Land Use and Urban Planning for **Resilient Cities: The Pacific Rim Urban Revolution** Bv Peter Newman **Professor of Sustainability** Curtin University, Western Australia

Responding to Peak Oil and Climate Change

Peter Newman, Timothy Beatley, and Heather Boyer

Resilience... Adapting to the big changes. Transforming our cities.

History of innovation and energy....

Each era changes the city form. Cities keep the best of that era and move on. Next era of city building is REDUCED CARBON – green economy.



The global green economy trends...

- In 2008 'peak fossil fuel power investment' occurred: global renewable power investment *higher* than fossil fuel power investment for first time. Now 2:1...
- In 2004 industrial cities began to show 'peak car use' with dramatic increases in sustainable transport...
- In 2006 'peak oil production' occurred...no increase in production for 5 years...
- Driving the competitive options for cities of the future.

One of the big drivers of change... now China and India are getting serious



Peak oil has potential to cause even more damage....

Figure 7: Oil production world summary



Peak oil



CYCLE OF WORLD OIL PRODUCTION is plotted on the basis of two estimates of the amount of oil that will ultimately be produced. The colored curve reflects Ryman's estimate of $2,100 \times 10^9$ barrels and the black curve represents an estimate of $1,350 \times 10^9$ barrels.

Predicted first by M King Hubbert in 1956 for US (1970) and 1971 for world (2000)

Global oil production has not risen for 5 years...

- Inexorable rise in oil price of 5% per year.
- Dramatic rise in 2008 revealing vulnerabilities of car dependent cities...





Is change happening quickly enough?

RALLY FOR CLIMATE ACTION

You might have heard the climate skeptics are organising an anti-carbon price rally. Let's have our own to show support for a price on carbon!

Wednesday March 23 @ 12 noon MAIN ENTRANCE, PERTH CONVENTION CENTRE

WEAR SOMETHING BLUE IF YOU CAN



Can cities transform dramatically towards the green economy?

Shanghai 1990 and 2010



1990's - Flirting with the American model...



Rapidly filled...

So what can be done?





Shanghai Metro...12 lines, 273 stations, 420km covering 80% of metro area... Built mostly since 2000; carries 8 million per day







Resilient cities will....

Reduce oil (and carbon) by 50% by 2050 whilst improving the city's liveability, and creating opportunities for a lot more people AT THE SAME TIME.

Requires transformative change.

There is some hope...

- Developed cities may have hit 'peak car use'... data from 8 nations. Millard-Ball and Schipper
- The predicted growth rates in developing cities cannot happen as traffic is already saturated...massive re-orientation to other modes beginning.
- According to Millard-Ball and Schipper the amount of carbon from transport could be reducing by 2020....

Peak Car Use - US cities...

- Declining in car use 4.3% in past year, plateau over the past 5 years.
- Increasing transit use – 6.5% in past year.
- Cities coming back in..





Public Transit Boardings and Vehicle Miles Travelled in US: March Quarter 2008 vs March Quarter 2007



Peak car use - Australian cities too

Figure 2.2: Estimated car passenger kms per capita (FY1990-2008)



Source: Bureau of Infrastructure, Transport and Regional Economics (2009), Australian Transport Ratistics Wearbook 2009, Department of Infrastructure, Transport, Regional Development and Local Government, Canberra; Australian Bureau of Statistics (2009), Regional Population Growth, Cat. no. 3218.0, ABS, Canberra;

Australian public transport is taking off...



Increase in public transport patronage since 1999

What will be needed for a Resilient City?

- Renewable Energy City
- Carbon Neutral City
- Distributed City
- Biophillic City
- Eco-Efficient City
- Place-Based City
- Sustainable Transport City

All are SMART and SUSTAINABLE

All involve ways of reducing carbon

1. Renewable Energy City







Pixel Building in Melbourne – zero carbon building – next precincts







European leadership... Vauban Frieburg 100% renewable

dm

QUART

Masdar City – first zero carbon city





Traditional narrow streets for shade Street level view at Masdar Institute between library and laboratory

IRINA and Masdar HQ





Traditional solar chimney











Chinese committed to 15% renewables by 2020; 1/3rd of new energy; eg Rizhao Solar City. 6 zero carbon cities



Wind farms around Perth (SW Grid)

- Albany 36MW
- Walkaway-Alinta 90MW
- Emu Downs 79MW
- Collgar (new) 206MW
- Next? Various seeking grid approval





PV Solar growing at 40% per year SUNTECH Australian technology

Challenge Stadium Geothermal





CETO Wave Power




Windpods - Roof mounted wind systems

City wind generation systems - Windpods on Shanghai Bank



How do you store renewables?



a. In electric vehiclesb. In renewable natural gas

a. Renewables can be stored in Li-ion batteries

Al Gore's moon shot:

Smart Grid + Plug-in EVs + Renewables



Electric Vehicle batteries providing the storage – renewable transport



Electric cars - Now! http://www.sahkoautot.fi/eng

Curtin University Sustainability Policy (CUSP) Institute www.sustainability.curtin.edu.au/renewabletransport

Public transport vehicles can be PEVs too



Alstom battery-powered light rail in Bordeaux

Tindo solar-electric bus in Adelaide





SOLAR SOLUTIONS AT GOOGLE

Google Headquarter, Mountain View, California, USA

Sharp's solar system provides 30%

On a typical day, the system produces more than 6,000 kilowatt-hours. Due to

KININ ?

· The carbon

b. Renewable natural gas...

- $CO_2 + 2H_2O \longrightarrow CH_4 + 2O_2$
- Needs solar energy and catalysts; like photosynthesis.
- Can keep building infrastructure for gas. No longer the 'transition fuel'....
- Who needs Hydrogen?

Natural Gas in Vehicles

- Easy option for heavy vehicles; CNG buses have shown how to do it.
- Australian technology used to convert Mumbai and Chenai buses.





Can we make renewable power and renewable natural gas a major development focus for regional Australia?





2. Carbon Neutral City

Reduce, renew and offset in the BIOREGION

Bed Zed – first carbon neutral development in UK. All urban development must be C-neutral by 2016.



City of Fremantle Carbon Neutral



GreenPower Accredited Renewable Energy

synergy



Gondwana Links.... being built by offsets

Gondwana Link Stan error Autor

Carbon Offsets... Bioregional connection, eg Greening Australia and Gondwana Links.

Oil Mallees – burying carbon and rebuilding the landscape

Pixel – 'Living Edges'

OGrocon

5 🚕

400 green roofs in Chicago to reduce urban heat island effect, reduce energy and recycle water...

Singapore first Biophillic City in Asia

Skyrise Greenery subsidies and Hort Park R&D area

Biophilic tram track in Kagoshima – 10 degrees cooler...

Biophilic Fremantle...

Can grow algal biofuels on rooftops

4. Distributed City – local water, energy and waste systems

Localised Solutions:

Any city of any size can go for green infrastructure – a leapfrog technology

Building capacity and resilience with distributed production systems

An initiative of the Victorian Eco-Innovation Lab and the McCaughey Centre

Are we on the edge of a 're-localisation' revolution?

With large, centralised infrastructure appearing vulnerable to climate change and 'peak oil', alternative models are emerging everywhere.

Energy, water and food are being delivered via networked, localised production and consumption systems that lower carbon, increase efficiency, build resilience and strengthen local economies. This 'distributed' systems model is over-turning old ideas of services and is re-shaping our image of

Singapore CBD - has its own water

All new major urban development projects across Australia are distributed...

- City of Sydney, Stirling City Centre 'Green Infrastructure' (Perth)
- Armstrong Creek in Melbourne showed \$500m NPV savings in infrastructure over 10 years....
- Makes centres work so less travel

Cockburn Coast Study – with PB and Kinesis (new model – design tool)

55% less Carbon for \$5600 per dwelling

Key performance indicator results High performance scenario

Key strategies

- high frequency LRT
- reduced car parking supply
- 7 star energy efficient buildings
- 4.5 star water efficient fixtures
- third pipe non potable water supply for irrigation and toilet flushing (wastewater and groundwater)
- solar photovoltaic systems
- solar hot water systems
 - best practice appliances (4.5 star energy; 4.5 star water)
- tri-generation (for multi-story residential and non-residential)
- 22% recycled content in concrete.

About to apply Z³D² model to Chinese Eco Cities – PB, CUSP, Kinesis

- Aim to be 100% renewable
- Localised energy and water systems
 Bioregional food and water.

How should the infrastructure in NZ and Japanese cities be rebuilt?

'Its time for myriad decentralised, small scale, clean-tech powered, infotech-enabled ways',

New Zealand Professor Dushko Bogunovich

5. Eco Efficient City

- Factor 4 10 efficiencies...
- Industrial ecology

Industrial ecology - Kwinana

- WA's largest industrial estate
- 22% of the Manufacturing sector, \$8.4bn output.
- Synergies project 180 resource exchanges – more than Kalundborg.
- Combined waste water recycling now from five main industries for process water.
Singapore eco-efficiency....



6. Place based cities

The importance of local identity in the city...



Restoring 'place', eg River in Seoul, buried under freeway



6–1 Cheonggyecheon Area after Restoration

(http://www.metro.seoul.kr/kor2000/chungaehome/en/seoul/2sub.htm/)





Seoul now has a green heart with a cultural icon restored: It received an international award in Washington DC in January 2006

7. Sustainable Transport City Restructuring the city.... Not just PV's on car parks



Sustainable transport

- Public transport investment works better than freeways
- Density increases will help
- Look after pedestrians and cyclists



The last train to Freo The start of the rail revival....

20 years of rebuilding the rail system...Perth's Northern Suburbs Railway





Opening of new Southern Railway 90% approval ratings and already paid off. Carrying 55,000 per day cf 14,000 on buses.



National and global model... \$17 mill per km.



Next phase for Perth?



Curtin-UWA LRT The 'Knowledge Arc' Rail



THE KNOWLEDGE ARC LIGHT RAIL: A CONCEPT FOR DELIVERING THE NEXT PHASE OF PUBLIC TRANSPORT IN PERTH

By Peter Newman and Jan Scheurer, Curtin University Sustainability Policy (CUSP) Institute with assistance from Diana Ryan, Michael Kane, Jeff Kerworthy, Mark Bachels and Brian McMahon



Infrastructure Australia funding – \$4.6b or 55% on urban rail....historic!



IA Public transport funds... All require TOD plans and PPPs.



Goal... the Polycentric City. Walkable centres linked by quality transit



Global Cities Database on 100 cities....

SUSTAINA BILITY Overcoming Automobile ndence PET

Private Passenger Transport Energy Use per Persor 1995



Cities

Atlanta – 18 counties of sprawl with no transit.





Barcelona



Urban Density, 1995 (Persons/Ha)



Cities

Fuel Use Decreases as Density Increases



Source: Kenworthy, J. R., 2010, Cities Data Base for 2005, CUSP,



Car dependent suburbs regenerated with a TOD... Directions 2031

Community reactions to TODs.... 'The end of the world'



TODs like East Perth can be beautiful..







PB-CUSP paper: each new fringe block

1. Is subsidised by \$85,000 in infrastructure.

Comparing redevelopment with

urban fringe....

- 2. Costs \$250,000 extra in transport costs over 50 years.
- 3. Produces 4.4 tonnes/yr more in greenhouse gases, and
- 4. Health is better and productivity 6% better

www.sustainability.curtin.edu.au





Reducing car dependence saves space

ONE LANE people per hr: Freeway 2,500 Busway 5000 LRT 10-20,000 Train 50,000



240 Persons travel to work: -- in 177 Cars -- in 3 Busses -- in 1 Tram





Making cities more walkable...





Melbourne.

And bicycle friendly...









Places for People 1994 Report by Jan Gehl

Places for People 2004 Report Gehl Architects

www.gehlarchitects.dk






New Street trees











New life in the lane ways



Pedestrian traffic weekdays daytime: +40% Pedestrian traffic evening: +100 % Stationary activities +200-300%



Creating culture of alternative transport Travel Smart 15% less car use - with 27% increase in muscle-powered transport....





Living Smart now on water, energy, waste and travel.... 1.5 T ghg reductions.

Dramatic changes can happen quickly ... exponential growth is now working in our favour



Transformative change needs...

- Vision
- A price signal....

Imagine the Possibilities



Transformation of a city...

Photo Series: UrbanAdvantage

