‘Being less bad is no good’

Hugo Spowers, RiverSimple LLP

Closed loops and service systems

HVM Class of 2008
Cambridge, 22nd April 2008

An industrial ecosystem

- Sustainability is the governing principle?
- Resource productivity a necessary condition for sustainability
  - But not sufficient
  - Need cyclical systems as well
- Energy efficiency will be King

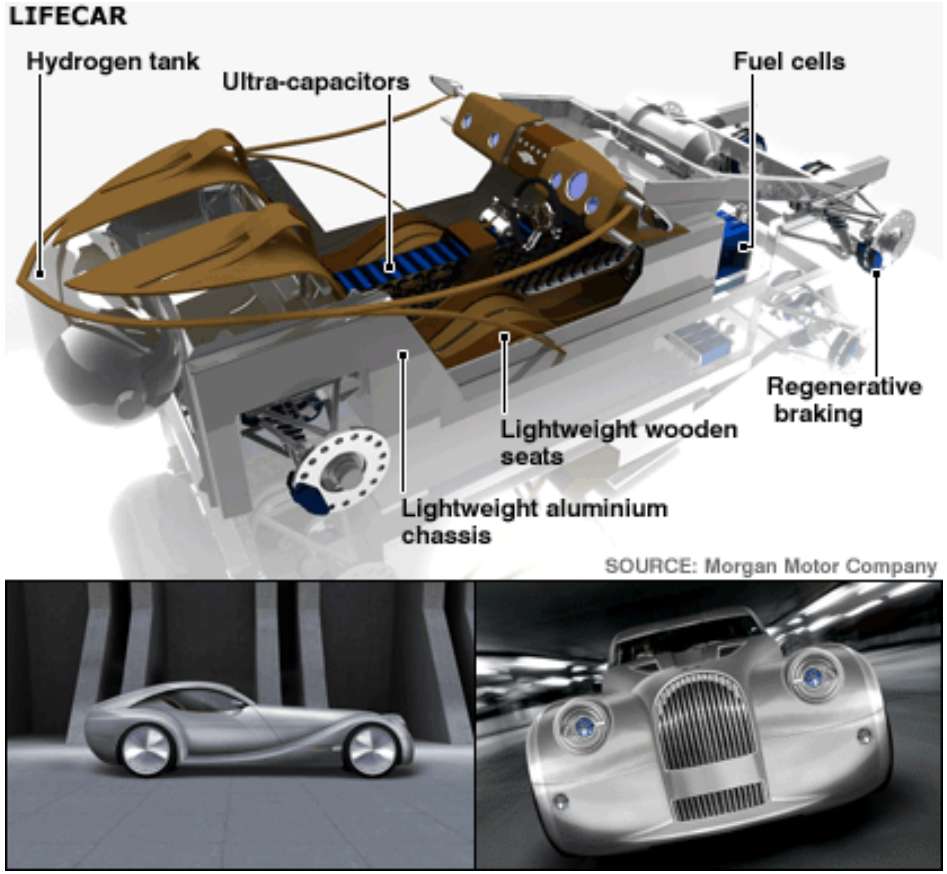
Whole system design

- Vehicle technology at top of S-curve of innovation
  - Not fit for purpose
  - Nor is the process by which personal transport service is delivered to society
- A step change achieved through a synthesis of existing technologies
  - none of which make overwhelming performance or economic sense on their own
- Then take WSD up a level - from technology to business strategy
  - ‘Aikido’ strategies
  - Self-regulating loops
  - Focus on resilience not profit

The Network Hybrid

- Popularly perceived barriers to FC vehicles
  - Cost of fuel cells
  - Hydrogen storage density
- Conventional solutions to these barriers
  - Throw money at the FC and storage technology
  - Basic science: lots of people, money and time
    - far from market
- Network hybrid solutions
  - Reduce FC power and power density required, Factor 4+ each
  - Reduce hydrogen consumption Factor 4+
  - Integration of existing technology: small teams, cheap and quick
    - near to market

LIFECar



- 0 to 100 km/h in 7 secs
- 1.9 l/100 km equivalent
- 400 km range
- Max speed 135 km/h
- 22 kW fuel cell stack

Sale of service

- Sale of product; if you make money from selling cars, you make more money from selling more cars

- A company that sells a transport service rather than vehicles:
  has a financial interest in reducing cost and maintenance and increasing reliability, ownership cycle and product life, as well as energy efficiency

- Thus currently opposed interests of society and manufacturers are aligned

Implications

- Inherently self-regulating
- The ‘problem’ of Longevity becomes a source of competitive advantage
- Changes economic impacts of design choices
- Must extend model upstream into supply chain

Barriers

- Adoption of model by suppliers
  - Product redesign as well as systems changes
  - The more mature a technology, the harder it is
- Significant working capital consequences
- Time value of money dilutes competitive advantage
- Rapid obsolescence in immature technologies

Advanced composites

- Mass and cost de-compounding advantages
  - Fuel cell, motors, ultracapacitors
  - Sale of service model bundles fuel cost with vehicle ownership
- Increased cost of carbon etc compensated for by:
  - lower component cost
  - vehicle efficiency over lifecycle
- Need closed loop recyclable resin/solvent system
- Cannot be developed in a sale of product world