

Cities, Urbanization and Sustainability:

Disruptive Innovation and Future Cities

By
Peter Newman
Professor of Sustainability
CUSP, Curtin University
Perth, Australia

Sustainability and cities.....

‘Decoupling footprint from liveability’

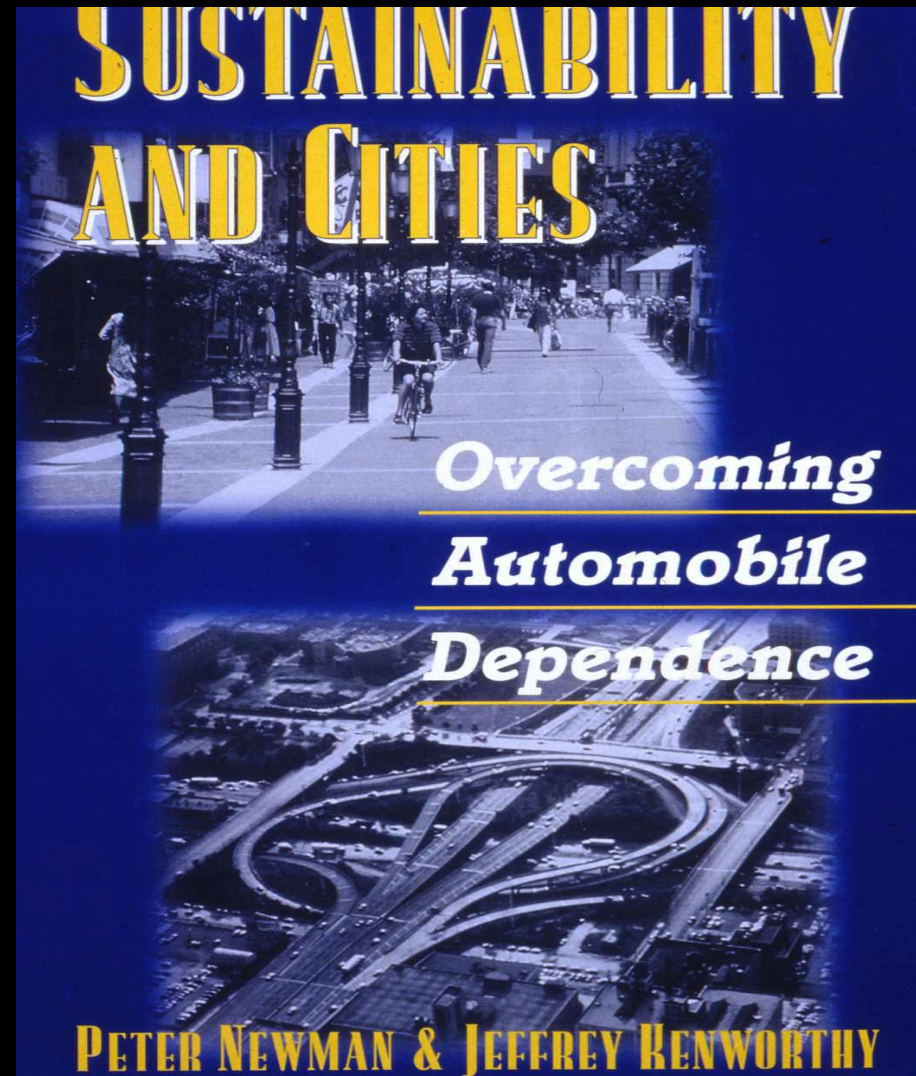
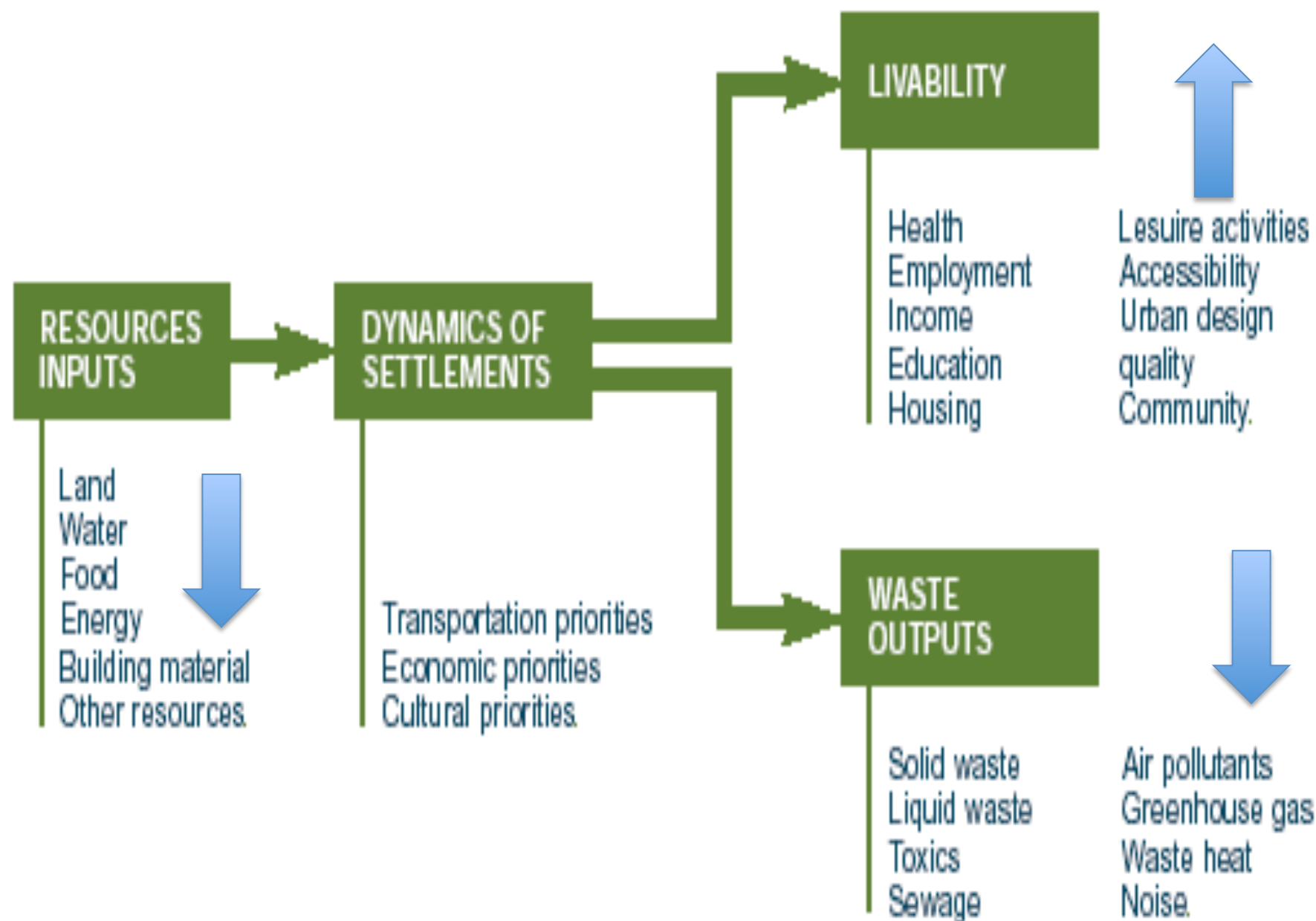
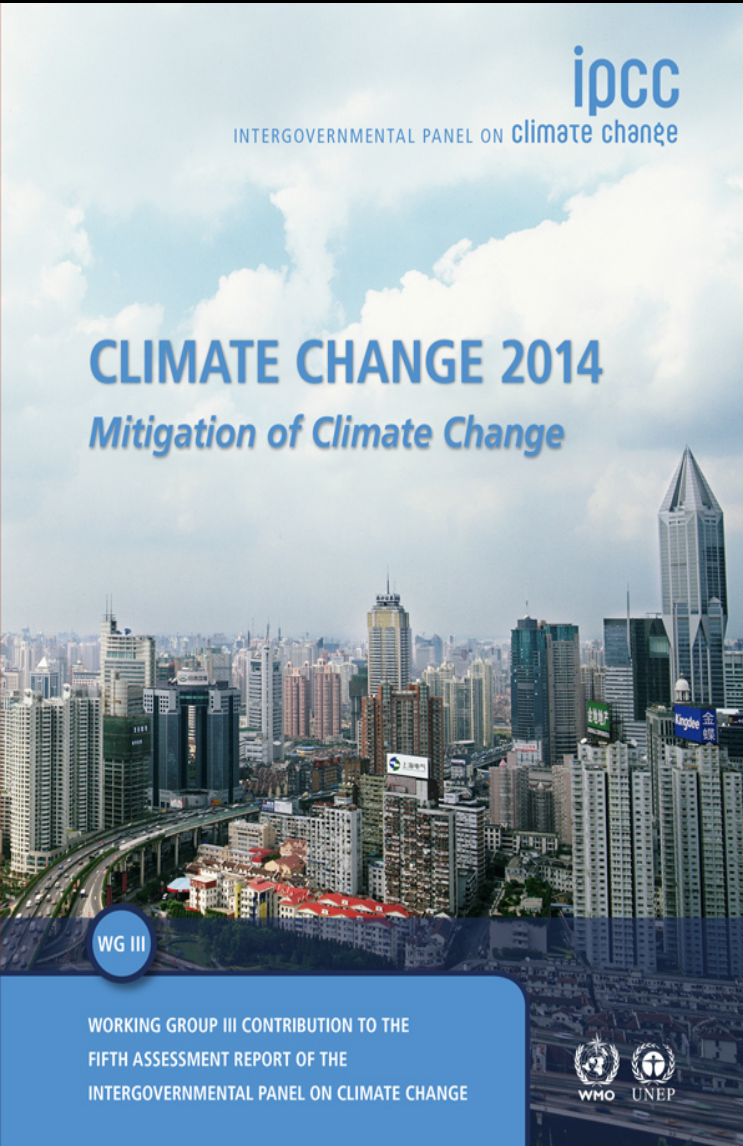


Figure 5. Extended metabolism model of human settlements.

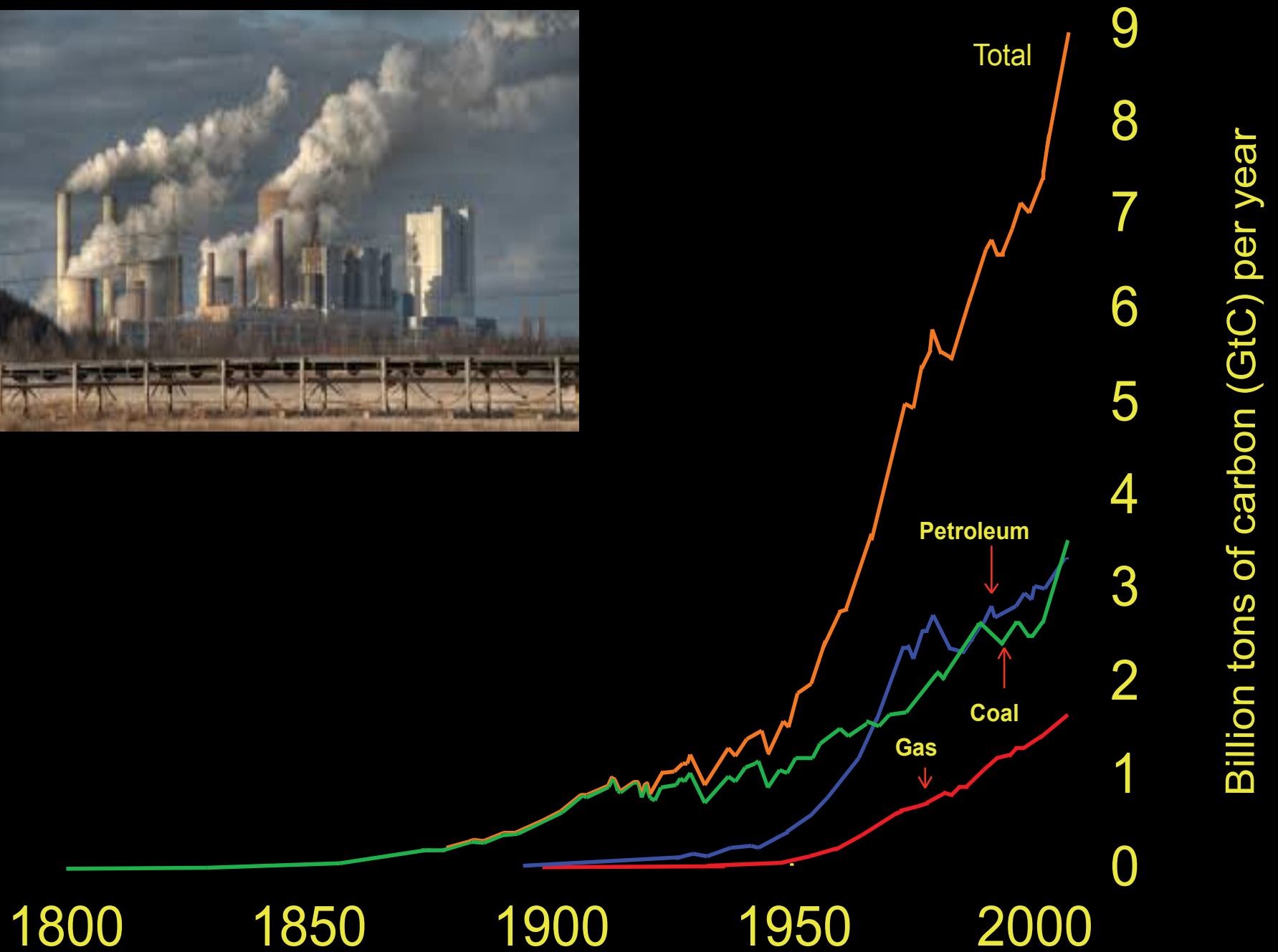


The challenge....

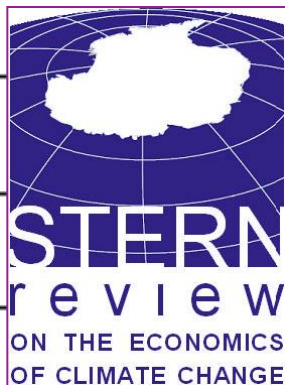


**80% less
CO₂ by
2050
to avert
climate
disaster**

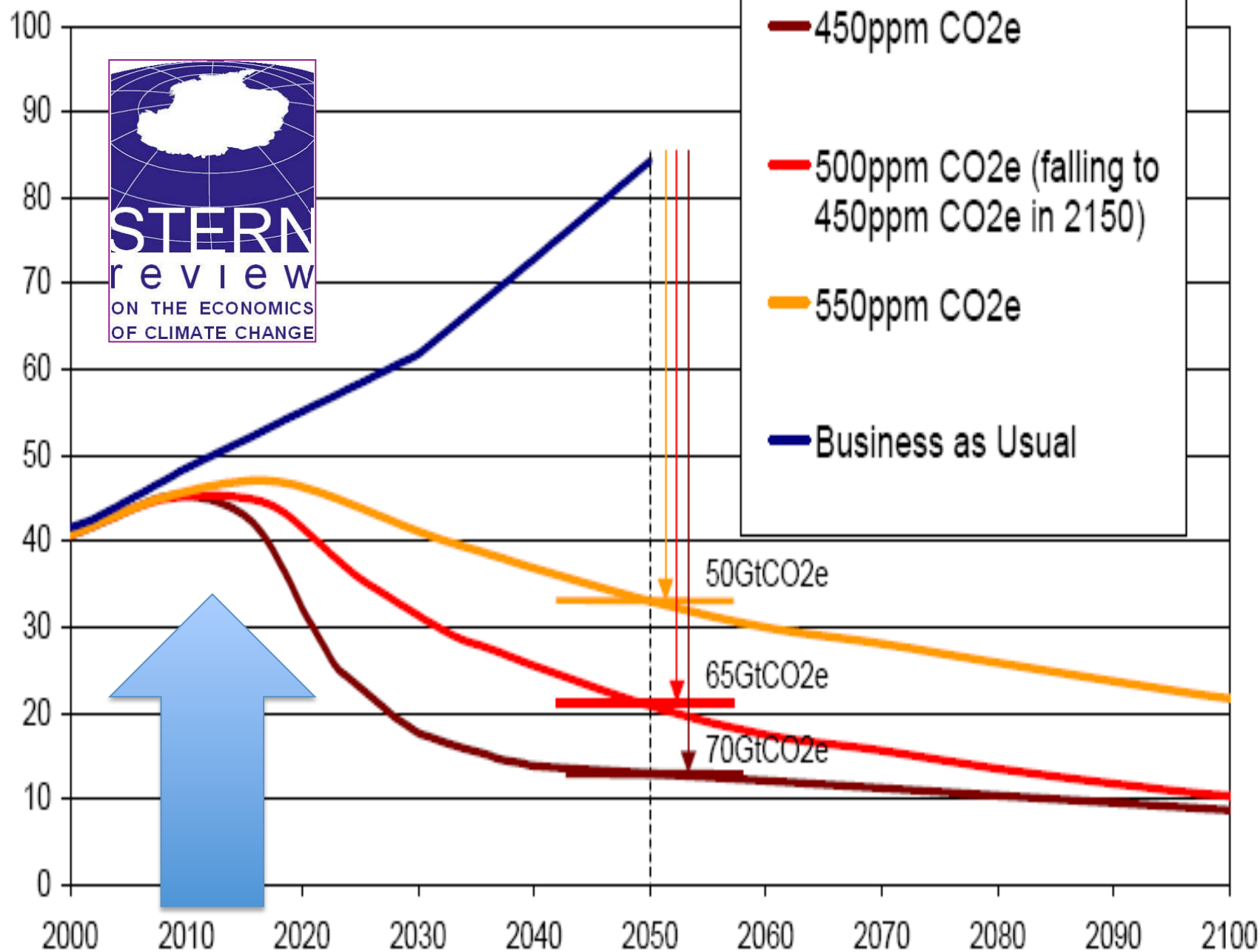




Global Emissions (GtCO₂e)



- 450ppm CO₂e
- 500ppm CO₂e (falling to 450ppm CO₂e in 2150)
- 550ppm CO₂e
- Business as Usual

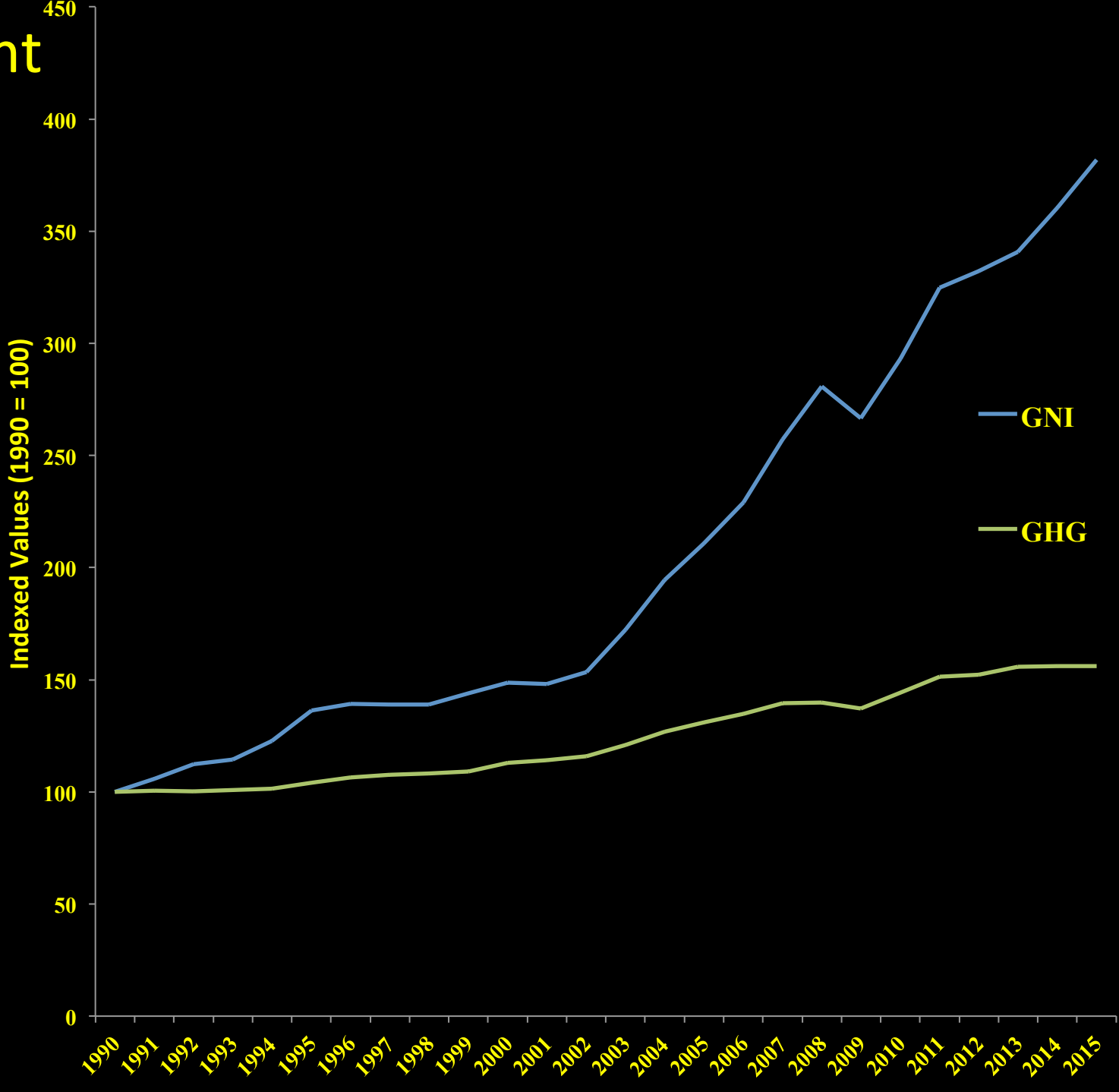


It seems too hard, but maybe not....cities to the rescue



Turning point
in world
history....

GHG
going
DOWN,
Wealth
going
UP



DENMARK

GNI in Current US\$ (As of Feb 2016) - Indexed (1990 = 100)

VS

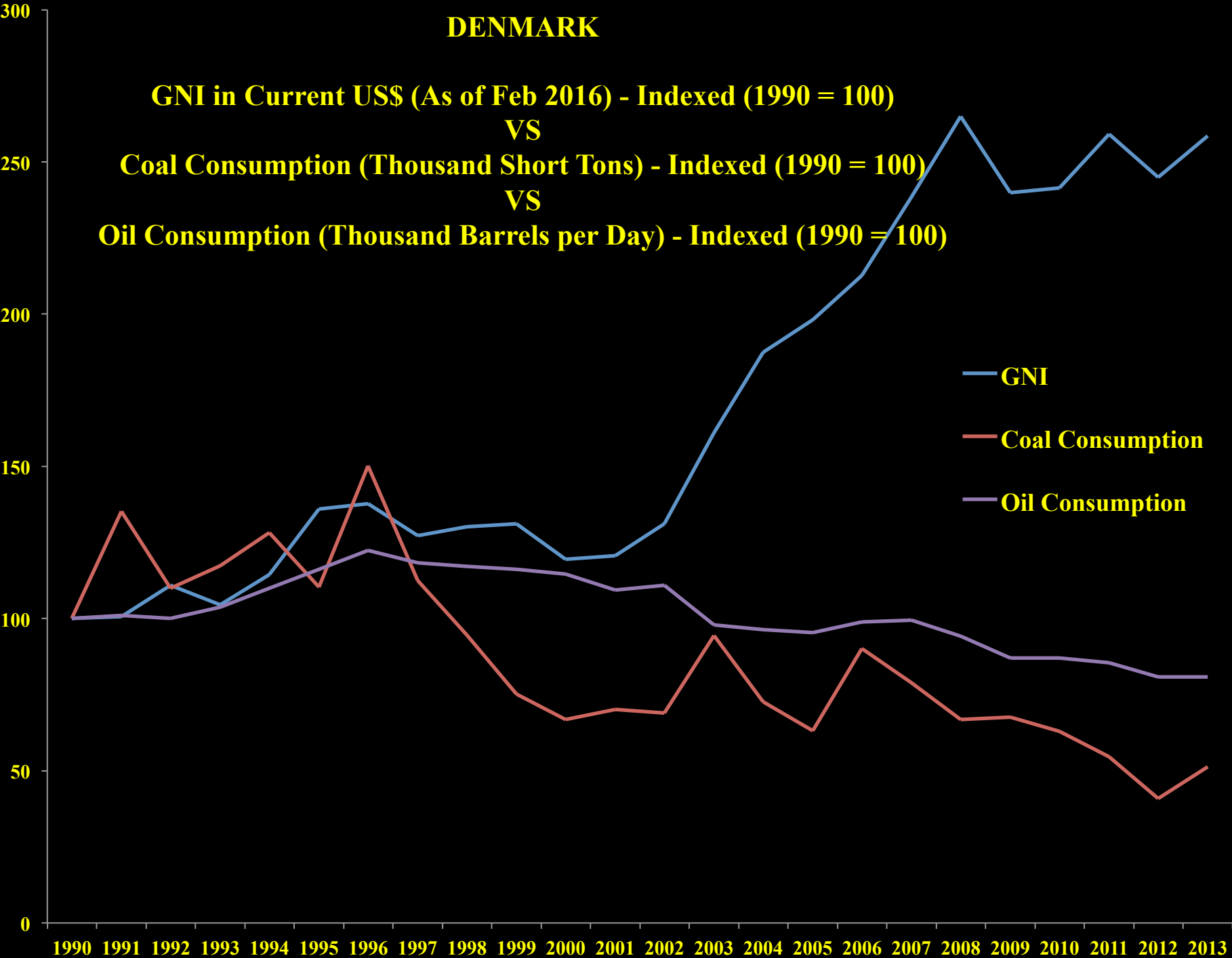
Coal Consumption (Thousand Short Tons) - Indexed (1990 = 100)

VS

Oil Consumption (Thousand Barrels per Day) - Indexed (1990 = 100)

Indexed Values (1990 = 100)

GNI
Coal Consumption
Oil Consumption



UNITED STATES

GNI in Current US\$ (As of Feb 2016) - Indexed (1990 = 100)

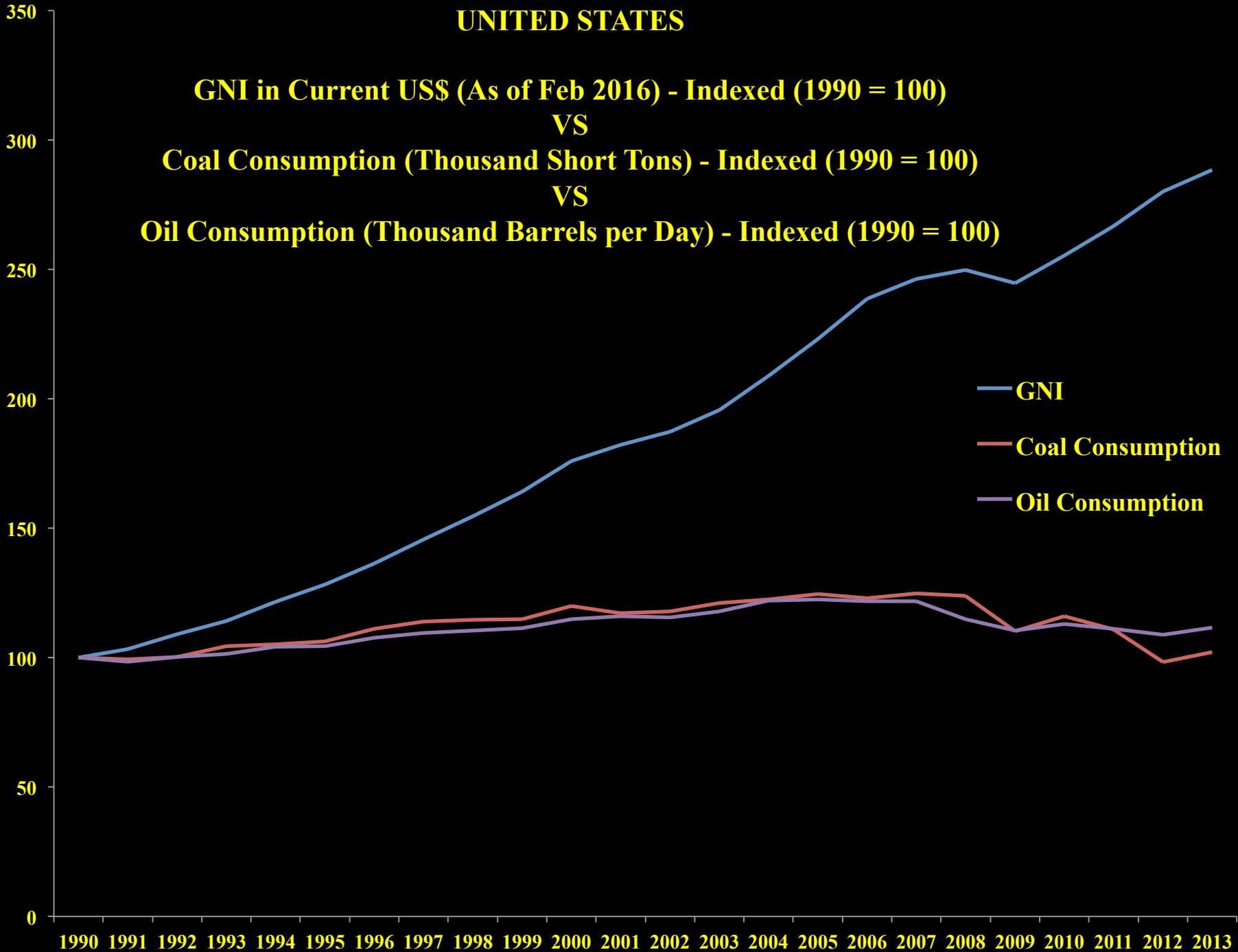
VS

Coal Consumption (Thousand Short Tons) - Indexed (1990 = 100)

VS

Oil Consumption (Thousand Barrels per Day) - Indexed (1990 = 100)

Indexed Values (1990 = 100)



AUSTRALIA

GNI in Current US\$ (As of Feb 2016) - Indexed (1990 = 100)

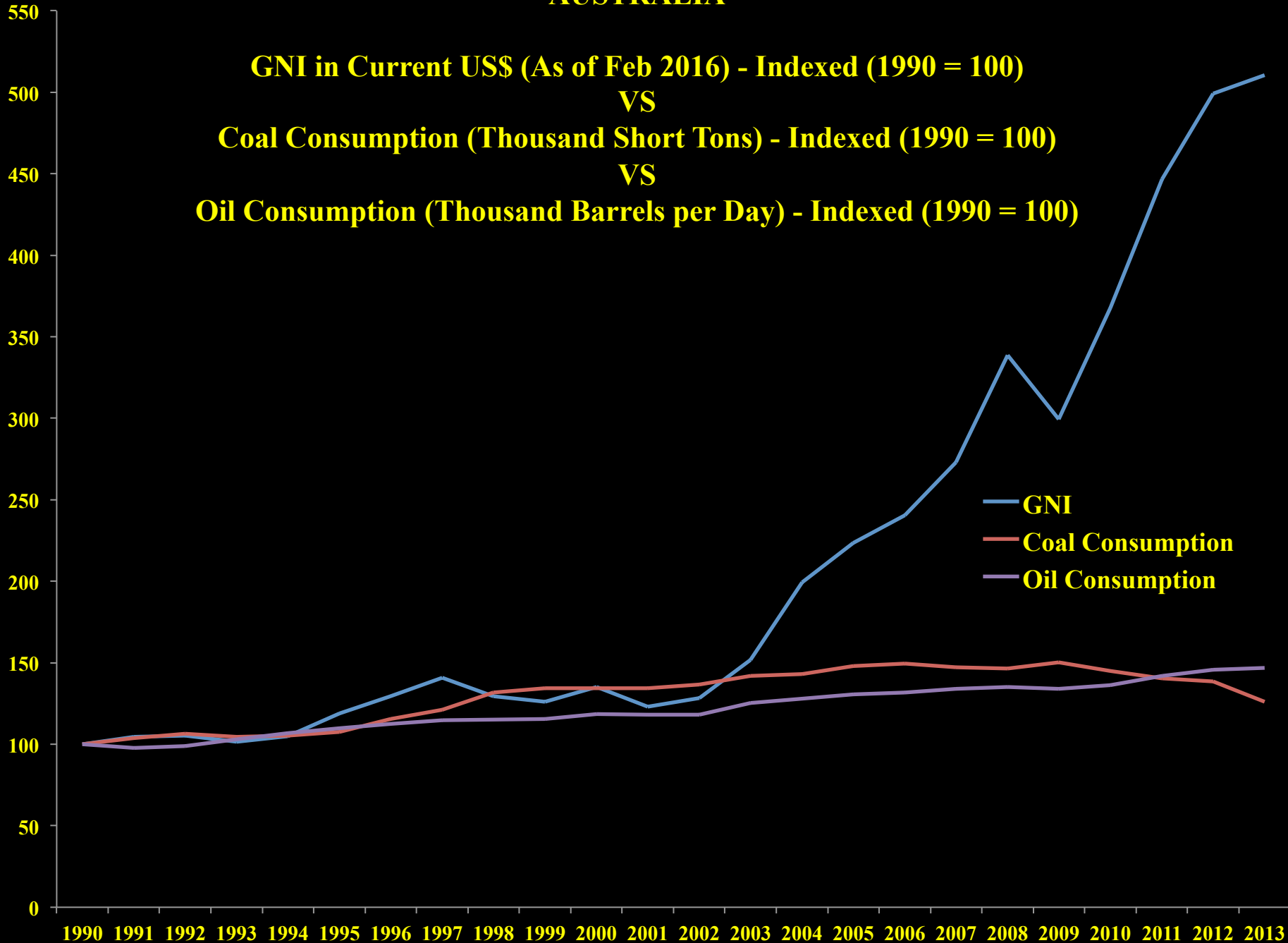
VS

Coal Consumption (Thousand Short Tons) - Indexed (1990 = 100)

VS

Oil Consumption (Thousand Barrels per Day) - Indexed (1990 = 100)

Indexed Values (1990 = 100)

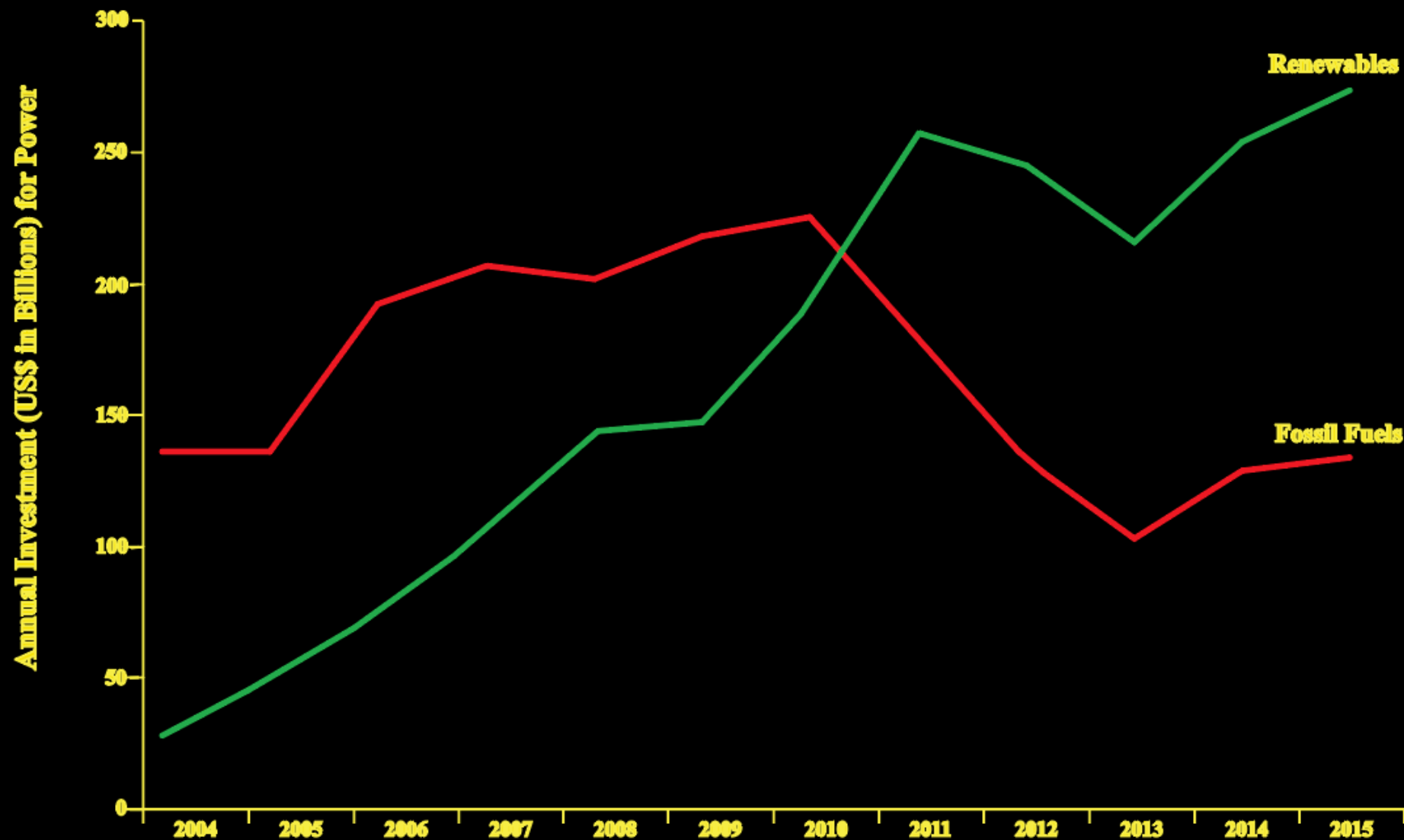


How is it happening?

1. **Investment** in renewables overtakes fossil fuels - for power

Well before government signed up

Power investment 2:1 Renewables to Coal and Gas.



Wind and Solar Are Crushing Fossil Fuels

Record clean energy investment outpaces gas and coal 2 to 1.

‘Coal is needed for humanity to reduce poverty...windfarms are ugly and cause health problems...’ Tony Abbott, June, 2015





US coal major Peabody files for bankruptcy ★₁

725
Shares



Published on 13/04/2016, 9:28am

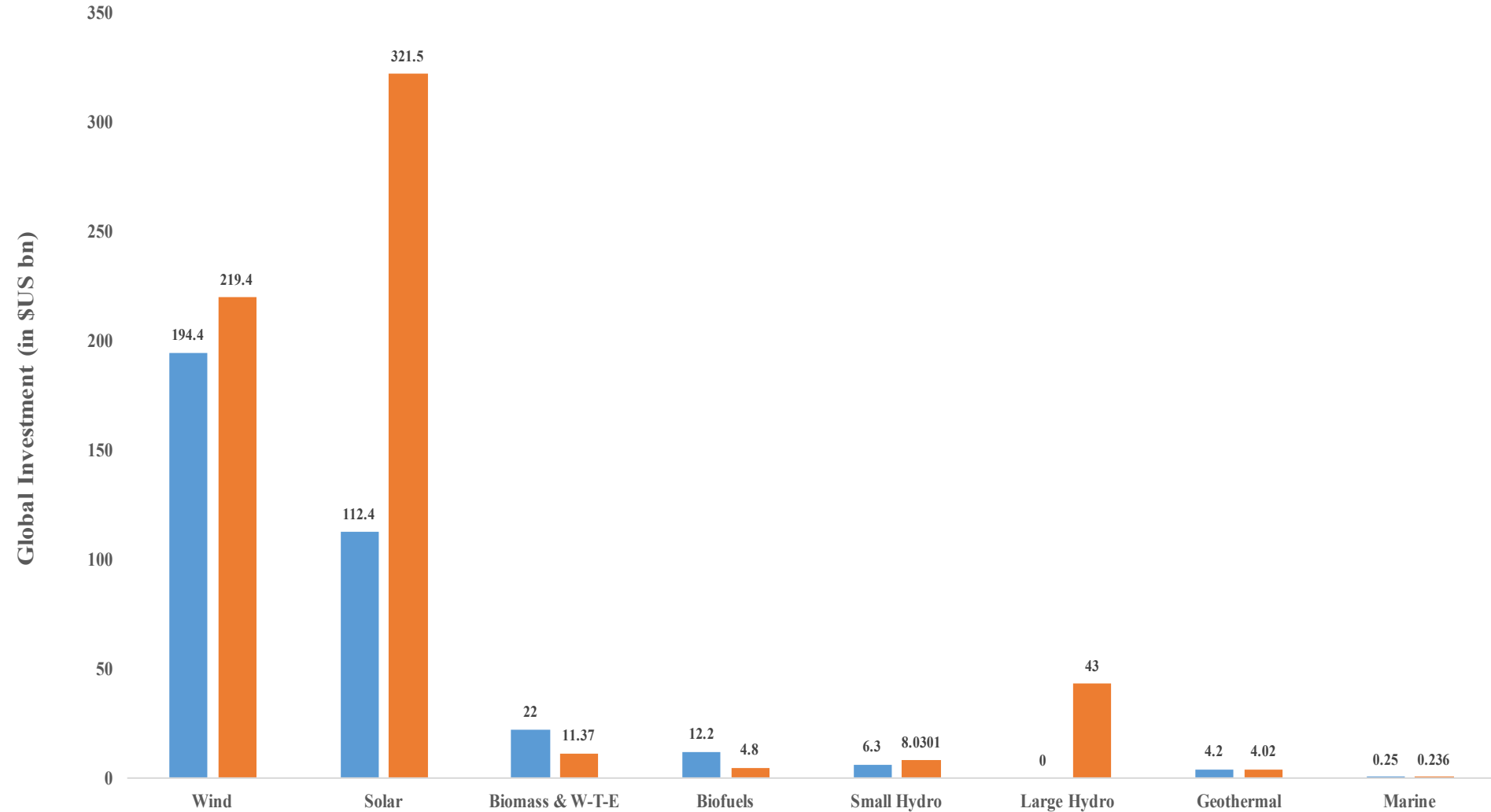
World's largest private coal mining company is mired in debt after failing to anticipate price downturn



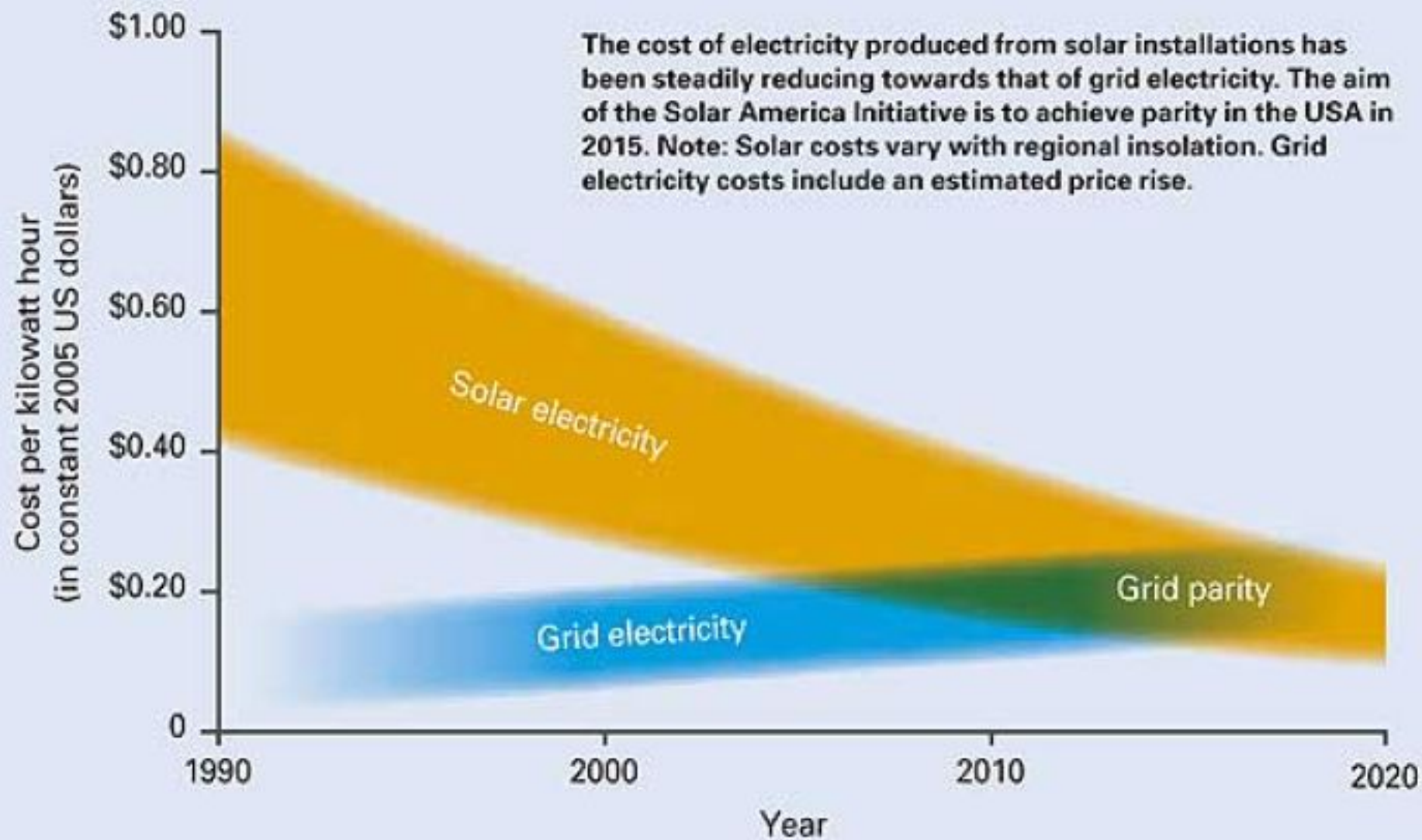
Solar takes off....

Global Investment in Renewables (in \$US bn) by Renewable Technology Type

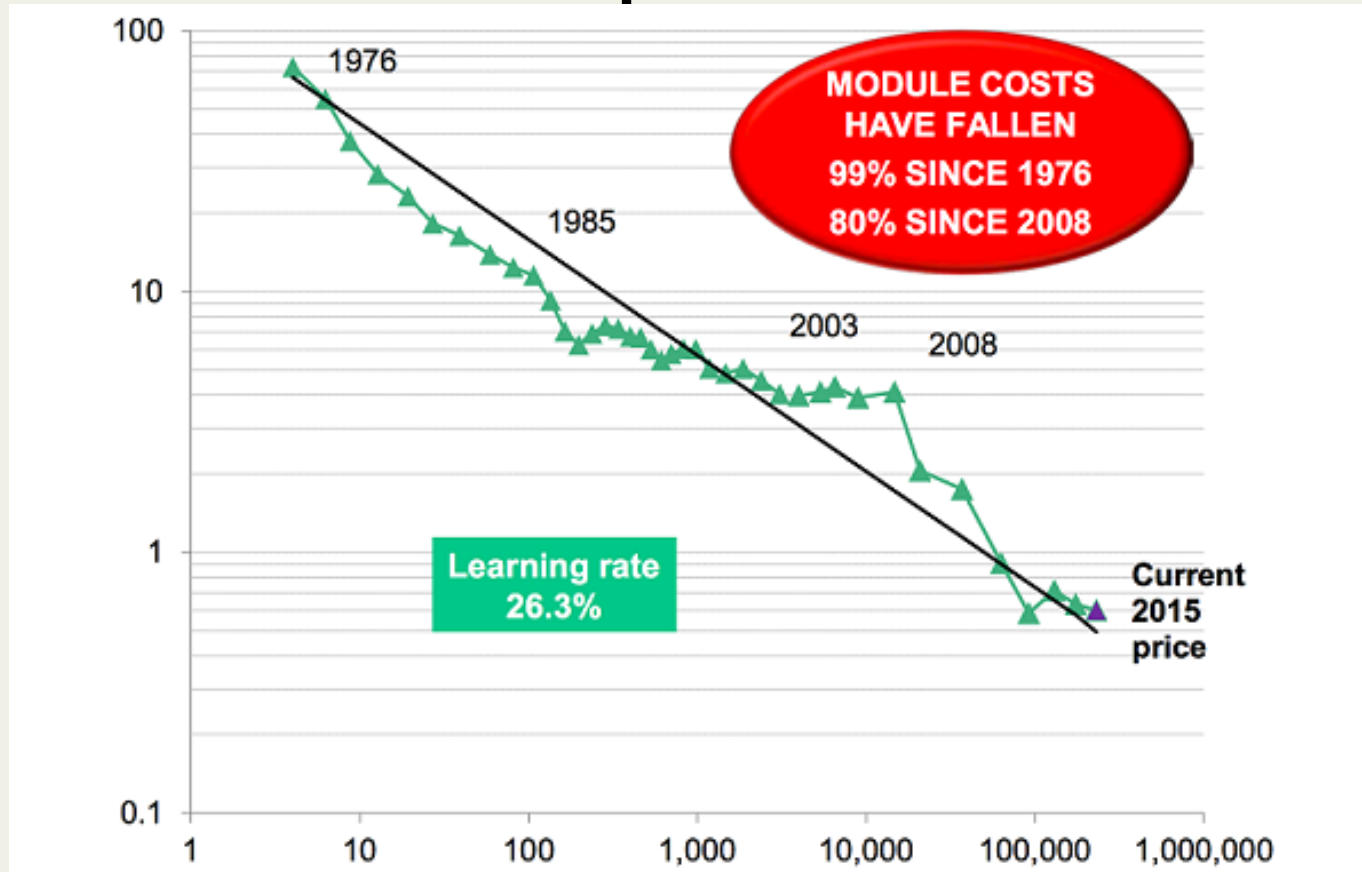
■ 2010 ■ 2015



THE PATH TO GRID PARITY

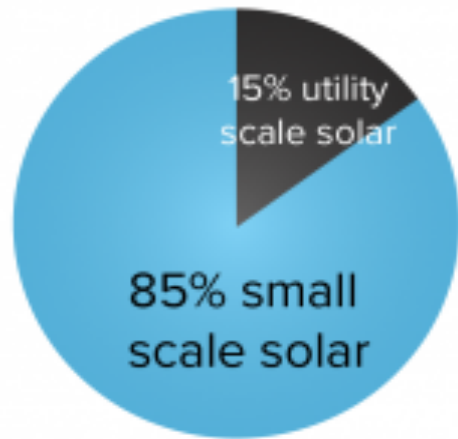


Every time the world's solar power doubles the cost of panels falls 26 per cent

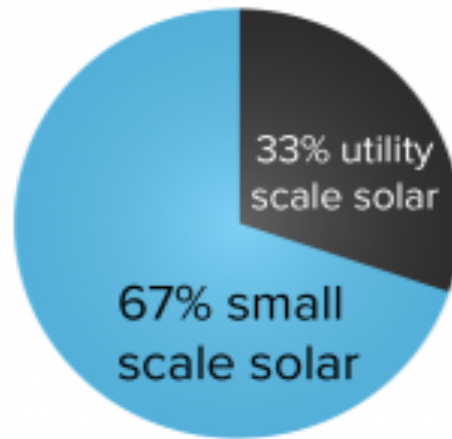


Source BNEF

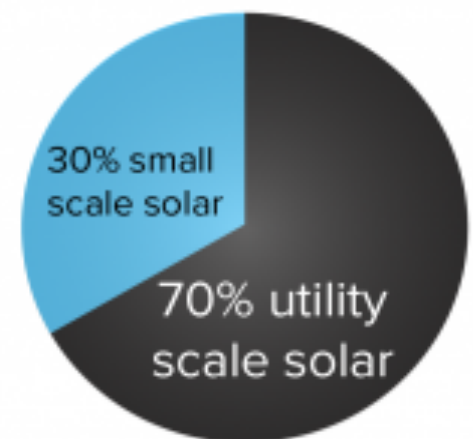
Australia tried to stop solar but households in cities took over...



AUSTRALIA



EUROPE



UNITED STATES

How is it happening?

2. Our **cities** are rapidly adopting
the new technology

Also with or without government...
by

DISRUPTIVE INNOVATIONS

New understanding of innovation...

DISRUPTIVE INNOVATION

- Came from Clayton Christensen at Harvard.
- Adoption of innovation comes 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.....Laptops
- Mainstream finds it hard to see innovation as they are looking at supply price...so they ignore it. The 'Kodak effect'- *stranded assets*.

The 6th wave – the Green Economy – Smart and Sustainable Cities

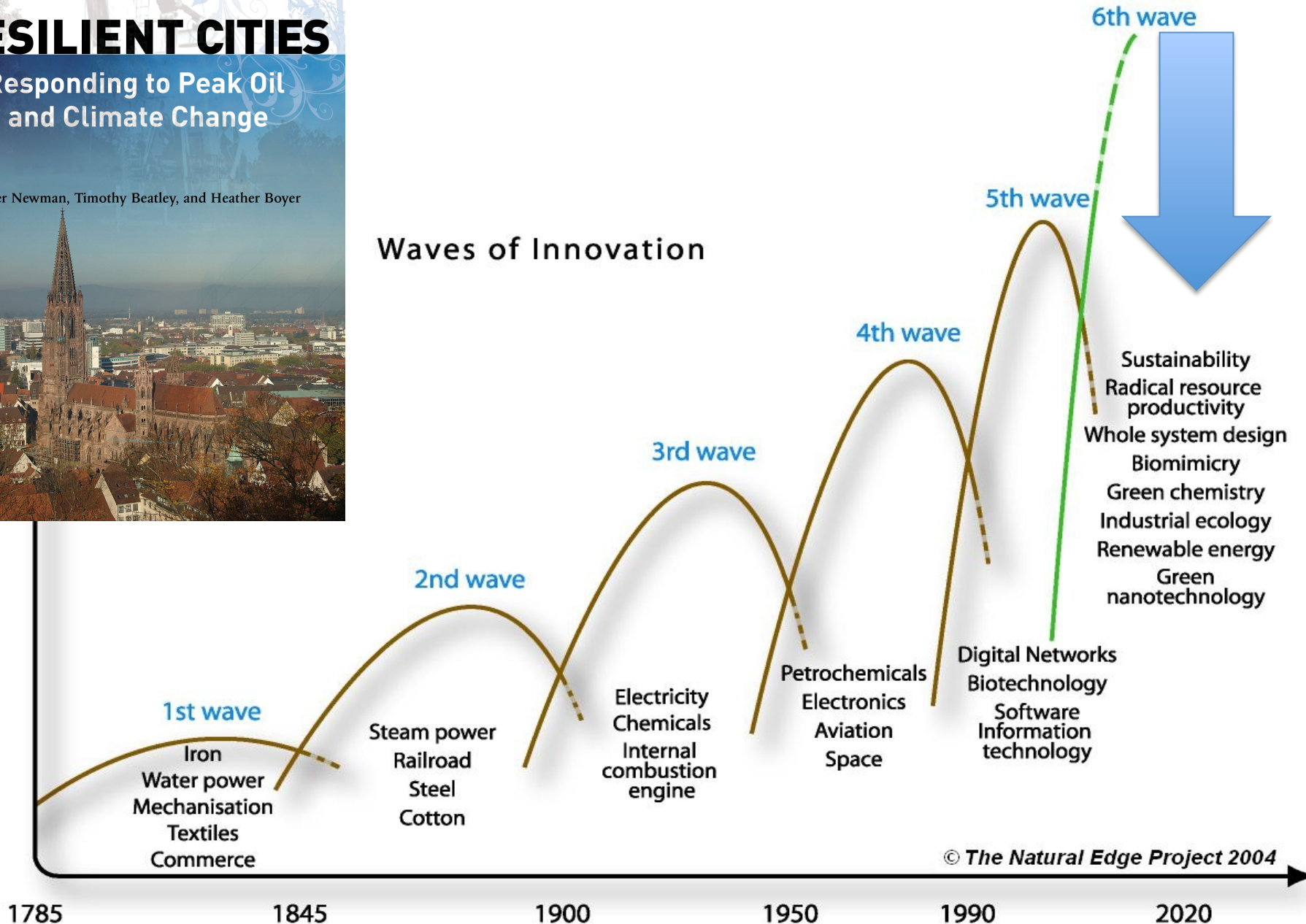
RESILIENT CITIES

Responding to Peak Oil
and Climate Change

Peter Newman, Timothy Beatley, and Heather Boyer



Waves of Innovation



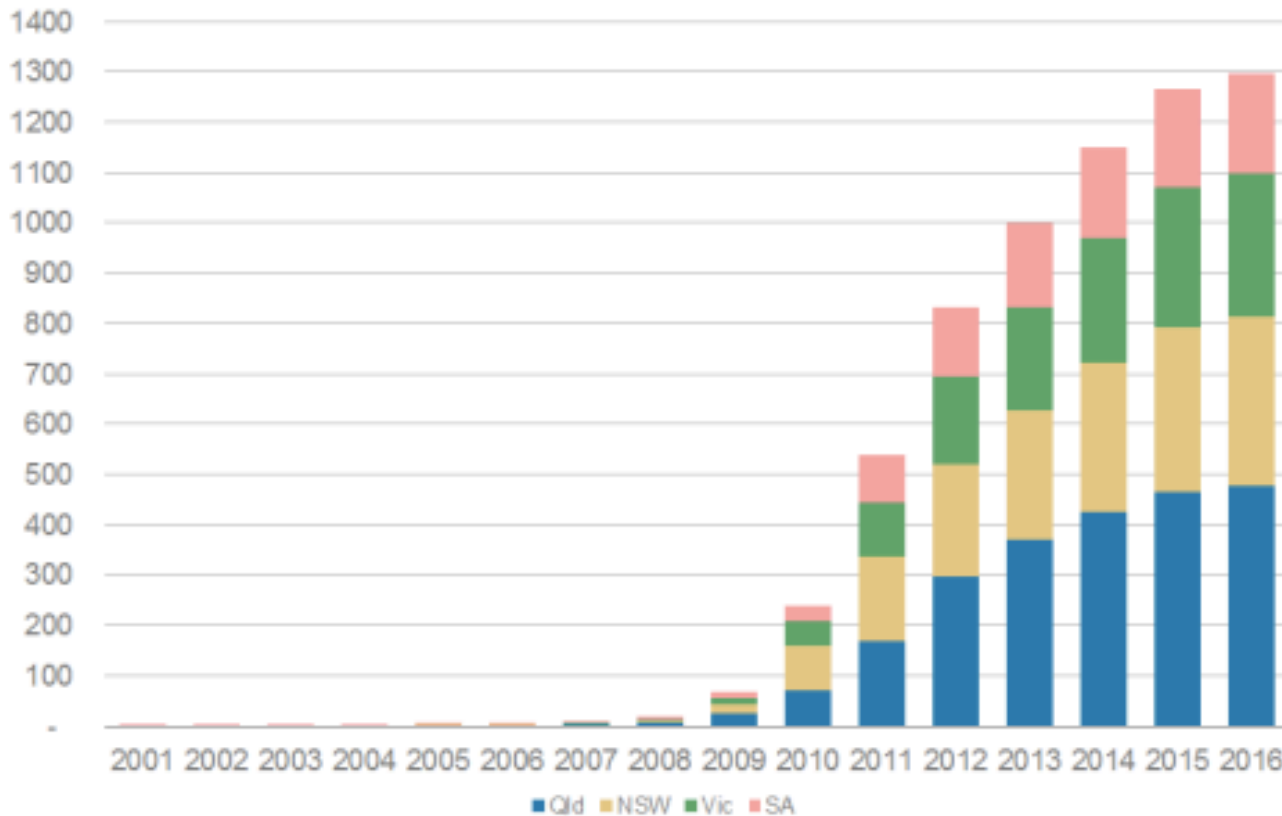
Disruptive innovations and 21st century cities....

1. Solar and battery storage.
2. Light rail and urban villages.
3. Modular construction.
4. Biophilic urbanism.

Disruptive innovations and cities....

1. Solar and battery storage.

Solar on Australian homes



Source: Australian Clean Energy Regulator (ACER).

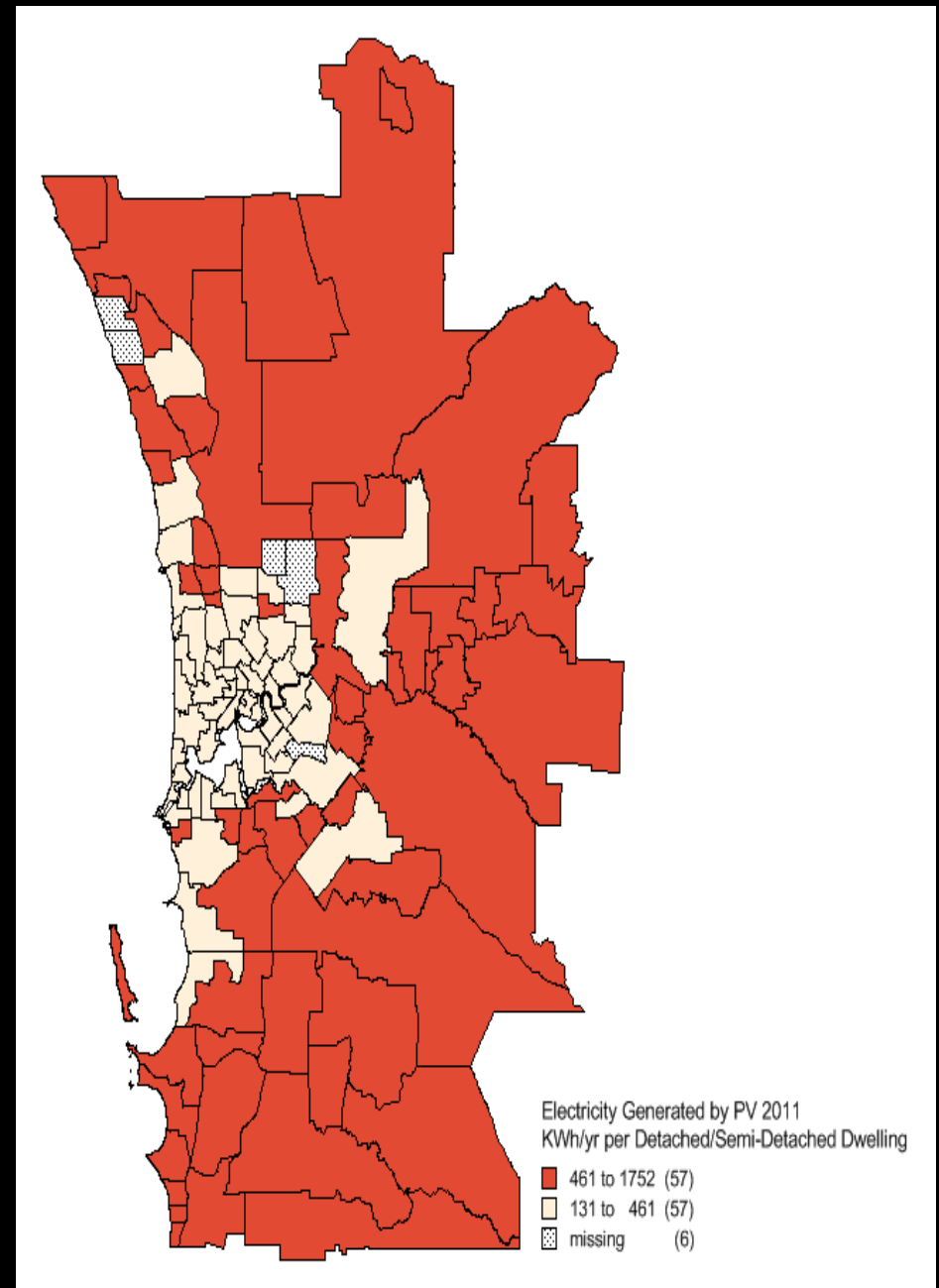
+1.5 million solar installations in 7 years

Solar power (PV)

25% of Perth homes
550 MW in 4 years...
Largest power station in WA

70% by 2025
'It is inevitable...'
Minister for Energy.

Coal assets stranded.



Despite this clear demand....

- No mainstream developer or project home provider is putting PV in as a standard facility.
- Still expanding homes on the fringe.
- Will new non-solar car-dependent homes become stranded assets?



JOSH'S HOUSE

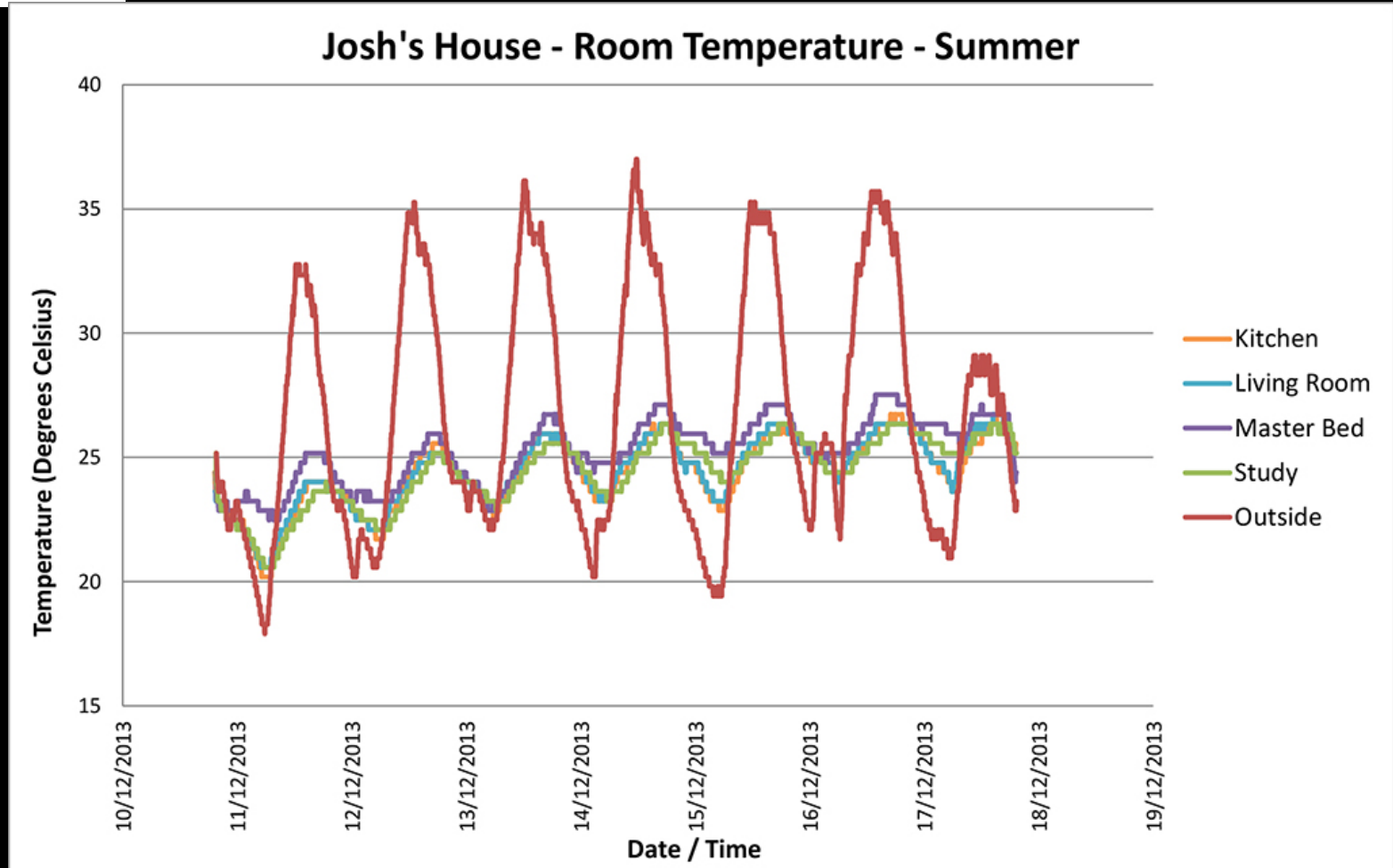
Showcasing how to build cheaply and sustainably...
Through urban regeneration.





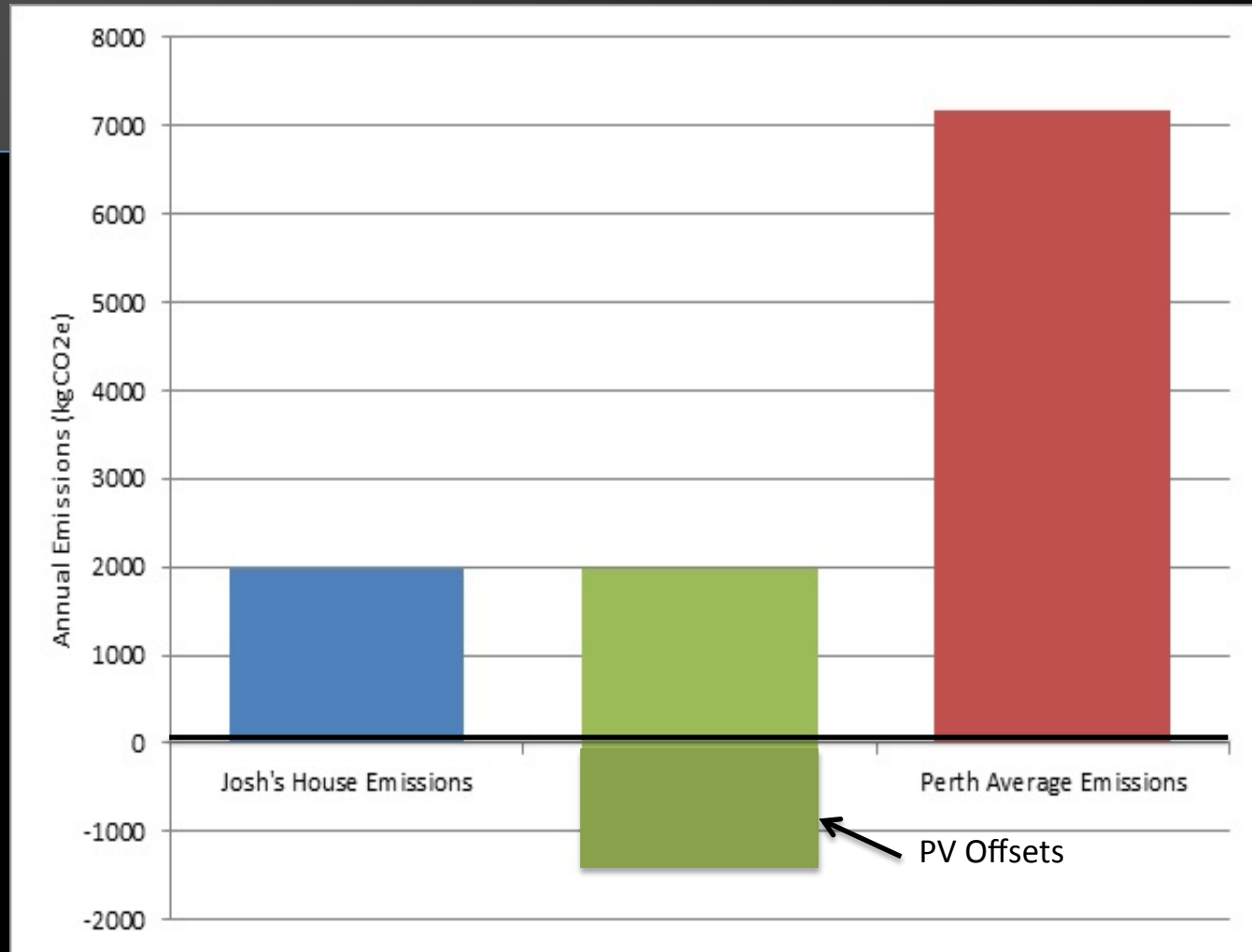
Summer Temperatures

No air con but always cool in summer...



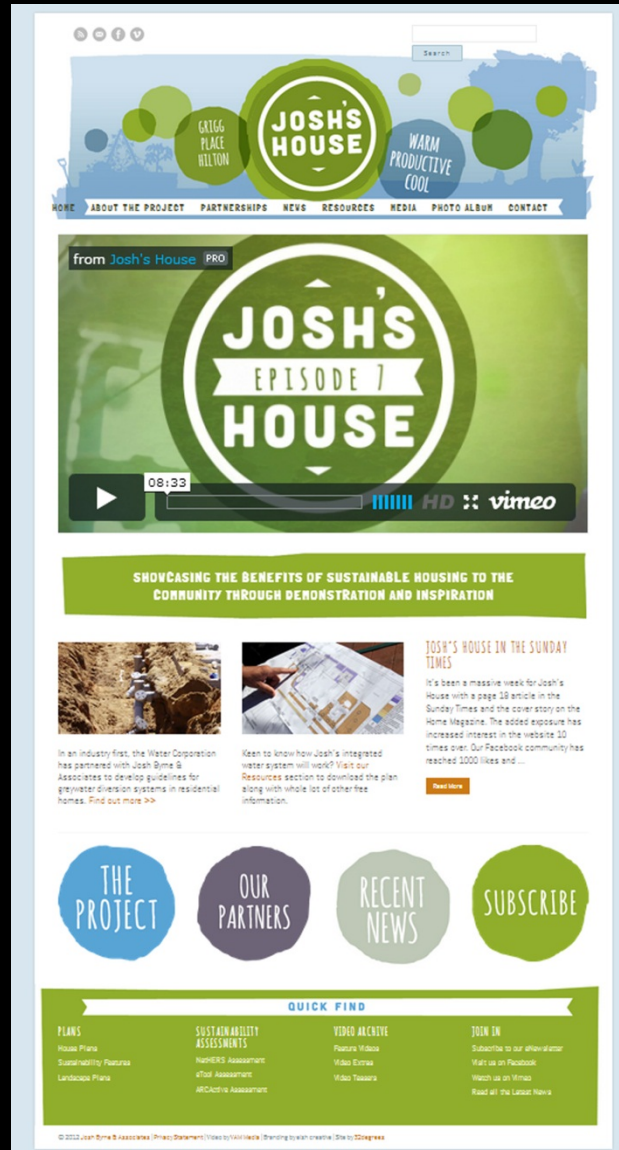
JOSH'S HOUSE

It's carbon positive!





JOSHSHOUSE.COM.AU



All designs on web.
40 million hits...

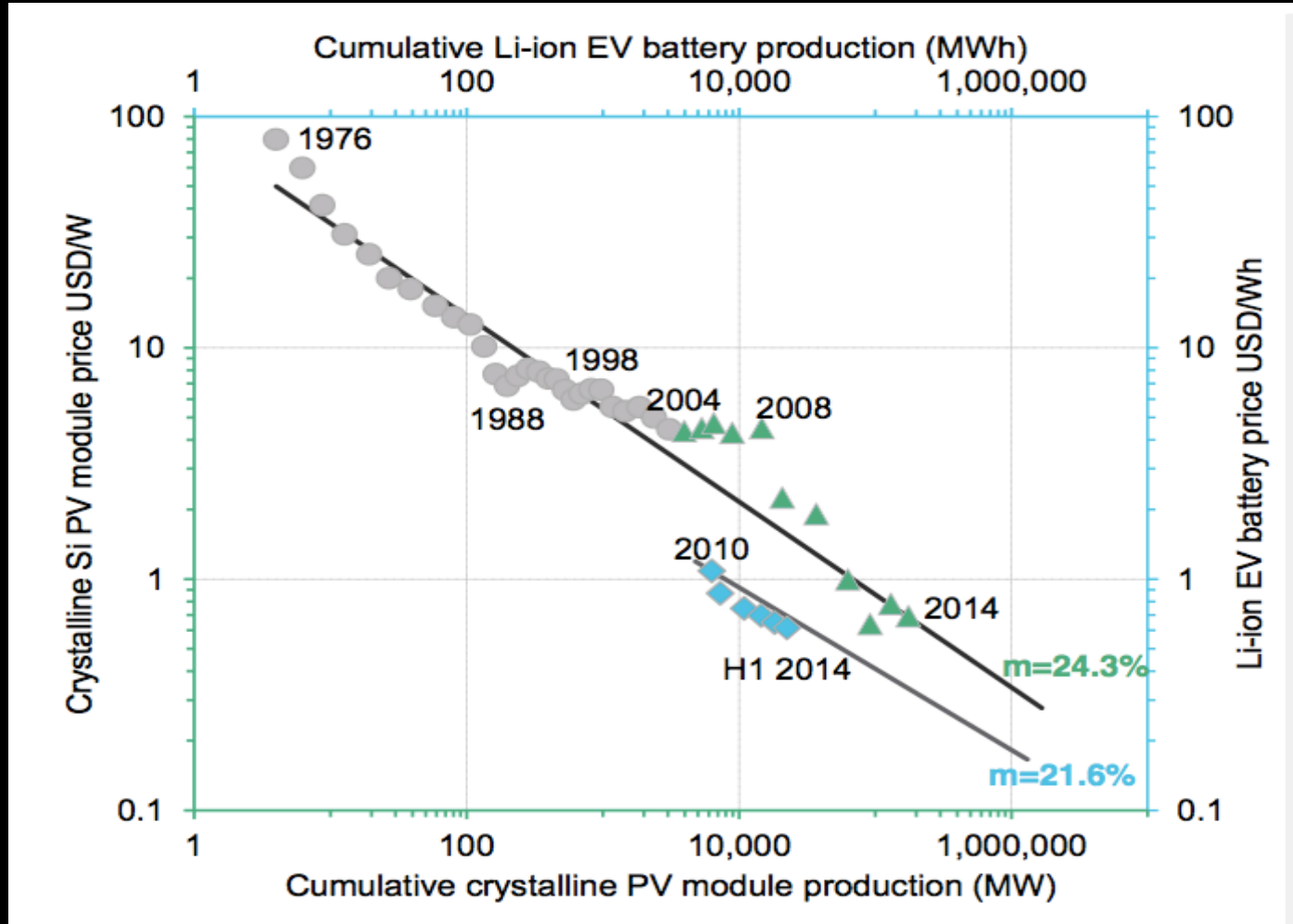
Next:
Batteries for storage,
then electric vehicle...

Research now on urban precincts



Curtin University

Li ion Battery prices falling at same rate as PV through mass production

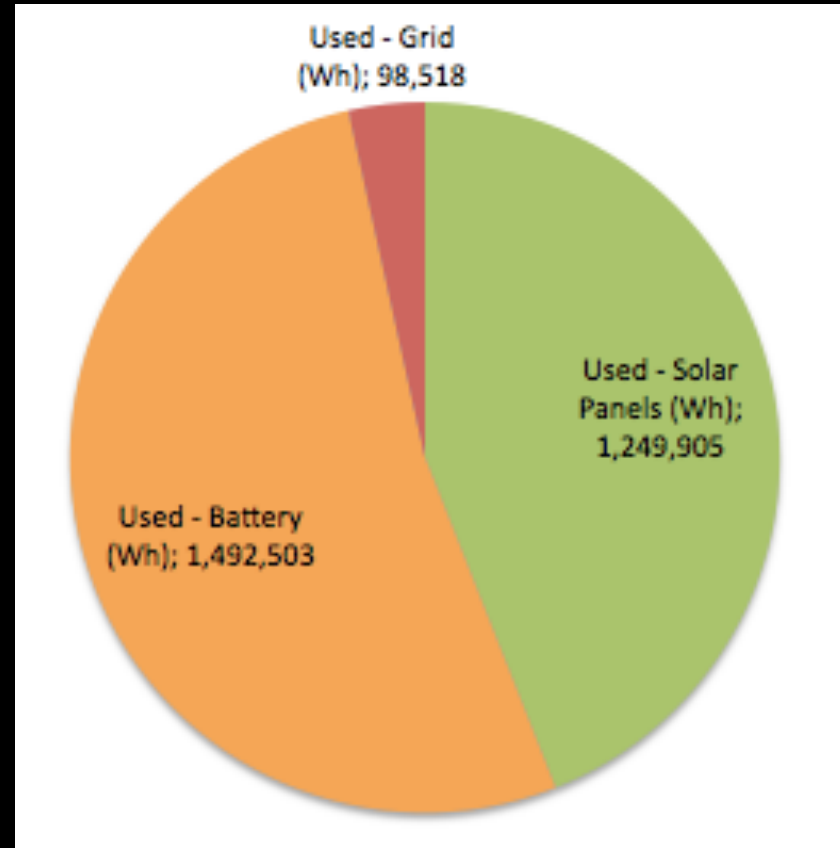
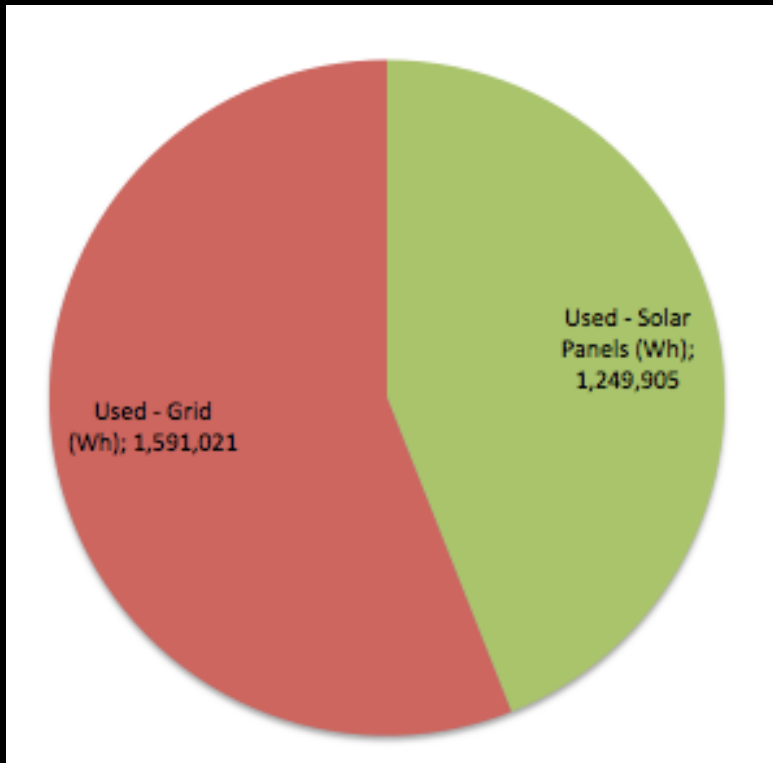




The holy grail arrives



Load defection scenarios: solar with and without and batteries

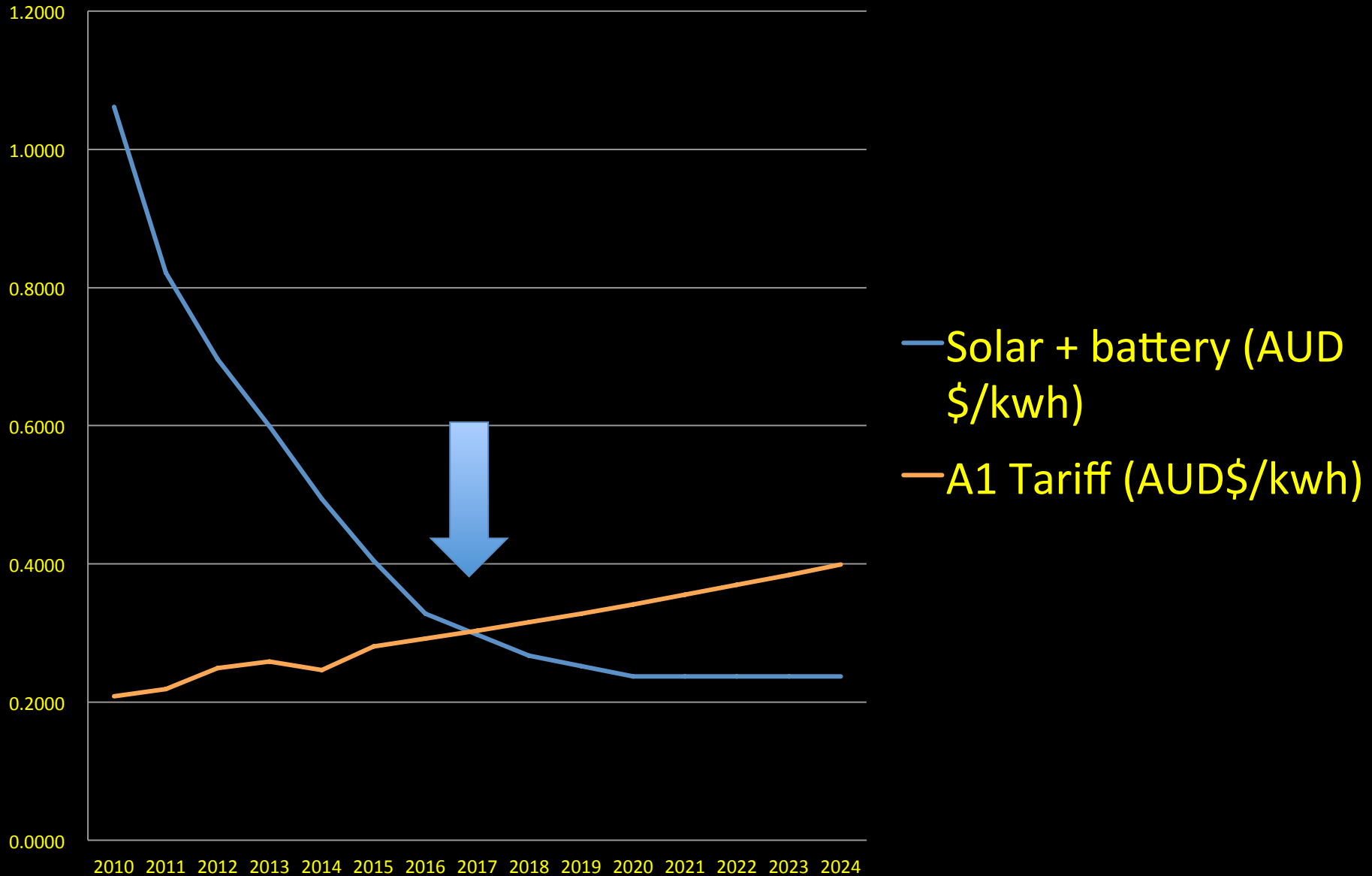


45% load defection 97% load defection

Why the grid is just as important but will change...

- Cities share through skills and mutual dependence...
- Just as its hard to be self sufficient in food, water, waste management, health, education and community supports...
- Grids will enable us to have two way flows of power, micro-grid management, network resilience....

A1 Tariff vs Battery plus Solar PV Cost in Perth



Honda Zero Carbon Home



Tesla

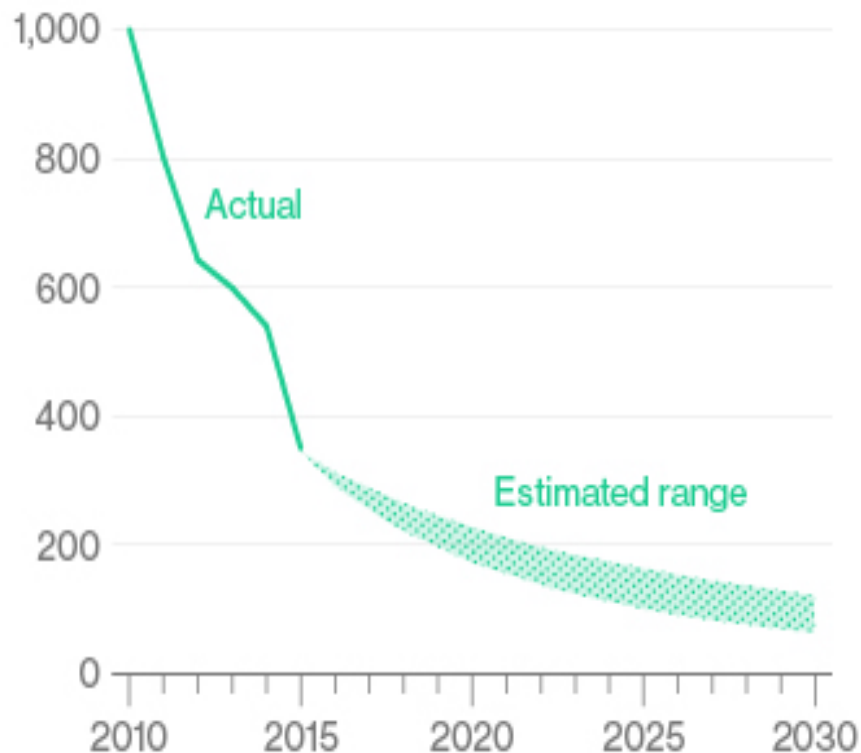


Electric cars are part of the story – its all about batteries

Source:
BNEF

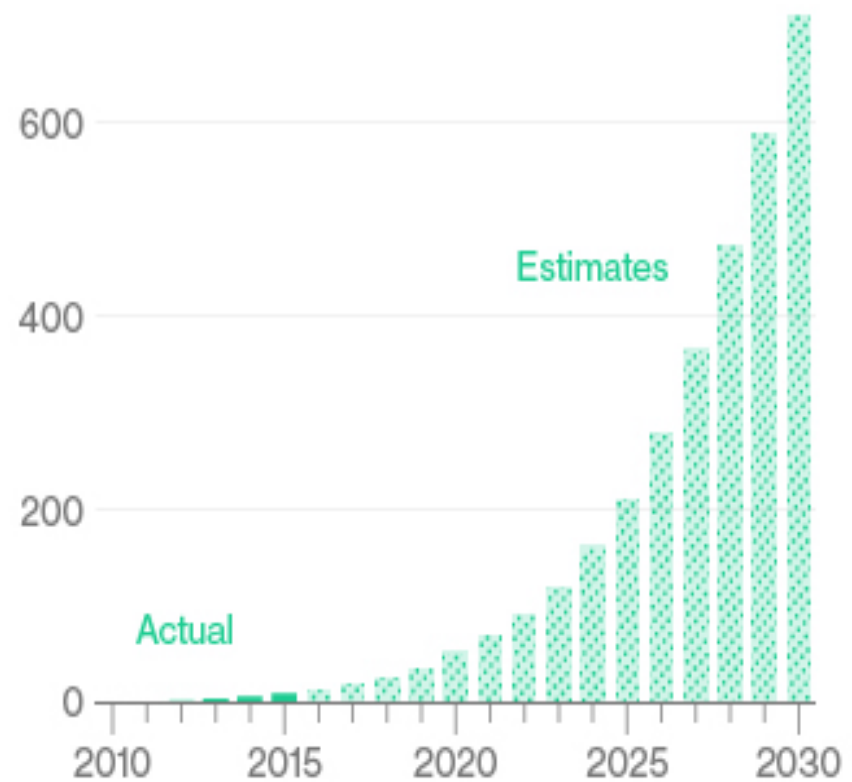
Cost for lithium-ion battery packs

\$1,200 per kilowatt hour



Yearly demand for EV battery power

800 gigawatt hours





Where does
most Lithium
come from?

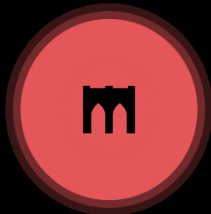
Will there be a
Li cartel?

WGV Solar-storage. ARENA. 'Citizen Utilities'

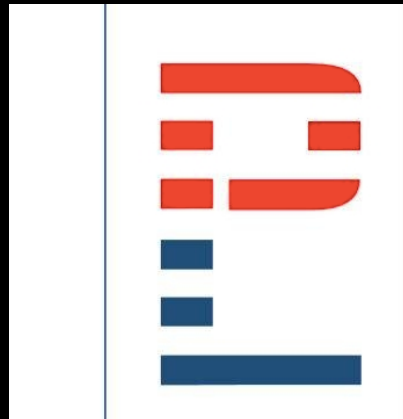


Blockchain Applications

ENERGY + BLOCKCHAIN



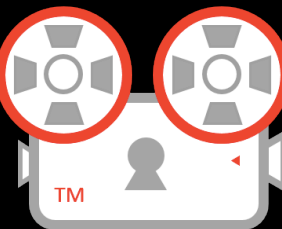
BROOKLYN
GRID



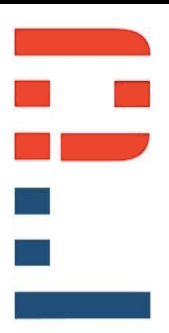
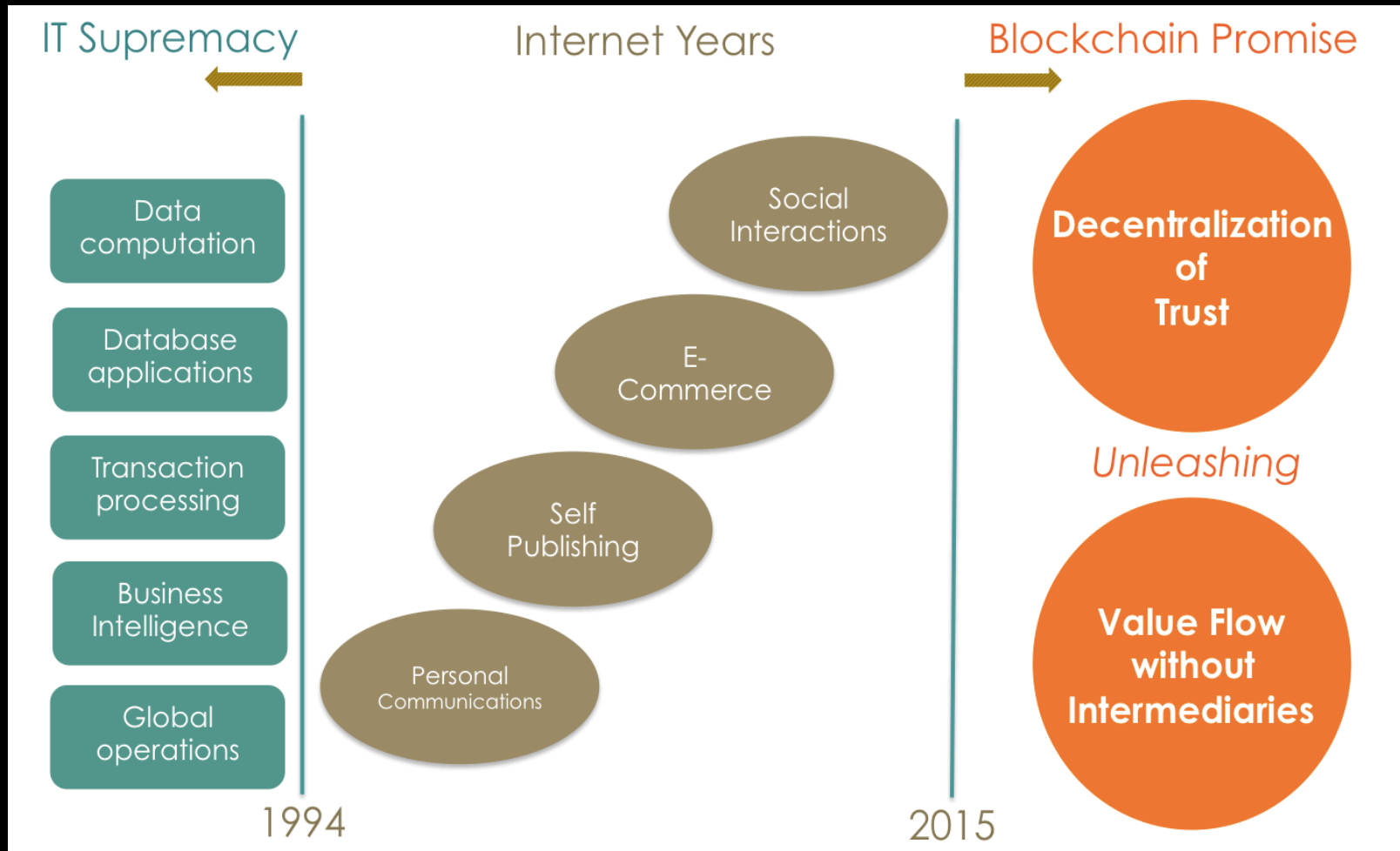
Digital Asset



UPROOV



Blockchain and technology eras



Citizen Utilities

- Citizens can sell their surplus electricity to each other, through 'land title manager' or 'local energy manager'...
- The grid becomes a trading platform for marketplace using the internet.
- As more renewable capacity is installed there will be increased grid utilization, not less.
- Generators can become asset owners and partners of distributed energy.

White Gum Valley — not just a zero carbon innovative precinct



8/5/16

46

LandCorp project

WGV Overview — One Planet Living National Certification

- Waste minimisation strategy, including reuse of materials during civil works
- Precinct non-drinking water scheme (community bore)
- Pre-development tree canopy targets (30%)
- Landscaping integrated with CoF Green Plan
- Stormwater sump rehabilitation
- Affordable housing included
- Energy and water efficiency initiatives embedded in Design Guidelines (for single lot product)
- Performance targets set in EOI's for apartments
- Rebate package for PV upgrade, plumbed rainwater water tank and advanced shade tree
- Resident engagement program to support sustainable lifestyles



zero carbon



zero waste



sustainable transport



local and sustainable materials



local and sustainable food



sustainable water



natural habitats and wildlife



culture and heritage



equity and fair trade



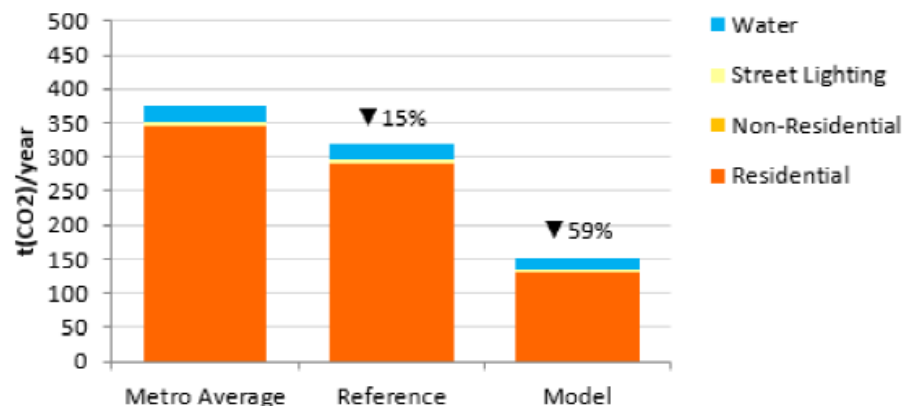
health and happiness



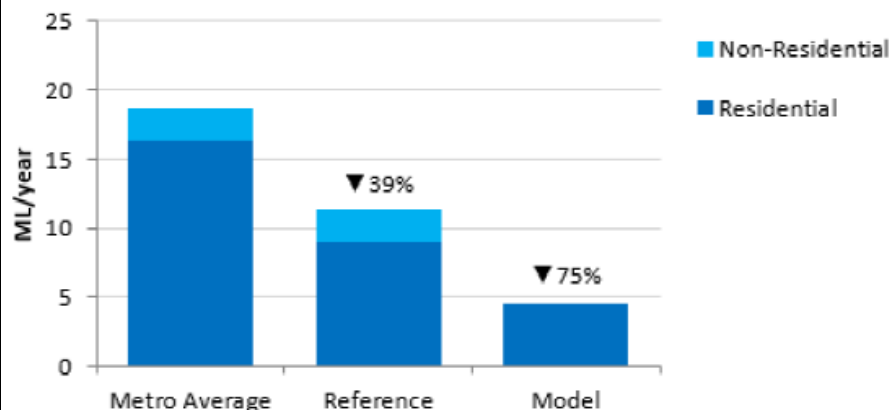
WGV Overview — Energy & Water Use Modelling

- 60% less grid energy compared to a typical Perth development
- 70% less mains water compared to the Perth metropolitan average
- Residents in the single-lot homes will save up to \$1,000 in power and \$200 in water bills compared to the Perth average with 3kW PV upgrade and plumbed rainwater tank covered by a 'Sustainability Rebate Scheme'

ENERGY (GREENHOUSE GAS EMISSIONS)



WATER



HOUSEHOLD OPERATING COST

WGV and liveability....

- artists social housing project
- community water and energy system
- community spaces for open space and art
- no NIMBY just 'we want to move there'



Integrated energy/water/waste with smart metering...

- For end of grid stand-alone systems
- For remote settlements
- Increasingly for parts of cities....eg Perth airport.



Australia's first commercial diesel displacement solar plant starts operation, Rio's Weipa mine.

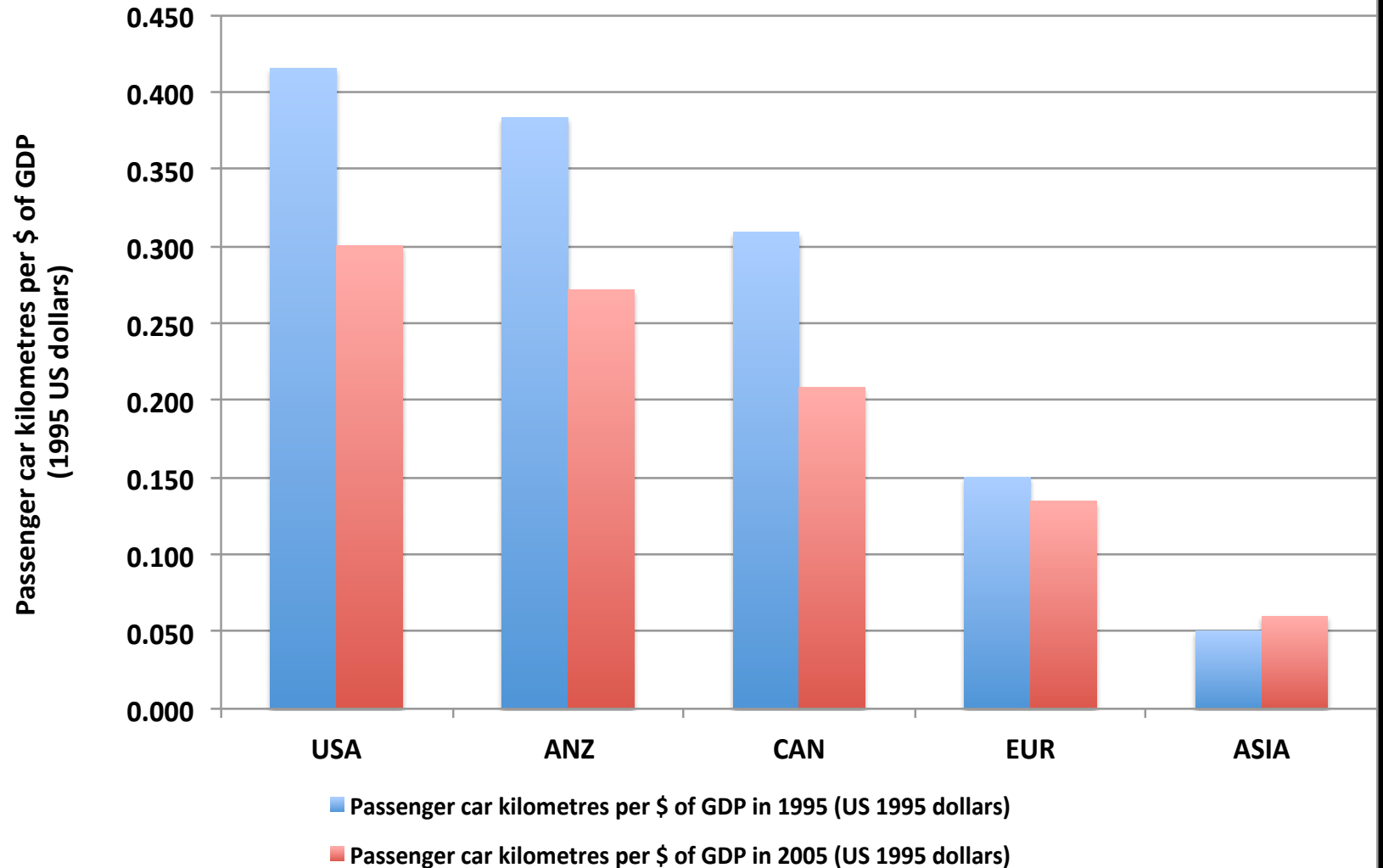




Disruptive innovations and cities....

1. Solar and battery storage.
2. Light rail and urban villages.

Decoupling car use and GDP



PETER NEWMAN *and* JEFFREY KENWORTHY

THE END *of* AUTOMOBILE DEPENDENCE

*How Cities are Moving
Beyond Car-Based Planning*

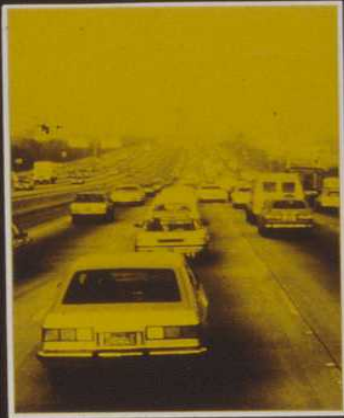
New era
emerging...

The third in a trilogy....



CITIES

AND AUTOMOBILE
DEPENDENCE



AN INTERNATIONAL SOURCEBOOK

PETER NEWMAN
JEFFREY KENWORTHY

First step - the war
begins...1989

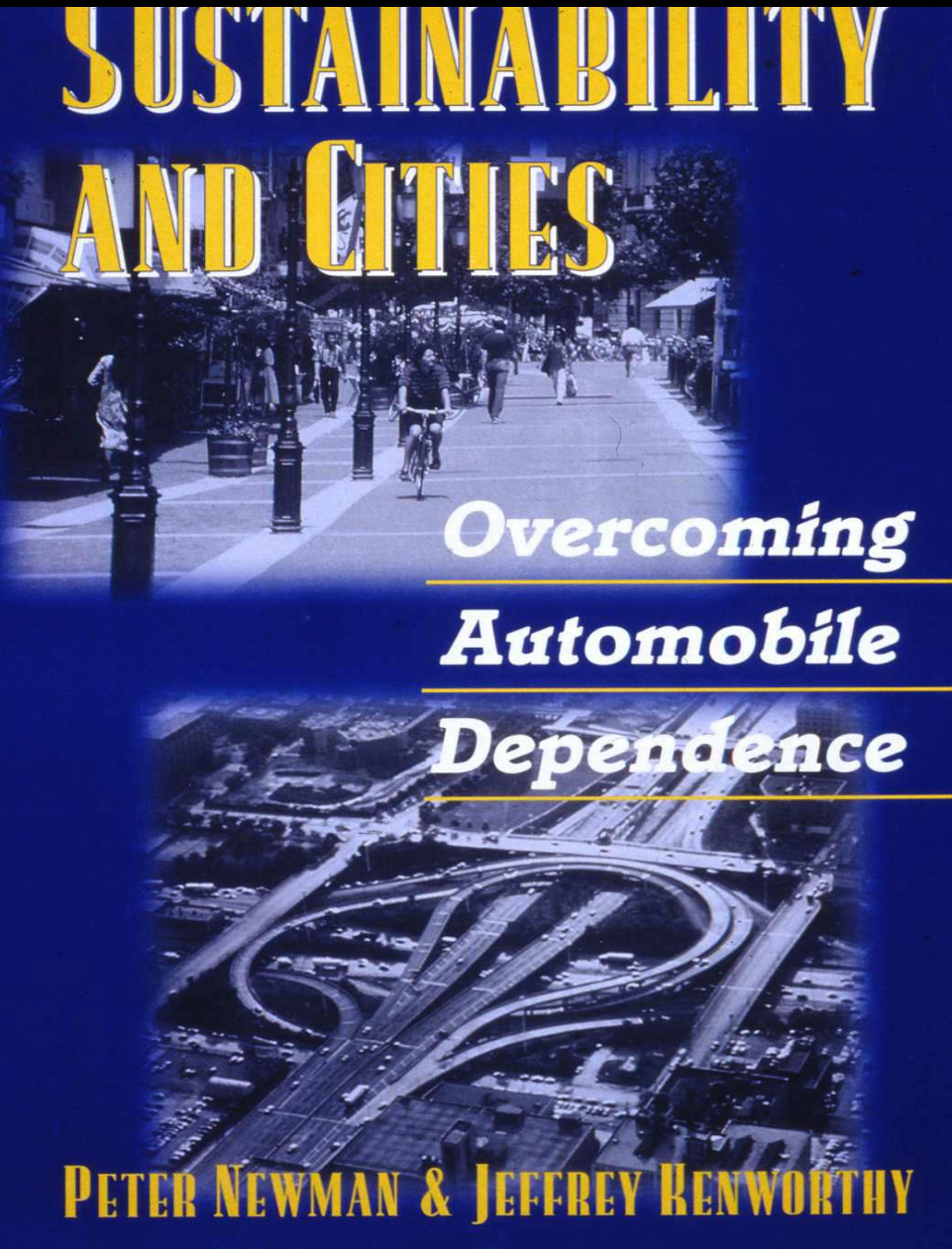
1. Defining automobile dependence in data.
2. Showing how we must 'reorient transport priorities and reurbanize our cities'

The reaction...in 1989

‘NK have written a troubling paper. Their distortions are not innocent, because the uninformed may use them as ammunition to support expensive plans for a central-city revitalization and rail-transit projects or stringent land use controls in a futile attempt to enforce urban compactness. Perhaps NK would be well advised to seek another planet, preferably unpopulated, where they can build their compact cities from scratch with solar-powered transit.’

Gordon and Richardson JAPA, 1989

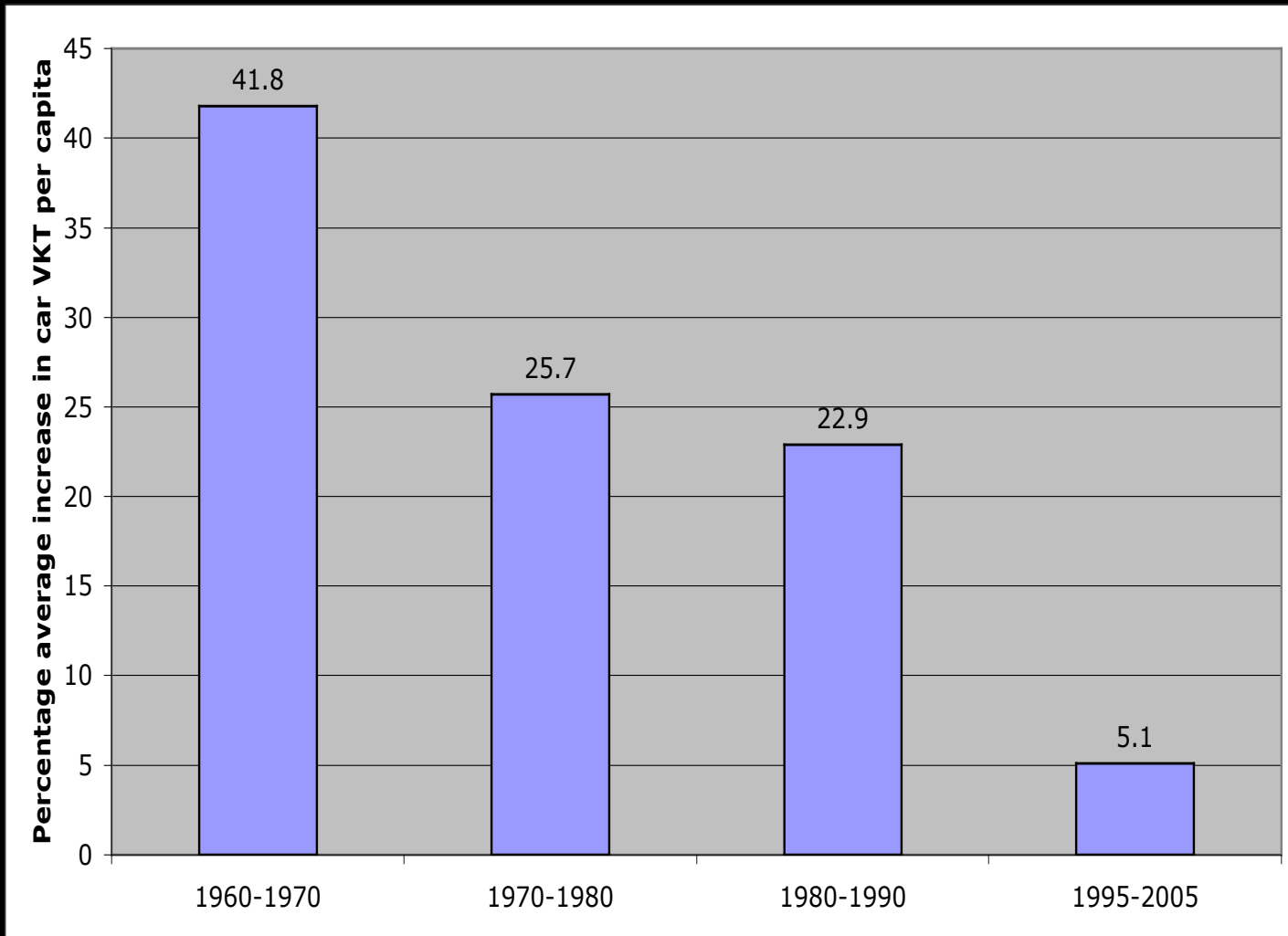
Second step - starting to win some battles, 1999



Some cities are
starting...

Global Cities
Database on 100
cities....

Signs of hope with transport over decades....



But we did not think the end of the war was nigh...

PETER NEWMAN *and* JEFFREY KENWORTHY

THE END of AUTOMOBILE DEPENDENCE

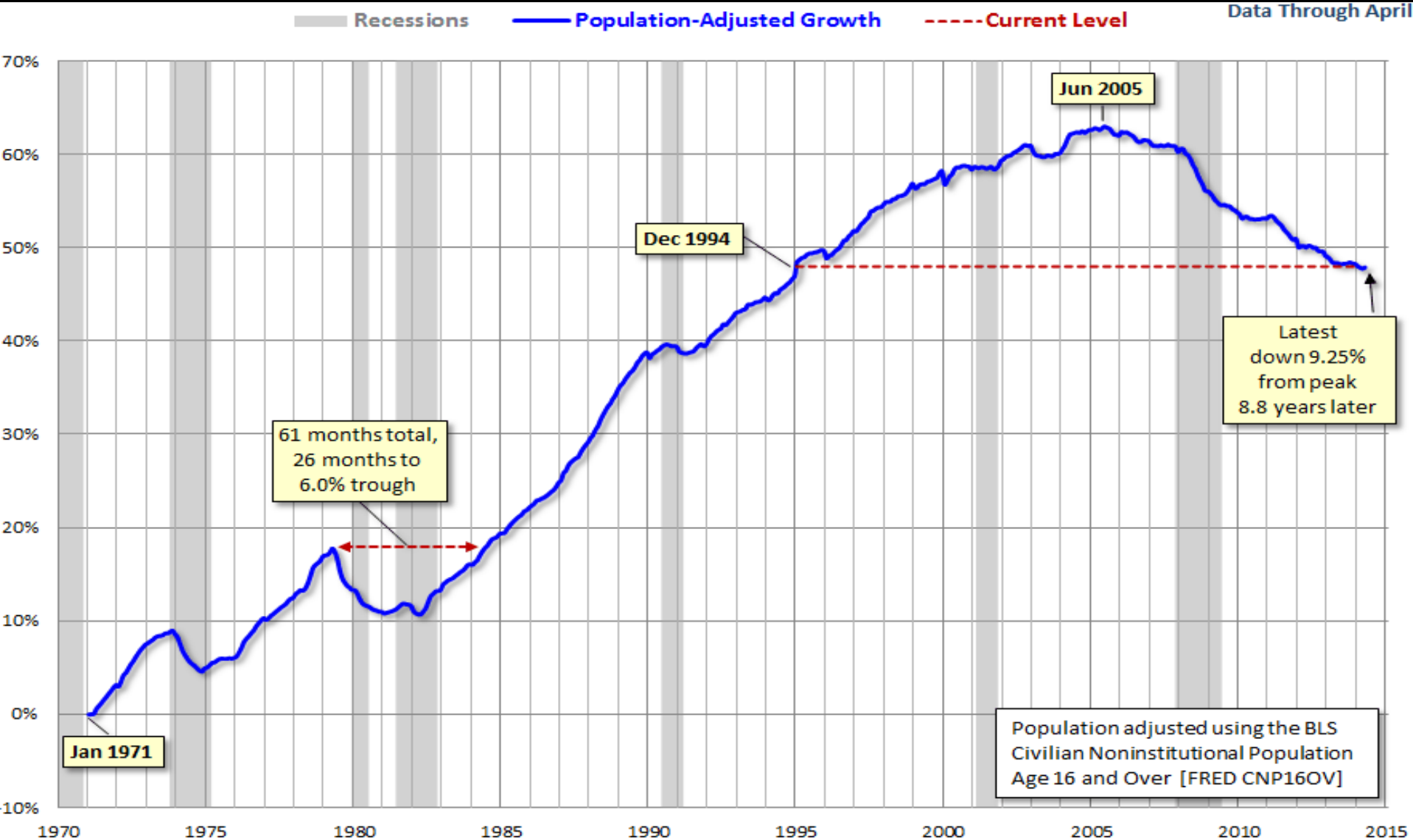
*How Cities are Moving
Beyond Car-Based Planning*



Third step -
the empire
begins to
collapse, 2015

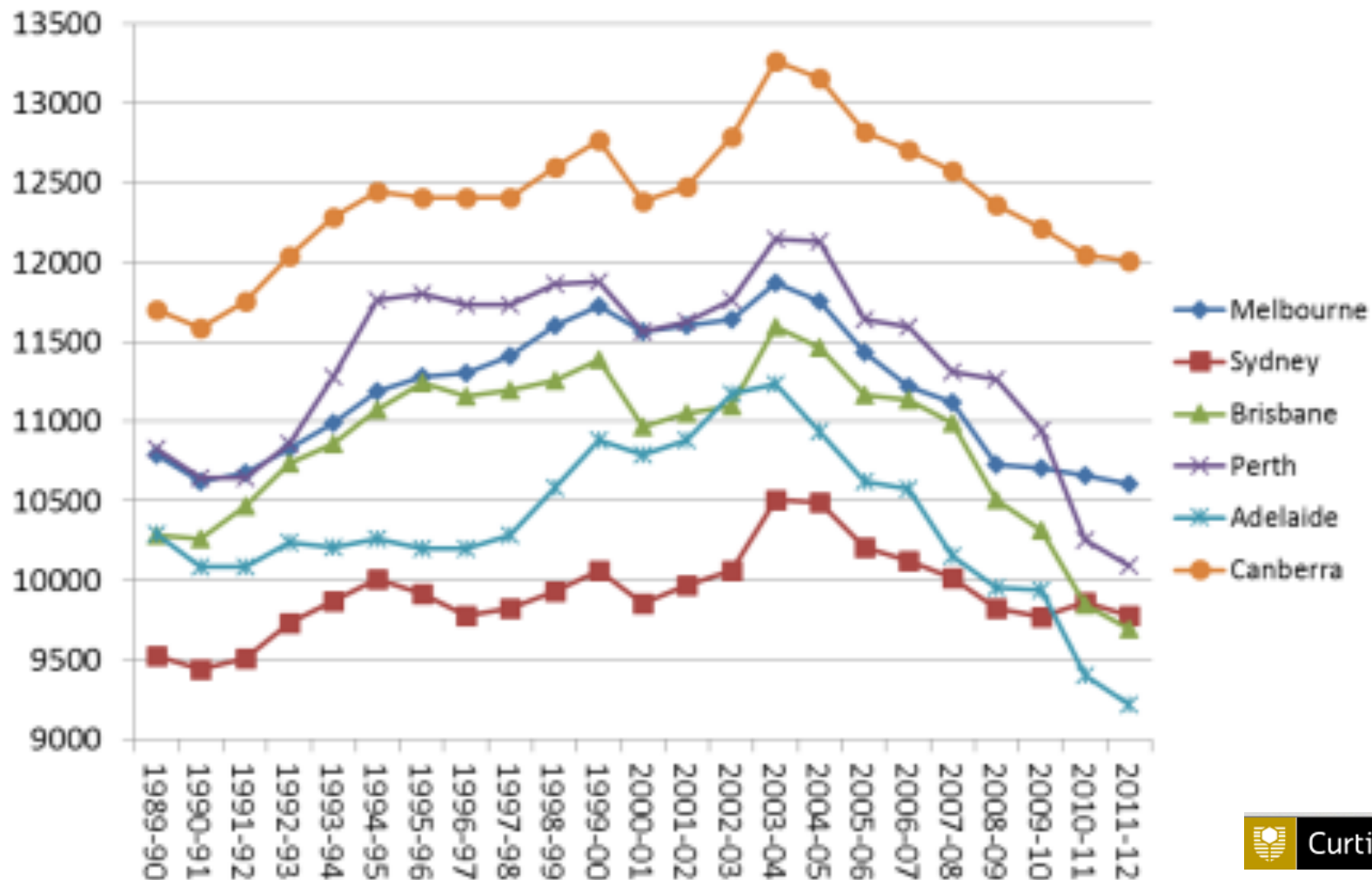
Peak car begins in every developed city

THE USA IS DRIVING LESS

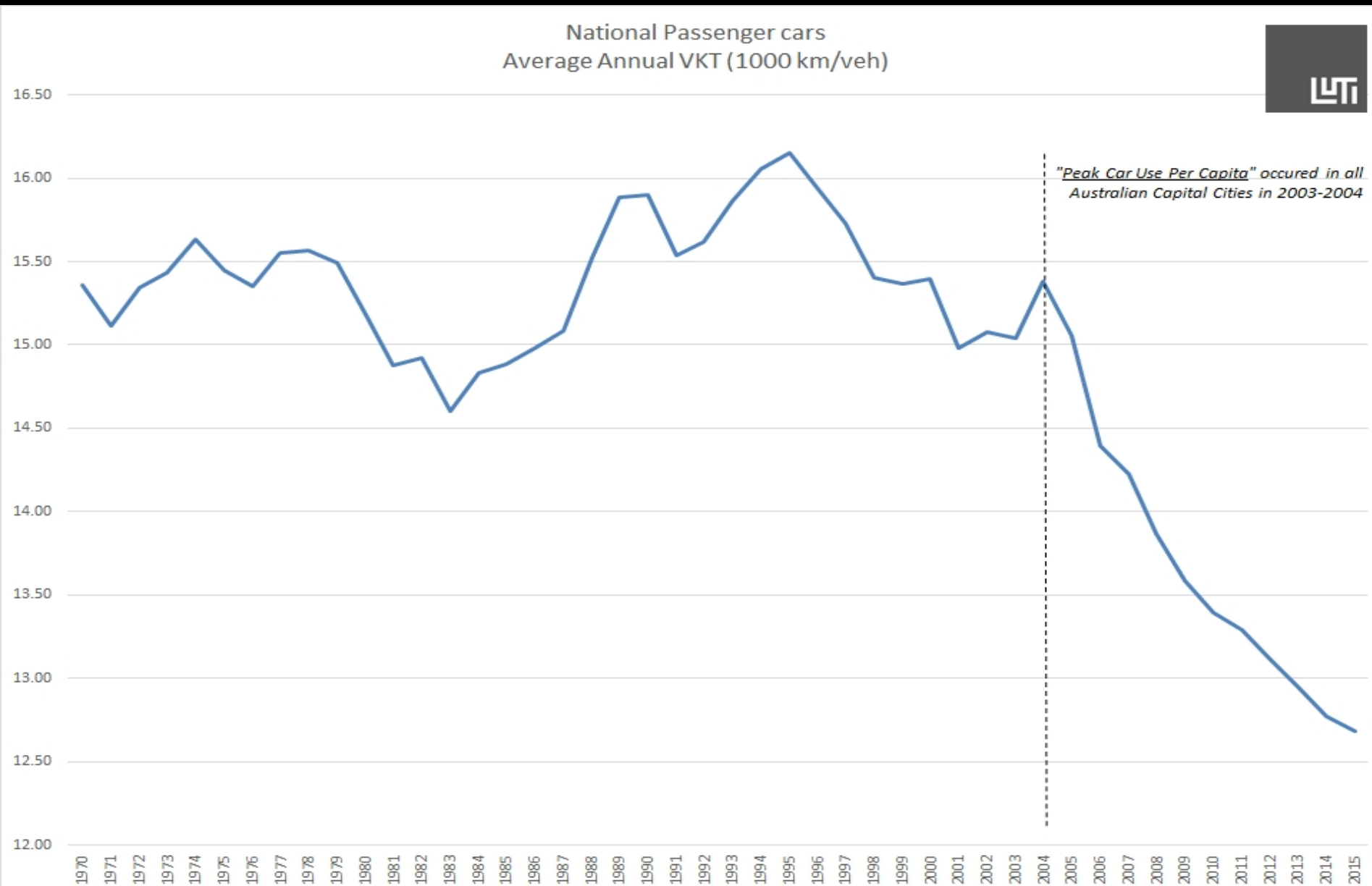


Australian city car use peaked the same year...

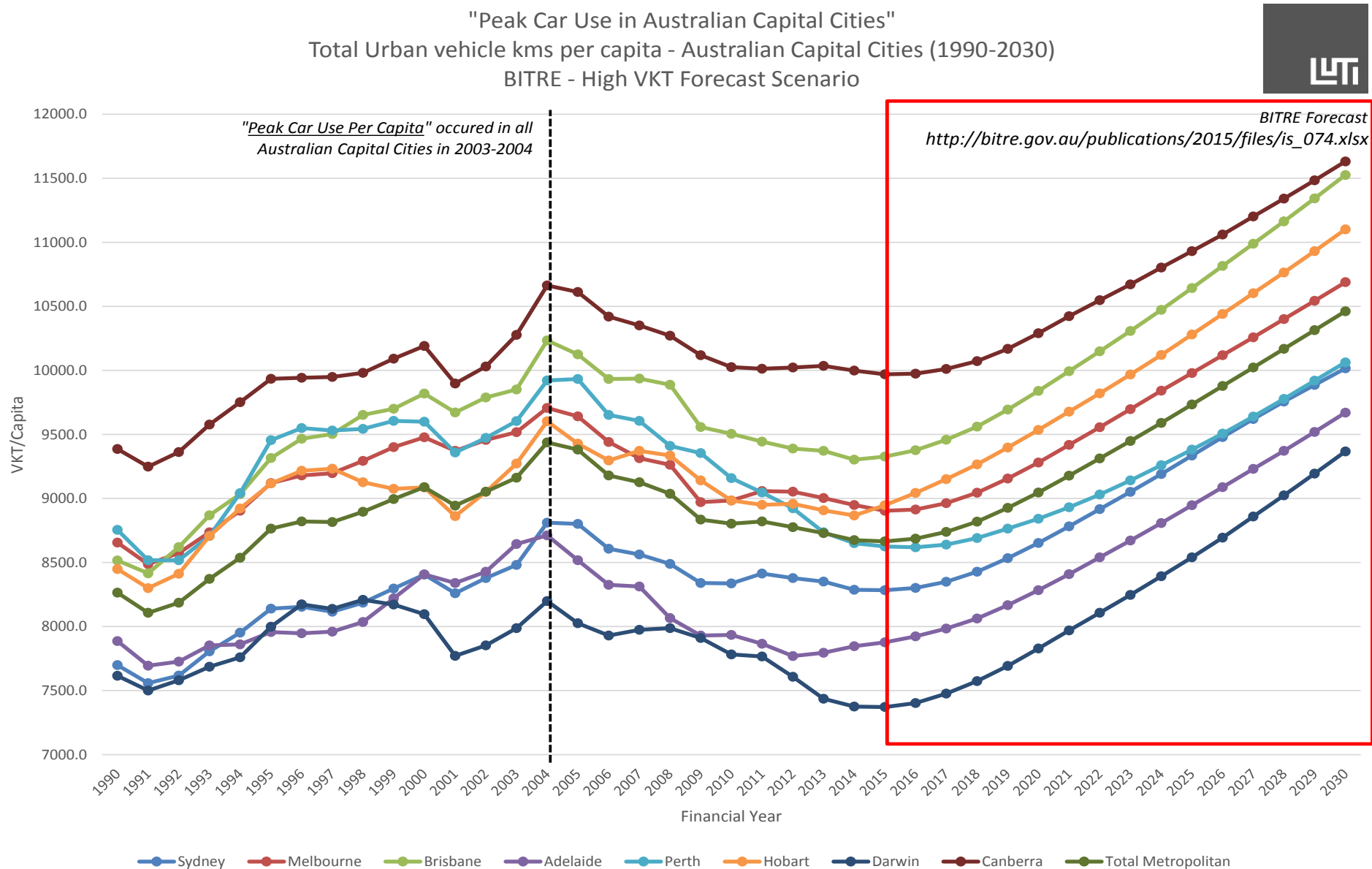
Estimated car passenger kms per capita - Australian cities



VKT per Vehicle fell off a cliff....



What traffic modelers are saying....

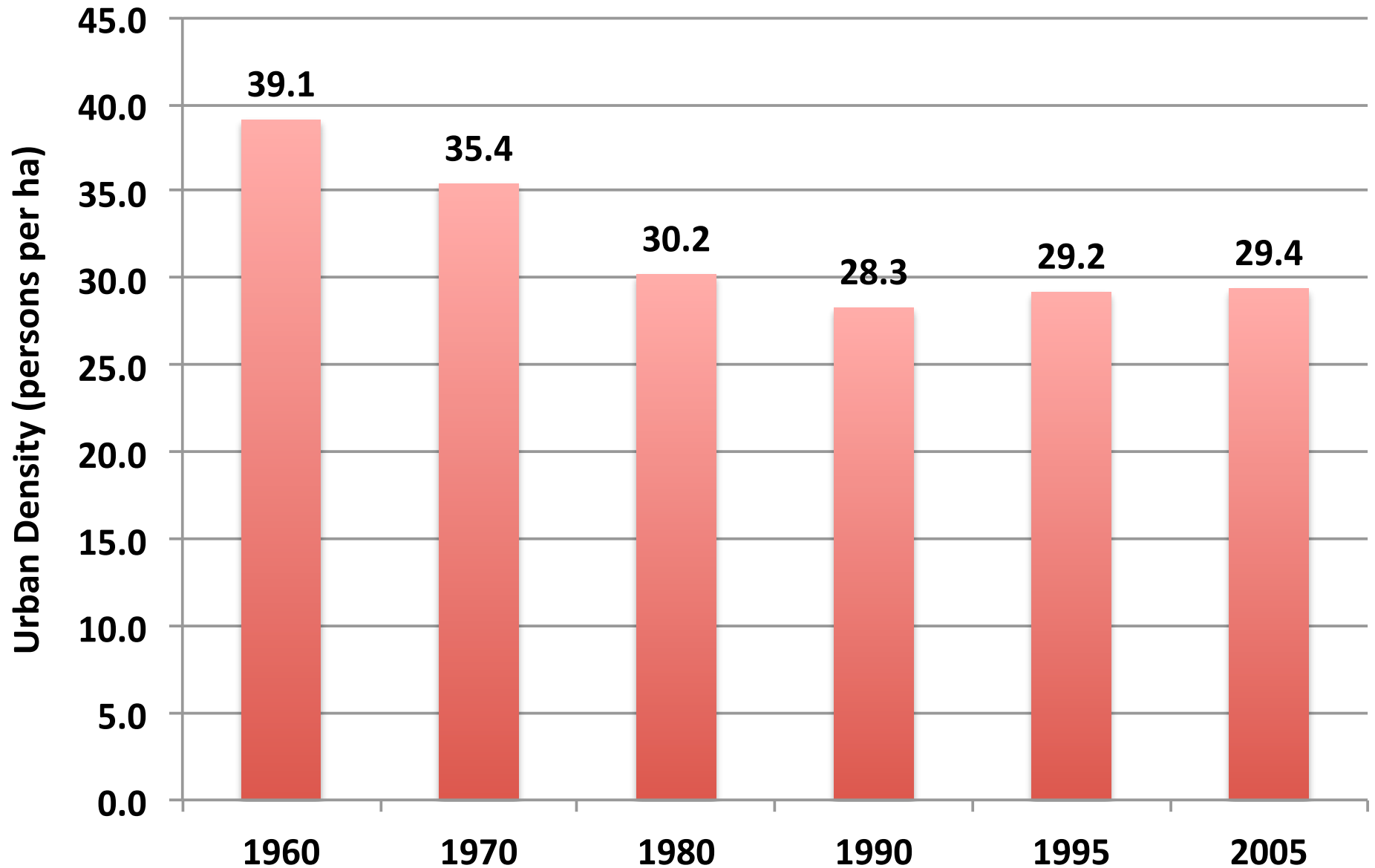


The causes of peak car...

1. Peak density decline...cities are coming back in.
2. Cultural change....especially with the Millennials
3. Travel time benefits now moving from cars to rail....cities are hitting the Marchetti wall.
4. Urban space efficiencies in the knowledge economy....people need face-to-face after all.

1. Peak density decline

Urban Density Trend in 23 Cities in the USA, Australia, Canada and Europe, 1960-2005

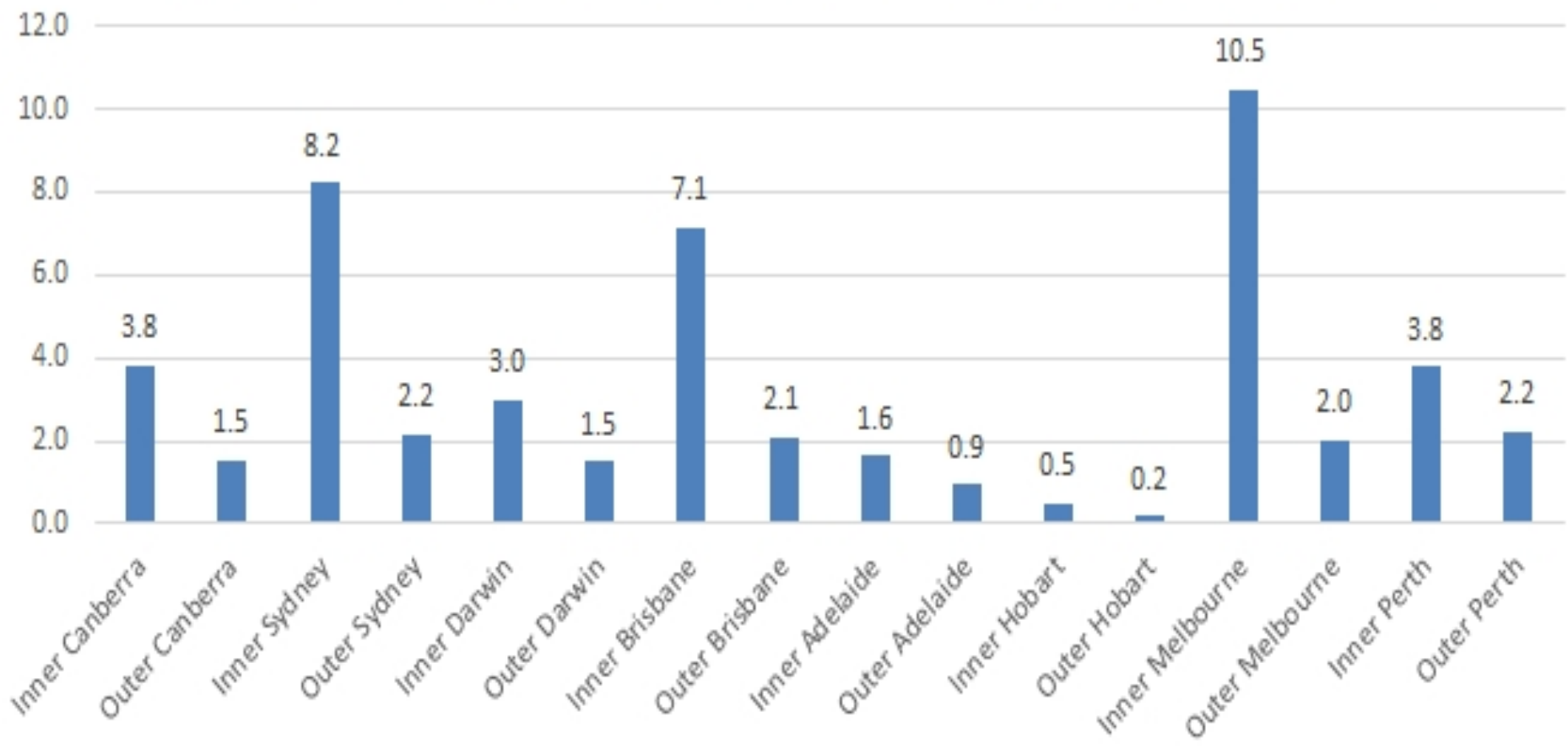


Australian cities coming back in....

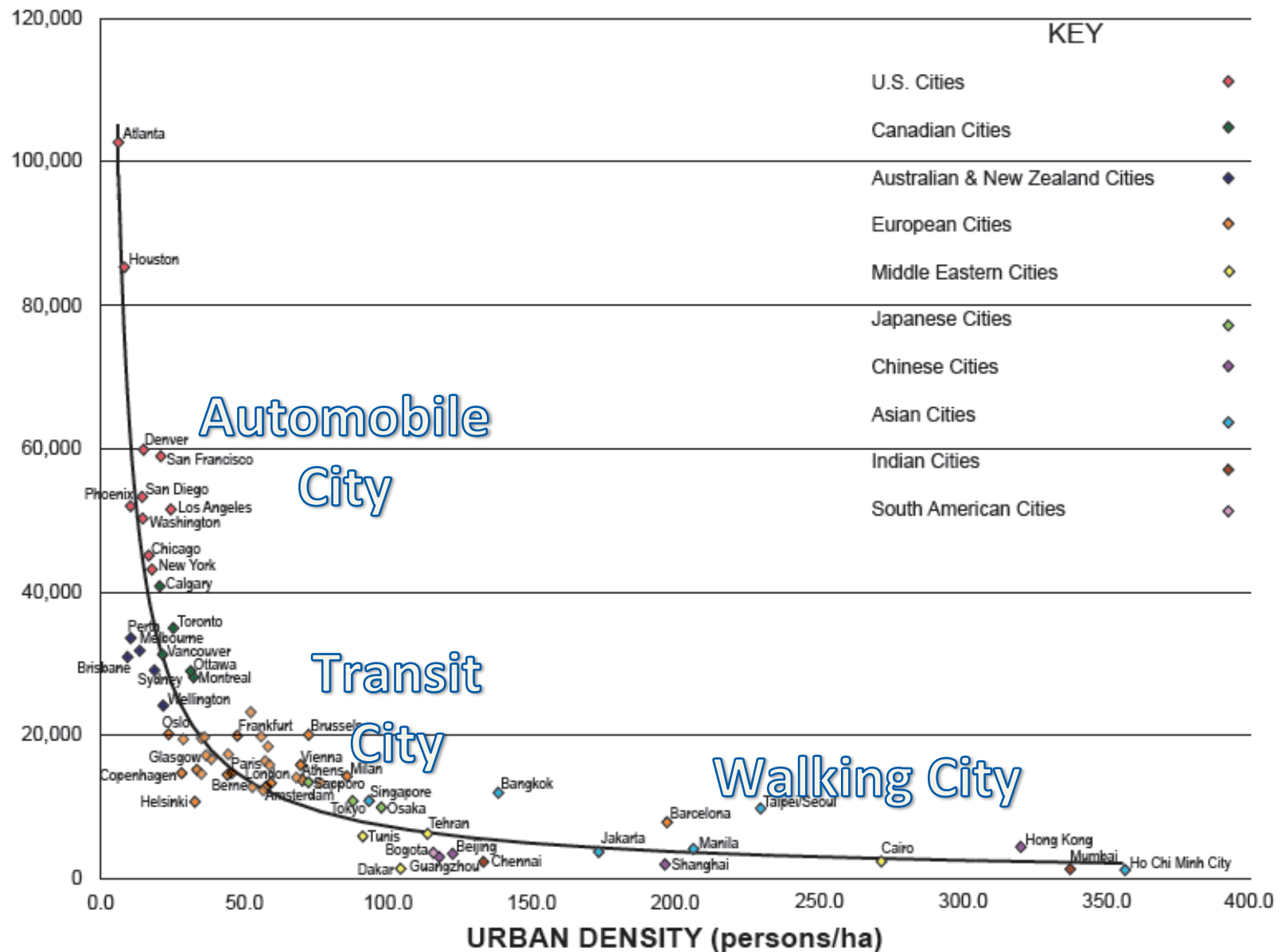
Change in Population Density 2003-2013 (People/Ha)

ABS SA2 Population data

<http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3235.02013?OpenDocument>

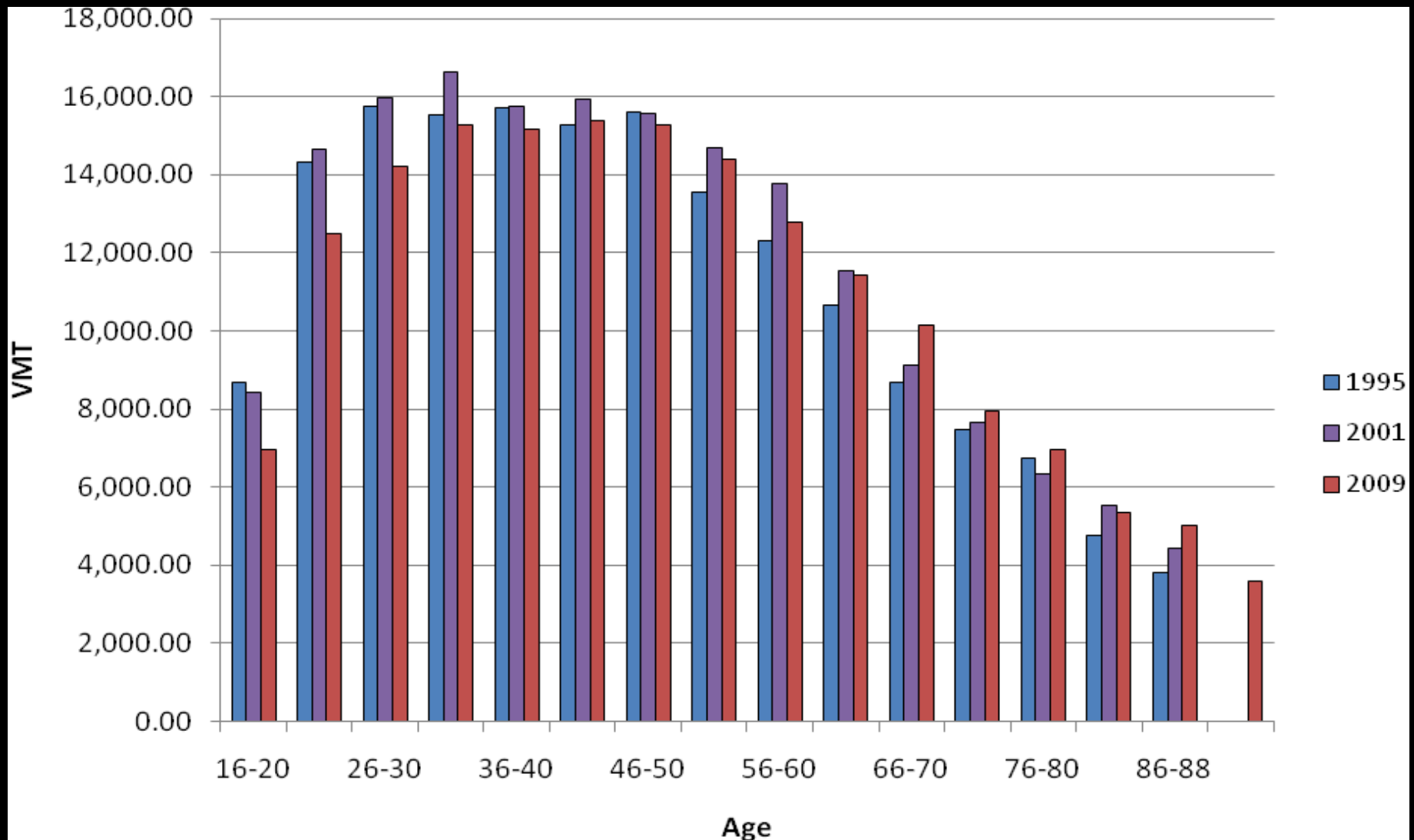


PER CAPITA PRIVATE PASSENGER TRANSPORT
ENERGY USE (MJ per annum)



2. Car Culture is changing

Car use by age group





‘Cars are so yesterday: young and rich leave guzzlers behind’



***Public transit 100%
Biking 122%, and
Walking by 37%
BUT MOSTLY CITIES ARE
COMING BACK IN.....***

From 2001 to 2009, car use by 16 to 34 year olds decreased from 10,300 miles to 7900 miles per capita – a drop of 23 *per cent*.

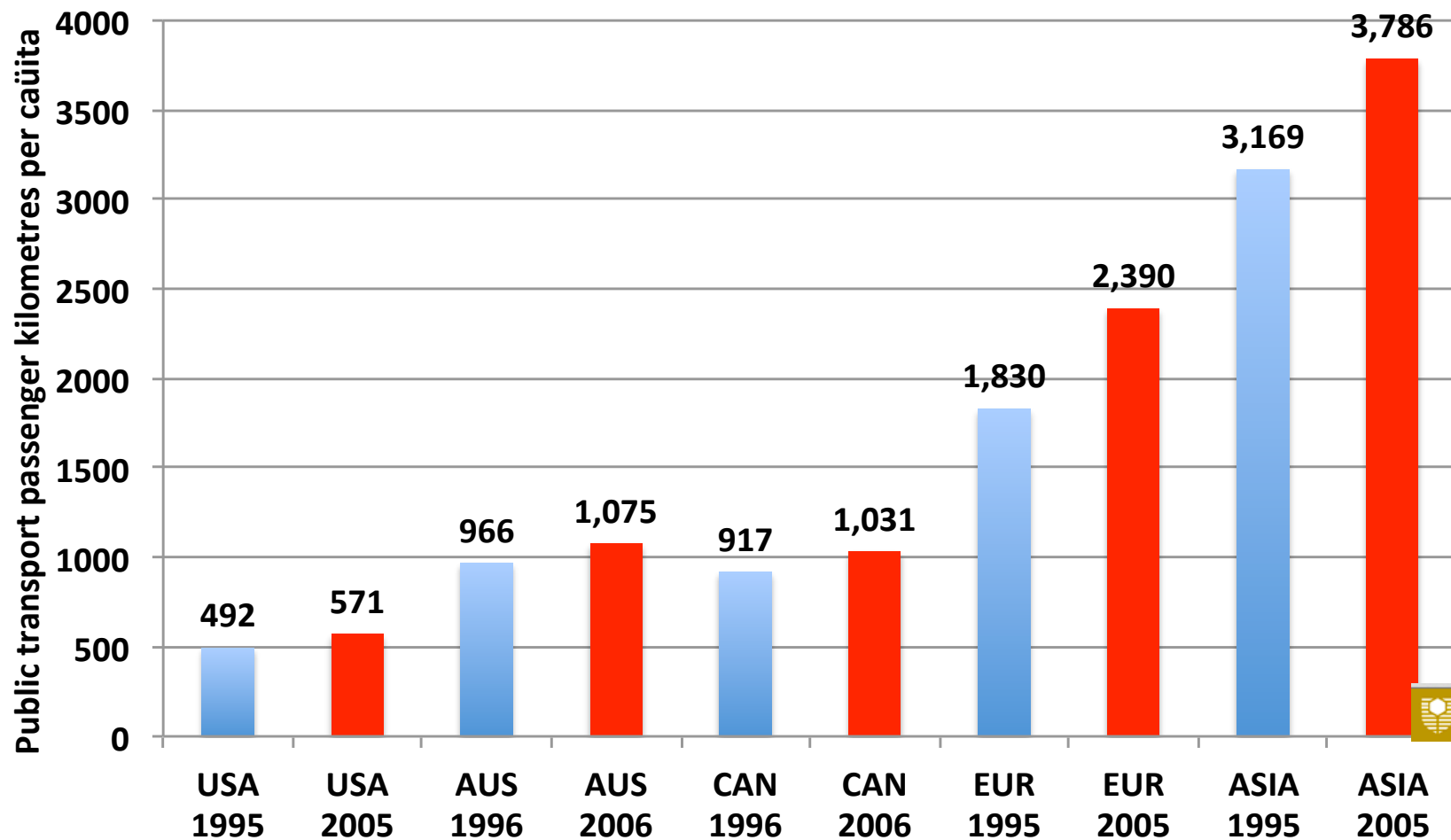
3. Travel time benefits moving away from cars...

Rail outstripping traffic speeds...

COMPARATIVE SPEEDS IN GLOBAL CITIES	1960	1970	1980	1990	1995	2005
Ratio of overall public transport system speed to road speed						
American cities	0.46	0.48	0.55	0.50	0.55	0.54
Canadian cities	0.54	0.54	0.52	0.58	0.56	0.55
Australian cities	0.56	0.56	0.63	0.64	0.75	0.75
European cities	0.72	0.70	0.82	0.91	0.81	0.90
Asian cities	-	0.77	0.84	0.79	0.86	0.86
Global average for all cities	0.55	0.58	0.66	0.66	0.71	0.70
Ratio of metro/suburban rail speed to road speed						
American cities	-	0.93	0.99	0.89	0.96	0.95
Canadian cities	-	-	0.73	0.92	0.85	0.89
Australian cities	0.72	0.68	0.89	0.81	1.06	1.08
European cities	1.07	0.80	1.22	1.25	1.15	1.28
Asian cities	-	1.40	1.53	1.60	1.54	1.52
Global average for all cities	0.88	1.05	1.07	1.11	1.12	1.13

Public transport – especially rail – is now booming everywhere

Total public transport passenger kilometres per capita



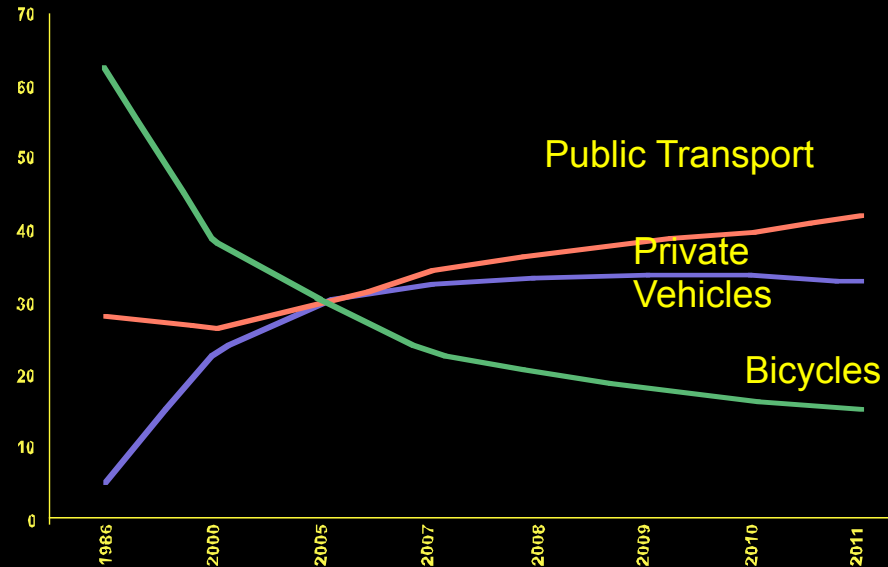
Global growth now in rail ...

- 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

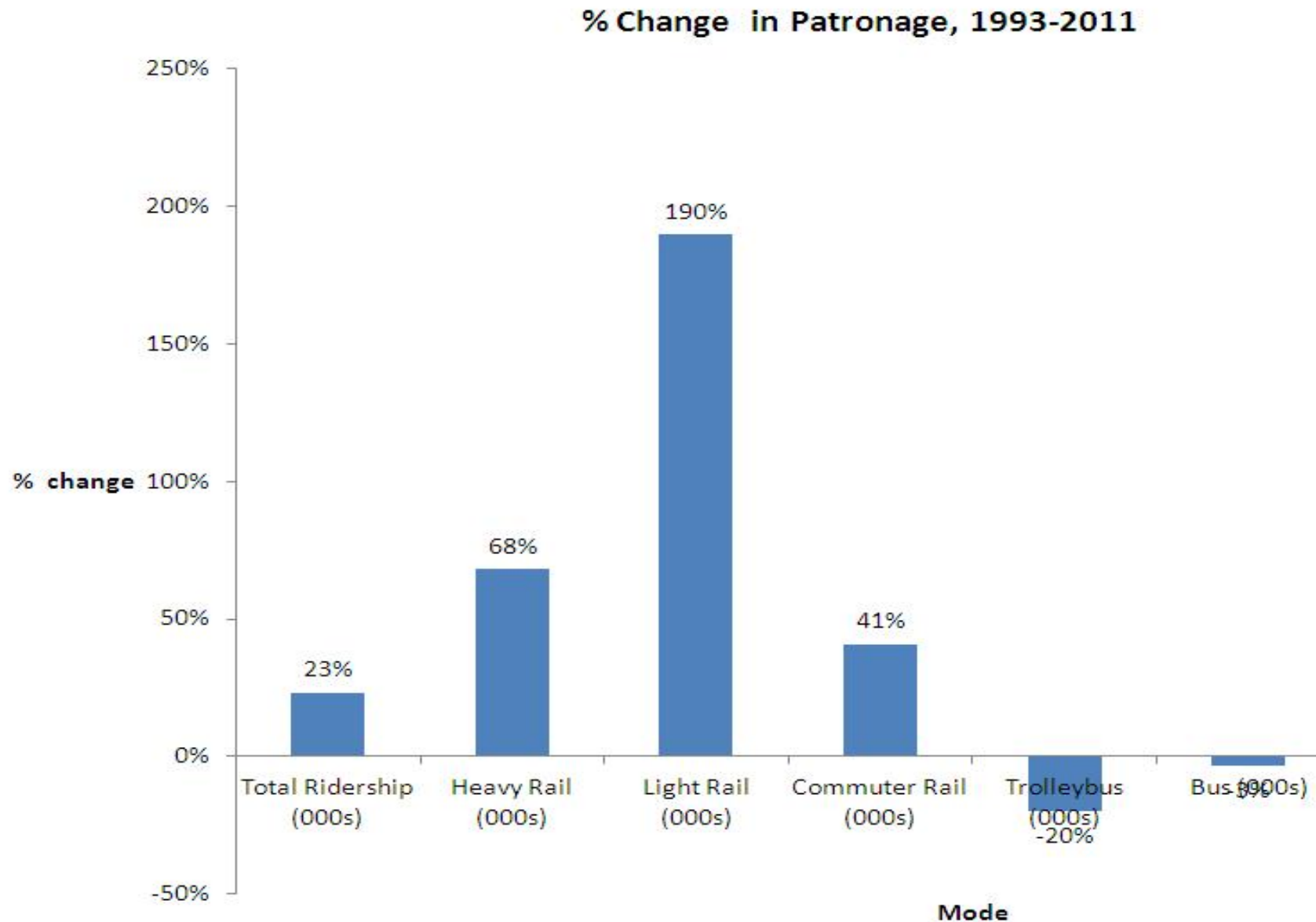


Proportion of Transport Modal

Beijing Transport Modal Split

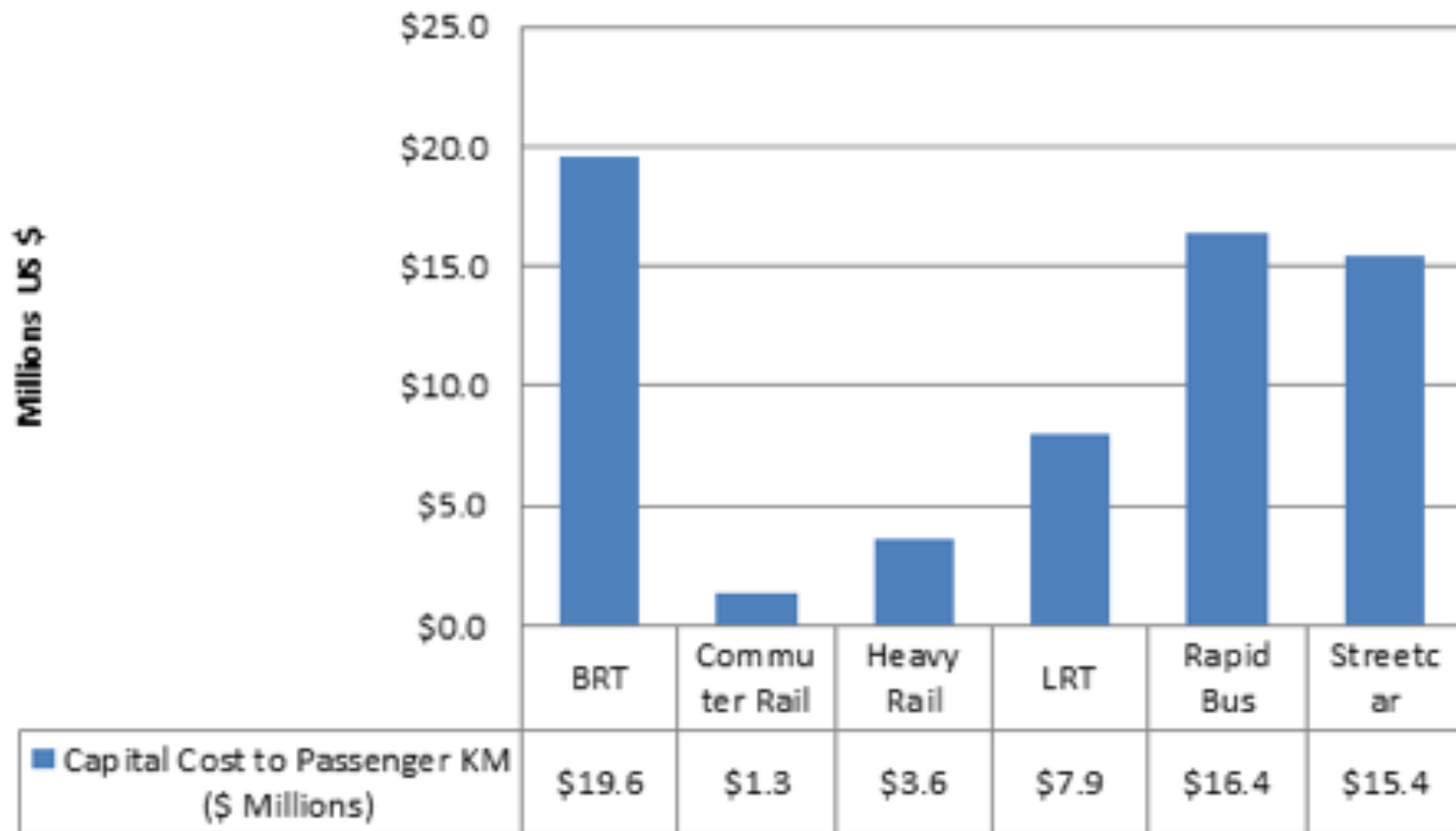


America goes for rail....esp LRT not buses



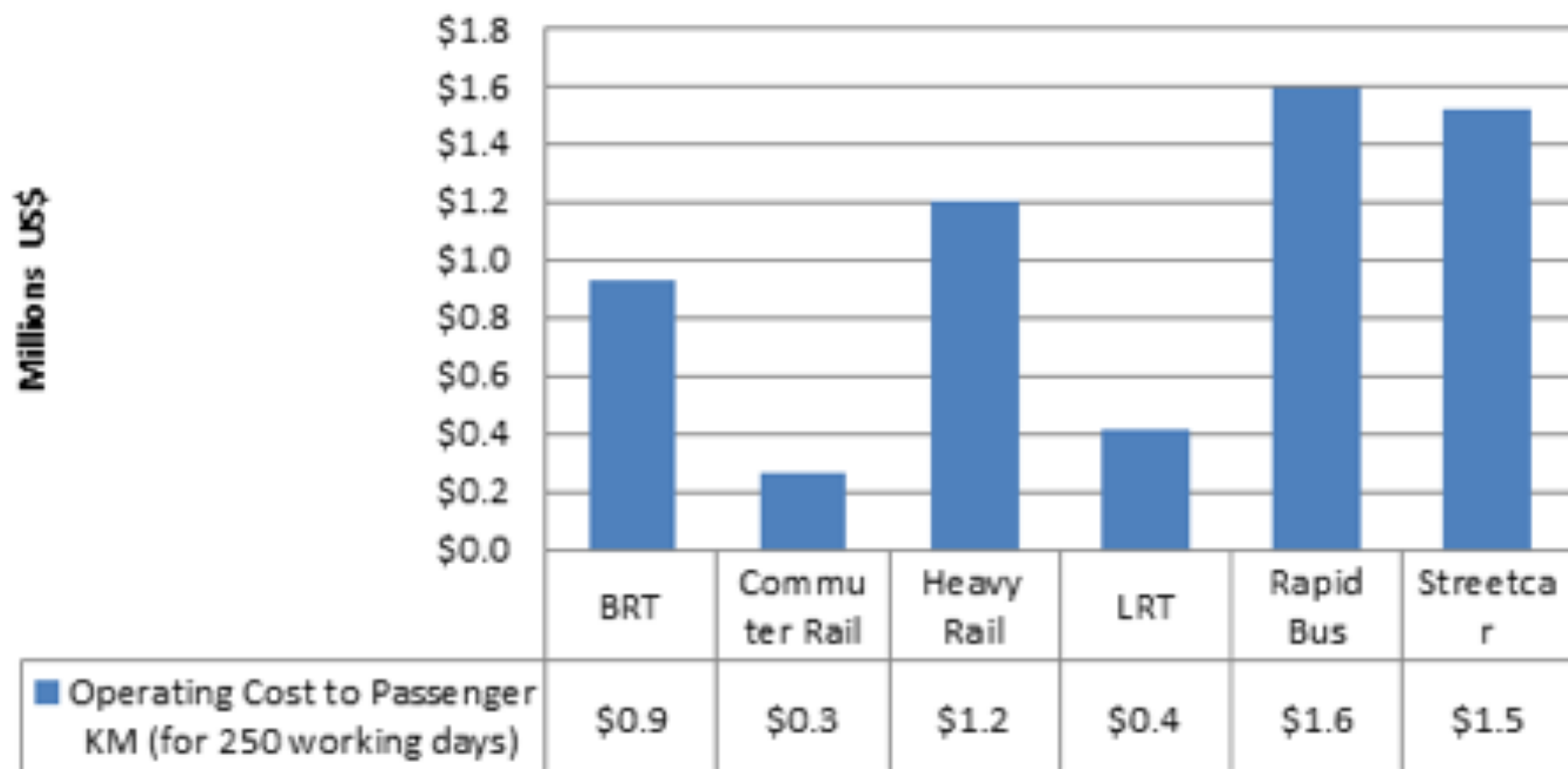
US capital cost of transit

Capital Cost to Passenger KM (\$ Millions)



US Operating cost of transit

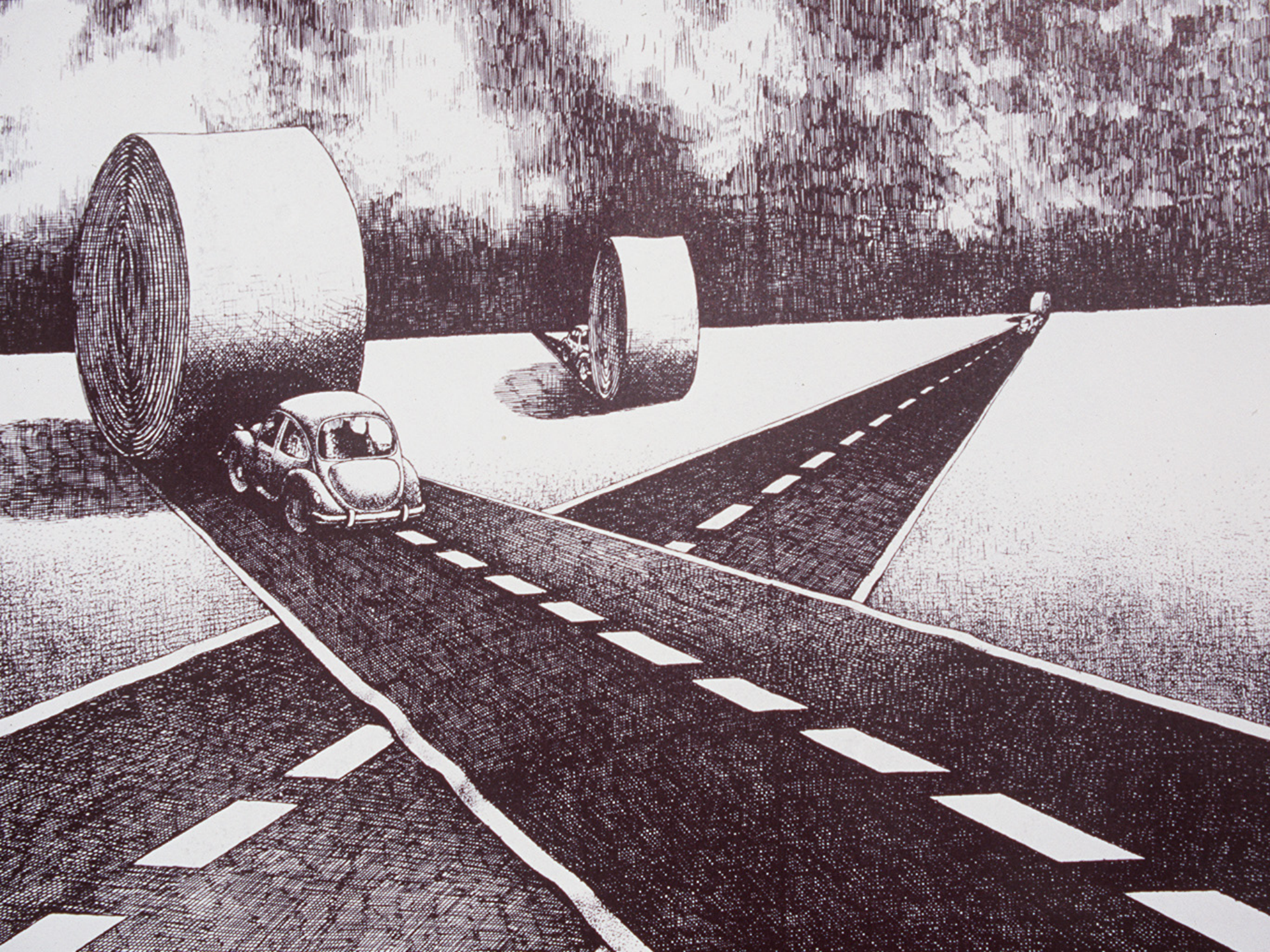
Operating Cost to Passenger KM (for 250 working days)



The rail revival in Perth...







ATTACK OF THE 50 FT. WOMAN



starring ALLISON HAYES · WILLIAM HUDSON · YVETTE VICKERS · PRODUCED BY
BERNARD WOLLNER
DIRECTED BY NATHAN HERTZ · WRITTEN BY MARK HANNA · AN ALLIED ARTISTS PICTURE

Year	Route Km
1982	42km
1983	63km
1993	92km
2004	96km
2005	100km
2006	172km
Total	172km



National and global model...
\$17-22 mill per km. Carrying 8 lanes of traffic.





Knowledge-city light rail...

THE KNOWLEDGE ARC LIGHT RAIL:

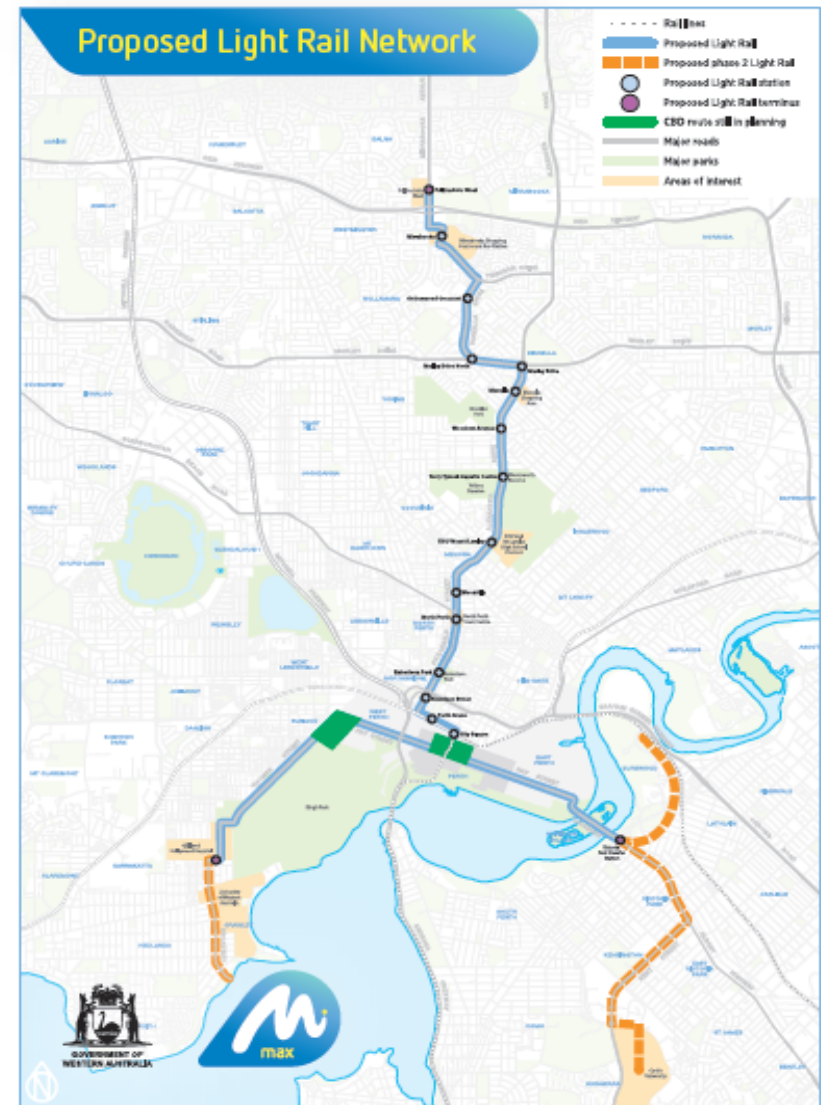
A CONCEPT FOR DELIVERING THE NEXT
PHASE OF PUBLIC TRANSPORT IN PERTH

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



Curtin
University of Technology

PARSONS
BRINCKERHOFF



4. Knowledge economy

- Needs face-to-face contact in a walkable area
- Requires spatial efficiency that only rail can create

Its all about space
and time....

Freeway 2,500
people per hr
Busway 5000
LRT 10,000 –
20,000
Train 50,000

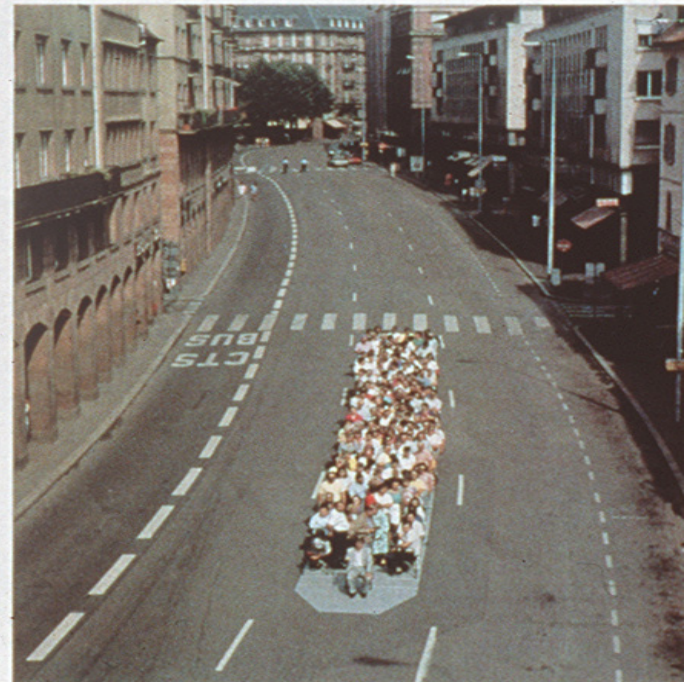


240 Persons travel
to work:

-- in 177 Cars

-- in 3 Busses

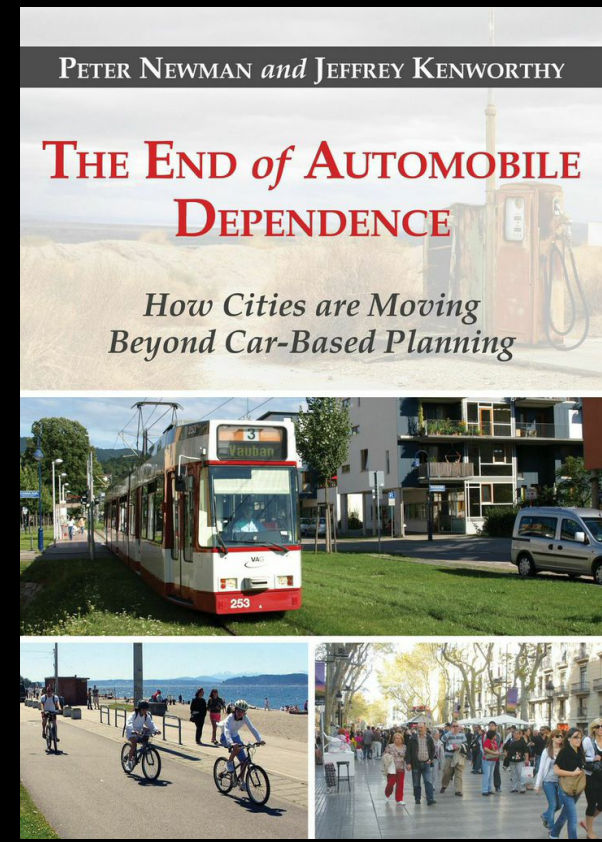
-- in 1 Tram



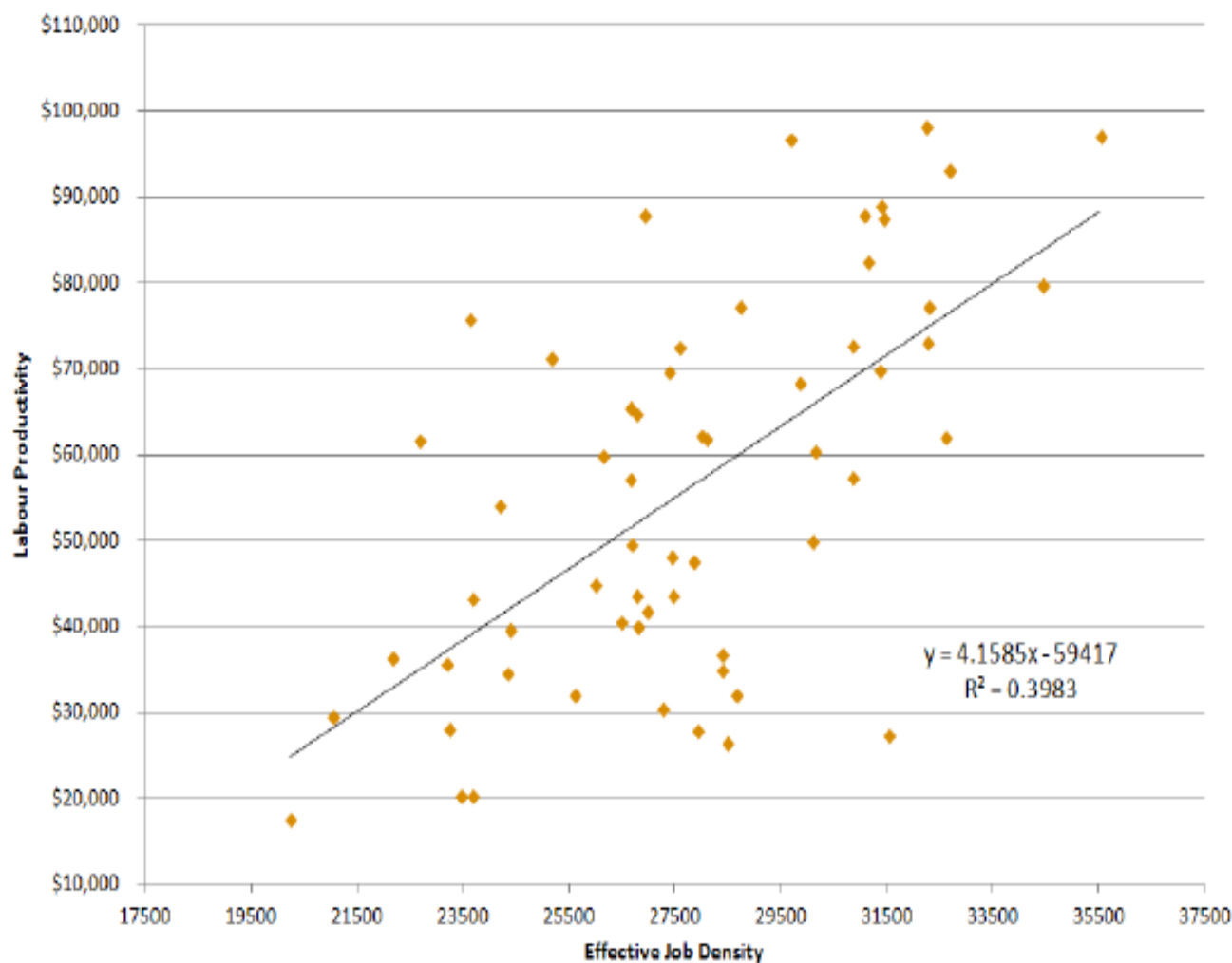


Ed Glaiser and Richard Florida were right...

The top 6 most walkable cities in the US have 38% higher GDP.
70% of knowledge economy workers in Boston live in walkable areas.



EJD and Labour productivity



Transformation of Broadway



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www.nyc.gov



© NYC Department of Transportation

**In Central London, traffic fell by 19%
between 2000 and 2009.**

The Times Nov 6, 2012

**‘café culture replaces car
culture’**



PETER NEWMAN *and* JEFFREY KENWORTHY

THE END of AUTOMOBILE DEPENDENCE

*How Cities are Moving
Beyond Car-Based Planning*

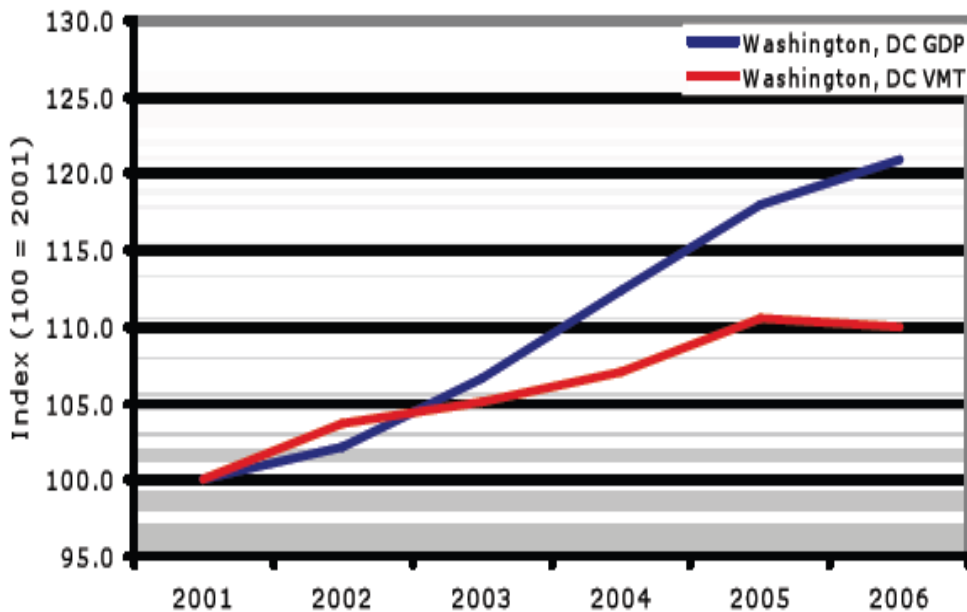


The 21st century
is reducing oil as
well as coal..

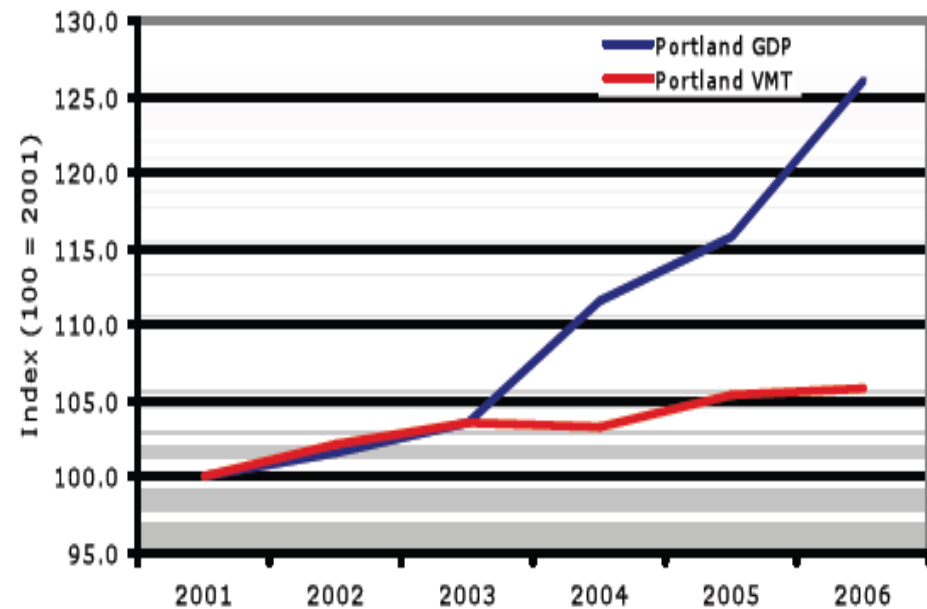
Cities reducing
car dependence
are showing that
economies work
better....

Decoupling mostly in the cities with rail investment, eg Washington DC and Portland

Indexed Primary Arterial VMT & Total GDP Growth in the Washington, DC CBSA, 2001 - 2006

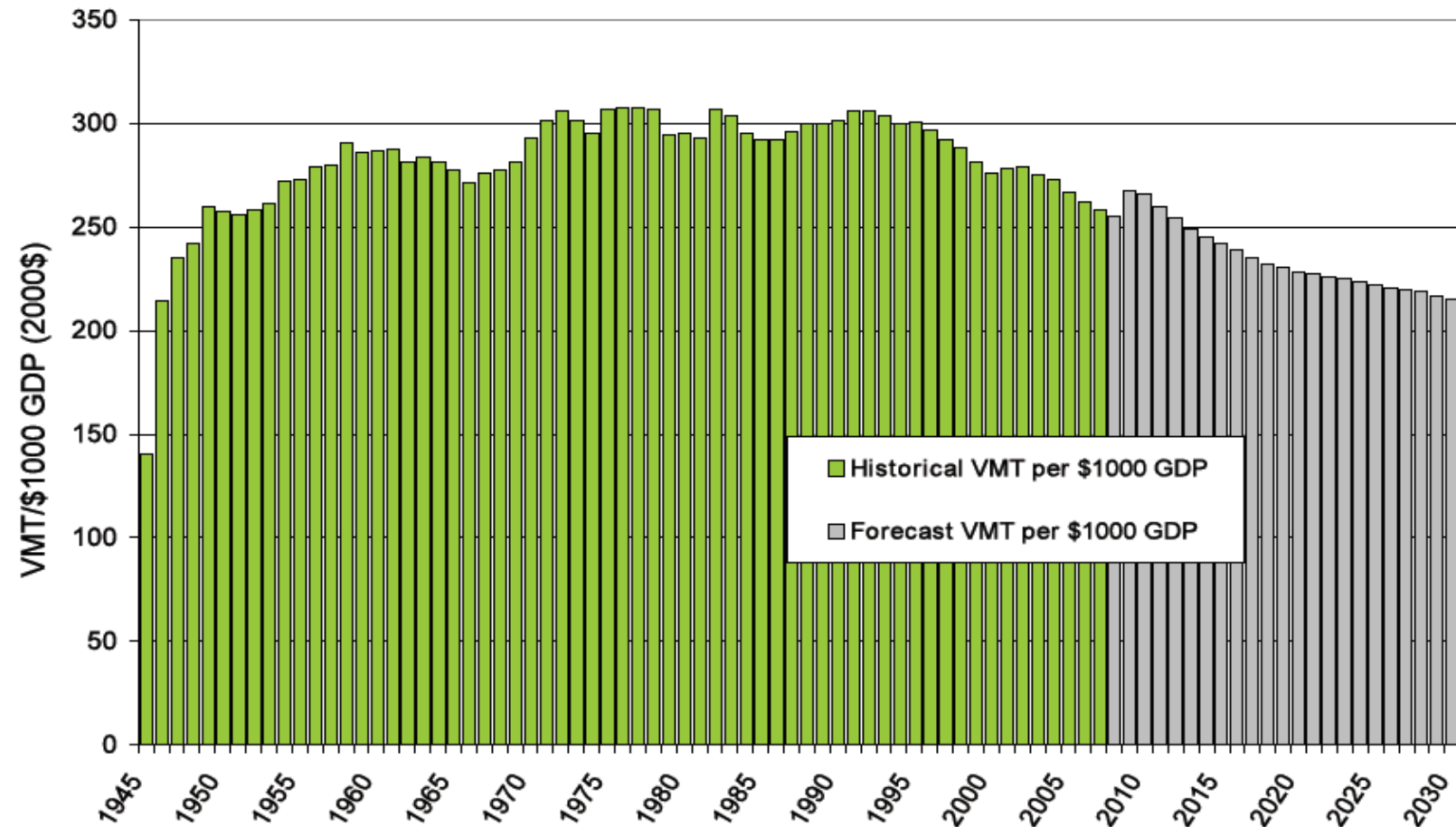


Indexed Primary Arterial VMT & Total GDP Growth in the Portland CBSA, 2001 - 2006



Car use is now officially recognised in the US to be decoupling from wealth

Transportation Vehicle Miles Traveled/\$GDP, 1945-2030



Solar electric transport in all modes...

Sydney's new light rail – no catenary



Will non-solar coal-based homes that are car-dependent and oil-dependent on the urban fringe become stranded assets in the emerging city of the future?

How do you fund something that
will simultaneously create walkable,
affordable, dense centres and zero
carbon electric urban rail....?

Get it off welfare now there is a
market for it....

► Turnbull looks to 'get creative' on infrastructure

PM explores radical road, rail funding

Prime Minister

Use land value....

Monday 12 October 2015 **AFR**
The Australian Financial Review | www.afr.com



Malcolm Turnbull, right, said direct grants were not the only way to support infrastructure. PHOTO: SCOTT FLETCHER

From page 1
Turnbull explores
road, rail funding

ment, not least because of sharply constrained federal and state budgets.

Prominent economist Saul Eslake estimates Canberra could borrow an extra \$50 billion for infrastructure

economy from the end of the residential investment boom.

Former Infrastructure Australia board member and Curtin University Professor Peter Newman said

Pearl District LRT paid for entirely
through land development....



FEBRUARY 2016

ENTREPRENEUR RAIL MODEL

A DISCUSSION PAPER

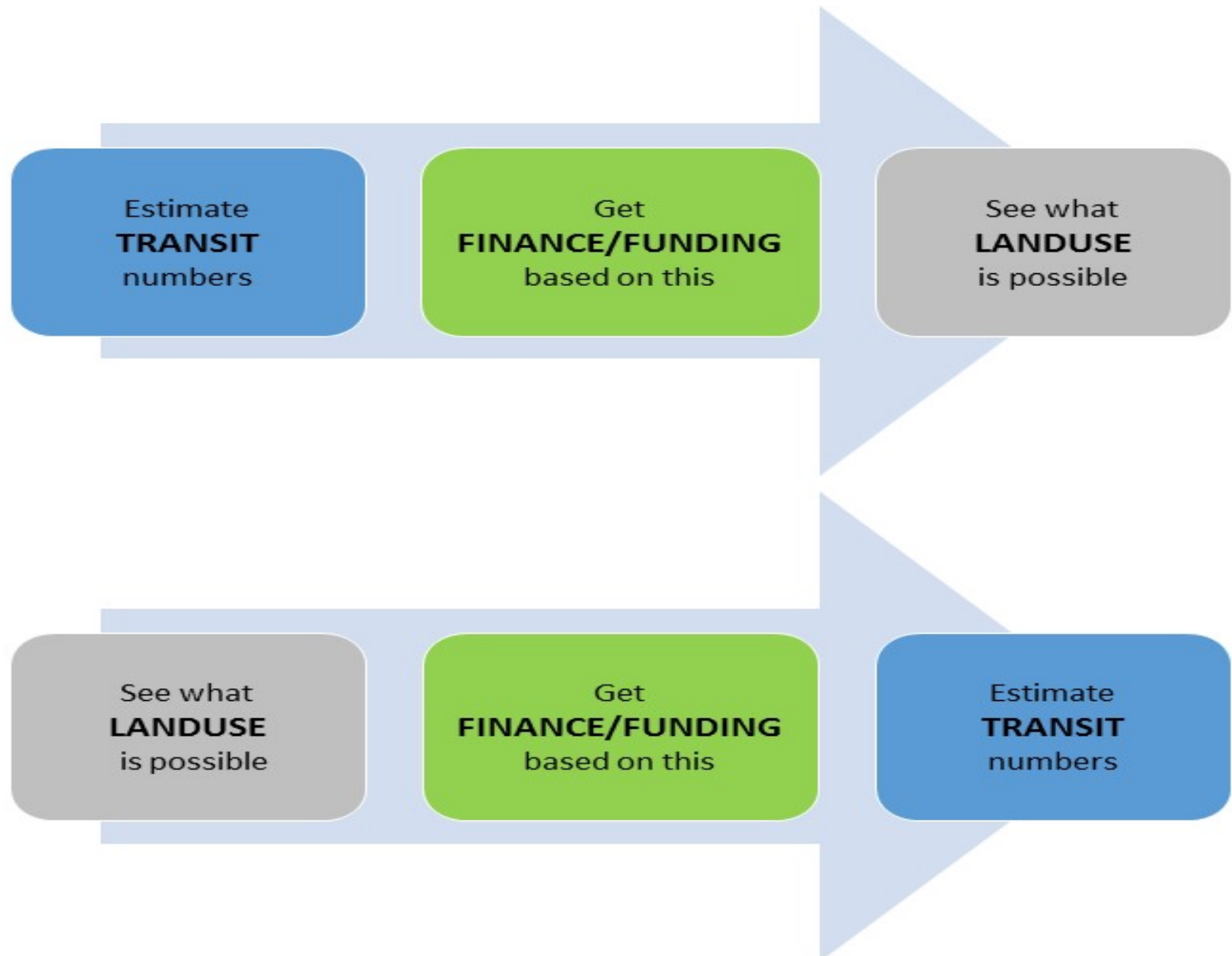


East Fremantle Now and After Light Rail – Images by Cole Hendigan

Tapping Private Investment for New Urban Rail

Prepared by Peter Newman, Brian Jones, Jemma Green and Sebastian Davies-Slate for Curtin University

From TFL to LFT....



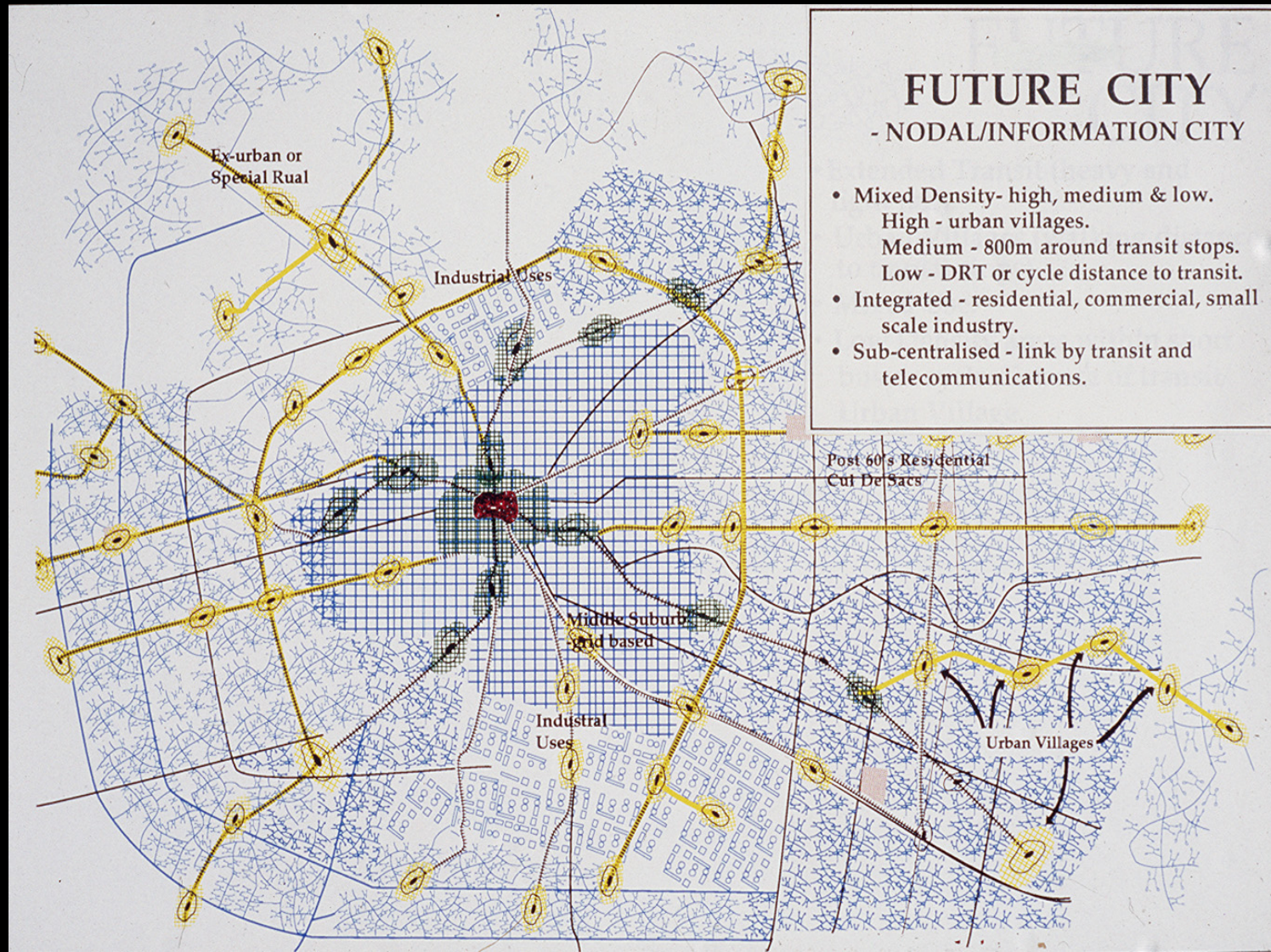
How?

- Don't define the route just a corridor.
- Call for expressions of interest from consortia that can build, own, operate and finance the rail project through land development. DBFM
- Government need to manage the procurement to enable transit system integration and land assembly.
- This is the Japanese system.

Results...

- Unlocks lazy land assets
- Integrates land use and transit as both depend on finance
- Changes the politics of redevelopment as communities get their rail
- Enables private sector expertise in land development to drive city form and transit – as it has mostly been through history.

Every city wants to create centres for their economy...can it be done with affordable housing?



Disruptive innovations and cities....

3. Modular construction.

Modular construction

Stella....Built in 11 days, next to a train station, 20% less cost, 40% less carbon, 80% less waste



Fully digital in design and construction



contribute to our strength
include a well-educated
citizenry, corruption-free public
institutions and a sense of

is the intangibles that are
Total Defence.
Francis Cheng

Singapore



Architects can create unique building facades like that of Parkroyal on Pickering through prefabrication. PHOTO: BUILDING AND CONSTRUCTION AUTHORITY

Benefits of taking prefab route

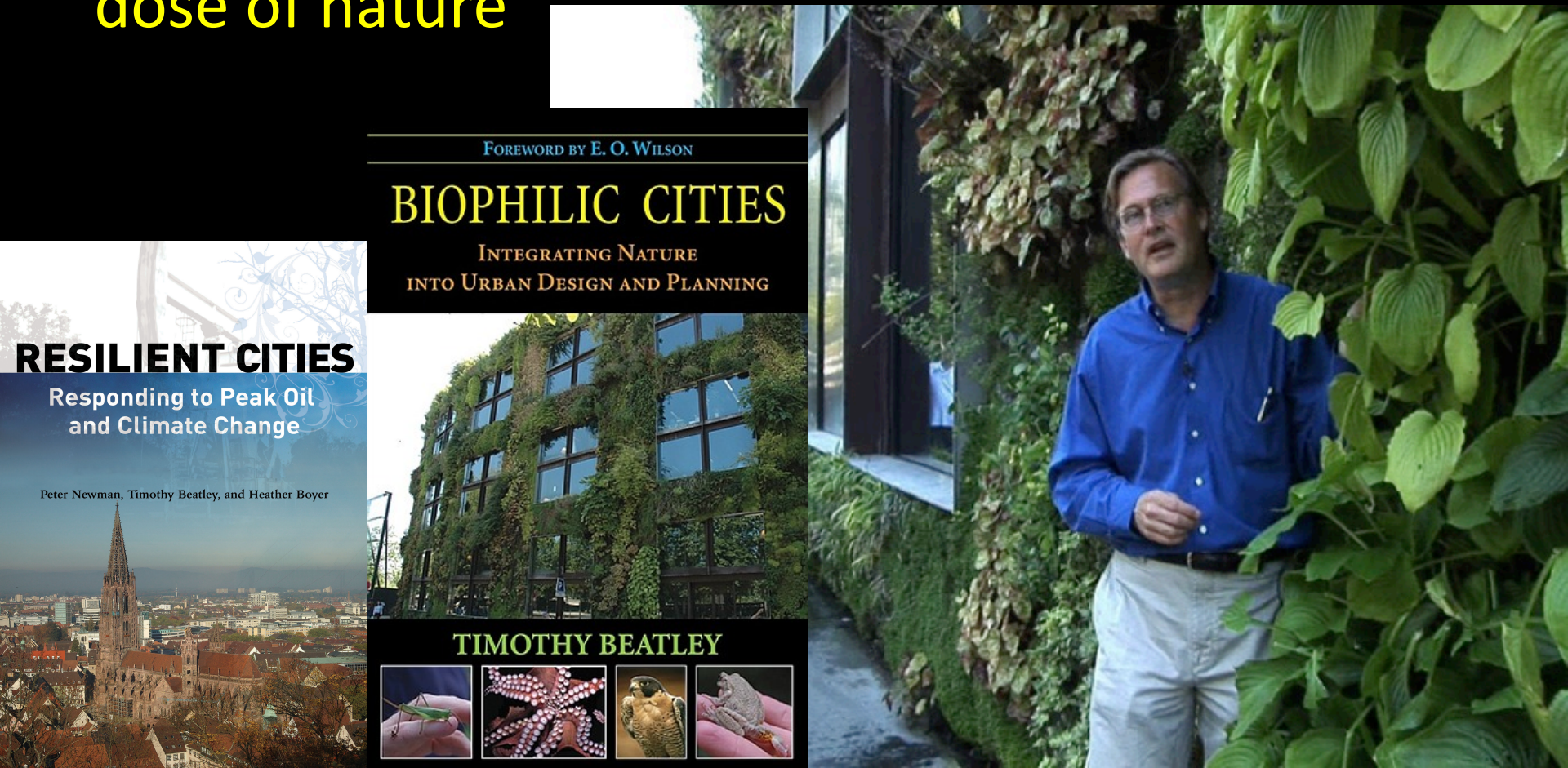


Disruptive innovations and placemaking....

4. Biophilic urbanism.

E O Wilson 'Biophilia' – human beings need nature

Tim Beatley 'Biophillic Cities' – we need a daily
dose of nature



Biophilic design – greening buildings



GREEN URBANISM IN ASIA

The Emerging Green Tigers

In *Green Urbanism in Asia*, Newman and Matan have produced an impressive tour de force — the first study of its kind to document and analyze the emerging green urban trends, amazing projects and wonderful stories of innovation found in Asian cities. Thoroughly researched and with remarkable detail, this path-breaking study will be the essential starting point and standard reference for years to come for anyone interested in understanding this fast-urbanizing part of the world. Newman and Matan show us what is possible, that there are compelling models for effectively integrating nature, sustainability and quality of life. These emerging green Asian tigers, so eloquently described and celebrated by Newman and Matan, point the way for cities around the world, and offer hopeful and inspiring antidotes to the sense of global gloom that often prevails.

Dr Timothy Bentley

Teresa Heinz Professor of Sustainable Communities, and
Chair, Department of Urban and Environmental Planning, University of Virginia

Asian urbanism is THE story of the 21st century world-system: never before in history have we seen the speed, scale, and complexity of urbanisation that we are witnessing today across the whole Asian continent and island archipelagos. To date green urbanism is an oxymoron but this book promises to be part of a new wave of innovations of ideas, policy regimes, and practices that can change that from an empty slogan of property developers flogging gated communities to transforming all our cities into liveable and sustainable ecosystems. We had better hope so for the long-term welfare of our world as a whole is now in the hands of this generation of Asian cities and their makers! This book is therefore not only timely but necessary. It is a handbook for students and practitioners of the urban alike. Let us all get cracking, book in hand!

Dr Trevor Hogan

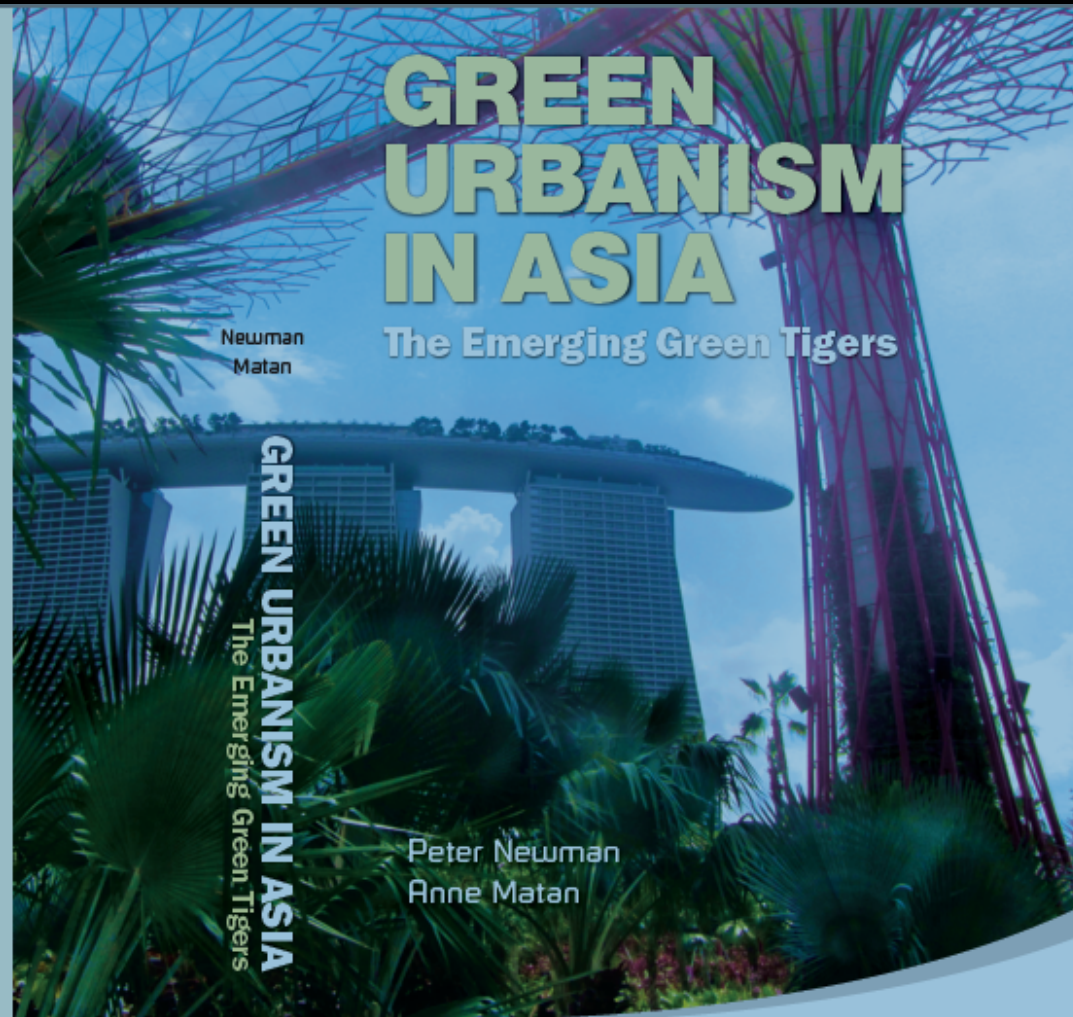
Deputy Director, Thesis Eleven Centre for Cultural Sociology, and
Senior Lecturer, Faculty of Humanities and Social Sciences, La Trobe University, Australia

This book is in a class of its own. It shows that Asia is in the forefront. Most new breakthroughs take place here, populations ask for it, and politicians respond. The book takes the jump from telling that we should green our cities to demonstrate how it can be done. That is the core of the book: How to do it.

Dr Joerges Overstroom Moeller

Visiting Senior Research Fellow at Institute of Southeast Asian Studies, Singapore, and
Adjunct Professor at Singapore Management University and Copenhagen Business School

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GREEN URBANISM IN ASIA

The Emerging Green Tigers

Newman
Matan

GREEN URBANISM IN ASIA
The Emerging Green Tigers

Peter Newman
Anne Matan



Curtin University



‘Singapore
biophilic city’
You Tube





KTP hospital



Creating healthier urbanism







Stefan Boeri's Vertical forest in Milan. 1 ha of forest

Disruptive innovation is not all about
gee whiz technology....

To be transformative it must be about people
and especially about people-oriented cities...

Demand means it is now mainstreaming...

though forecasters are stuck in the past and dominated by those
with the most to lose.

Predictions – After the Peak

