - 470 kg
 - carbon fibre chassis frame
 - 2 seats plus lots of luggage



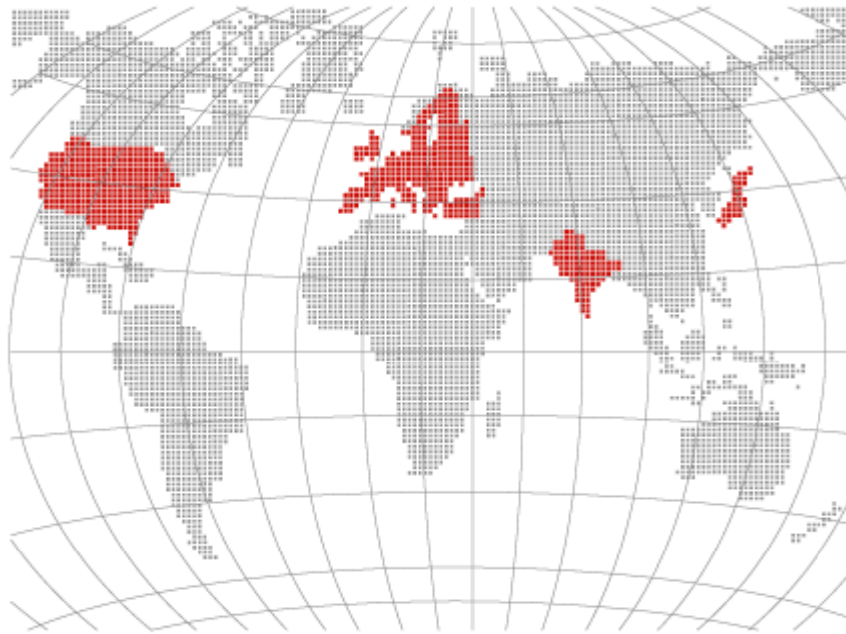
- Prius 1/x** – 500cc petrol engine
- plug in hybrid
 - 420 kg
 - carbon fibre chassis frame
 - 4 seats little luggage

Steel to Carbon : that's us



- Low tooling cost
- Mature market with many models
– *great competitive advantage*
- Half weight, half power. Same P:Wt ratio, half CO₂

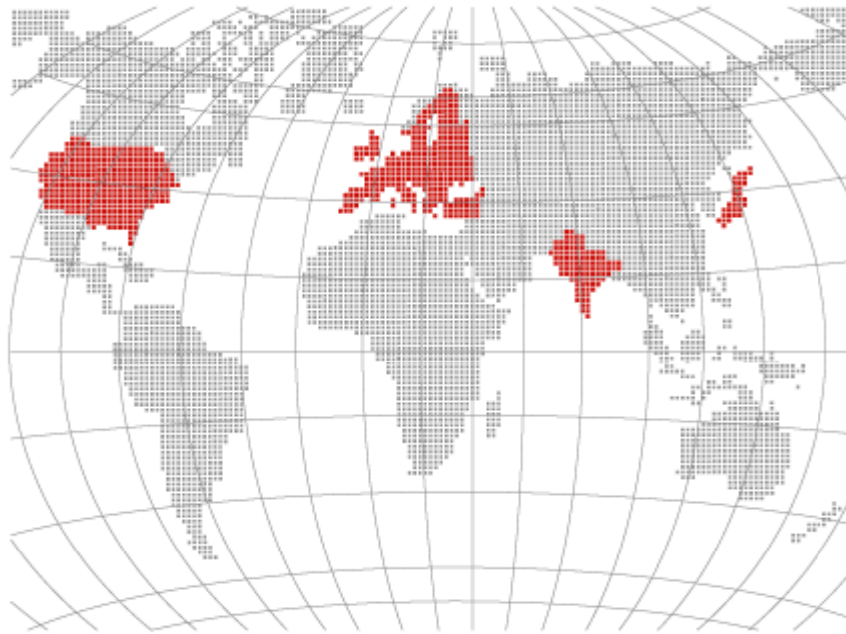
Geographical Advantage



- Electricity abundant
 - France Nuclear
 - Denmark Wind
 - USA Coal
- Therefore Electric Vehicles make sense

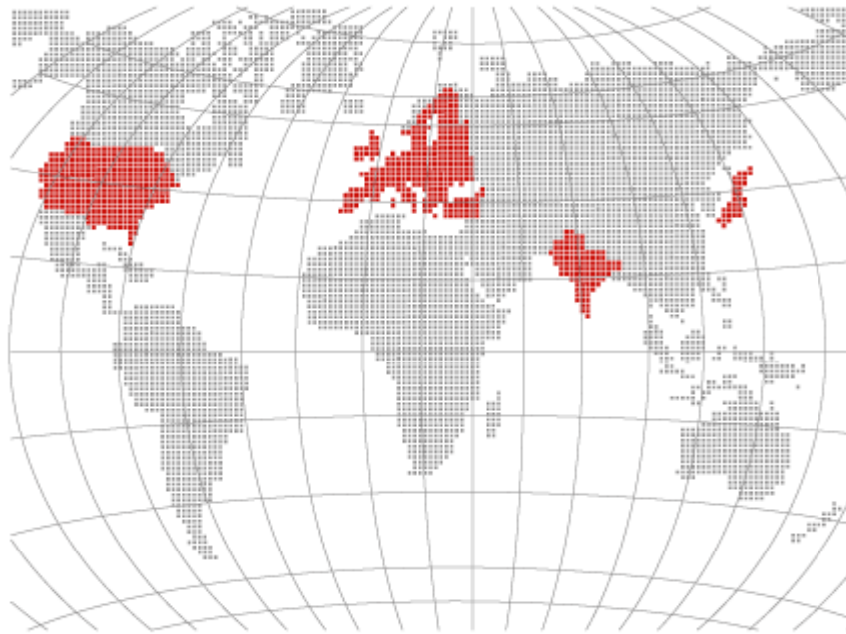


Geographical Advantage



- **UK strengths**
 - **IC engines**
 - **Composites**
 - **Design engineering**
- **Electricity deficit**
 - UK rebuild existing supply

Geographical Advantage



- **India strengths**
 - **CNG infrastructure**
 - **Compact car mfr**
 - **R&D facilities**
- **Electricity deficit**
 - increasing supply

CO2 savings to 2020



- Target 1/3 CNG consumption for compact car via light weighting in new materials + smaller efficient IC engines
- 'Leapfrog' strategy for body in white to body in black (carbon fibre)
- Lets have a collaborative demonstration project putting India & UK together....

Future



Iconic Indian
1/3 consumption
H-CNG 700kg car
In Carbon Fibre
advanced materials