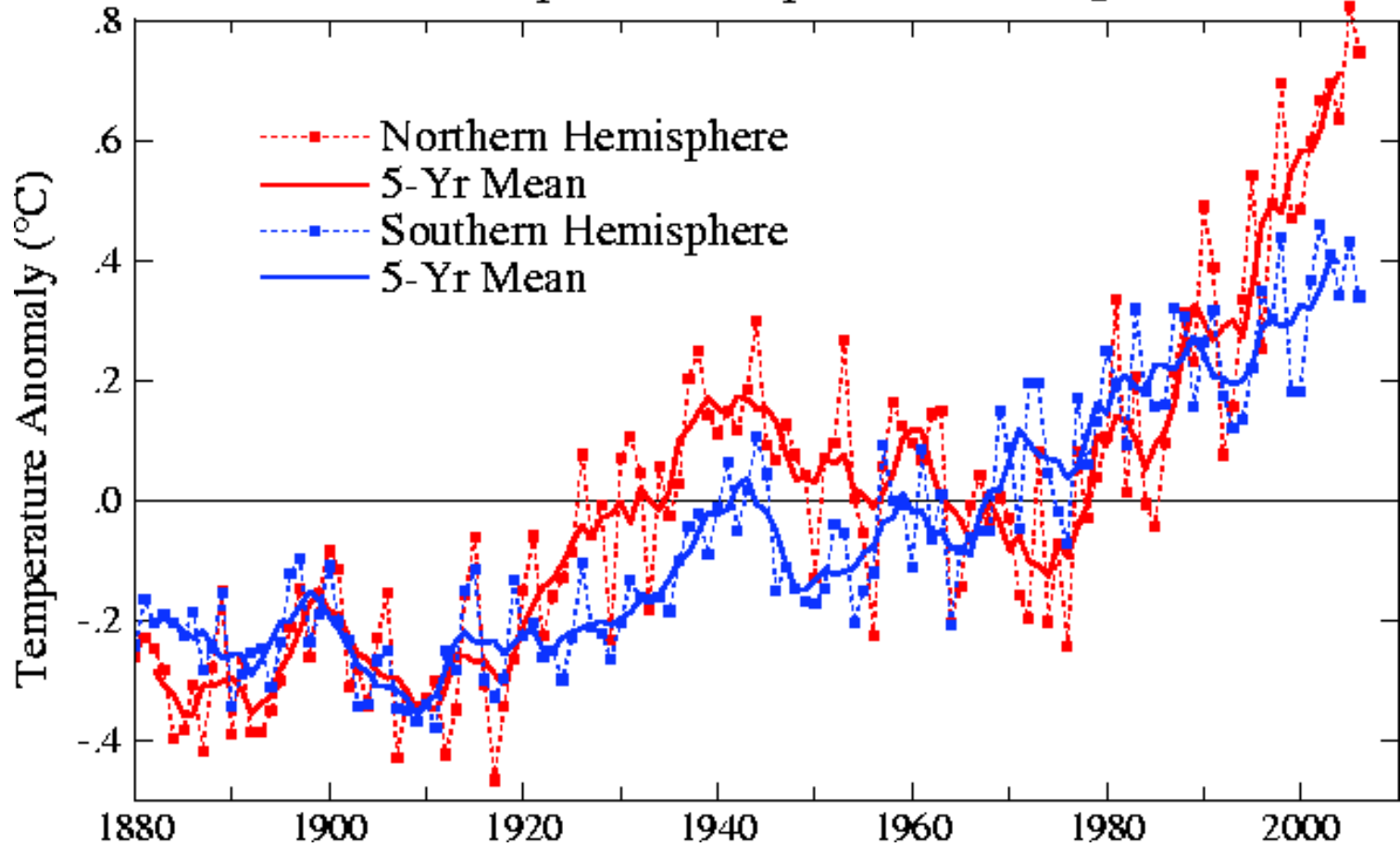


Fuels for Transport Runners, take-up and timing

**SEEDA Conference Expo
Oxford
19 September 2007**

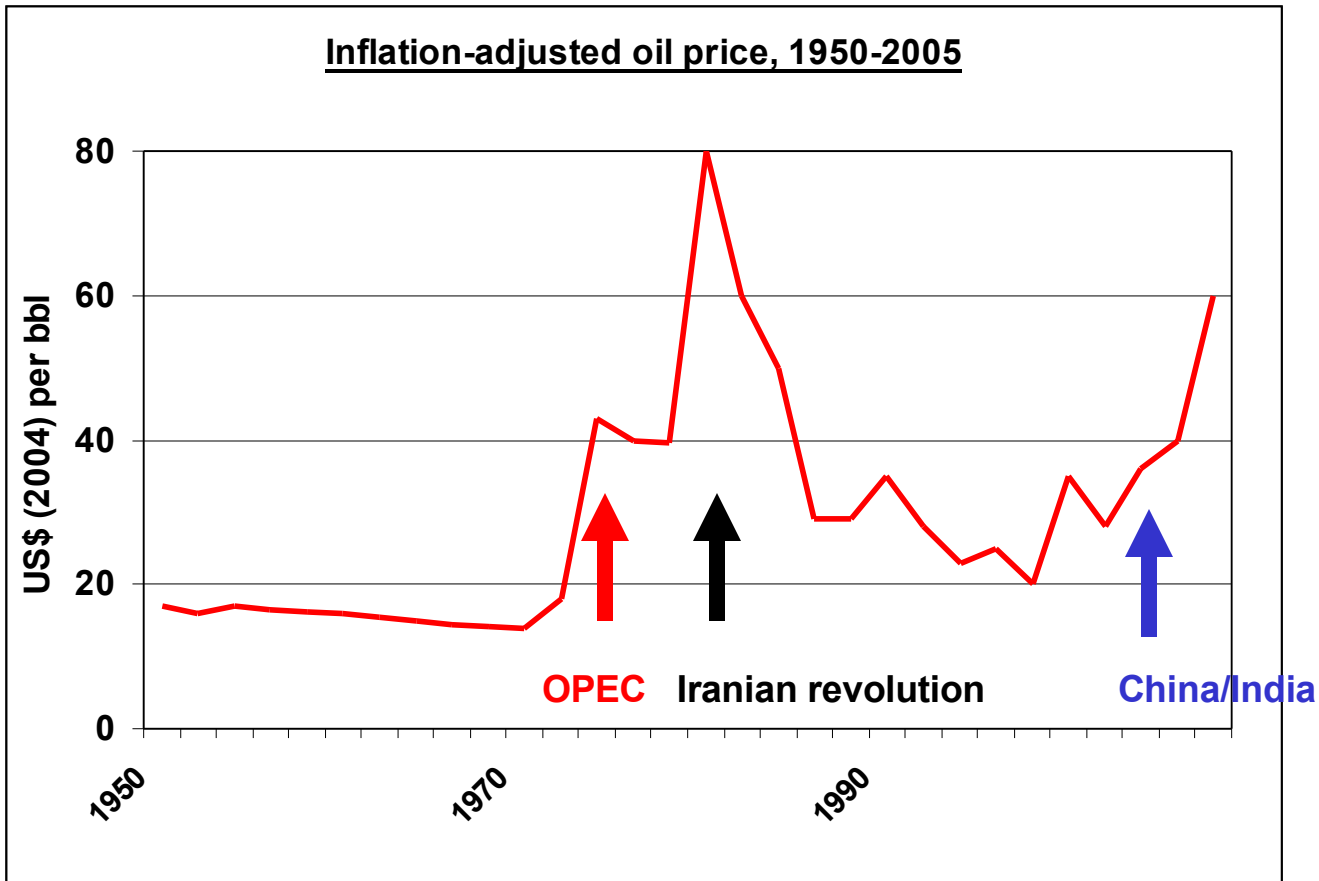
We do appear to have a problem with anthropogenic global warming

Hemispheric Temperature Change



Source: GISS

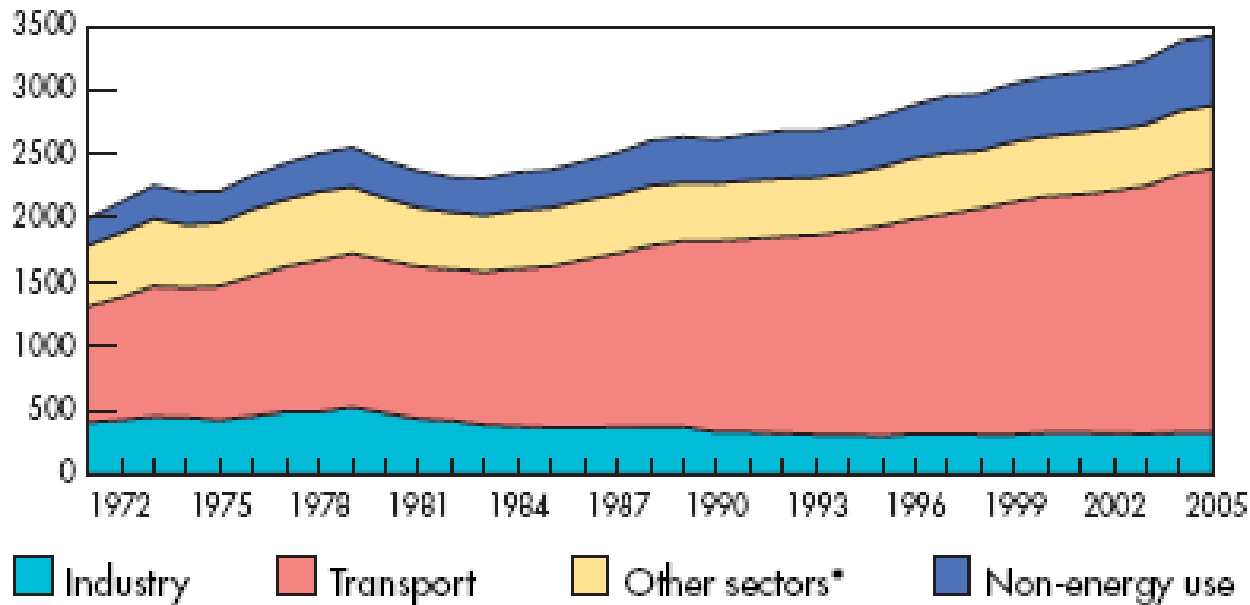
The oil price increase is structural this time



Source: BP, *Energy in Focus*, quoted in *Sustainable Fossil Fuels*, Jaccard 2005

Transport is the largest and fastest-growing consumer of oil

Evolution from 1971 to 2005 of Total Final Consumption by Sector (Mtoe)



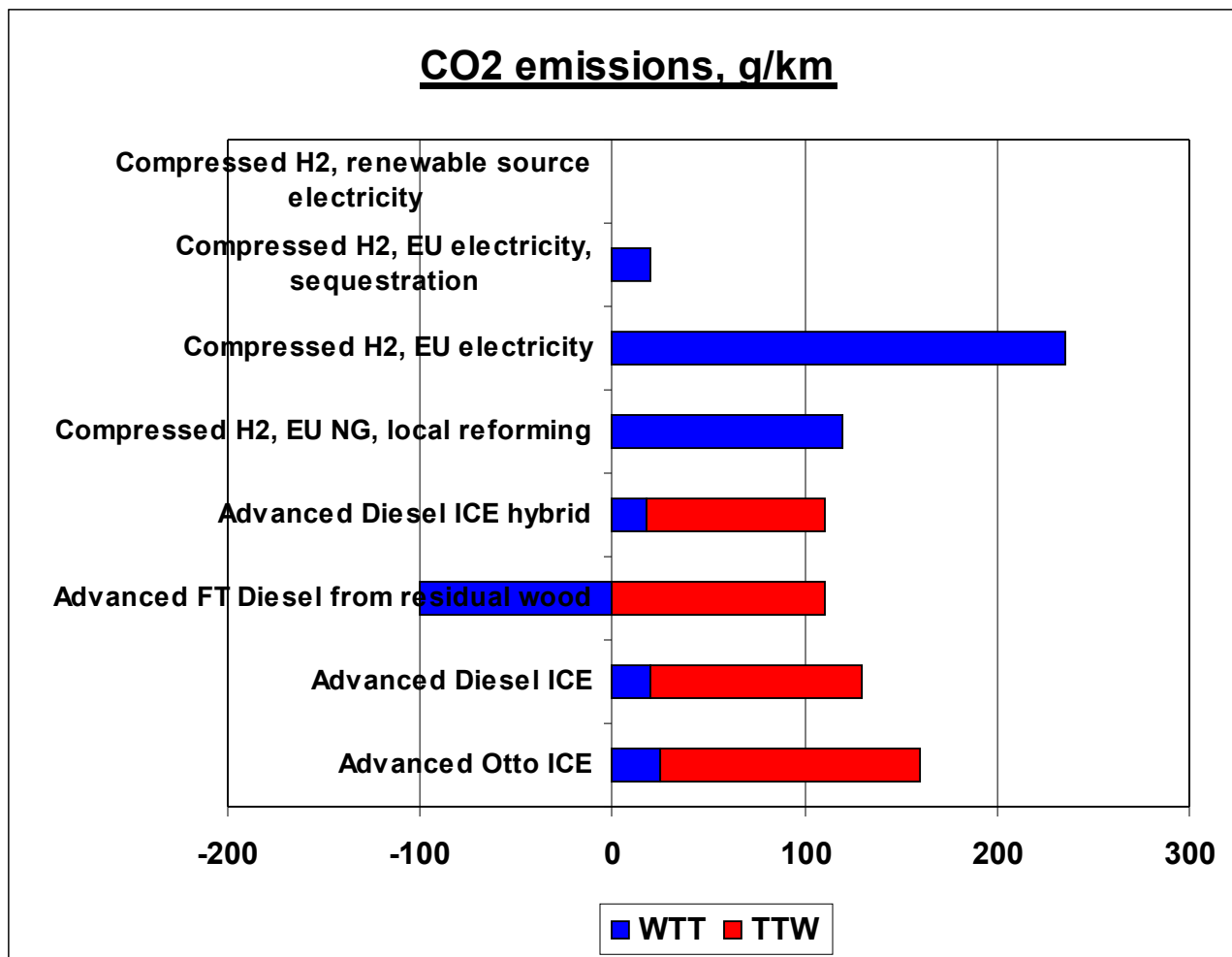
- 45.4% of 2260 = 1026 Mtoe in 1973
- 60.3% of 3431 = 2069 Mtoe in 2005
- I.e. 2.2% per year

Source: IEA, Key World Energy Statistics 2007

Most gains are modest or distant, costly and difficult

- **Pkm/capita/year ... 50 years ?**
- **Pkm/Vkm ... 5-10 years but limited potential**
 - **Modal share**
 - **Ride sharing**
- **Mechanical/thermal losses ... 10-20 years ... big impact**
 - **Vehicle mass x acceleration/braking**
 - **Aerodynamics x speed**
 - **Rolling resistance**
- **Conversion efficiency ... 5-25 years ... limited**
 - **WTT**
 - **TTW**

There is no single magical conversion efficiency fix

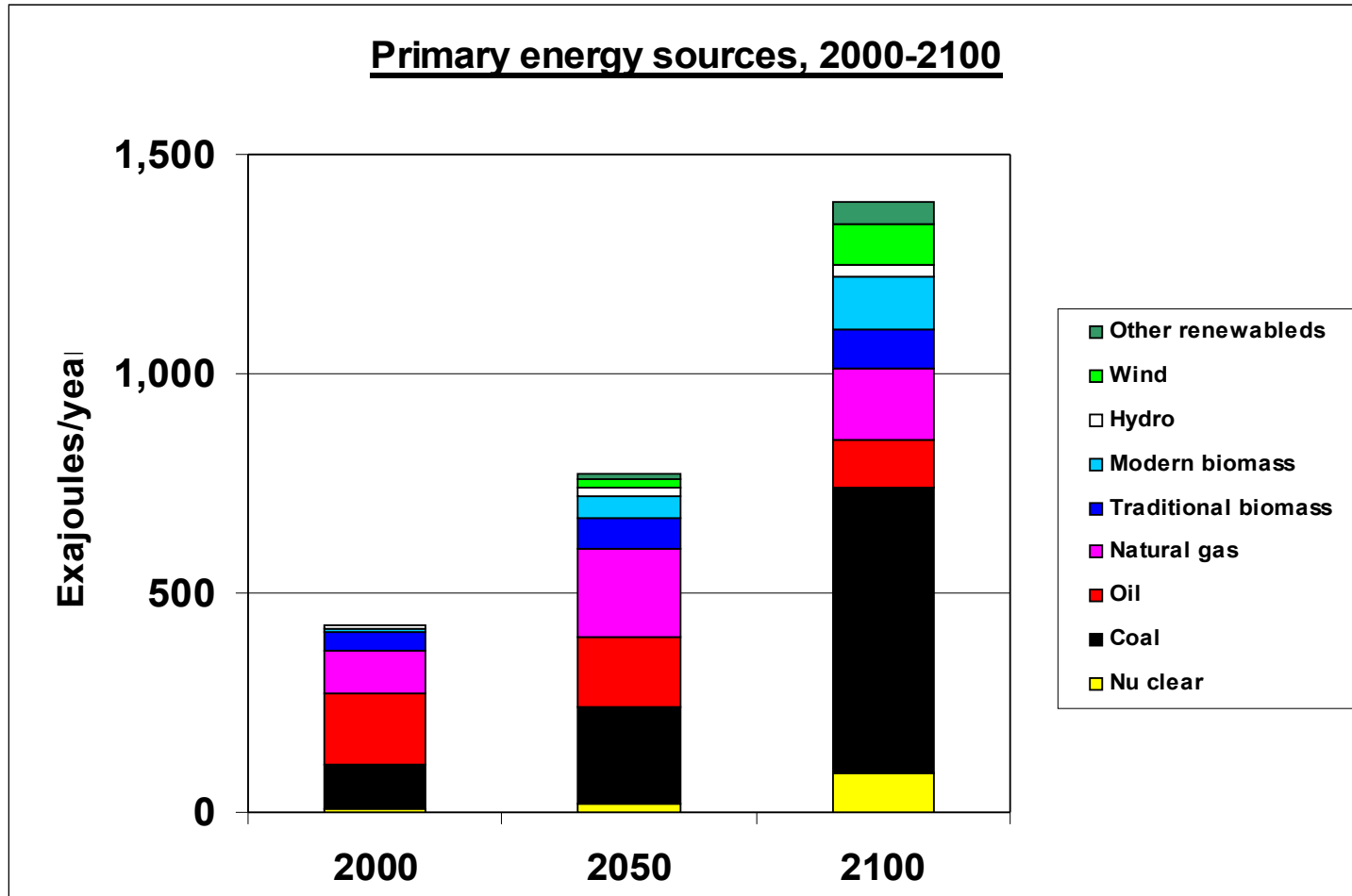


Source: Sustainable Mobility Project

All alternative fuels have problems and constraints

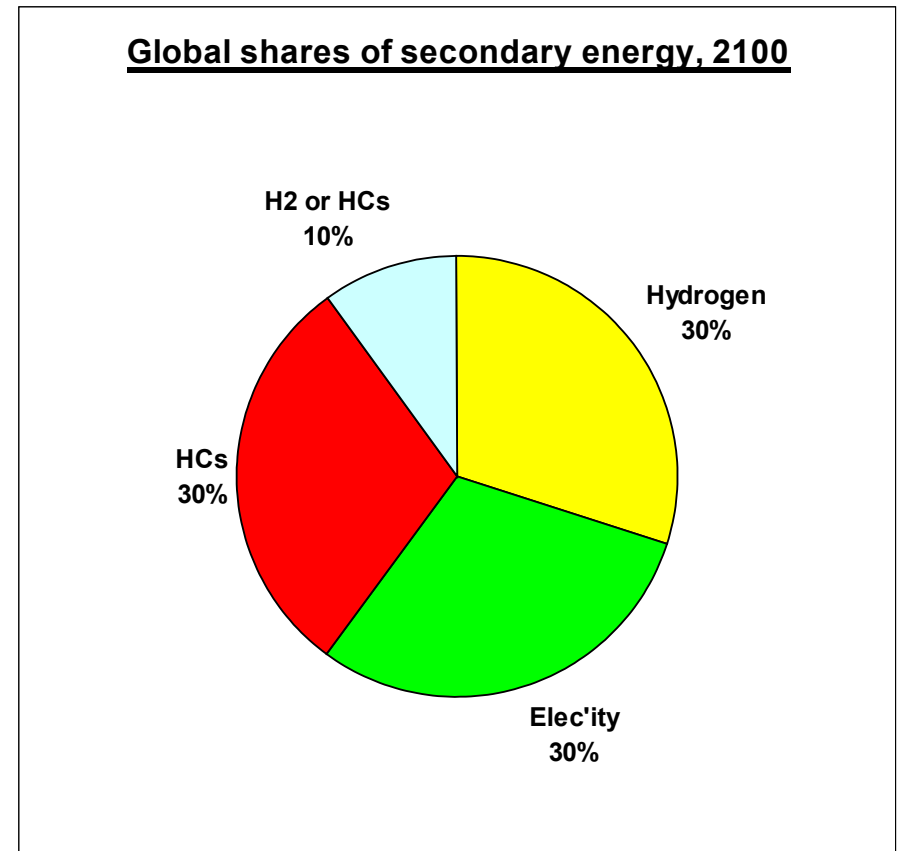
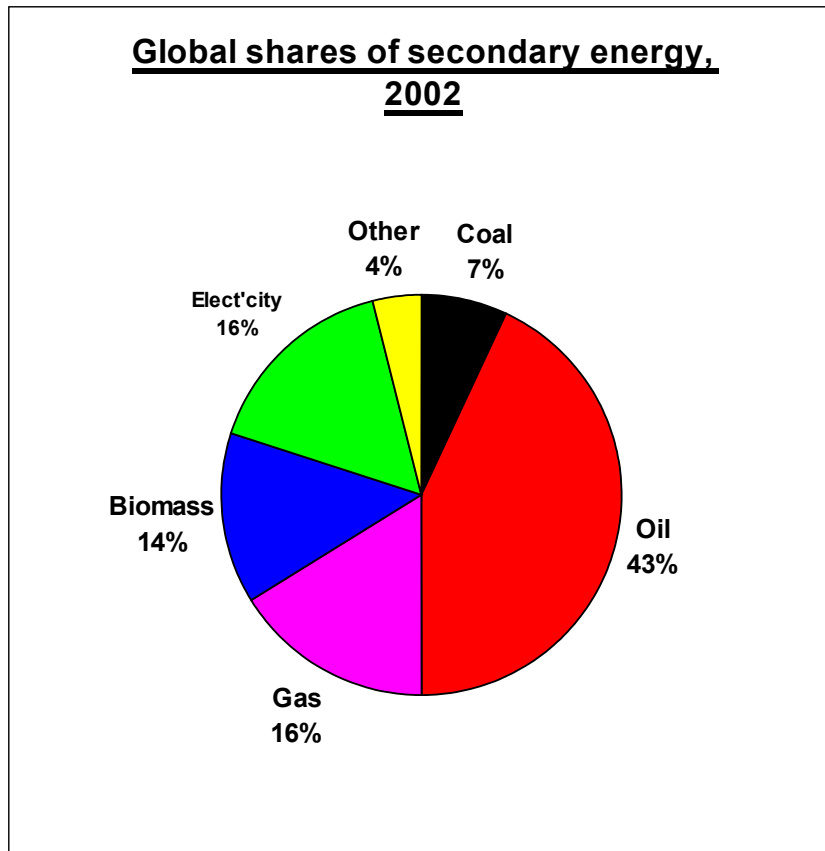
State	Fuel	Basis	Converter	On-board storage	Station network	Distribution	Production	Primary resource
Liquid	Distillates	Petroleum	Green	Green	Green	Green	Green	Orange
	Synthetics	Coal	Green	Green	Green	Green	Red	Green
		NG	Green	Green	Green	Green	Red	Yellow
		Biomass	Green	Green	Green	Green	Red	Yellow
	Ethanol	Sugars	Green	Green	Green	Green	Yellow	Red
	Diesel	Veg oils	Green	Green	Green	Green	Yellow	Red
Gaseous	LPG	Petroleum	Green	Green	Yellow	Green	Green	Orange
	CNG	NG	Green	Orange	Red	Green	Green	Yellow
	H ₂ ICE	NG	Green	Orange	Red	Green	Green	Yellow
	H ₂ ICE	Water	Green	Orange	Red	Red	Red	Green
	H ₂ FC	NG	Red	Orange	Red	Green	Green	Yellow
	H ₂ FC	Water	Red	Orange	Red	Red	Red	Green

King Coal reigns again ?



Source: Sustainable Fossil Fuels, Jaccard 2005

A massive shift to electricity and hydrogen as secondary energy carriers



Source: Sustainable Fossil Fuels, Jaccard 2005

Runners, impact, timing, policies

<u>Category</u>	<u>Runners</u>	<u>Impact</u>	<u>Timing (years out)</u>	<u>Policies</u>
Demand - fundamental	Structure of travel	Slow, uncertain	20-50	Land planning, economic development
Demand - marginal	Modal shift	10-20%	5-10	Incentives, fiscal
	Ride sharing	5-15%	5-10	Incentives, fiscal, HOV lanes
Vehicle design & technology	Downsizing	20%	5-10	Fuel pricing, rationing
	Downweighting	30%	10-15	Fuel pricing, rationing
	Drivetrain	10%	5-15	Fuel pricing, rationing
	Speed	10%	5-10	Universal tachograph
	Traffic flow	10%	5-10	Universal tolling
Alternative fuels	Bio	5%	1-10	Fiscal
	Synthetic	30-40%	15-50	Fiscal
	LPG	5-10%	1-10	Fiscal
	CNG	10%	1-10	Fiscal
	Hydrogen	?	25+ years	Primary energy

We are going to have to pull on every string, not just rely on alternative fuels

- **Demand management can be exercised nationally and locally**
 - The means mainly exist, for marginal gains
 - There is a beginning of political acceptance
 - Making large gains is very problematic
- **Vehicle design & technology can only be changed at the European level and through considerable political pressure**
 - Considerable potential gains
 - The means mainly exist
 - Requires a complete re-orientation of the automotive industry
 - And huge investments
- **Alternative fuels are like demand management**
 - The means mainly exist, for marginal gains
 - There is a beginning of political acceptance
 - Making large gains is very problematic