Western Australia's Sustainability Strategy and the Hydrogen Future

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State Sustainability Strategy

Definition

Sustainability:

Meeting the needs of current and future generations through simultaneous social, environmental and economic improvement.

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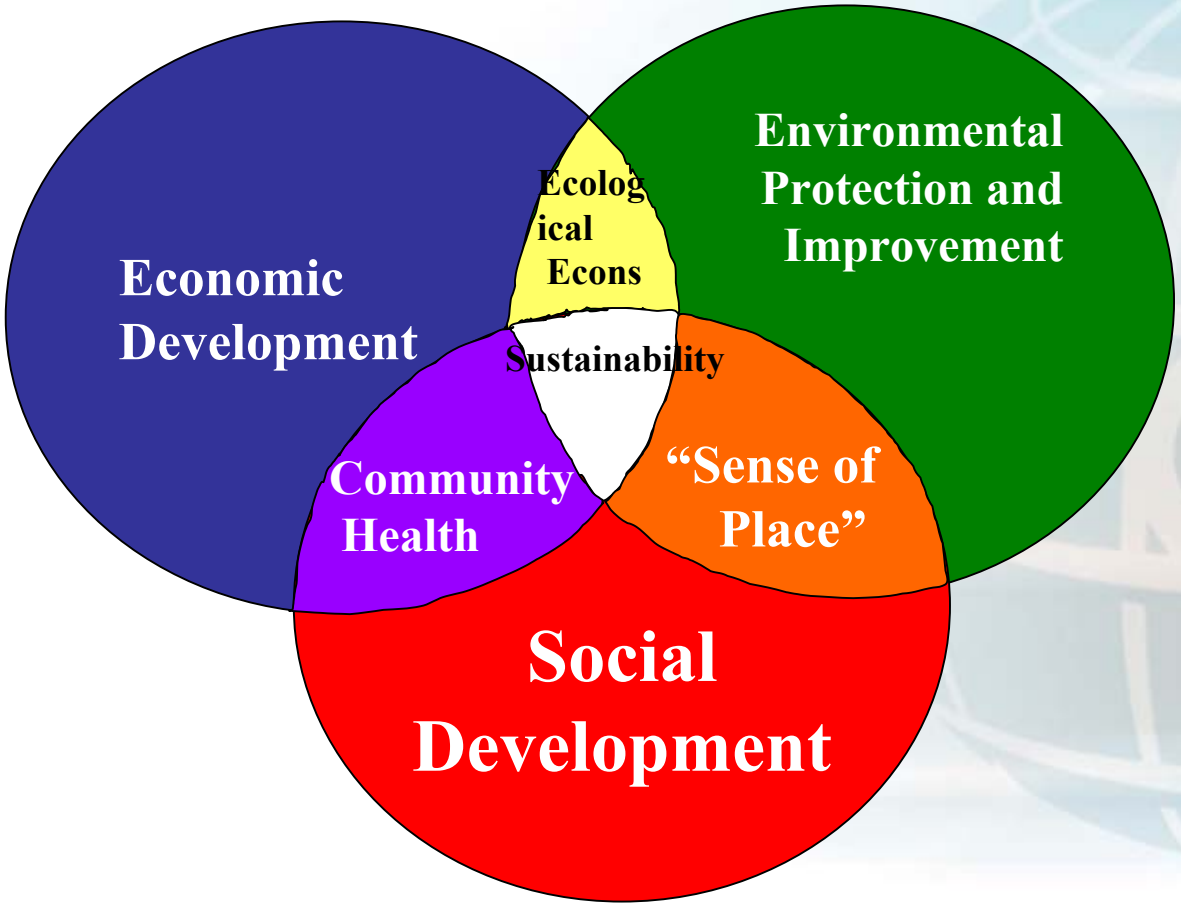
State Sustainability Strategy

Sustainability Dimensions

1. Disciplinary/Professional Dimensions
2. - **How we think.**
2. Sectoral Dimensions
3. - **How we act.**
3. Geographically Dimensions
4. - **Where we focus our thinking & actions.**

The Sustainability Story

Mid 90's to 2000



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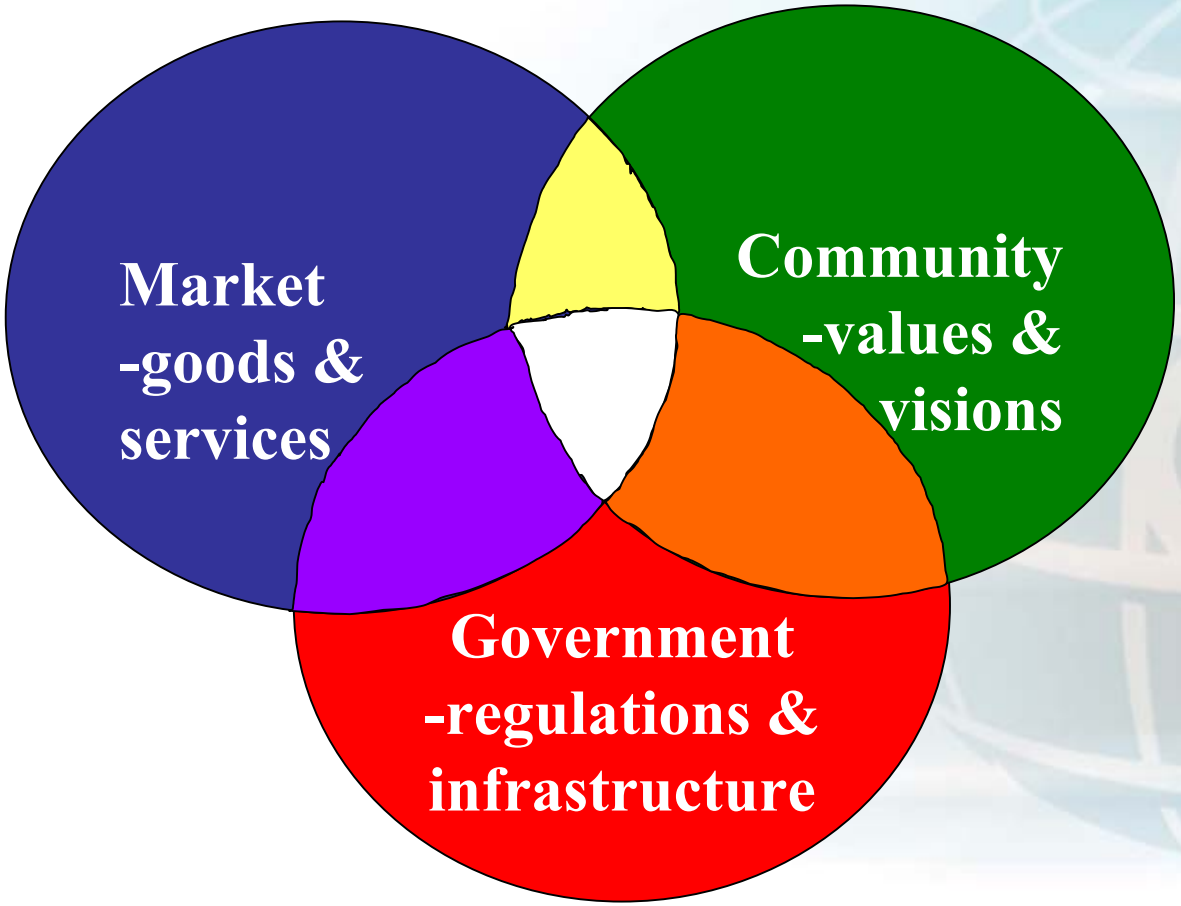
Sectoral Dimensions



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Geographical Dimensions

State Sustainability Strategy

- **Comprehensive assessment of sustainability across 42 areas of government.**
- **Based on 30 Background Papers and 43 Case Studies done by research students and academics.**
- **Website (www.sustainability.dpc.wa.gov.au) receives thousands of hits a day with 35% from the US.**
- **Has engaged the public across the state and in many different groups and professions (140 seminars in 6 mths).**

State Sustainability Strategy

Sections of the Strategy

- **Governance**
- **Global Contributions**
- **Natural Resources**
- **Settlements**
- **Community**
- **Business**

Contributions to Global Sustainability

- **Population, Development and Environmental Technology.**
- **Maintaining Our Biodiversity.**
- **Responding to Greenhouse and Climate Change.**
- **Oil Vulnerability, the Gas Transition and the Hydrogen Economy.**

State Sustainability Strategy

Rec 2.24:

Establish a Taskforce to examine issues to do with oil vulnerability, the gas transition and the Hydrogen economy.

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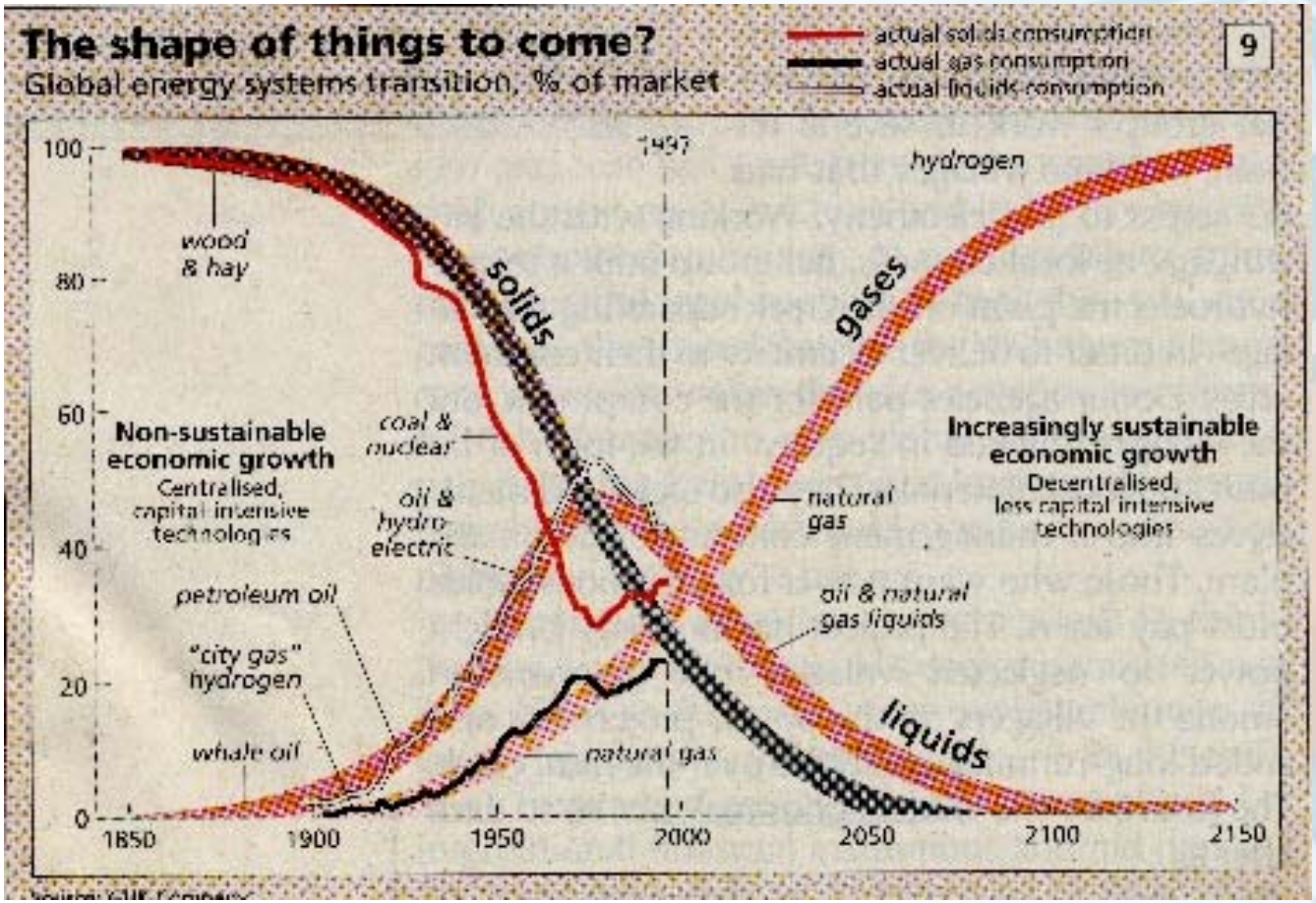
Future Fuel of Choice?



Source: Economist, 2001

DECARBONISING THE ENERGY ECONOMY:Transition in C:H Ratio

- **Wood is 10C:1H**
- **Coal is 2C:1H.**
- **Oil is 1C:2H.**
- **Gas is 1C:4H.**
- **Hydrogen is all H.**

In the global energy transition it can be expected that there will be less and less carbon in the energy mix. Coal growth now –0.3%/year. Carbon and economic output have 'decoupled' in the past 25 years.

The Global Politics of the Hydrogen Economy

"We happen to believe that fuel cells are the wave of the future; that fuel cells offer incredible opportunity".
US President George W. Bush Feb 25, 2002.

"Federal Officials may have staked our energy future on hydrogen."
Dan Vergo of USA Today.

"Hydrogen is getting major attention by the Bush administration. The administration has caught the vision of hydrogen and what it can do for our economy, our energy security and the environment."
John Turner, NREL 2002.

Goal: 2-4 million households by 2010
10 million households by 2030

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Sustainability Considerations for H_2-Economy

- **Oil Vulnerability**
- **Climate Change**
- **Health and Air Quality**
- **Infrastructure Requirements**
- **Opportunities for WA**
- **Transition to the H2 Economy**

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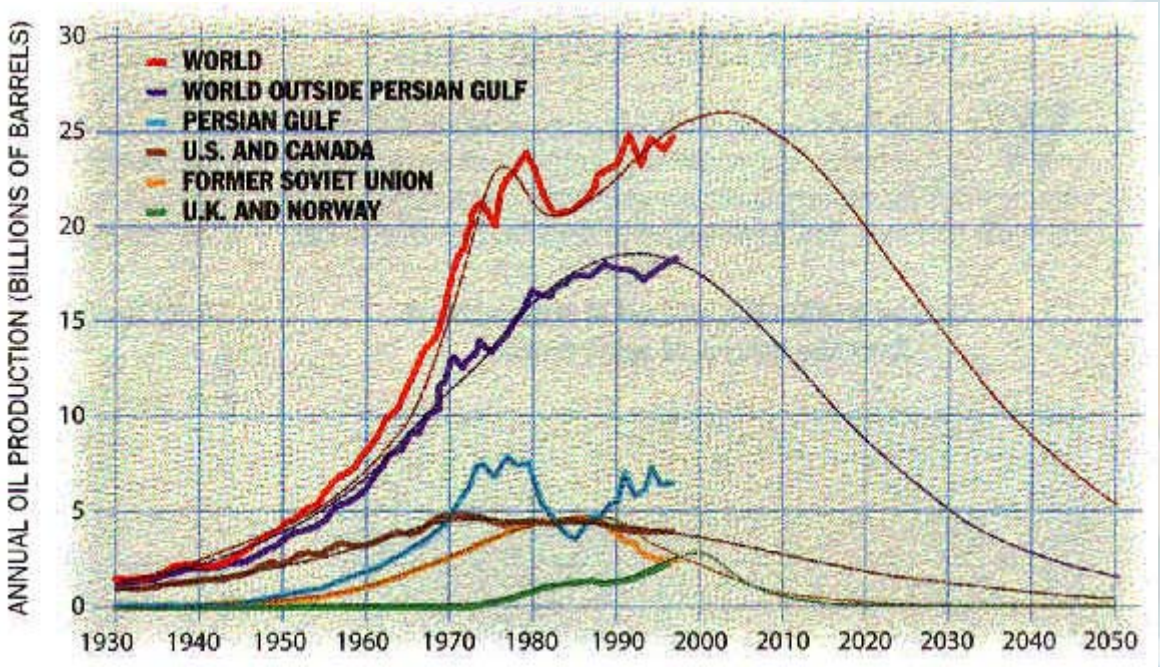
Oil Vulnerability

Peak in Production



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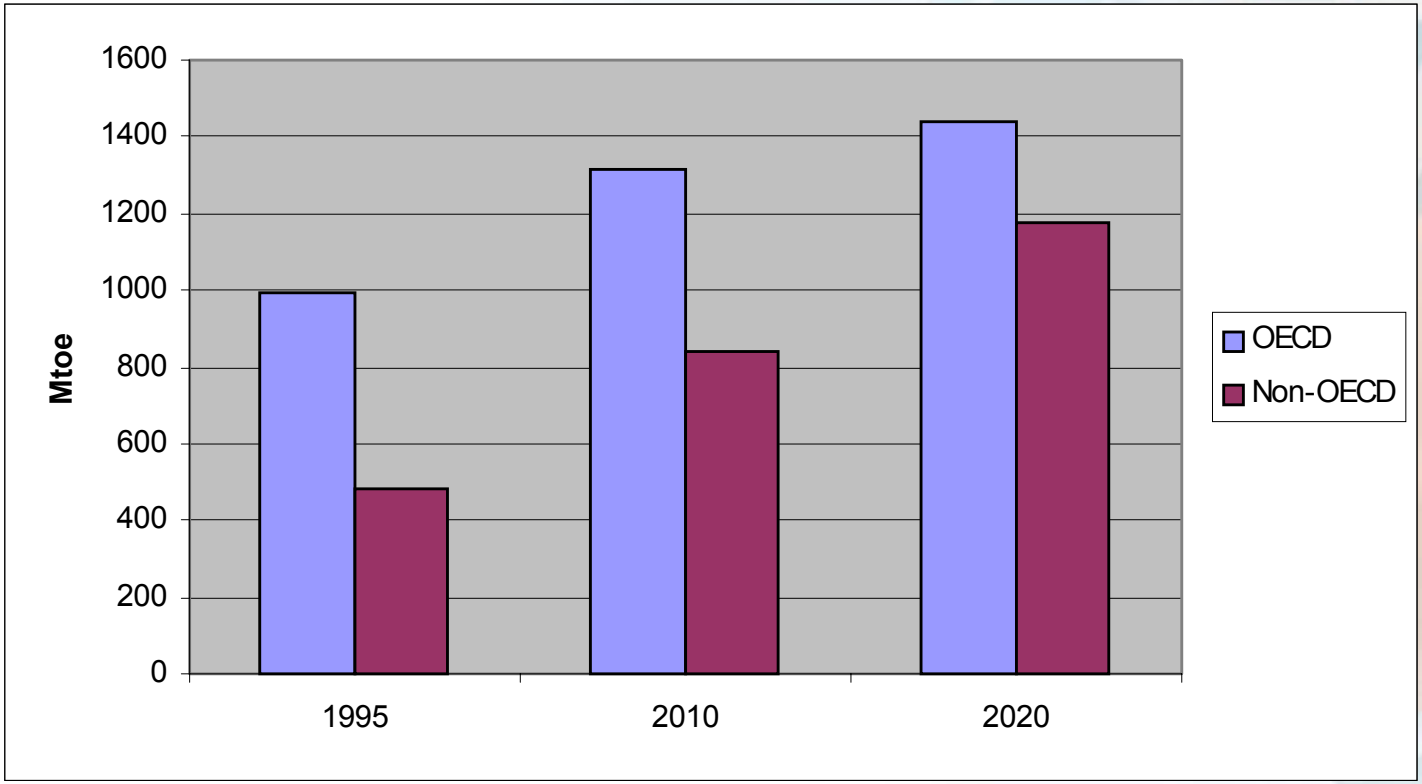
Oil Vulnerability

Increasing Demand for Oil



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Oil Vulnerability

Increasing demand for oil that cannot be met.

GLOBAL TRANSPORT ENERGY EFFICIENCY HAS BEEN DECLINING FOR MOST OF THE PAST DECADE…..
US fuel efficiency was the worst for 22 years in 2002.
Signs of an 'over-mature' industry that recognises there will be a new technology replacing it shortly.
And the continuing problem of automobile dependence in cities.Need more sustainable cities as well as more sustainable fuels.

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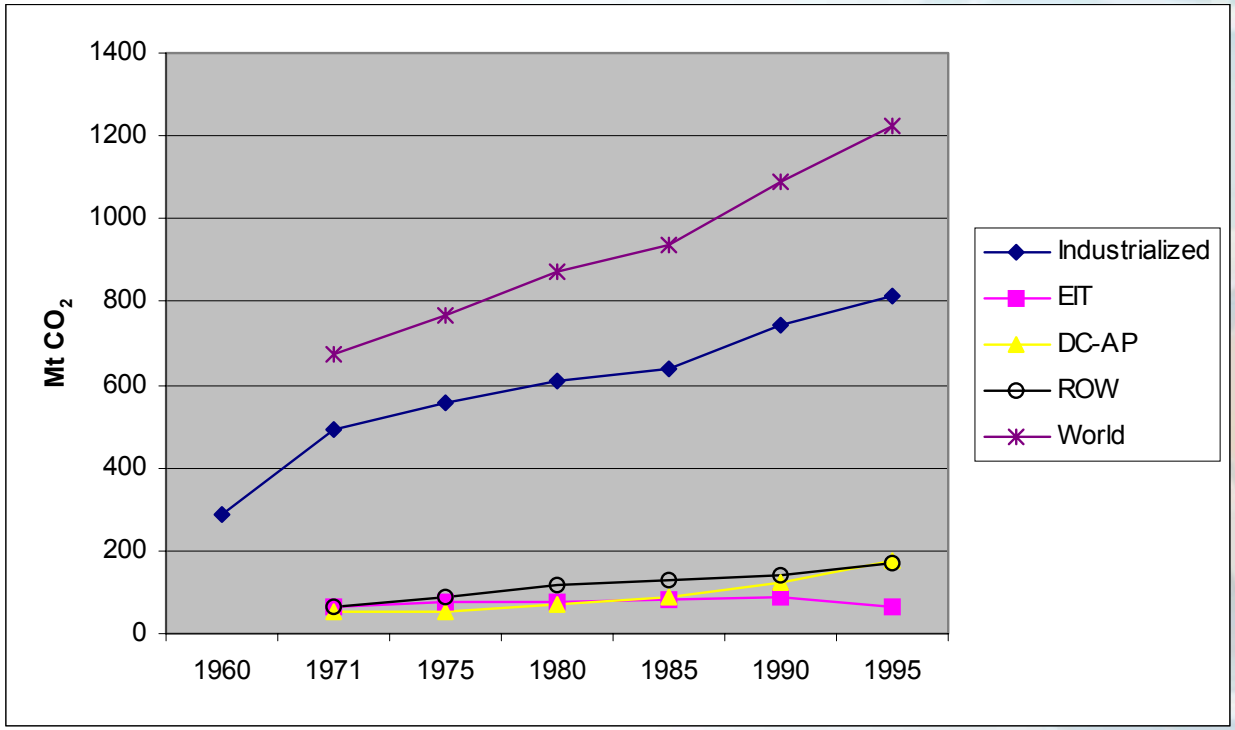
Climate Change

Trends in Transport CO2 Emissions



Health and Air Quality

- **Air pollution from fine particles (mostly from diesel) is now considered to be worse than traffic accidents in Europe.**

- **Smog and haze, caused by organic compounds from vehicle exhaust that participate in atmospheric photochemical reactions, continue in most major cities.**

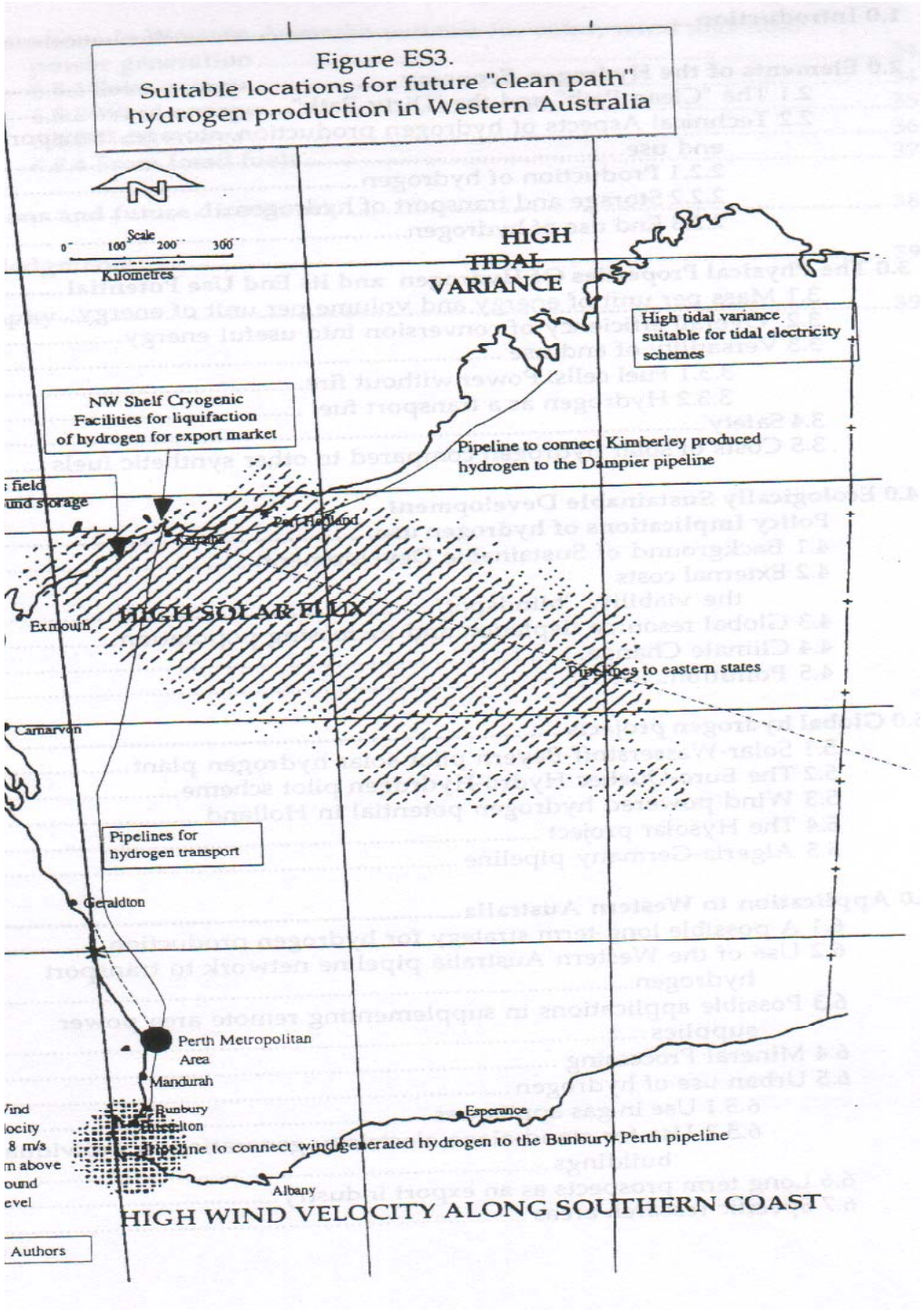
Fuel Infrastructure Requirements

Infrastructure for transition fuels needs to lead directly to the Hydrogen economy, otherwise it will be wasted…

The pathway needs to be mapped.

Opportunities for Western Australia

Gas, Gas, Gas….
and eventually large scale renewables.
As well as the infrastructure we now possess for liquifying and transporting gas.



Opportunities for Western Australia

From Reed, Stocker and Newman, 'The Hydrogen Economy: A Western Australian Perspective for the Long Term Future', ISTP, Murdoch University, 1992.

Opportunities for Western Australia

"How do you get wind or sunshine into a gas tank, and on a still dark night? That question which has stumped generations of engineers, has now been answered by automobile and energy companies around the world. Hydrogen will be the fuel of choice – to be produced from renewable energy, stored underground, and carried to our cities and factories by pipeline."

Janet Sawin 'Charting a New Energy Future', p109,
State of the World, 2003.

Ease of Transition to Hydrogen Economy

- **The push and pull of the above factors.**
- **Overcoming barriers to Hydrogen (safety perceptions, regulations…).**
- **Ensuring infrastructure decisions are part of the map to the future.**

Hydrogen Fuel Cell Vehicles

- high efficiency (2 x ICE)
- modularity (thus OK for trucks, buses, trains as well as cars),
- increasing efficiency at low loads,
- low maintenance,
- low noise, and
- zero emissions except for water.

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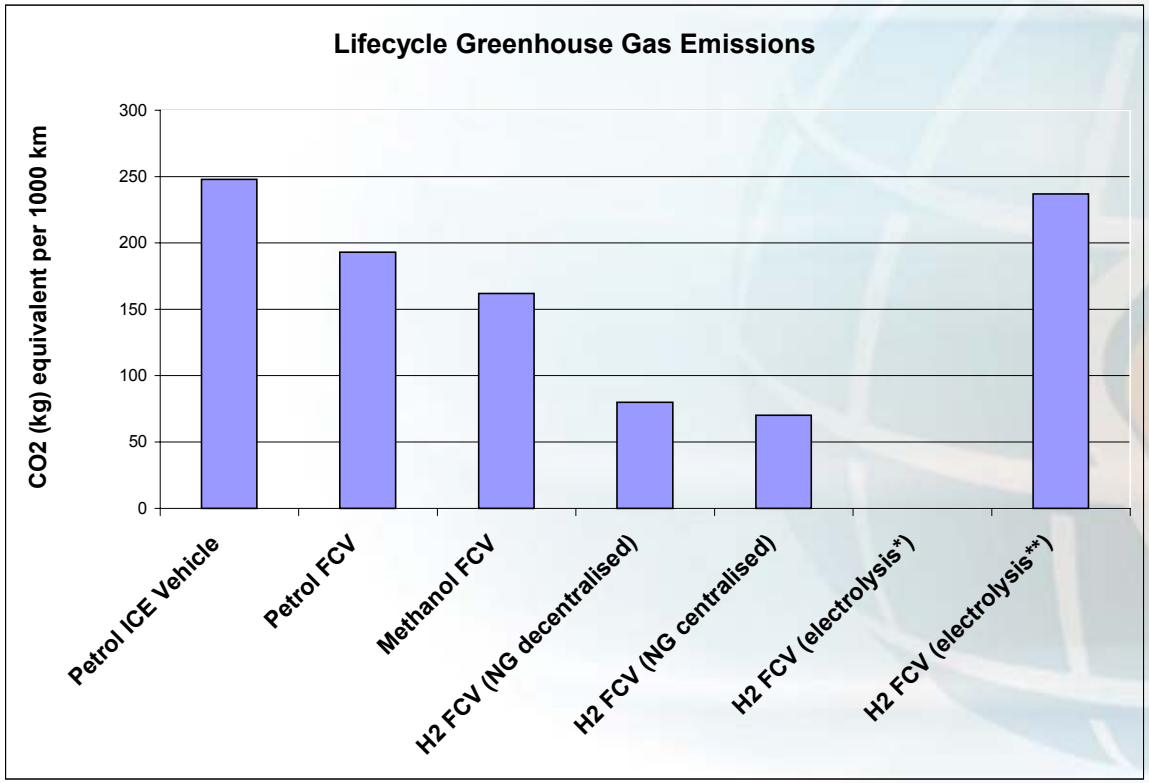
Lifecycle Greenhouse Emission



Barriers to Hydrogen Fuel Cell Vehicles

- **Infrastructure**
- **Storage and Transport**
- **Public acceptance/safety**

Barriers to Hydrogen Fuel Cell Vehicles - Infrastructure

Methane reformers provide the cheapest way to make Hydrogen. They can be small scale or large scale. Thus the transport system can easily make the transition to Hydrogen fuel cells if there is sufficient methane gas infrastructure.

Barriers to Hydrogen Fuel Cell Vehicles - Safety

Hydrogen Fuel Leak

Petrol Fuel Leak

Barriers to Hydrogen Fuel Cell Vehicles - Cost

- **Lifecycle costs already equal to petrol vehicles (Ogden study).**
- **Can reduce infrastructure costs by step wise introduction.**

Transition Fuels

Fuel/Factor	Not Oil Sourced	Abate Greenhouse Gases	Health & Air Quality
LPG	+	+	+
GTL Diesel	++	+1	++
Bio-Diesel	++	++	?
CNG	++	+	++
LNG	++	+	+
DME	++	+	++

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Transition Fuels

Fuel/Factor	Existing Infrastructure	Opportunities for WA	Leads to hydrogen economy
LPG	+	+	?
GTL Diesel	+	++	+
Bio-Diesel	+	++	?
CNG	-	+	++
LNG	-	+	++
DME	-	++	?

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Steps along the Hydrogen Path…

1. **Hydrogen Fuel Cell Bus Trial**
   - establish protocols and regulations for Hydrogen.
   - get public acceptance for Hydrogen.

2. **Use CNG and LNG as much as possible as transition fuels**
   - ensure gas infrastructure in place.
   - trial some methane reformer 'Hydrogen Stations'.

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Steps along the Hydrogen Path…

3. Facilitate Hydrogen Fuel Cell Transport

- provide methane reformers at service stations.
- begin phasing out petrol.

4. Develop Hydrogen from Renewables

- build more and more renewable electricity systems where excess power goes into Hydrogen from electrolysing water.
- develop gas infrastructure to be able to store and transport Hydrogen.
- begin phasing out gas.