Disruptive Innovation and Energy

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The 6th wave – the Green Economy, incl. Low Carbon Cities

RESILIENT CITIES
Responding to Peak Oil and Climate Change

Peter Newman, Timothy Beatley, and Heather Boyer

Waves of Innovation

1st wave
Iron
Water power
Mechanisation
Textiles
Commerce

2nd wave
Steam power
Railroad
Steel
Cotton

3rd wave
Electricity
Chemicals
Internal combustion engine

4th wave
Petrochemicals
Electronics
Aviation
Space

5th wave
Sustainability
Radical resource productivity
Whole system design
Biomimicry
Green chemistry
Industrial ecology
Renewable energy
Green nanotechnology

6th wave
Digital Networks
Biotechnology
Software Information technology

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New understanding of innovation…
DISRUPTIVE INNOVATION

• Came from Clayton Christensen at Harvard.
• Innovation came from demand, often before it was cheaper than mainstream options. But it ‘felt cheaper’…it performed for them.
• Eg 3.5 inch discs cf 5.5 inch discs…..Notebooks!
• Exponential growth and system disruption
• Mainstream finds it hard to see innovation as they are looking at supply price…so they ignore it. The ‘Kodak effect’
Disruptive innovation and energy…

• Phase out of fossil fuels is happening without disrupting GDP
• Solar energy is happening much quicker than most utilities expected.
• Next phase will be solar/batteries/electric transport
• City transport systems are disrupting
Decoupling GDP and fossil fuels…
American GDP vs Oil Consumption

Year

American GDP
American Oil Consumption

Consumption (Indexed 1995=100)
Australian GDP vs Coal Consumption

- **Australian GDP**
- **Australian Coal Consumption**

<table>
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<th>Year</th>
<th>GDP vs Consumption (Indexed 1998 = 100)</th>
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**Year**

China decouples GDP and coal
India rapidly decoupling GDP from fossil fuels....
Solar takes off....
The cost of electricity produced from solar installations has been steadily reducing towards that of grid electricity. The aim of the Solar America Initiative is to achieve parity in the USA in 2015. Note: Solar costs vary with regional insolation. Grid electricity costs include an estimated price rise.
Perth solar city

20% of Perth homes
490 MW in 3 years…
‘It is inevitable…’
Minister for Energy

26/02/2016
Next phase solar/batteries/EV’s
The holy grail arrives
JOSH’S HOUSE

It’s carbon positive!
Honda Zero Carbon Home

Tesla
Most new redevelopment can now use solar-batteries, eg WGV
We can now make cities in the suburbs....

- Redevelopment so far is mostly in the city and inner area
- Now can make precincts work in the suburbs. An organizational principle for creating community and bringing people to live/work together.
- System change...
Cities are disrupting…
Cities reducing oil through less car dependence
THE USA IS DRIVING LESS

Population adjusted using the BLS Civilian Noninstitutional Population Age 16 and Over [FRED CNP16OV]
Australian city car use peaked the same year...
Two major causes...

1. Rail is now faster than traffic down most corridors. So rail investment is happening
2. The new economy is being created in walkable urban areas where people can meet easily. So density has reversed its decline and cities are coming back in.
The top 6 most walkable cities in the US have 38% higher GDP. 70% of knowledge economy workers in Boston live in walkable areas.
Decoupling car use and GDP

Graph showing passenger car kilometres per $ of GDP in 1995 (US 1995 dollars) and 2005 (US 1995 dollars) for USA, ANZ, CAN, EUR, and ASIA.
Car use is now officially recognised in the US to be decoupling from wealth

Transportation Vehicle Miles Traveled/$GDP, 1945-2030

Historical VMT per $1000 GDP
Forecast VMT per $1000 GDP
Decoupling most of all in the cities with rail investment, eg Washington DC and Portland
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
Global growth now in ELECTRIC rail ...

82 Chinese cities building metros and high speed rail between cities Shanghai 8m passengers/day
51 Indian cities building metros Any city over 1m.
Middle east cities building rail for first time
Sydney’s new light rail – no catenary, so can be zero carbon
PM explores radical road, rail funding

How can private sector build rail?
From TFL to LFT....

1. Estimate TRANSIT numbers
2. Get FINANCE/FUNDING based on this
3. See what LANDUSE is possible
4. See what LANDUSE is possible
5. Get FINANCE/FUNDING based on this
6. Estimate TRANSIT numbers
Curtin CRCLCL Node of Excellence in Regenerative Cities and Regions
Thank you

To find out more, contact:

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