

Alan Forster
Shell WindEnergy



LSU Alternative Energy Conference



Agenda

1. New energy drivers
2. Industry overview
3. Shell Renewables
4. Carbon Management
5. The solution...?



Agenda

1. New energy drivers
2. Industry overview
3. Shell Renewables
4. Carbon Management
5. The solution...?



Renewables drivers are increasing

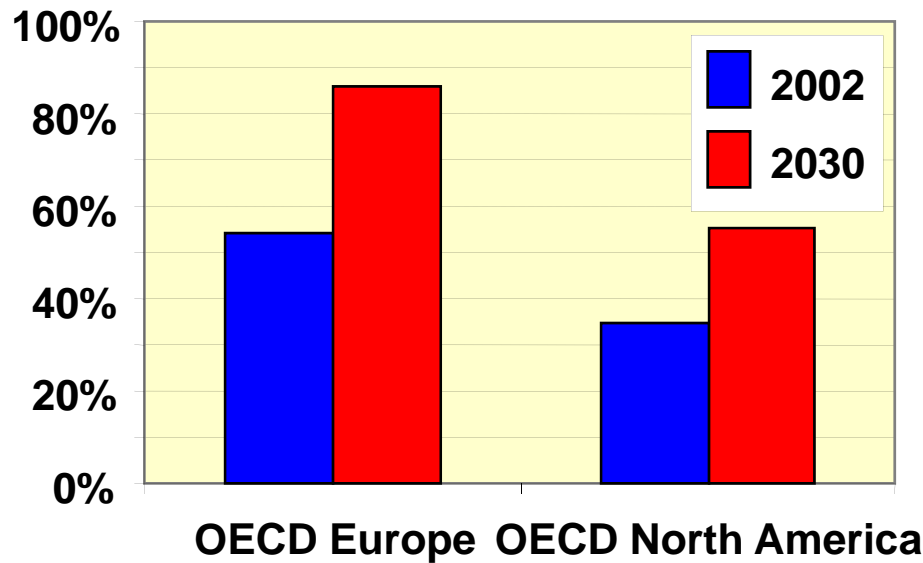
Driver:	1970's	Today
• Security of supply:	Oil Shocks	Energy Security
• Environmental:	Air quality	+ Climate change
• Technology dev:	R&D	+ Deployment
• Market structure:	Limited Source	Personal choice

=> Most OECD & some non OECD countries have set RE targets

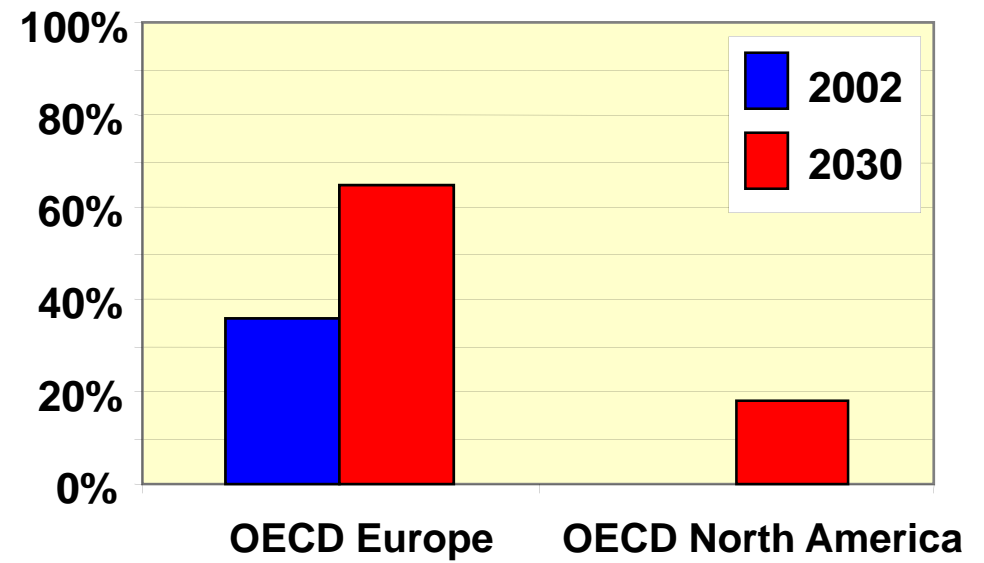


Energy Independence: Oil and gas import dependence will increase

Oil Import dependence



Gas Import dependence



Source: World Energy Outlook 2004, IEA

=> Renewable energy is largely indigenous



Renewables drivers are increasing

Driver:	1970's	Today
• Security of supply:	Oil Shocks	Energy Independence
• Environmental:	Air quality	+ Climate change
• Technology dev:	R&D	+ Deployment
• Market structure:	Limited Source	Personal choice

=> Most OECD & some non OECD countries have set RE targets



Environmental drivers



- Debate is drawing to close, even in the U.S.
- Science will become irrelevant – perception is reality
- Cost of doing nothing greater than cost of action e.g. Kyoto
- Popular pressure will drive policy
- Public tone of White House has already changed e.g. “Energy Hog” campaign



Renewables are not the only solution to these drivers

Others include:

- Carbon Sequestration
- Energy Efficiency
- Fuel switching (e.g. Coal to gas, coal/gas to nuclear)
- “Clean” hydrocarbons

Renewables are the solution of choice for those countries with either a major indigenous renewable resource, firm social/political will, or because a market support framework has created an industry



Agenda

1. New energy drivers
2. Industry overview
3. Shell Renewables
4. Carbon Management
5. The solution...?



Faster growth than conventional energy...

1990-2000
growth (%)

10 pa)

8
6
4
2
0
-2

Coal Oil Gas Hydro Nuclear Renewables

Coal

Oil

Gas

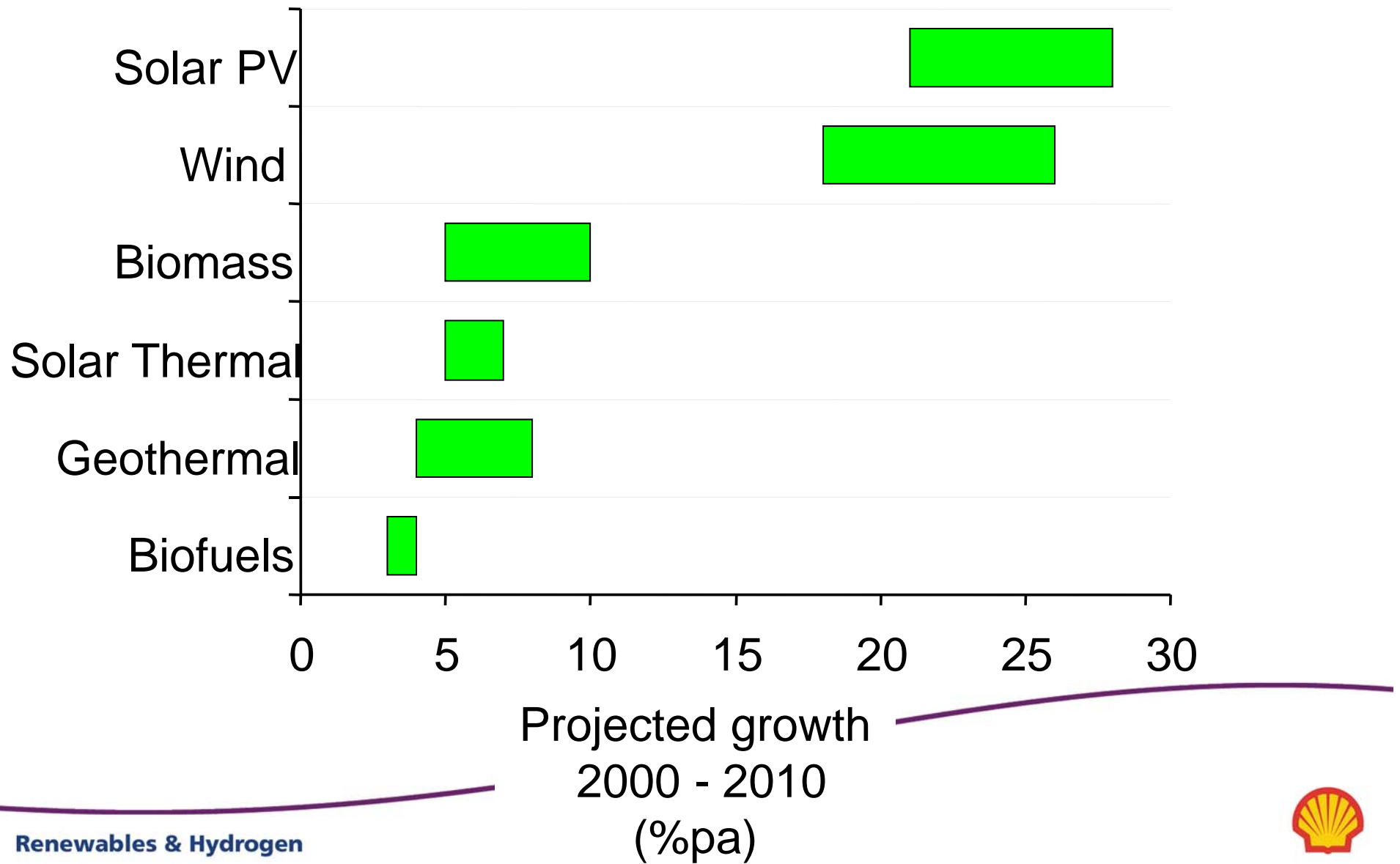
Hydro

Nuclear

Renewables



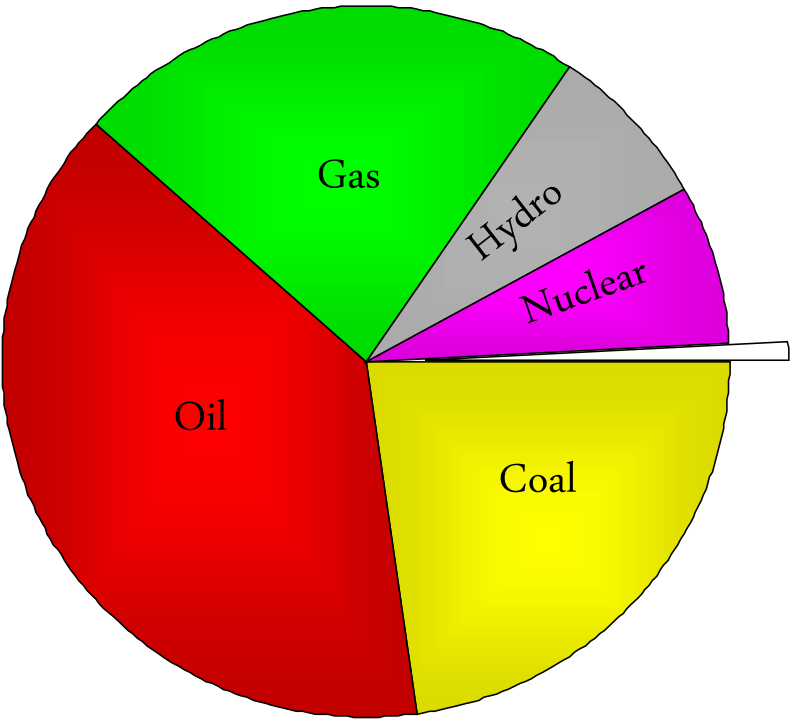
Continued strong growth ahead



A small but growing share of primary energy

Total primary energy:

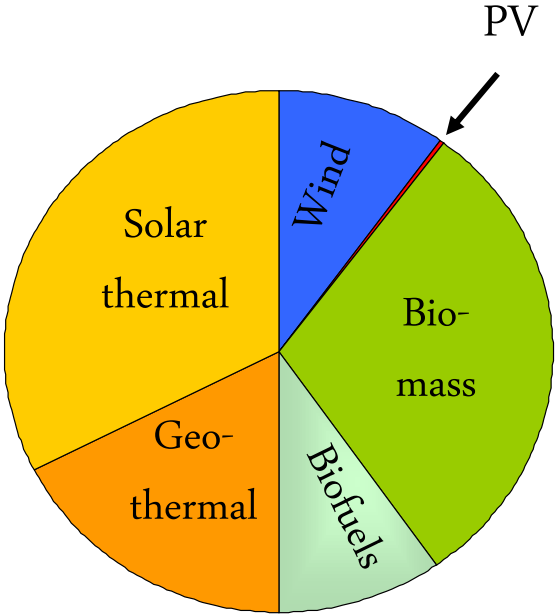
114'000TWh/year



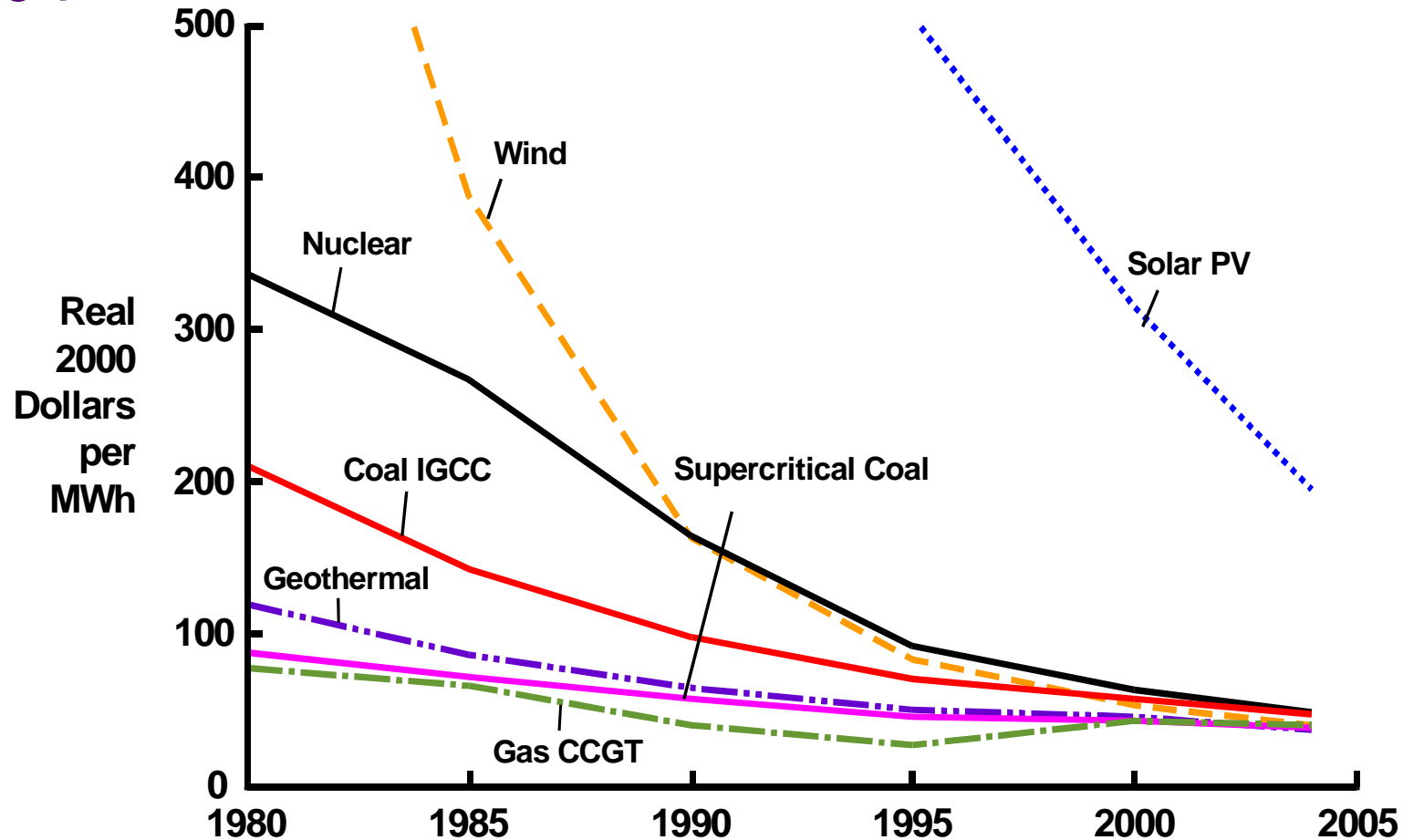
Renewables

Renewables:

1'100TWh/year



The Narrowing Band: U.S. Generation Costs, 1980–2004



Source: Cambridge Energy Research Associates.
40321-5



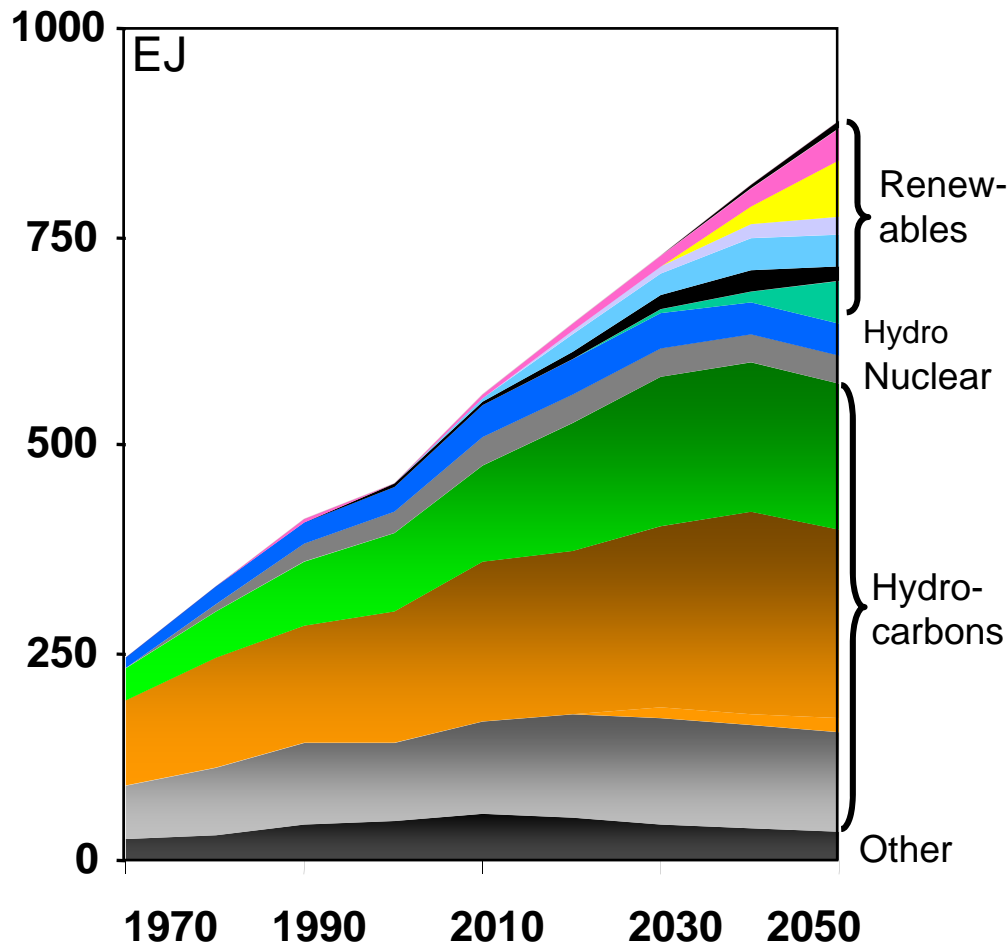
Agenda

1. New energy drivers
2. Industry overview
3. Shell Renewables
4. Carbon Management
5. The solution...?

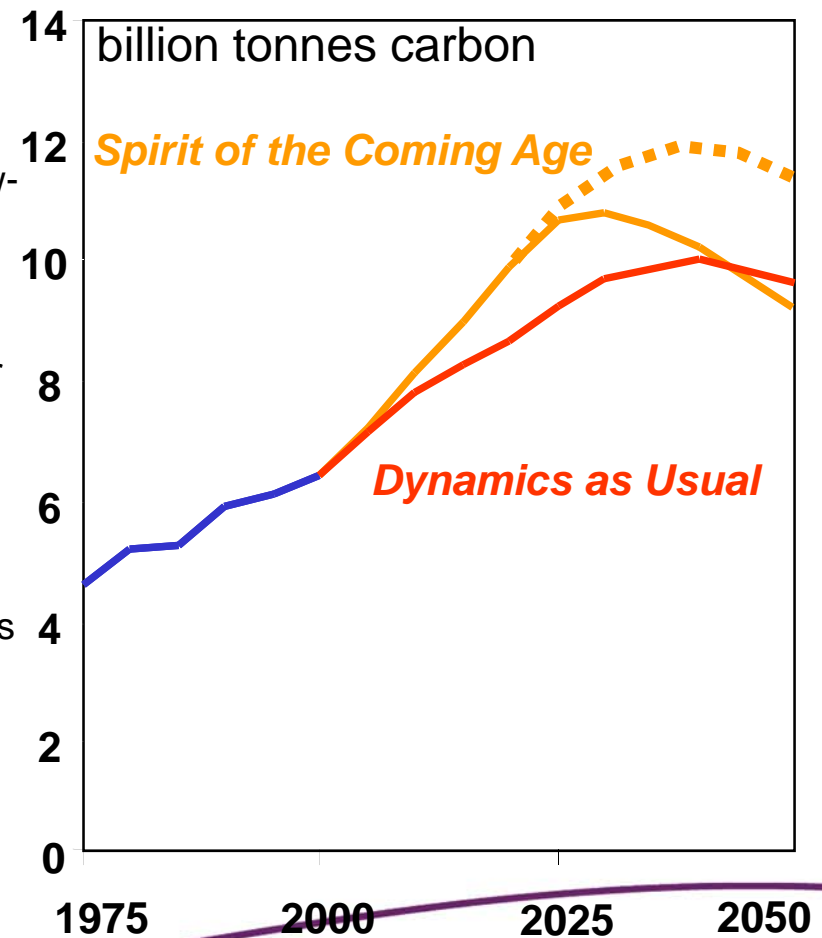


Carbon constrained futures

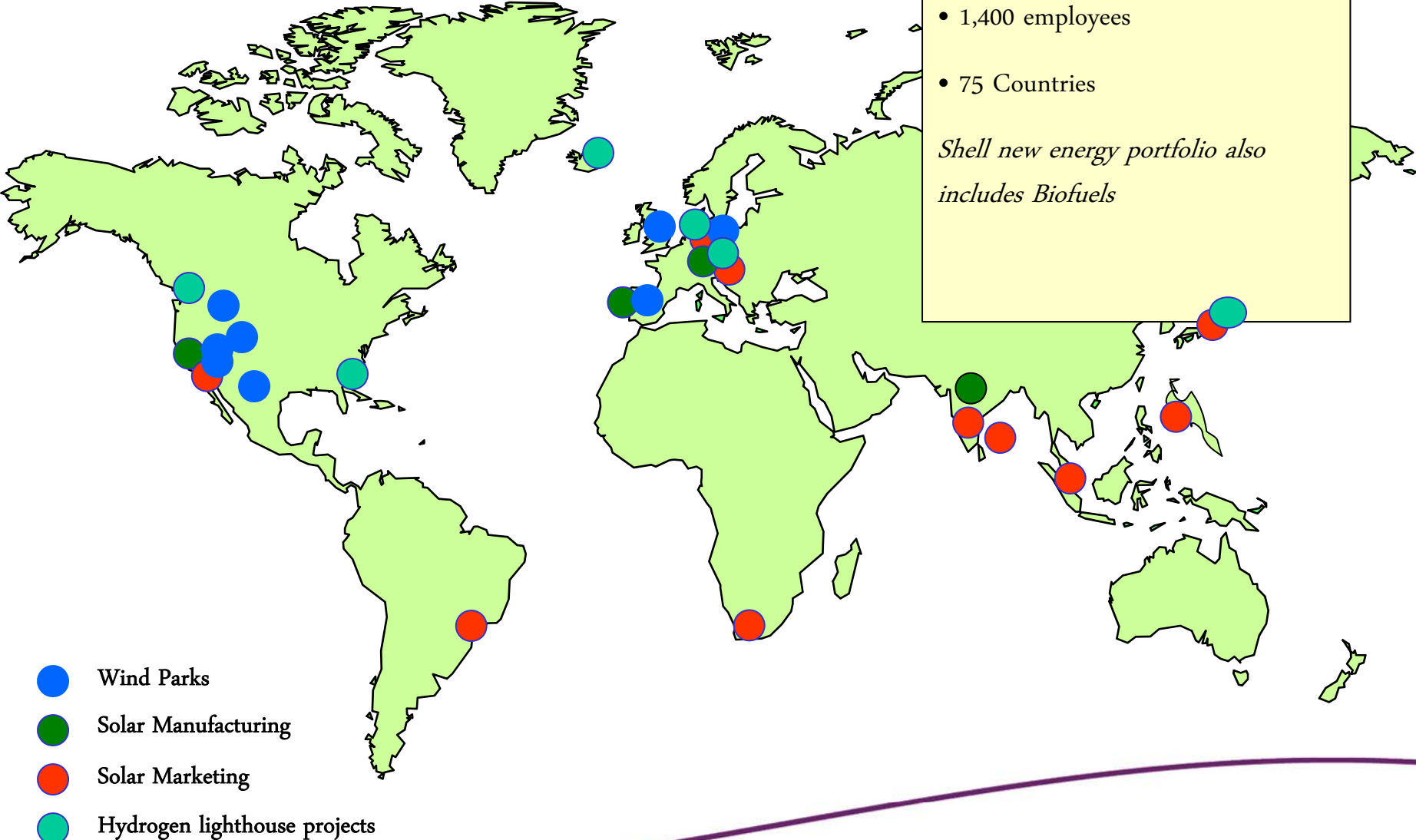
Energy system mix



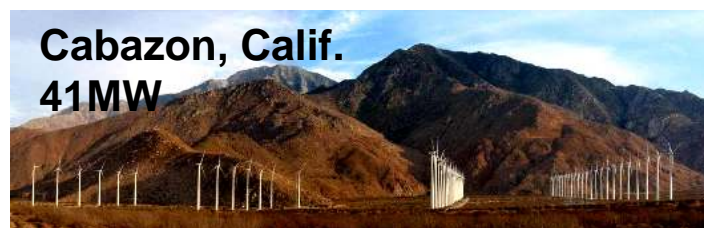
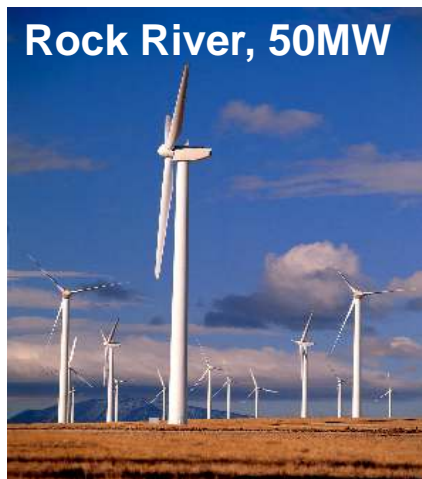
Carbon emissions



A global presence



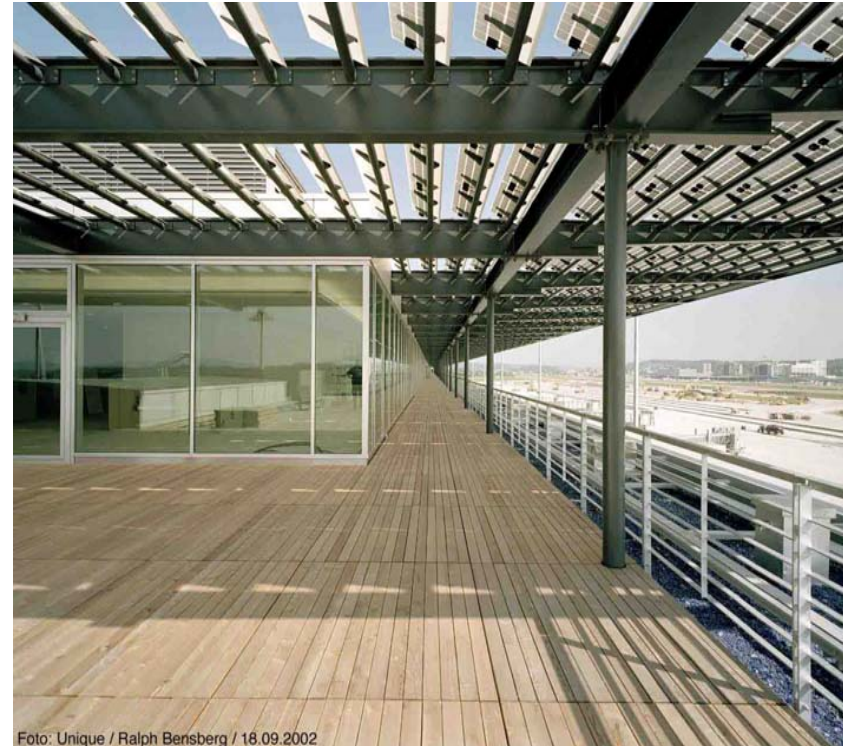
Shell WindEnergy Inc.



- Shell WindEnergy Inc owns/operates 634 MW (gross);
- Supplies ~2TWh of emission-free electricity: equivalent to 90% of the residential electrical demand of Wyoming.



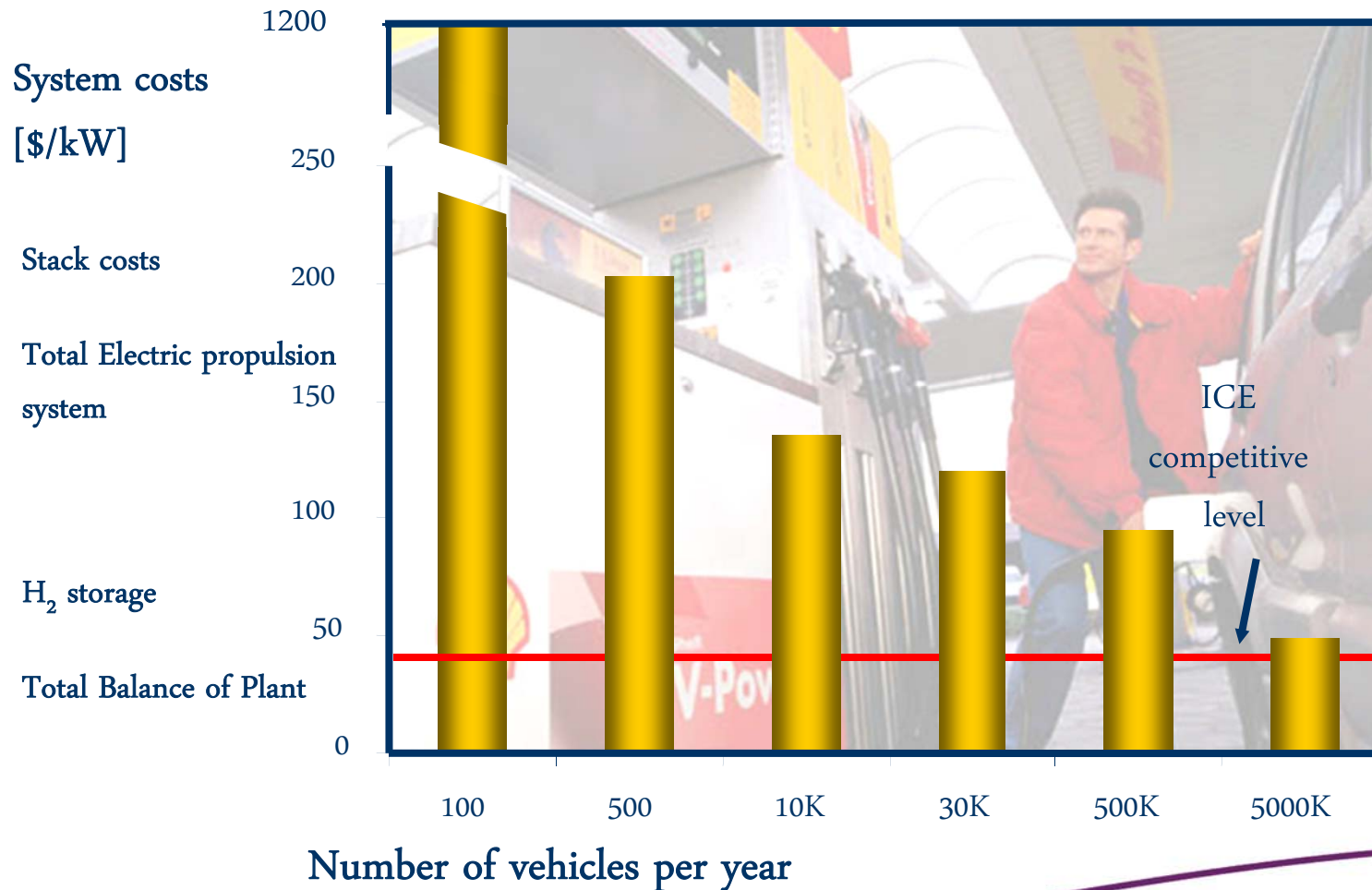
Solar PV – mainly crystalline today



Future rests with other technologies: CIS



Hydrogen – how long is the road to competitiveness?



Shell is putting *theory* into practice...

In safe operation for more than a year



Washington D.C.

Planned for '06



Los Angeles

Planned for '06



New York State

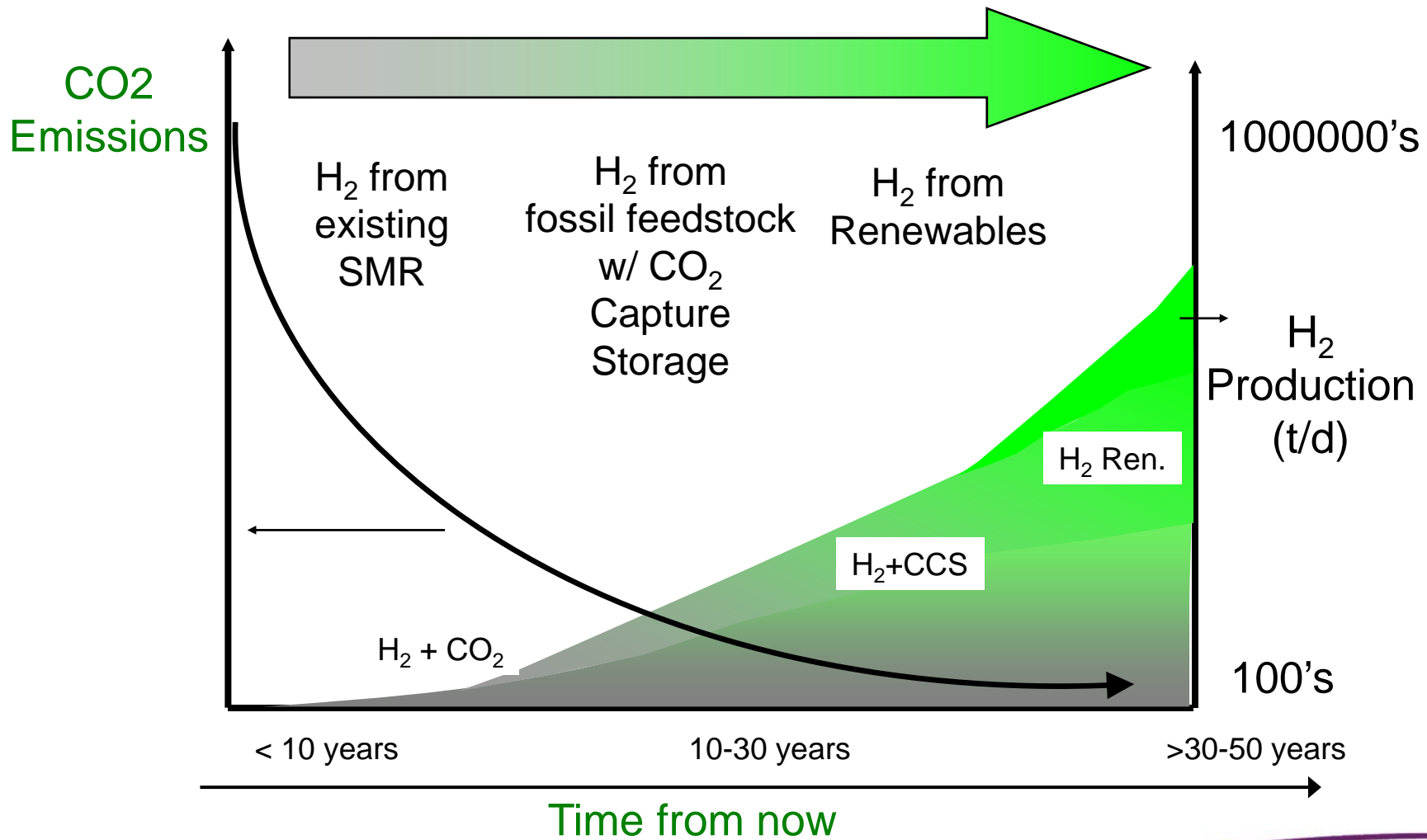


Agenda

1. New energy drivers
2. Industry overview
3. Shell Renewables
4. Carbon Management
5. The solution...?



There needs to be a steady Migration Pathway to CO₂-Free H₂

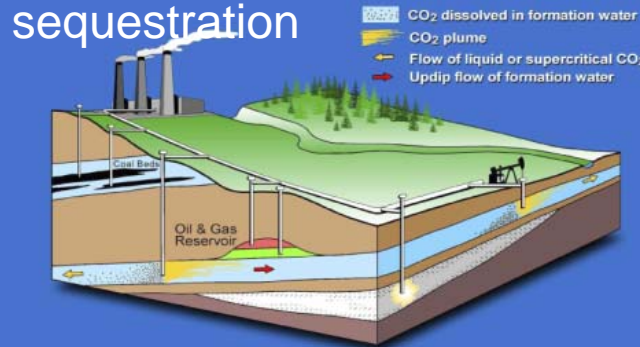


Carbon Management, A license for growth

renewables



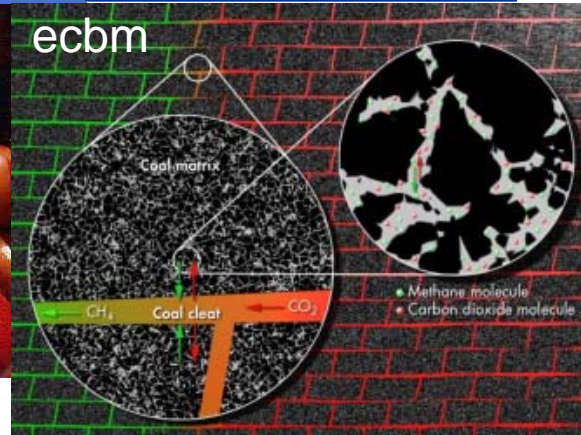
sequestration



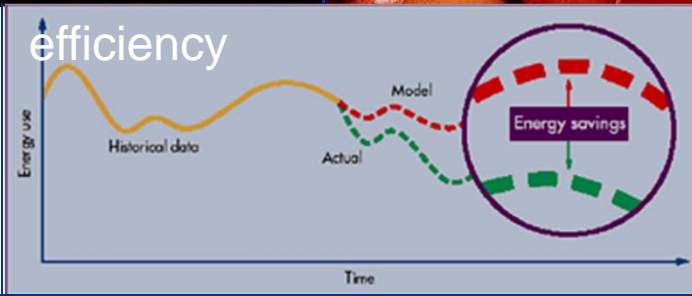
alternatives



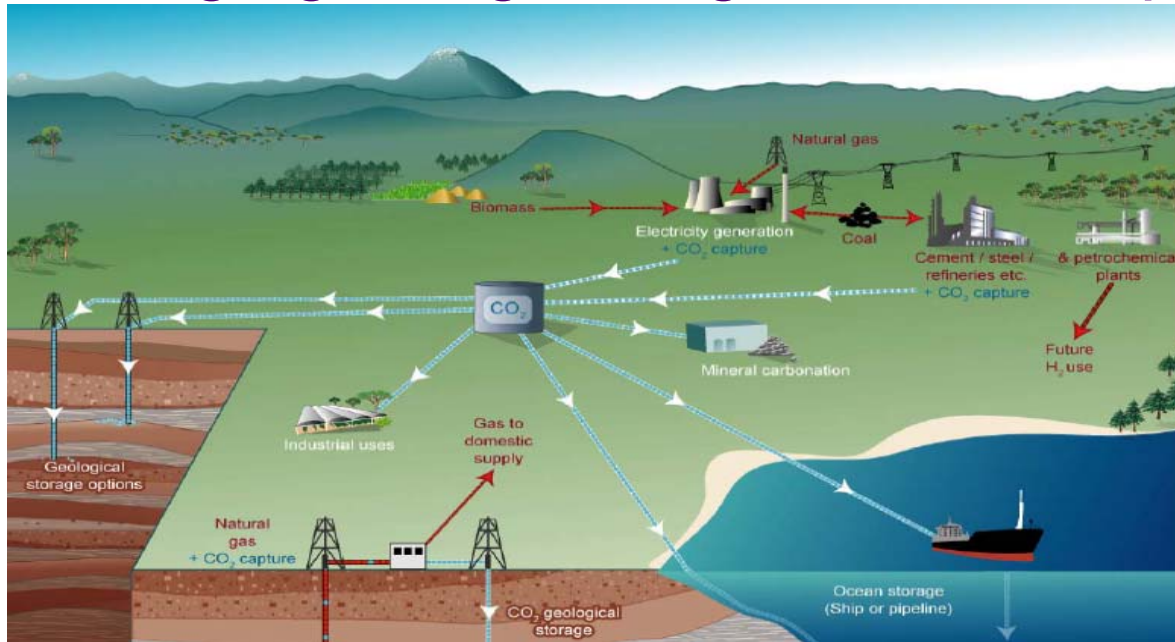
ecbm



efficiency



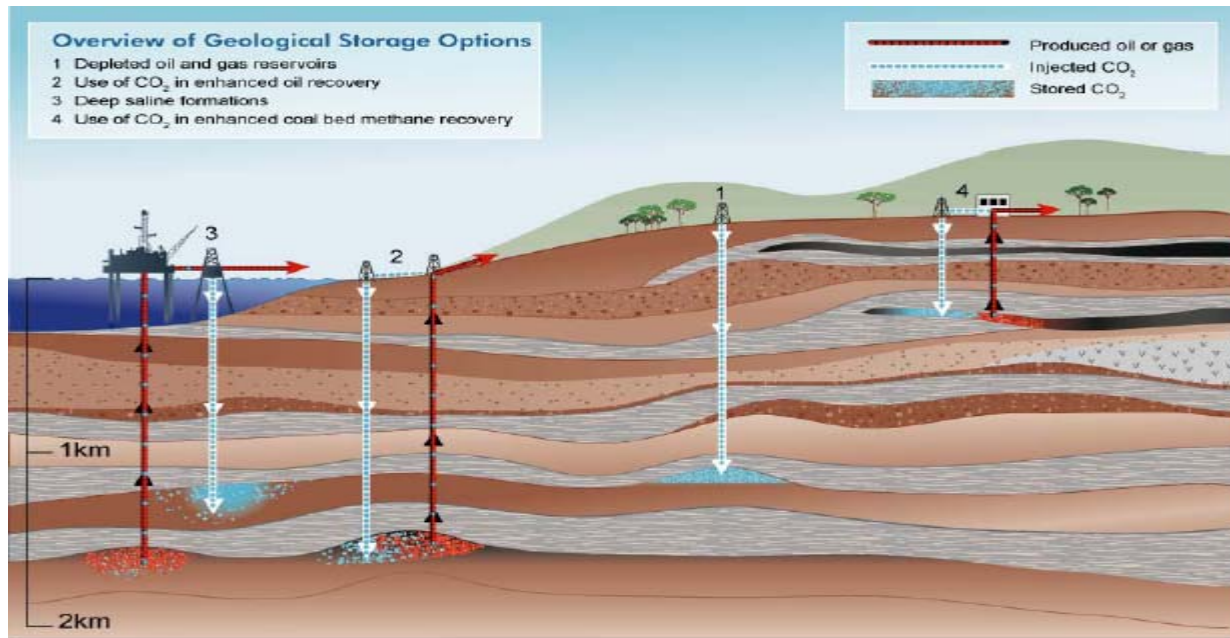
Managing our growing carbon footprint



- Economics of sequestration don't add up - UNLESS you view it as an enabler for growth
- No sequestration = no chance to exploit unconventional/coal
- Geological sequestration is possible without technology advances



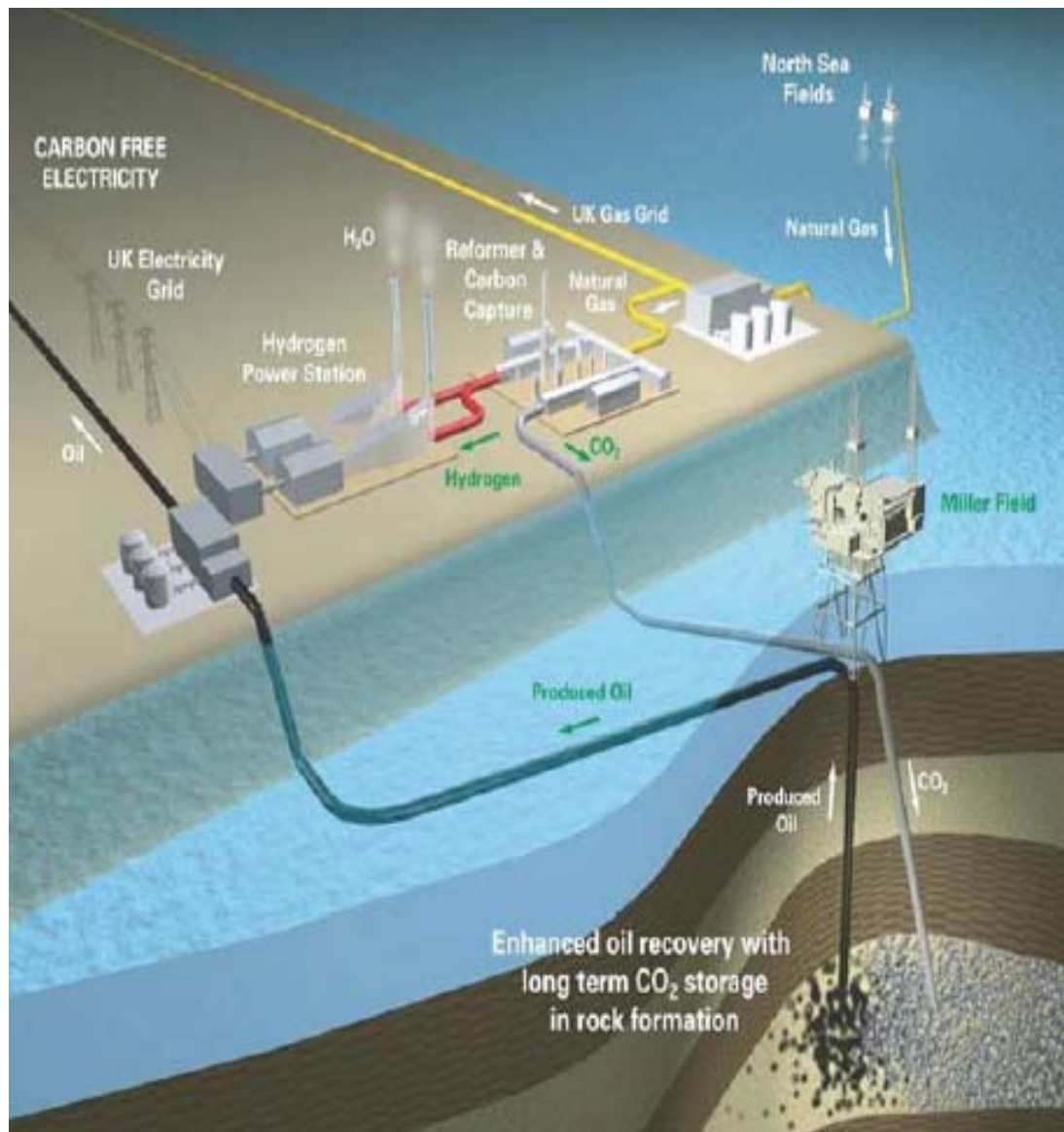
Managing our growing carbon footprint



- Proving safe storage is the challenge
- Governments needs to clarify legal liabilities wrt storage
- Public understanding is low – NGO's are ready to fill the gap if we don't
- It's time to get moving



Clean Power, CO₂ sequestration - Miller, Scotland



Agenda

1. New energy drivers
2. Industry overview
3. Shell Renewables
4. Carbon Management
5. The solution...?

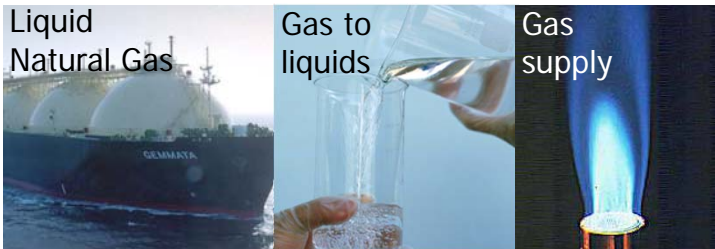


A Portfolio enabled by technology



Hydrogen

Developing tomorrow's hydrogen infrastructure.



Natural gas

World leader in LNG;
Making cleaner transport fuels with 'gas to liquids' technology.



Solar

Making the world's most energy efficient commercial solar panels.



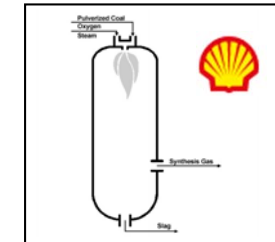
Bio-products

One of the world's largest bio-fuel users today;
Researching advanced bio-products for tomorrow.



Geological Co2 sequestration

Partnering in research and development initiatives.



Coal gasification

Licensing advanced gasification technology.



Wind

Powering hundred of thousands of homes with Wind energy.



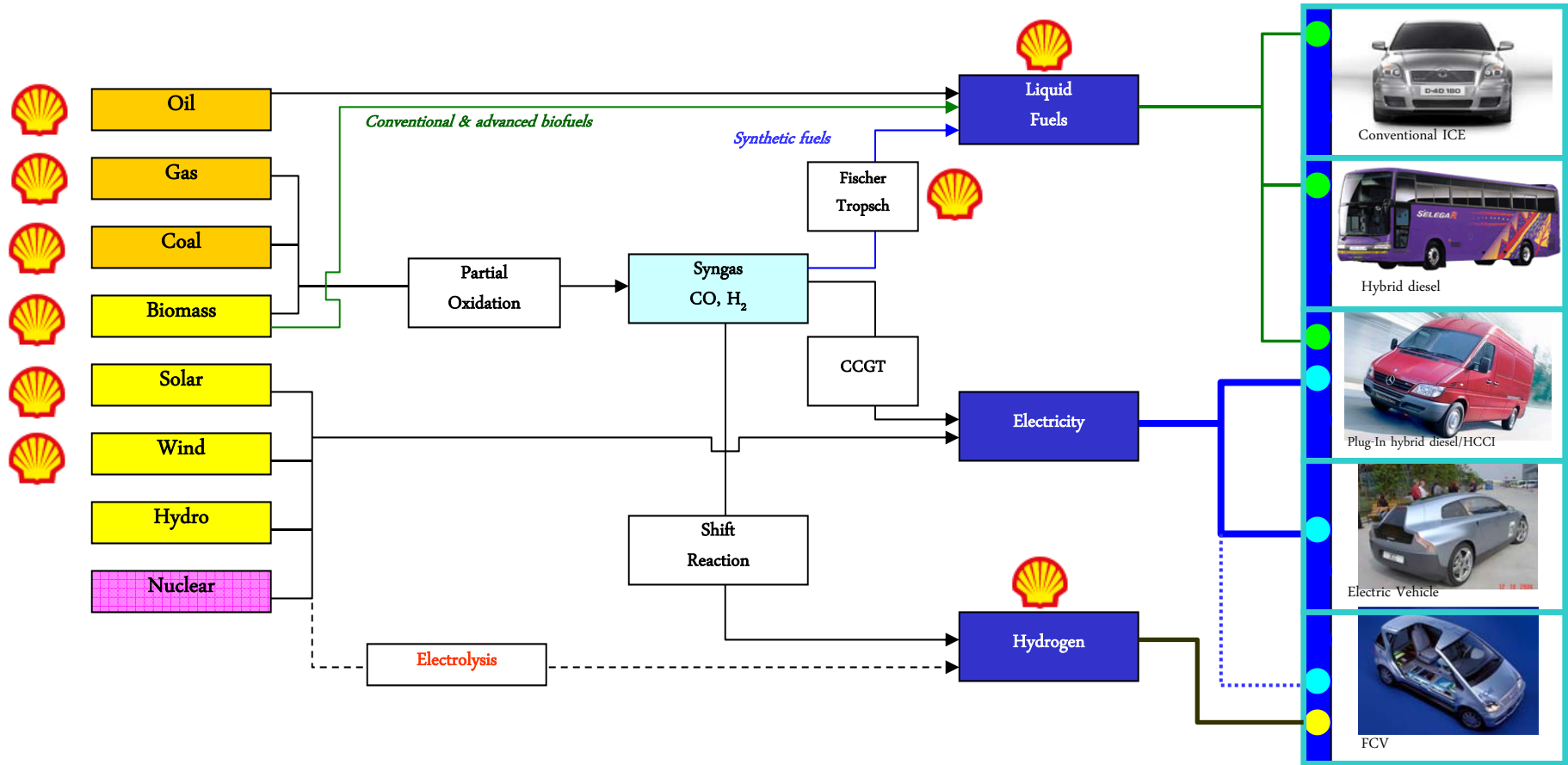
Shell supplies 10% of the worlds transport fuels

with many delivery options

Energy Sources

Energy Carrier

drive-train options



The solution is the energy mix

- There is no single solution – **diversity** of energy sources will increase, including other new energies like Hydrogen
- Renewables will be part of the solution – costs will decrease, but stability, scale and new fast growth markets will determine pace of competitiveness
- All choices (including nuclear) need time to build

So the time to make decisions is *now*...not only for new renewables, but also traditional fuels....



