The Australian Perspective of The Future

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An Australian Conundrum

- Rapidly growing economy
- Steadily increasing energy needs out to 2020 (average of 2% consumption growth per annum)
- Similar growth in transport sector
- Need for adequate supplies of competitively priced energy

No problem ……except that ……

- Continuing strong reliance on fossil fuels (particularly in power generation)

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- Energy intensive industry sector

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High GHG emissions per capita

Government commitment - achieve economic growth but with a lower emissions signature

How?

- Encouraging routes to cost-effective, low emission technologies
- Power generation sector:
  - efficiency improvements (eg supercritical/ultra-supercritical, Ultra Clean Coal, IGCC)
  - CCS
- Industry:
  - energy efficiency
  - CCS?

Addressing the Transport Sector – Steps Towards a Hydrogen Economy

- Synthetic liquid fuels ('Gas-to-Liquid' – GTL)
- Hydrogen

GTL Fuels

- Fischer-Tropsch chemistry
- Allow range of feedstock (gas, 'syngas', CBM, refinery wastes, some biomass)
- Lower emission transport fuels ('ultra-clean' diesel)
- Suitable for existing engine technology (diesel, ICE)

GTL Fuels – a 'Bridge' to a Hydrogen Economy?

- Higher H_2 content fuels – also suited for advanced engines and fuel cells
- H_2 content can be increased $\rightarrow$ dense H_2 carrier
- Easily transported and stored using existing infrastructure
- Easily reconverted into H_2 using established fuel processing technologies

GTL Fuels – a 'Bridge' to a Hydrogen Economy?

- Potential synergy with IGCC: 'polygeneration' (ie electricity, GTL fuels, hydrogen)
- Verasile, 'hydricity'
- To be a near-zero emissions energy plant, CO_2 stream $\rightarrow$ CCS

A Gasification-based 'Polygeneration' Concept

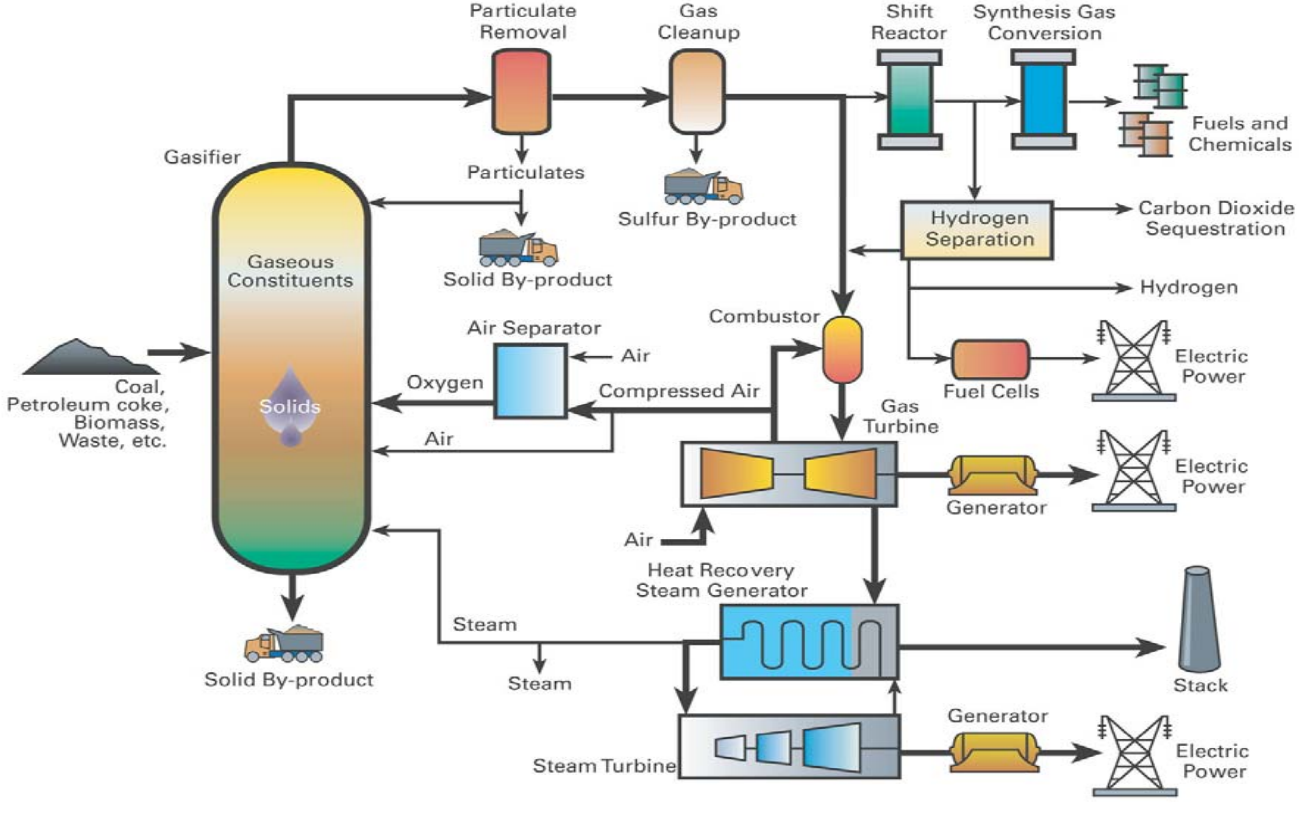


Image courtesy of Nexant Inc, USA

GTL Activity in Australia

- APEL - Victoria Power & Liquids Project (Syntroleum Corporation's GTL process)
- GTL Energy Ltd – agreement to conduct feasibility trials with International Power (Australia) at Hazelwood power station, Victoria (Rentech Inc's GTL process)
- Others ……

Route Towards a Future Hydrogen Economy

- What is a “hydrogen economy’?
- Sourcing the H_2? Broad consensus on the role of fossil fuels
- Growing interest worldwide
- Australia’s circumstances $\rightarrow$ heightened interest in H_2
- The National Hydrogen Study, 2003
- Transitional role for fossil fuels

Development Horizons to a Hydrogen Economy

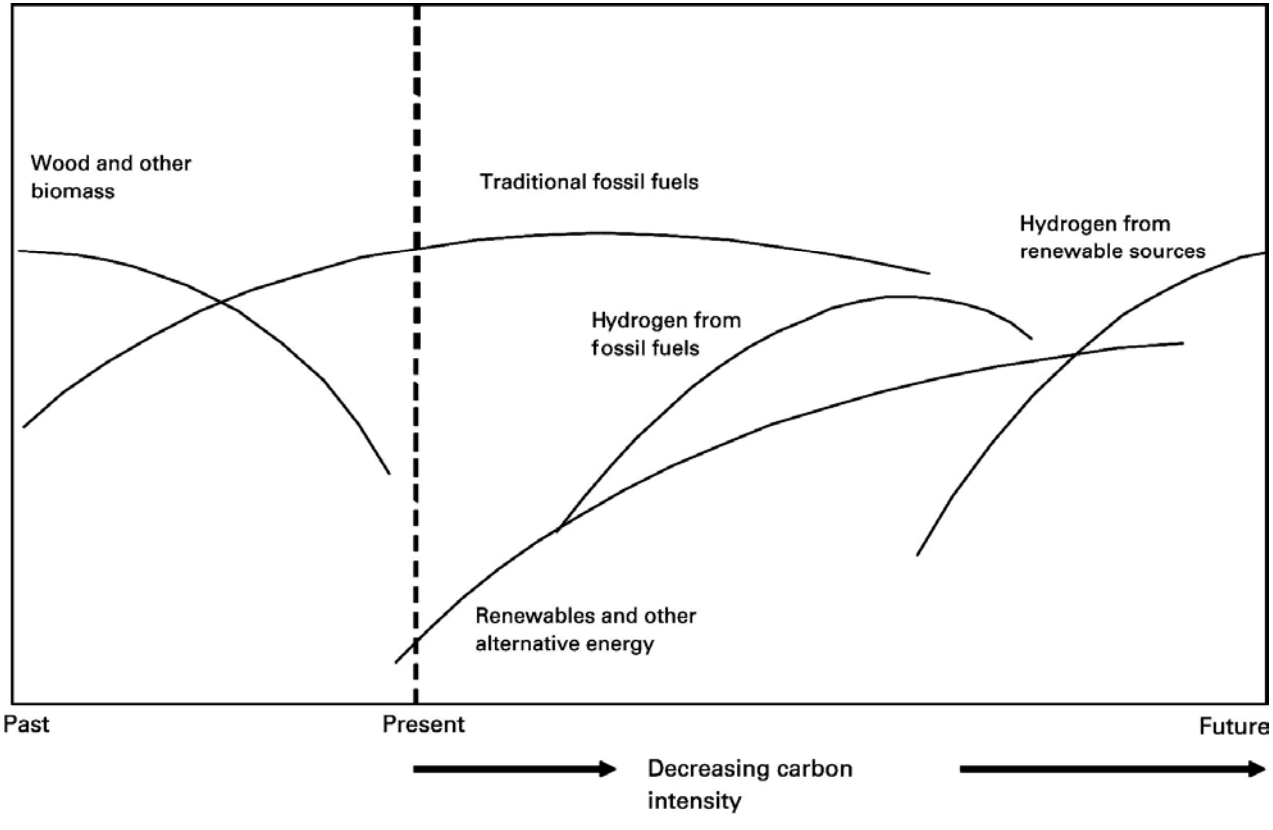


Image courtesy of DITR

National Hydrogen Study

- Commissioned by DITR (for Aus. Gov.)
- ACIL Tasman and Parsons Brinckerhoff
- High Level Advisory Group
- Conference, May 2003
- How might H_2 enter the energy mix?
- Does Australia need to do anything?
- What should Australia do?

NHS: Nine Recommendations

- Establish a policy framework
  1. Adopt a vision for hydrogen
  2. Commit to addressing policy/regulatory barriers
  3. Review policies/measures every 2-3 years
- Encourage collaboration & partnerships
  4. Participate in bi-/multilateral R&D programmes
  5. Encourage private sector participation
  6. Establish an Australian Hydrogen Group
  7. Government to be early adopter – market confidence

NHS: Recommendations and Actions

- Laying the groundwork for transition
  8. Australia to play active role in codes and standards
  9. Develop technology roadmaps to help target R&D

Timeframe for action (2004-05)

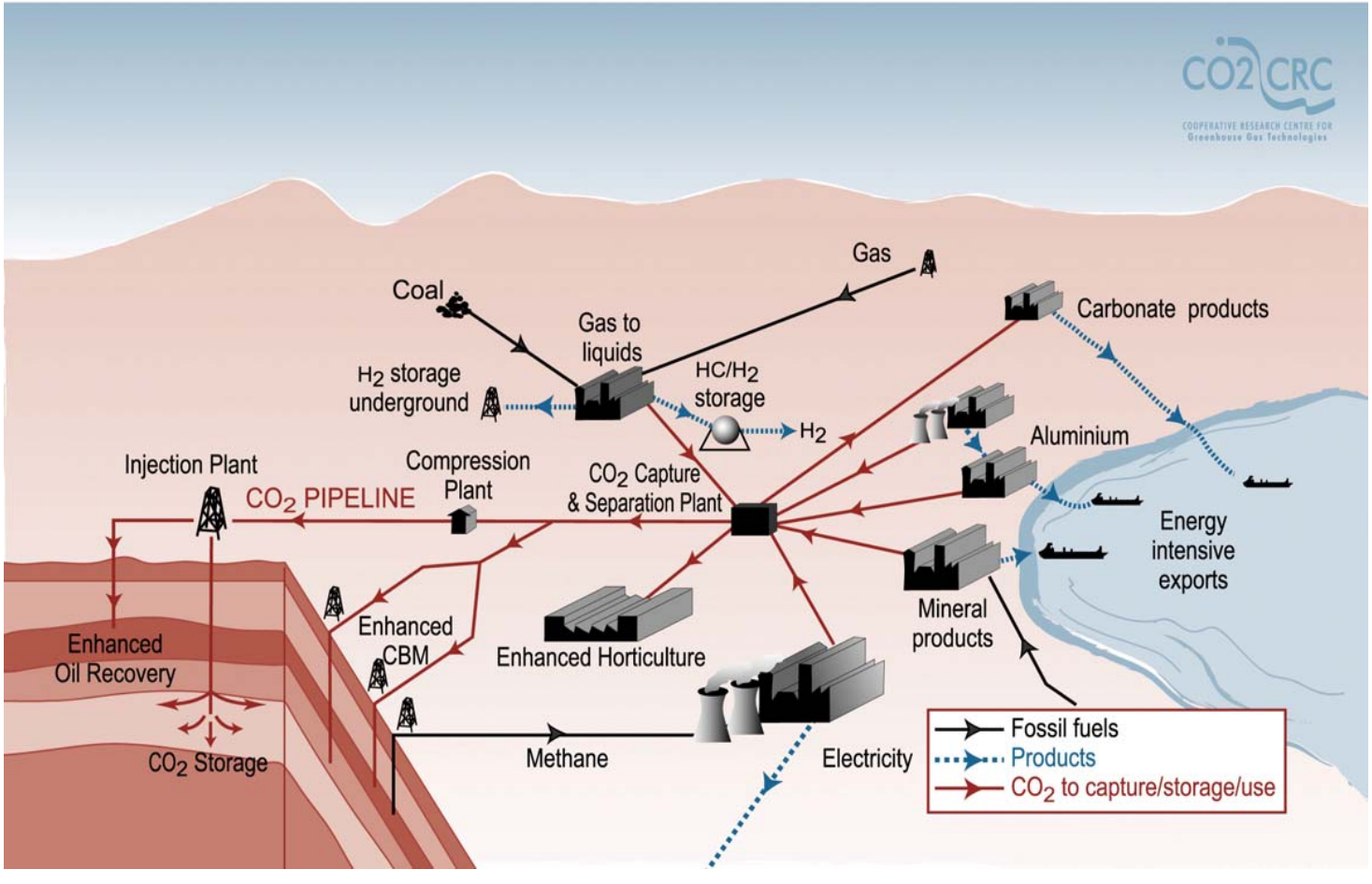
Membership of the International Partnership for the Hydrogen Economy

CSIRO ‘Energy Transformed’ Flagship

CCS – a Key Precursor

- CO2CRC Technology Roadmap (TRM)
- CCS is an early ‘enabling technology’
- TRM is not a hydrogen roadmap
- Possible large-scale, low emission ‘hubs’

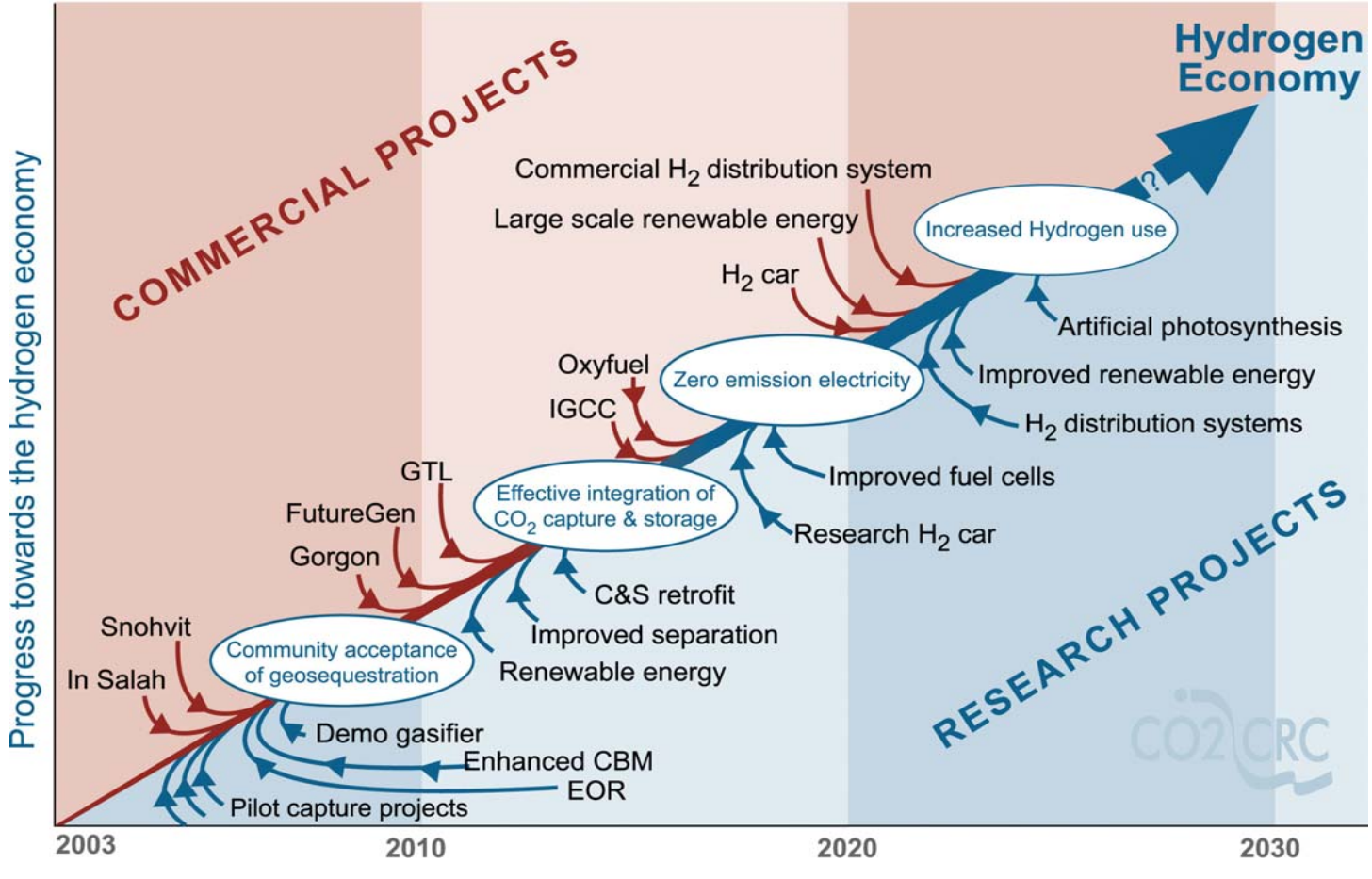
An Emissions-free Vision



Steps Towards a Hydrogen Economy

- Acceptance of CCs technologies
- Deployment of CCS and low emission power generation from fossil fuels
- Co-production of electricity and H_2 from FFs with widespread application of CCS
- Development of H_2 infrastructure
- Wide-scale use of H_2 in power/transport
- Production of H_2 from renewables

CO2CRC's Level 3 Roadmap



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In Summary……

- Technology developments needed for an emerging hydrogen economy are broader than just CCS
- Cost effective, safe, verifiable and acceptable CCS technologies are needed – key step on route to near zero emission energy systems