Cool Planning:
Climate Change and Our Urban Future

By

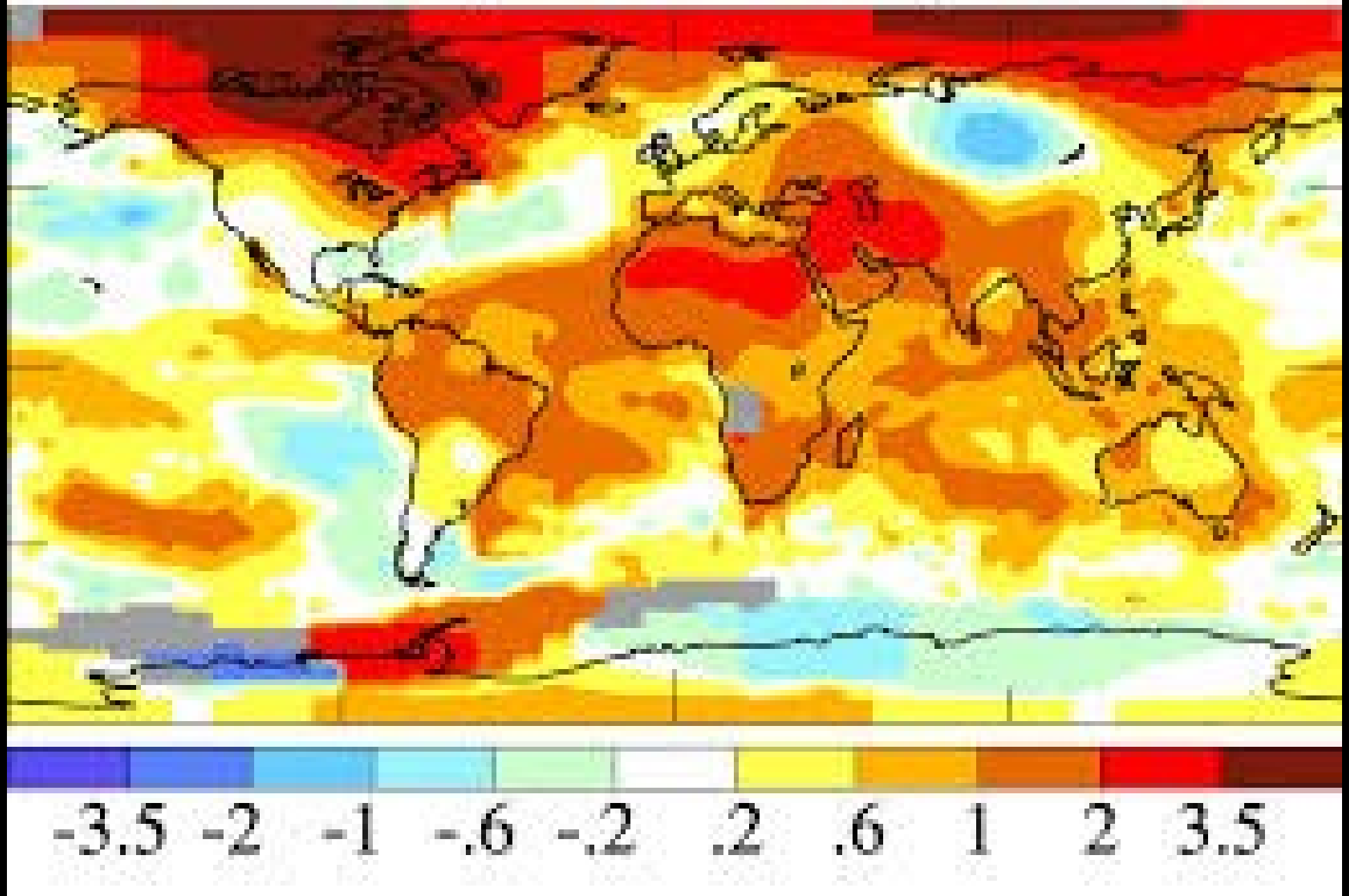
Professor Peter Newman AO

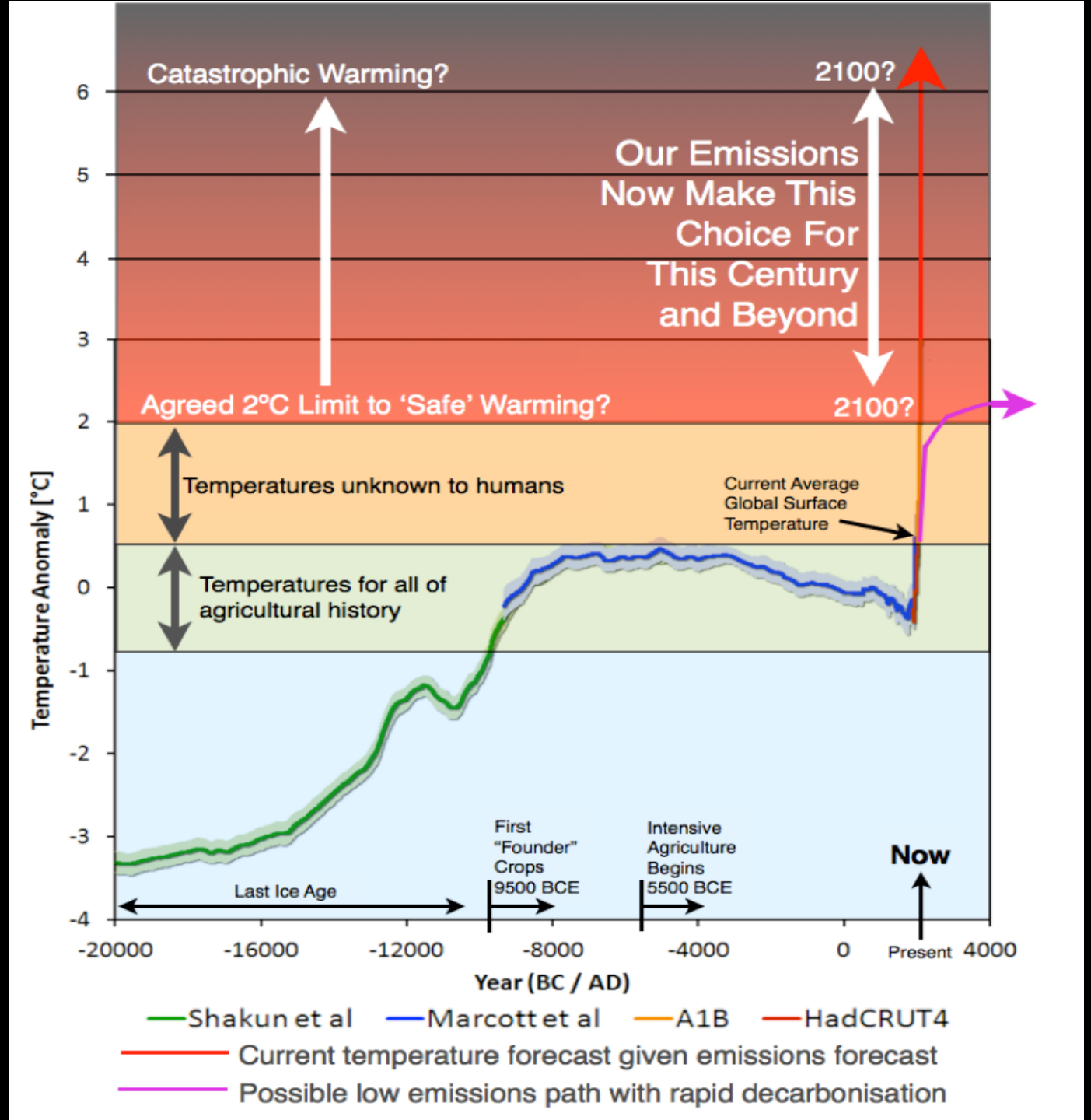
Curtin University, Perth, Australia

Greetings from the top of the world…

The Blue Marble 1972 in first orientation

Global Temperature Changes 2010

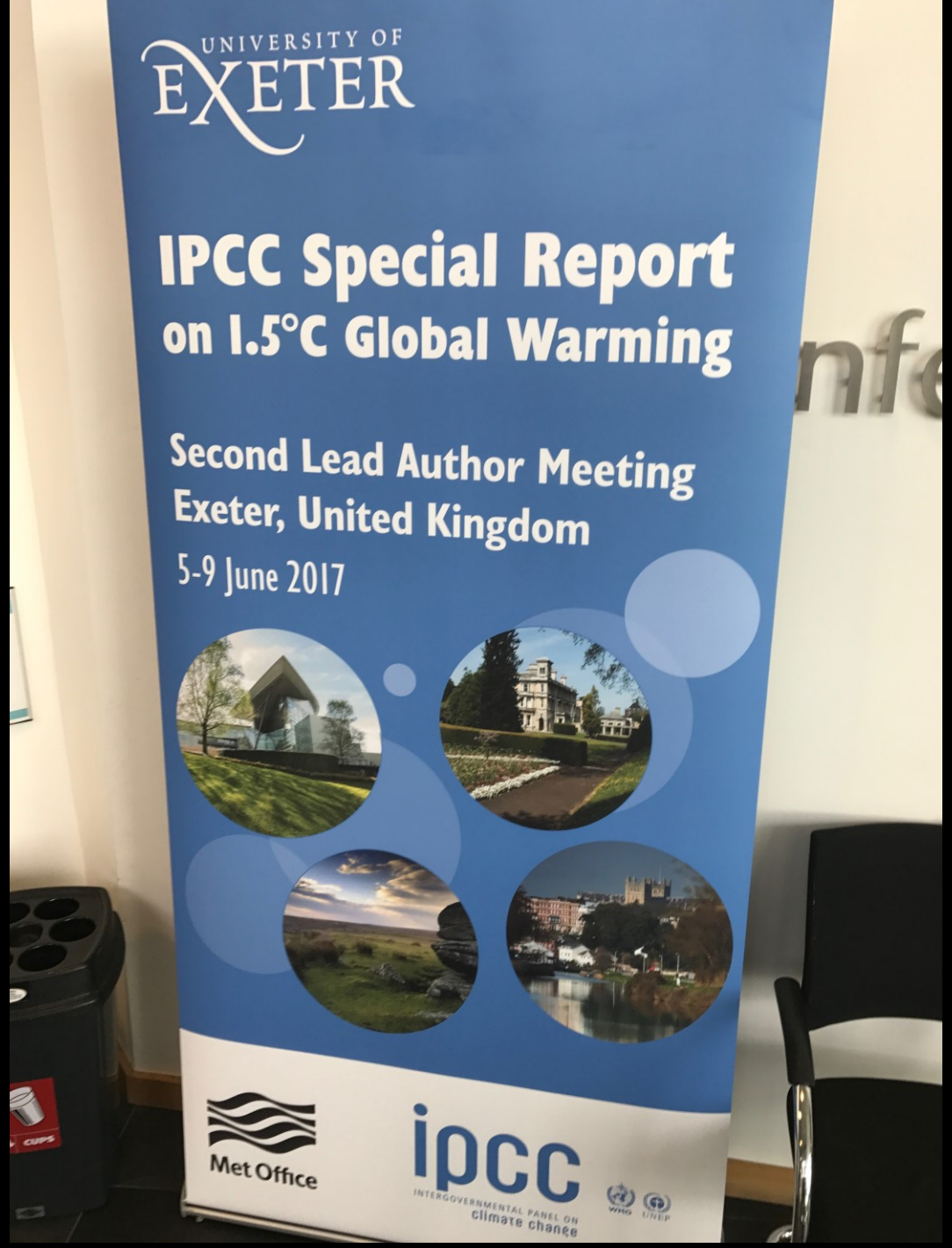




Sami been around 10,000 years and Indigenous Australians 60,000.

Its our cities and agriculture that are threatened….

The earth must not increase more than 2^0C above the pre-industrial average temperature…. Its already $1.1^{0.}$ IPCC



Now it must be 1.5C…

Report on Monday

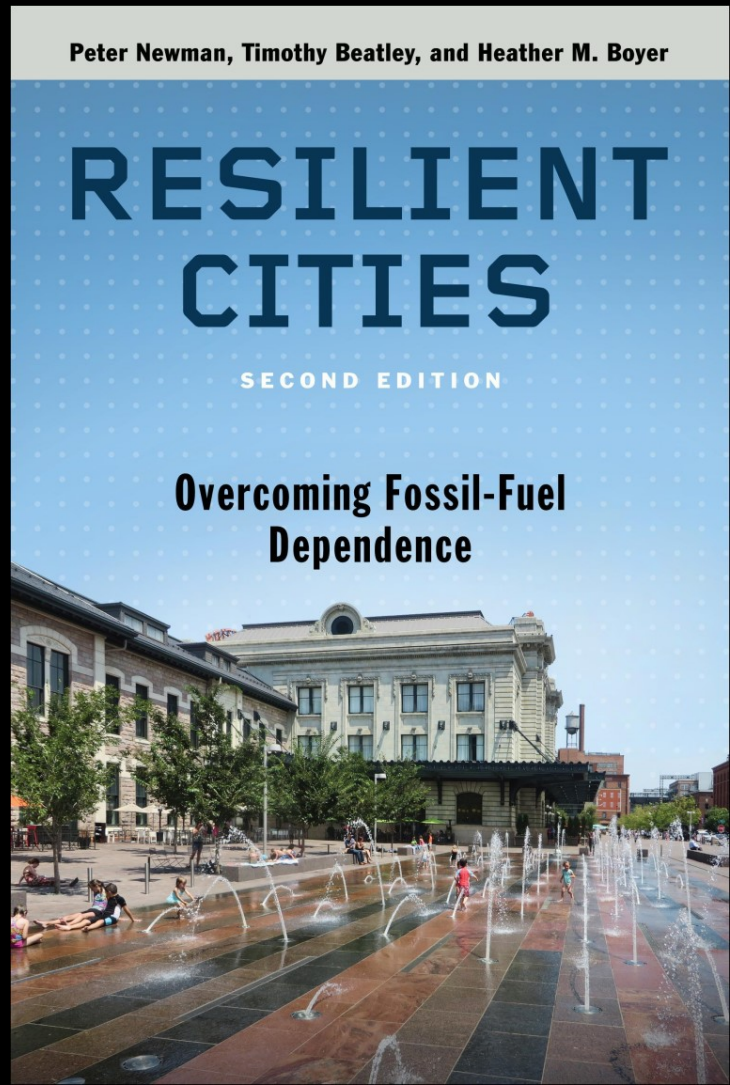
Fear abounds.... Are we RESILIENT?
WHA**T KIND OF FUTURE CAN WE CREATE?**

What can planners do?

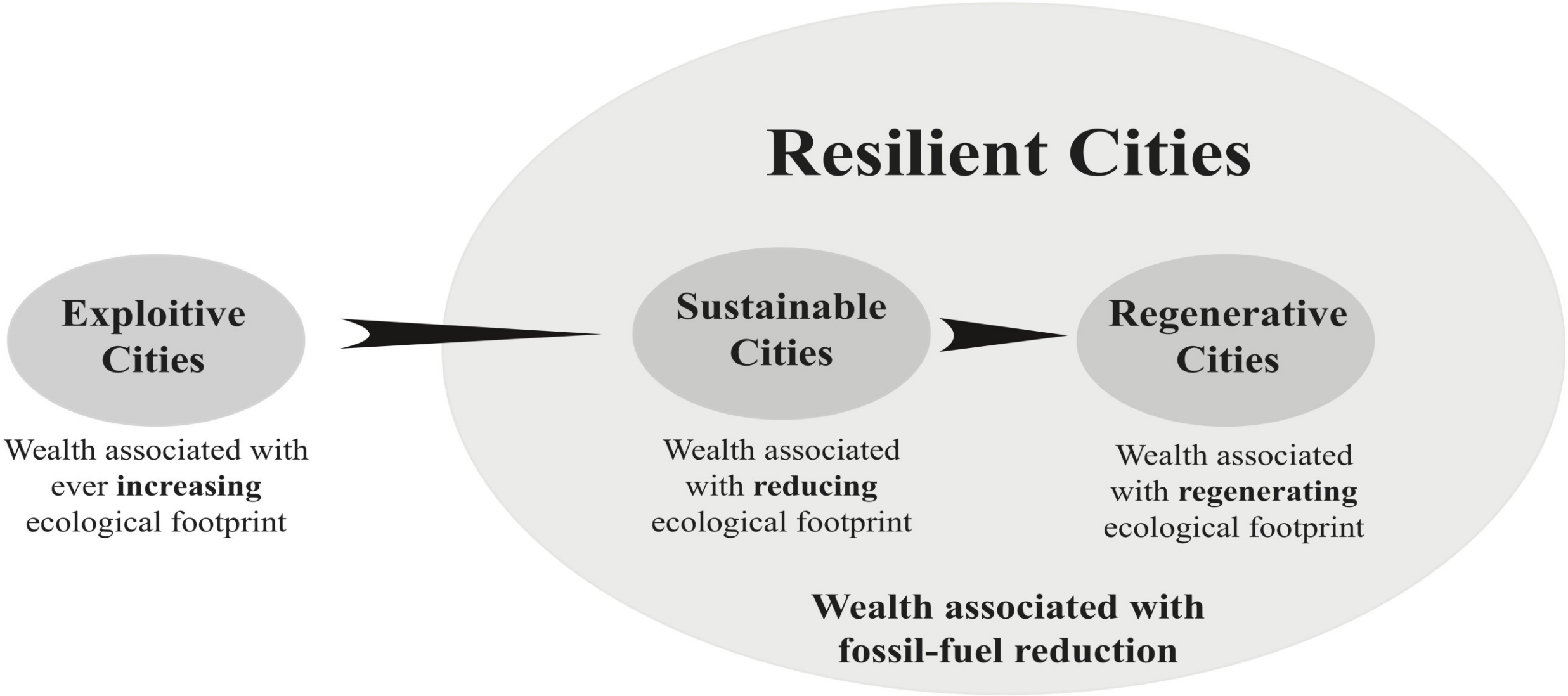
1. How can planning help cities adapt to a warming world?
2. How does biophilic design cool cities?
3. How do cities bounce forward while bouncing back from climate disasters?
4. What are the big changes in decarbonizing cities that are well underway and which need to be mainstreamed into planning?
5. Can the Theory of Urban Fabrics help?
6. What are the areas in climate change policy that still need big changes?

1. How can planning help cities adapt to a warming world?

Adapting to slow loss of natural capacity but building more resilient and sustainable options

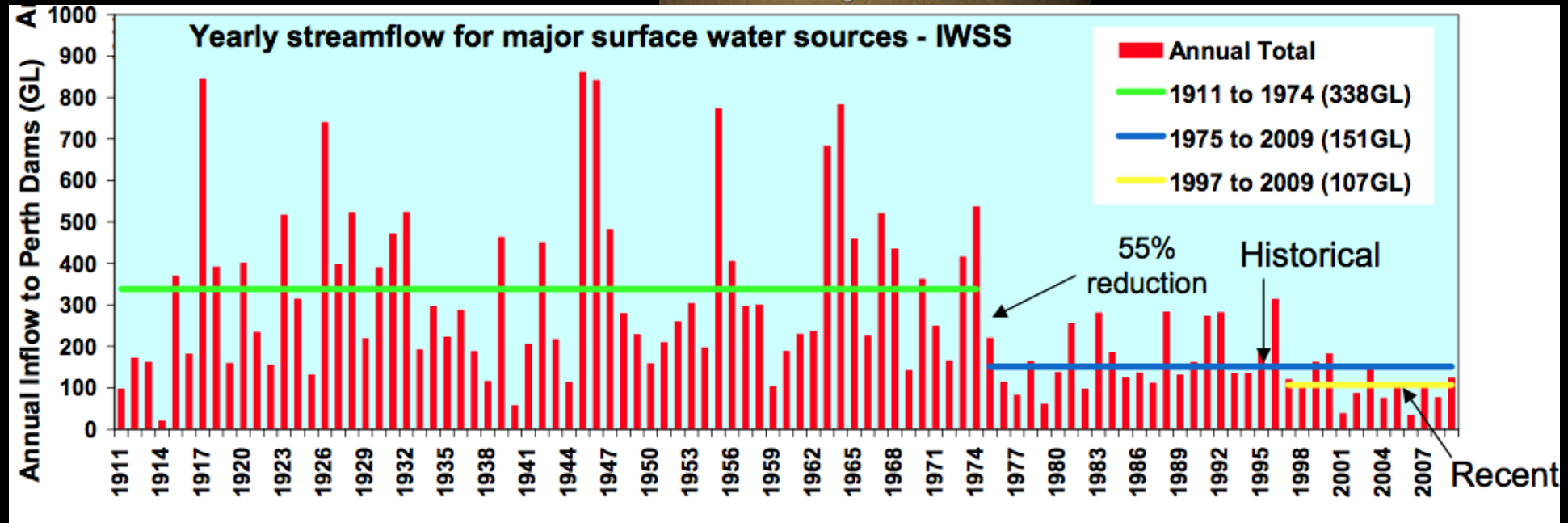


The urban transition…both resilience and sustainability, together

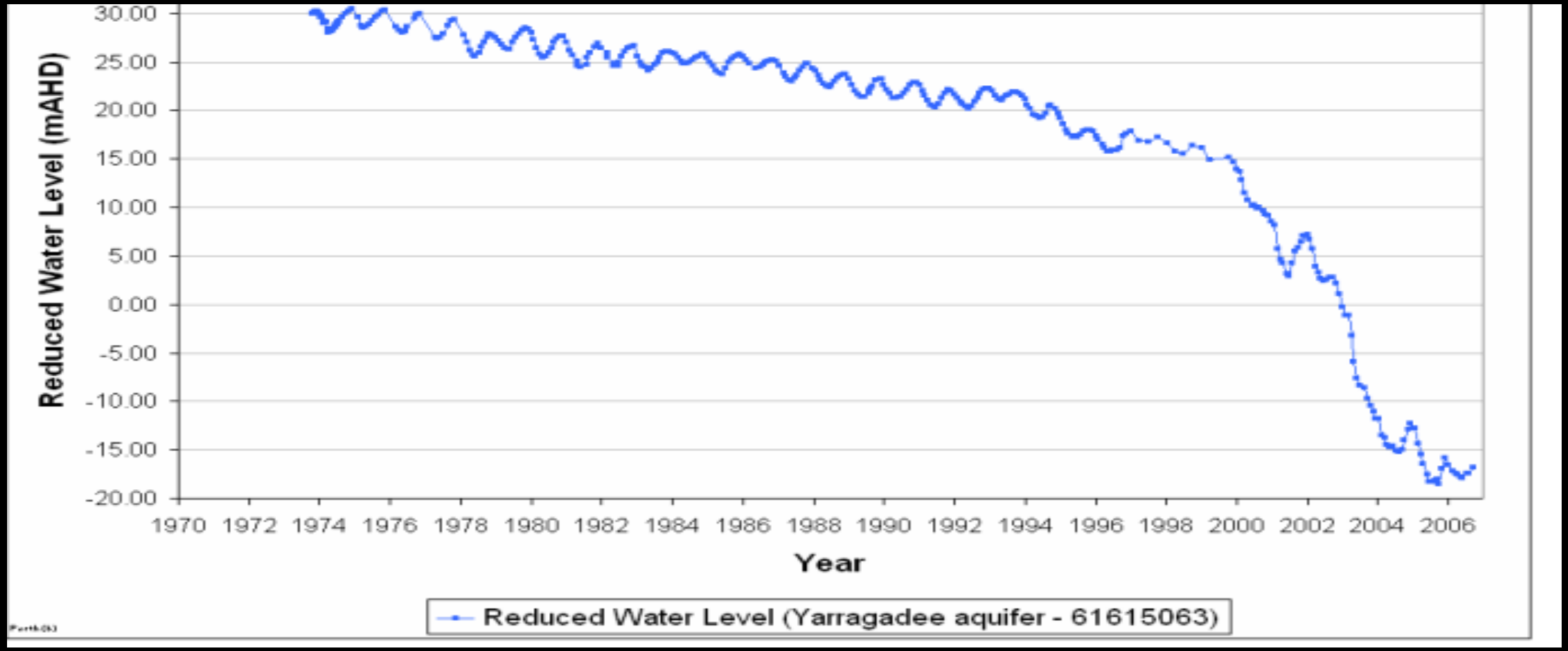


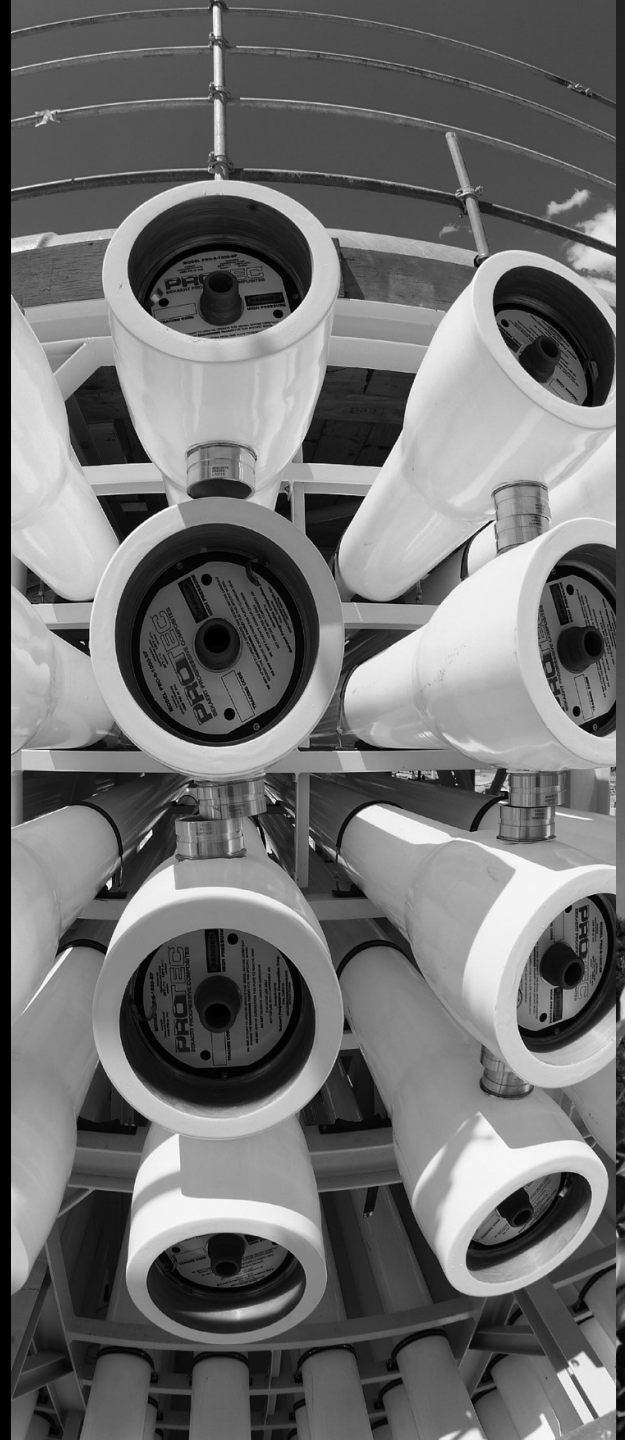
Perth and Capetown warned 40 years ago that rainfall would diminish drastically…

Perth water supplies have halved…in 2001 it stopped altogether



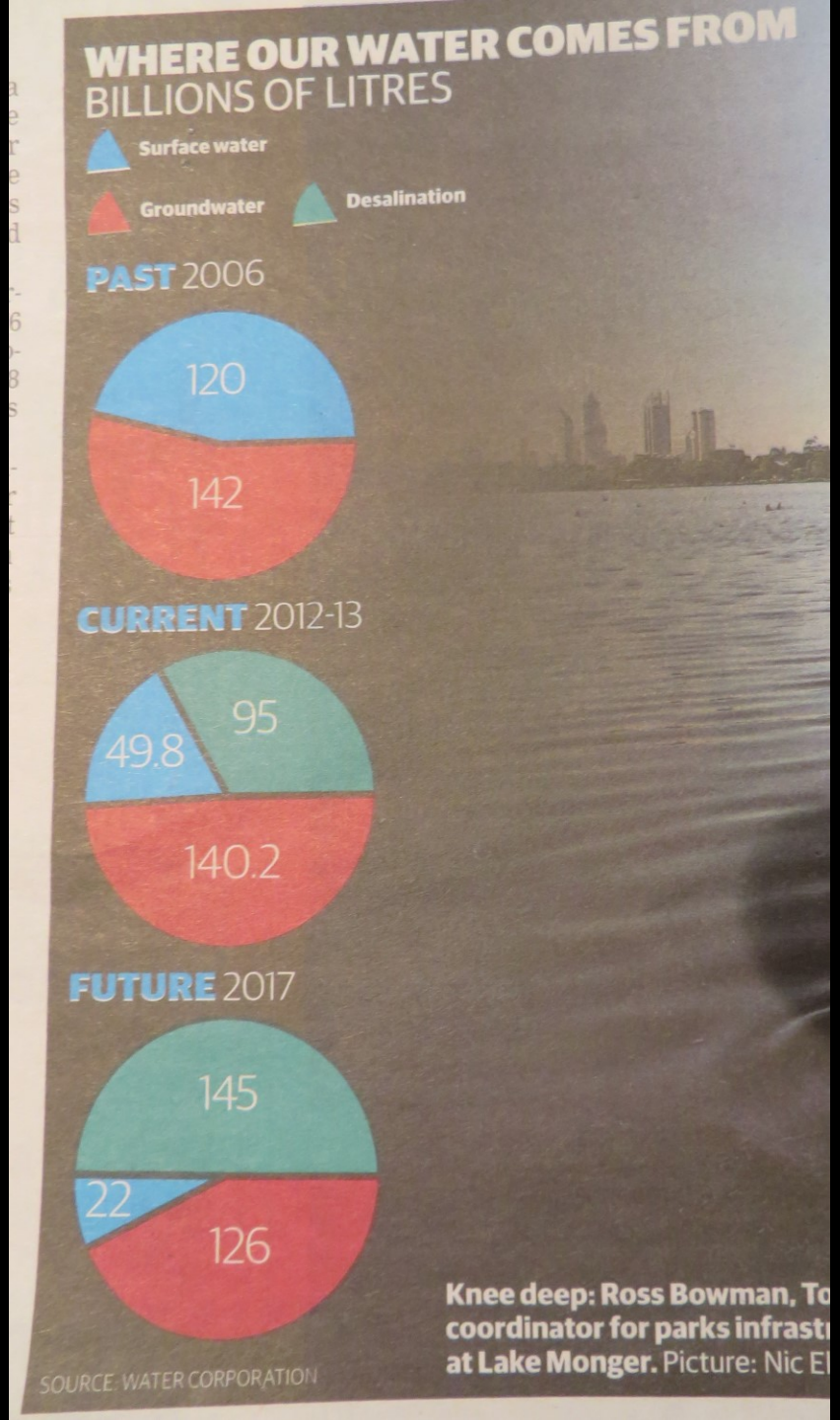
…reduced rainfall means groundwater retreating…. multiple costs.





Wind-powered Desal to the rescue….

55% of Perth’s water from renewably powered reverse osmosis of sea water



A story of resilience…and city-region scale infrastructure

Next step sewage recycling.

And bottom up scale WSUD water sensitive urban design…site by site….

Using natural systems to minimize irrigation and recycle waste water

WSUD in Vitoria-Gasteiz, Spain….

Localising water supplies and recycling everything… Singapore CBD with its own water supply…each part joined to a city-region system.

Marina barrage…created water reservoir and adapts to storm surges. Both more resilient and more sustainable.

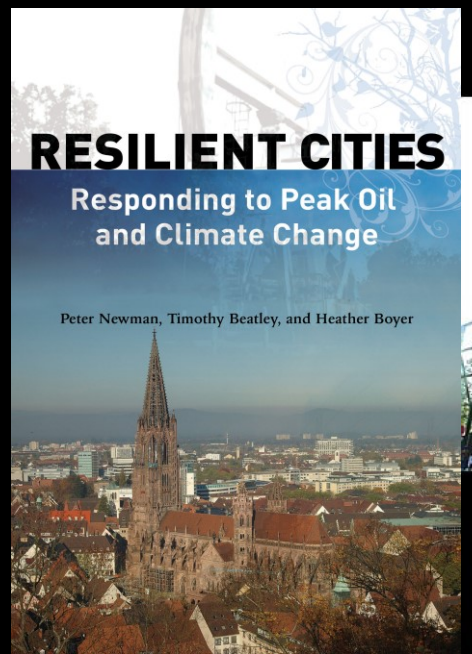
Coastal adaptation - rebuilding coasts as natural systems, helping in storm surges and taking carbon out of the atmosphere…mangroves, seaweed, fisheries…whilst regenerating special places….sacred sites – both R and S

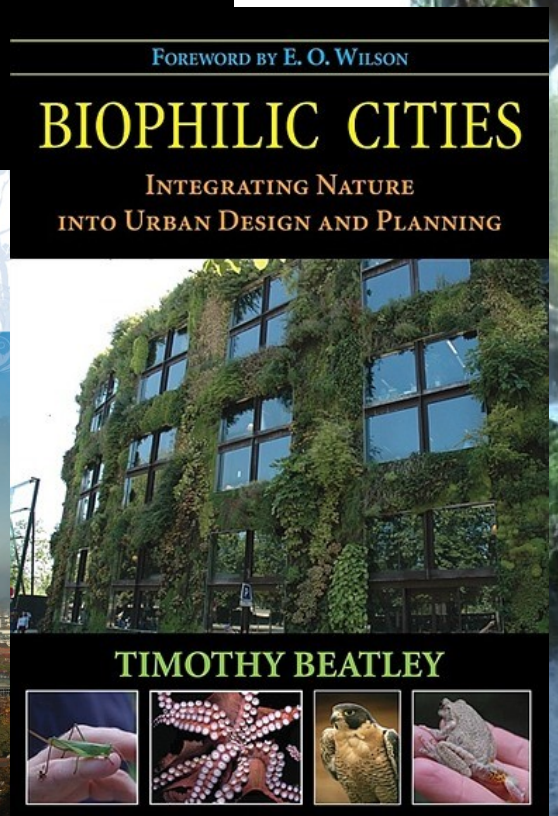
2. How does biophilic design cool cities?

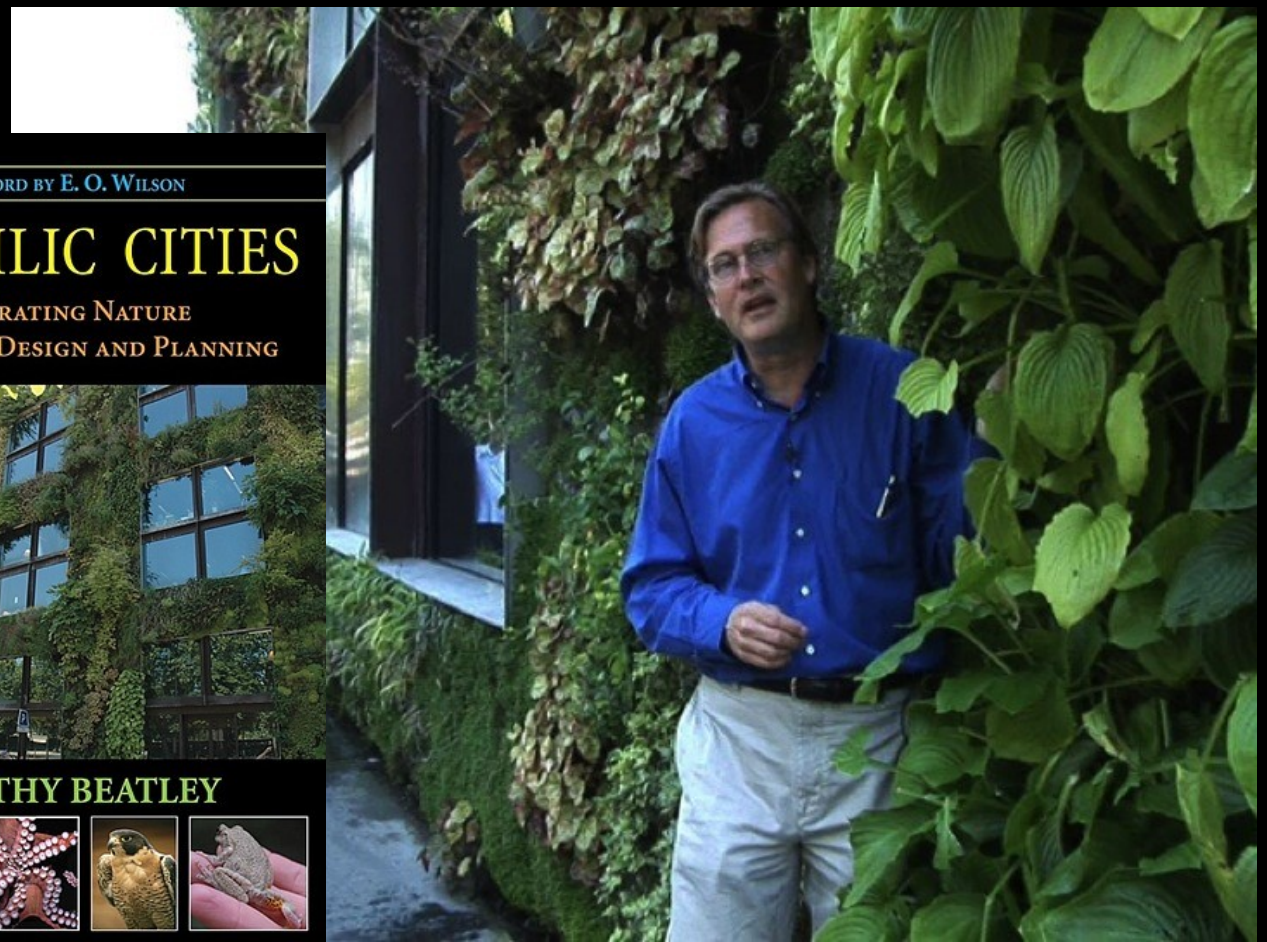
Building natural systems into and onto every building…
for resilience and sustainability, even regeneration…

E O Wilson ‘Biophilia’ – human beings need nature

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







Park Royal Hotel Singapore

Regenerating an old building with nature!

KTP hospital – improved healing rates…

Milan…

3. How do cities bounce forward while bouncing back from climate disasters?

Rebuild without depending on fossil fuels

How should the infrastructure in disaster cities be rebuilt?

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

Professor Dushko Bogunovich

CBS NEWS

Hurricane Florence crippled electricity and coal -- solar and wind were back the next day

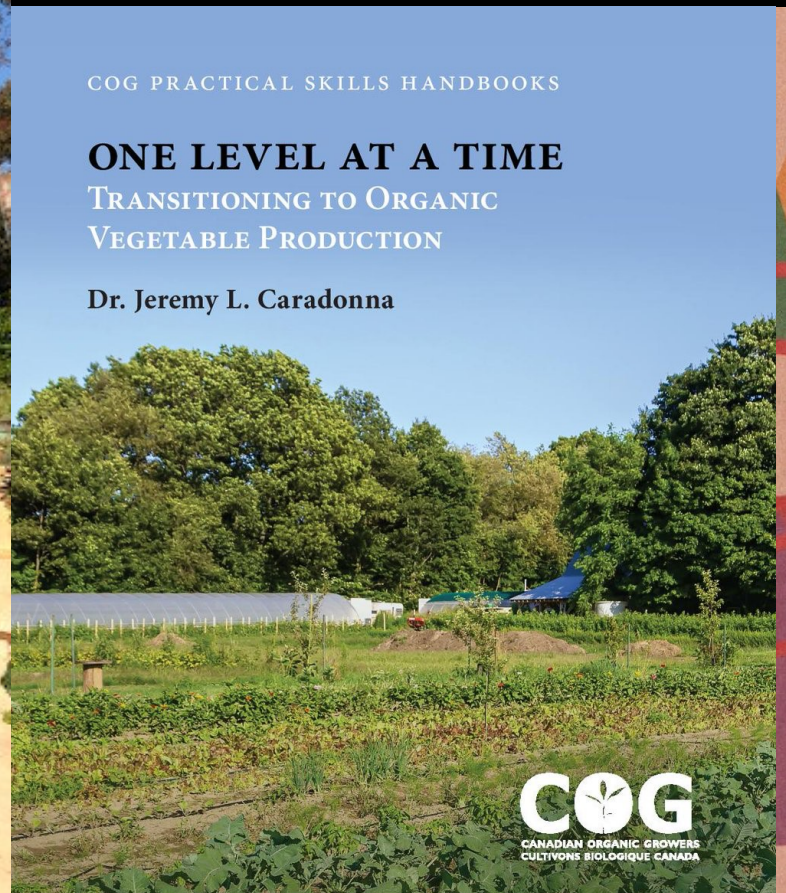
SEP 25, 2018 9:24 AM EDT TRENDING

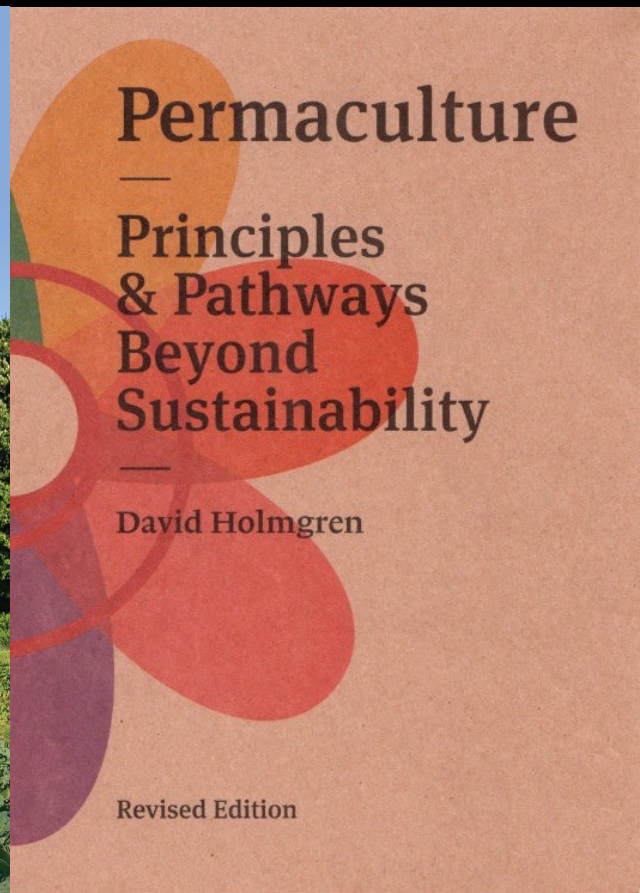
BY IRINA IVANOVA / MONEYWATCH

YES, BUT WHAT SCALE?

Localised systems, modernist large scale grids or even informal individual, backyard-based systems?

The permaculture system can inform all three scales but…individual scale is anti-urban and anti-economic growth, do it all your self…





What about transport and equity… cities are about sharing….

Localised Solutions:

Building capacity and resilience with distributed production systems

The shift away from modernist top down infrastructure…

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

The McCaughey Centre
VicHealth Centre for the Promotion of Mental Health and Community Wellbeing

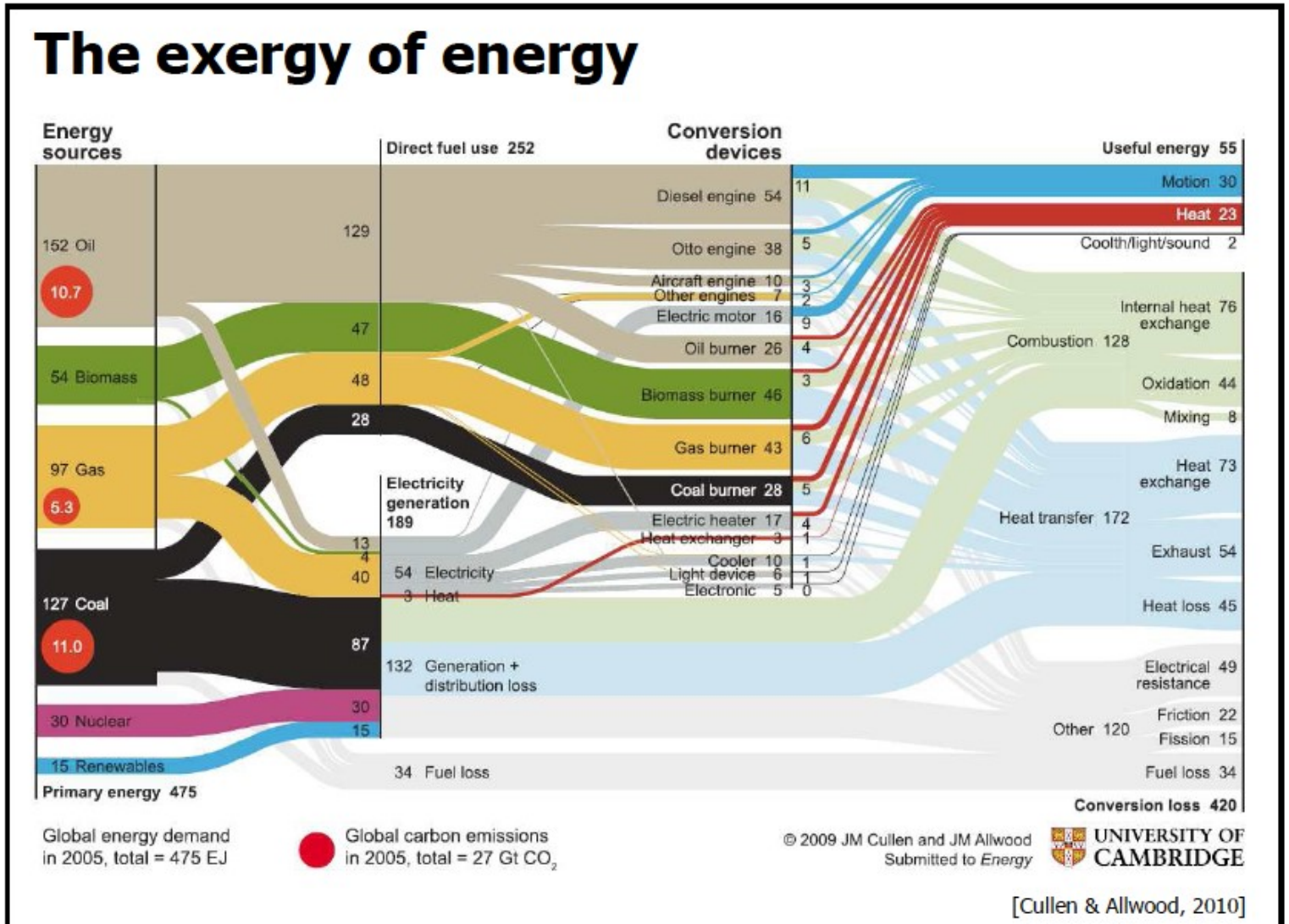
VEIL | victorian eco innovation lab

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

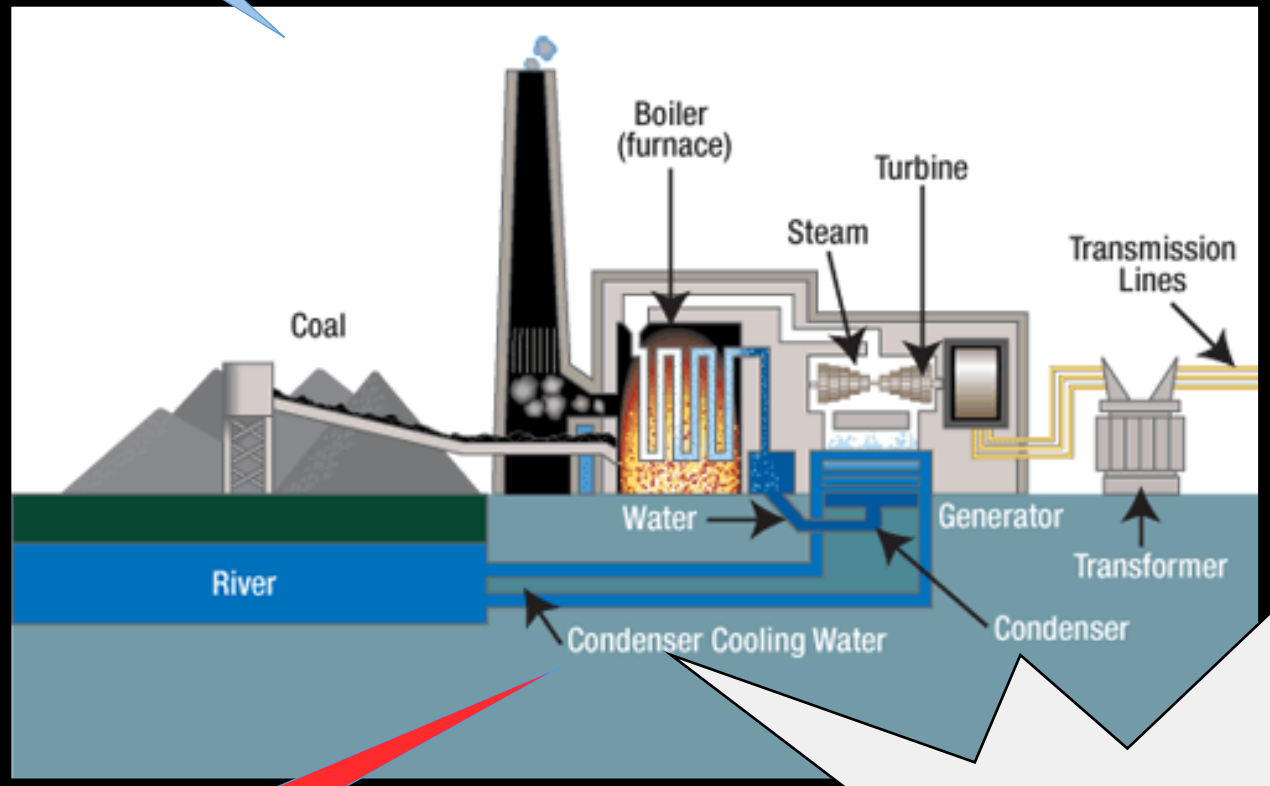
Centralised energy is wasteful and dumb



[Cullen & Allwood, 2010]

Generation Process

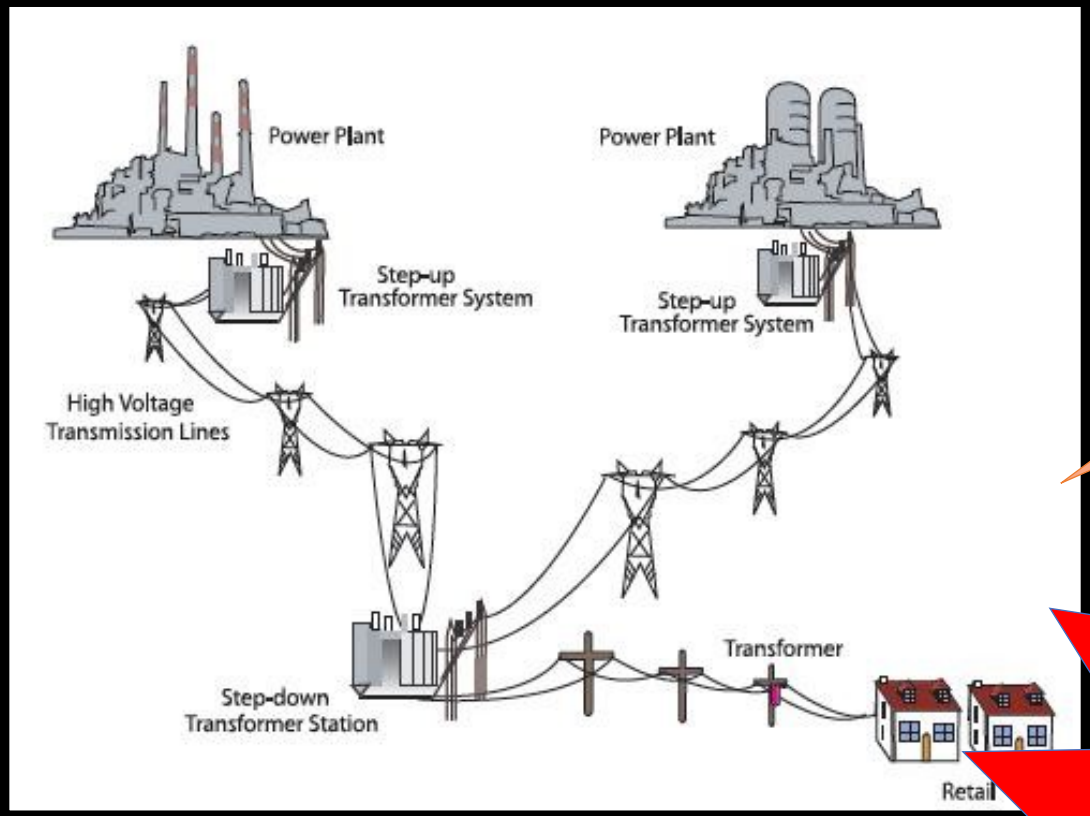
Wasted heat energy



Wasted hot water

2/3 of energy produced is wasted!

Transmission and Distribution



Further 7% energy lost from T&D

PROCESS IS ONLY 32% EFFICIENT

Conventional Water Management

Centrally sourced → Treated to drinking standard → Wastewater pumped out → Treated again & discharged into waterways & out to sea

Conventional Waste Management

LANDFILL

Centralised Infrastructure

Essentially **linear metabolism**,

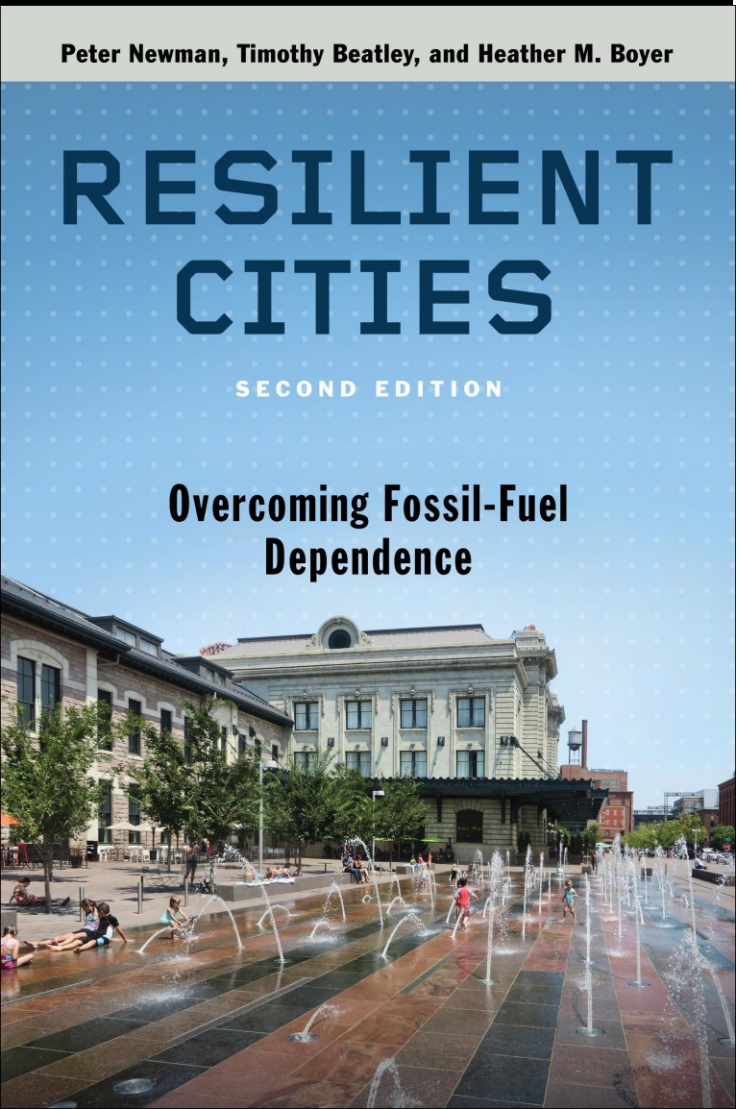
systems function **isolation**

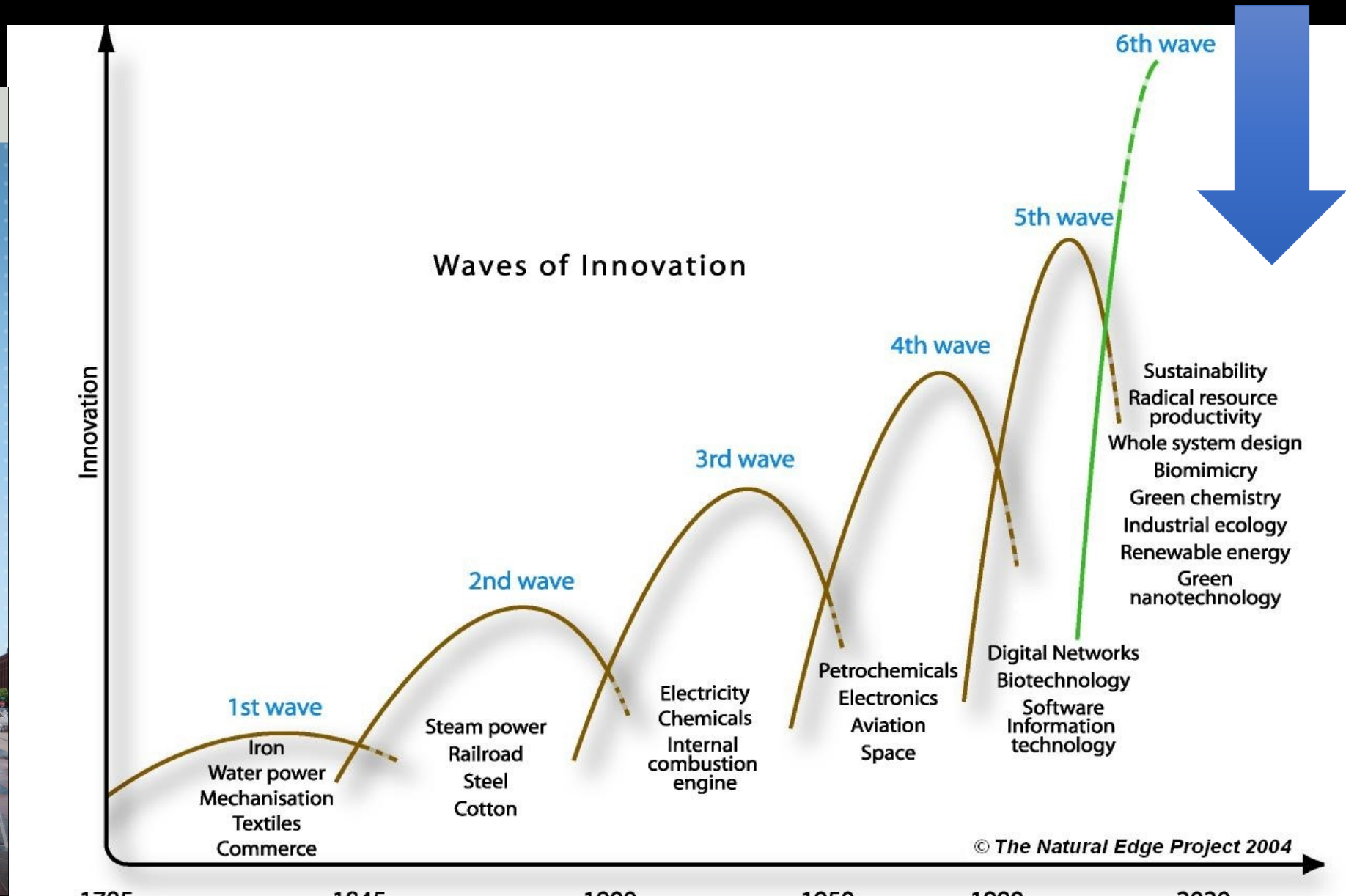
Resources pumped ‘through’ cities and urban systems with little regard by consumers to their origin or destination (Giradet 2004)

Closing loops

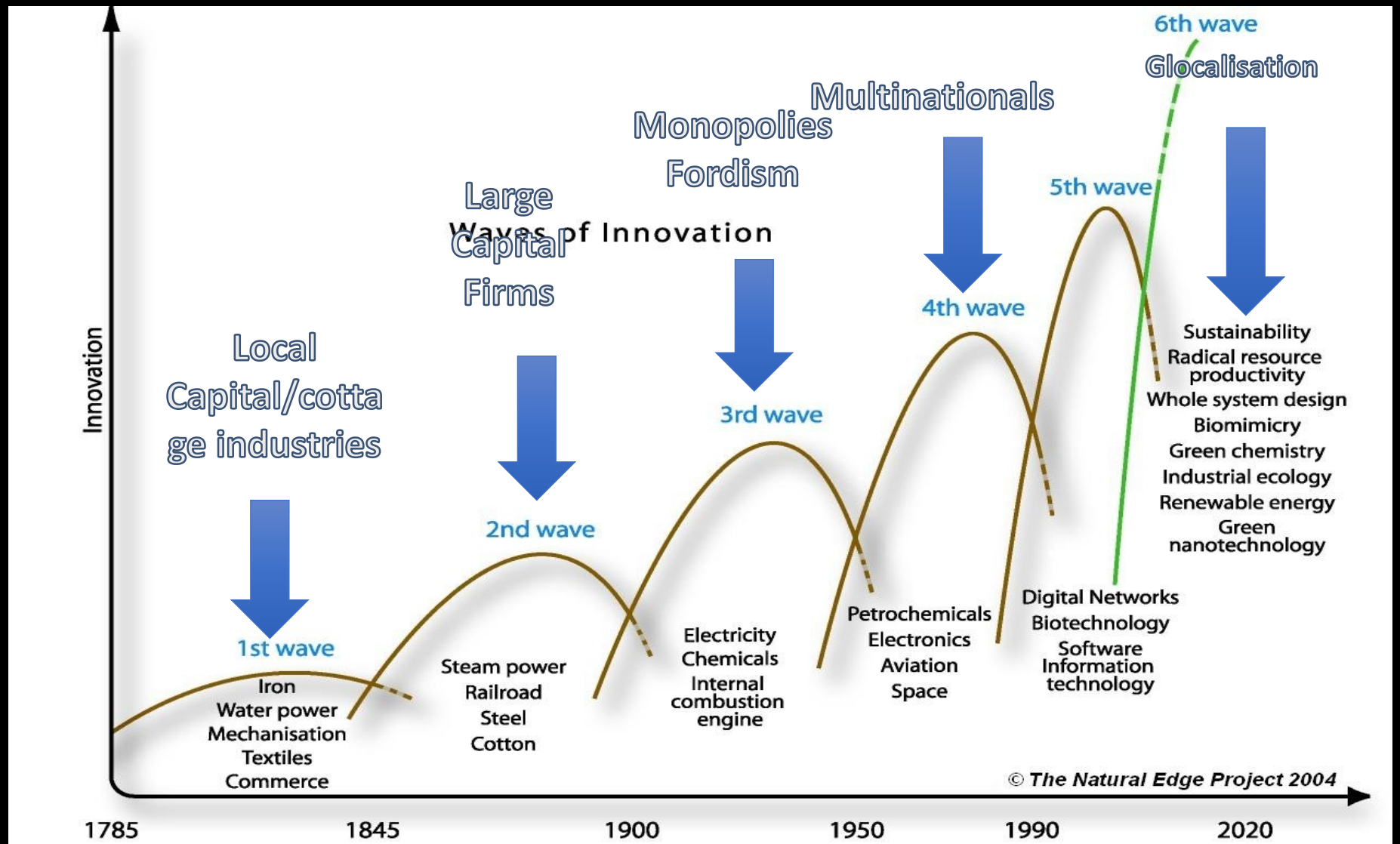
Through decentralised green infrastructure…BUT WHAT SCALE?

The next urban economy will be LOCAL SHARED TECHNOLOGIES IN A CITY WIDE GRID SYSTEM….





History of innovation and business models….



History of innovation and energy….

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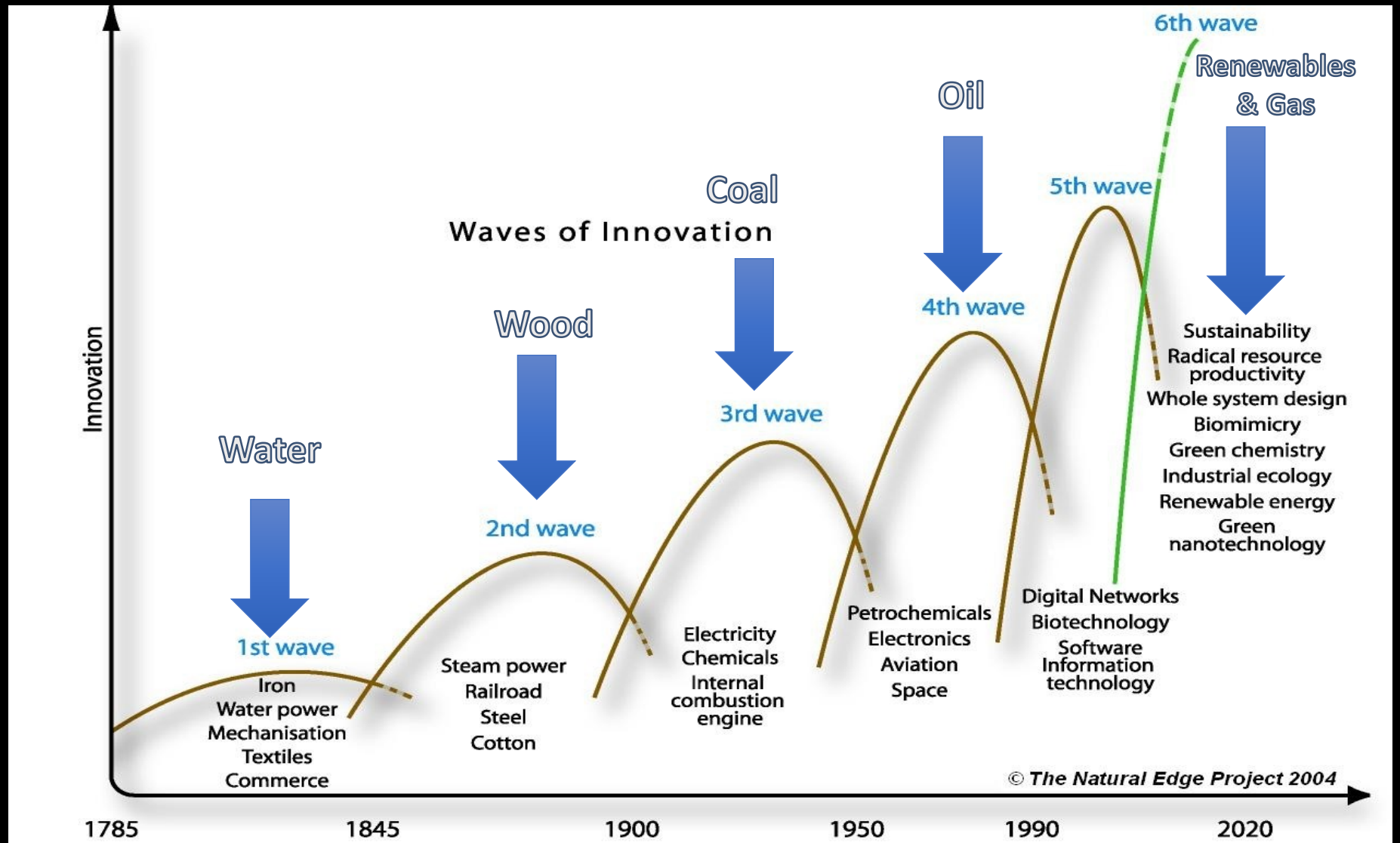
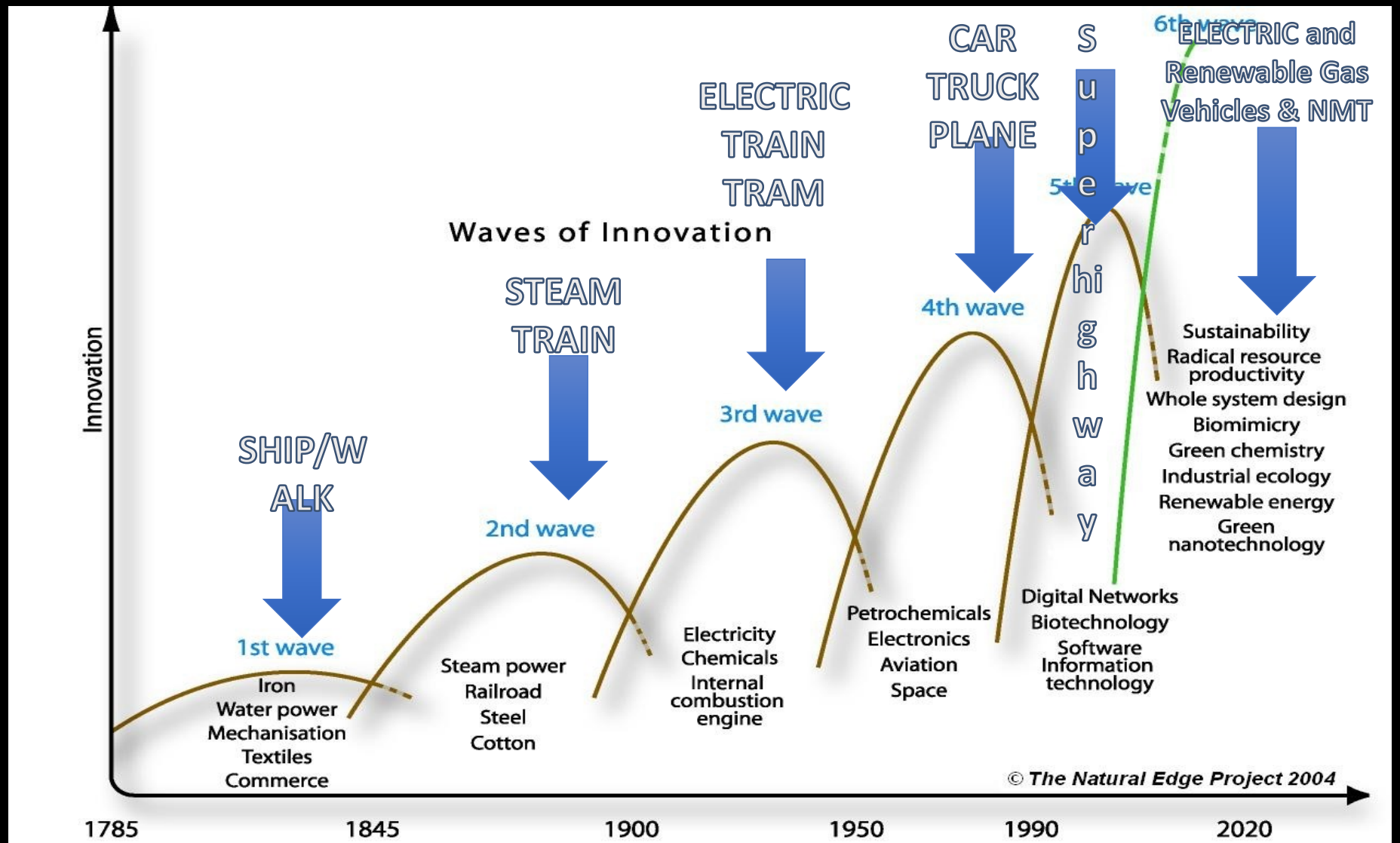
Next era of city building is REDUCED CARBON – green economy.



History of innovation and cities….
Transport shapes

Each era changes the city form. Cities keep the best of that era and move on.
Next era of city building ….

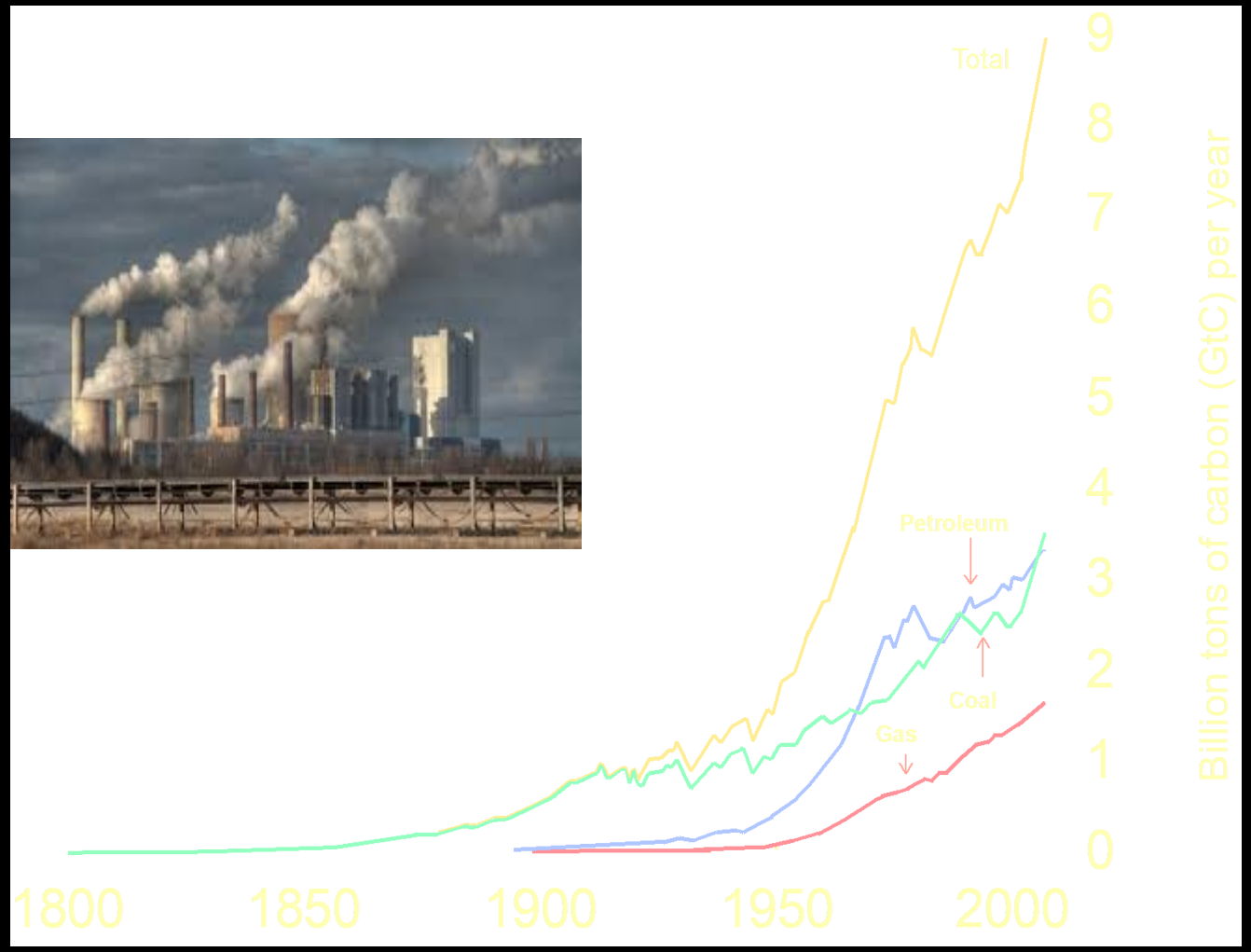


4. What are the big changes in decarbonizing cities that are well underway and which need to be mainstreamed into planning?

Decoupling and disruption.

The solar-batteries-blockchain-EV dance….

Out of control?

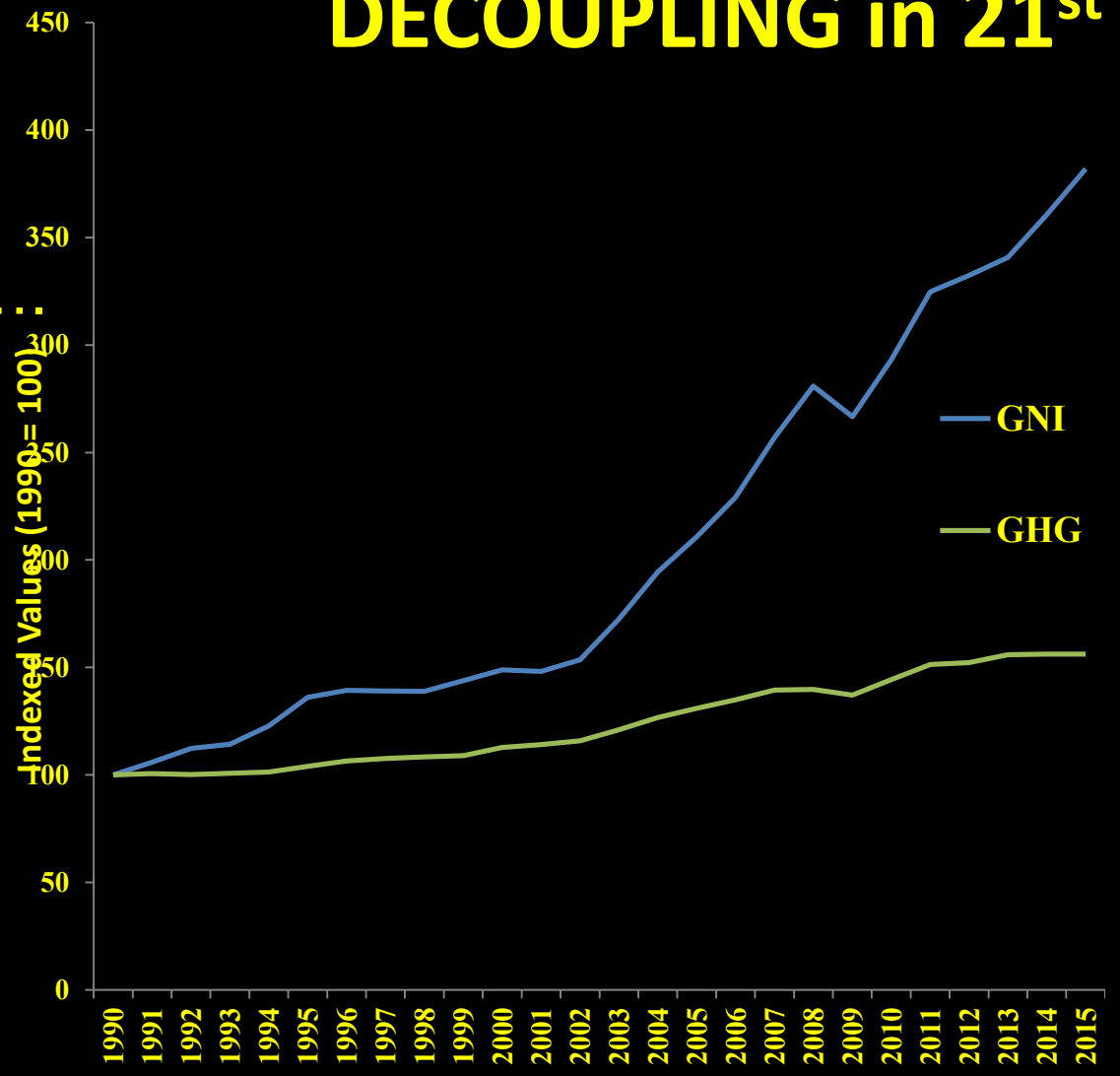


DECOUPLING in 21st century

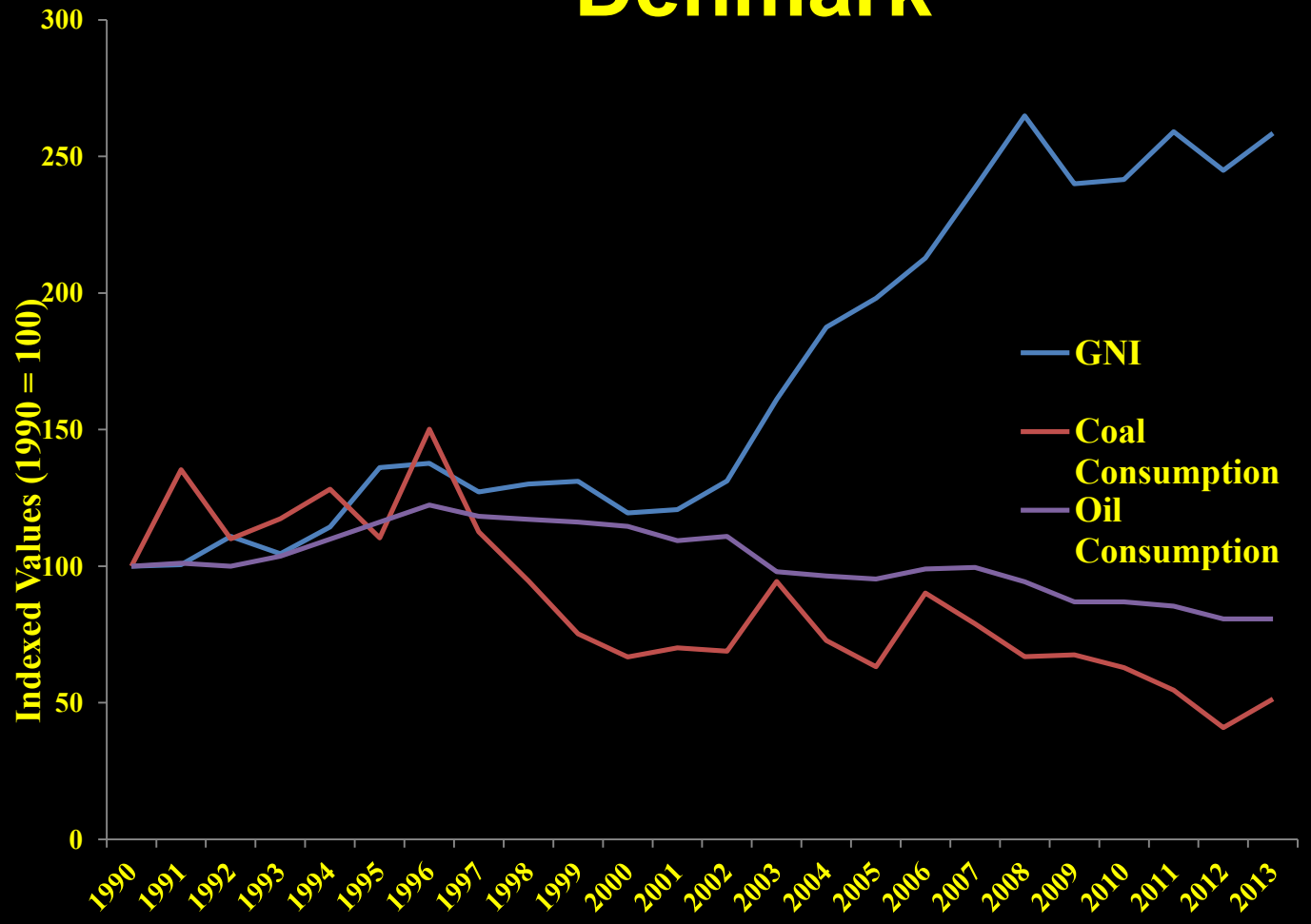
Turning point in **world history**….

GHG going DOWN,

Wealth going UP



Denmark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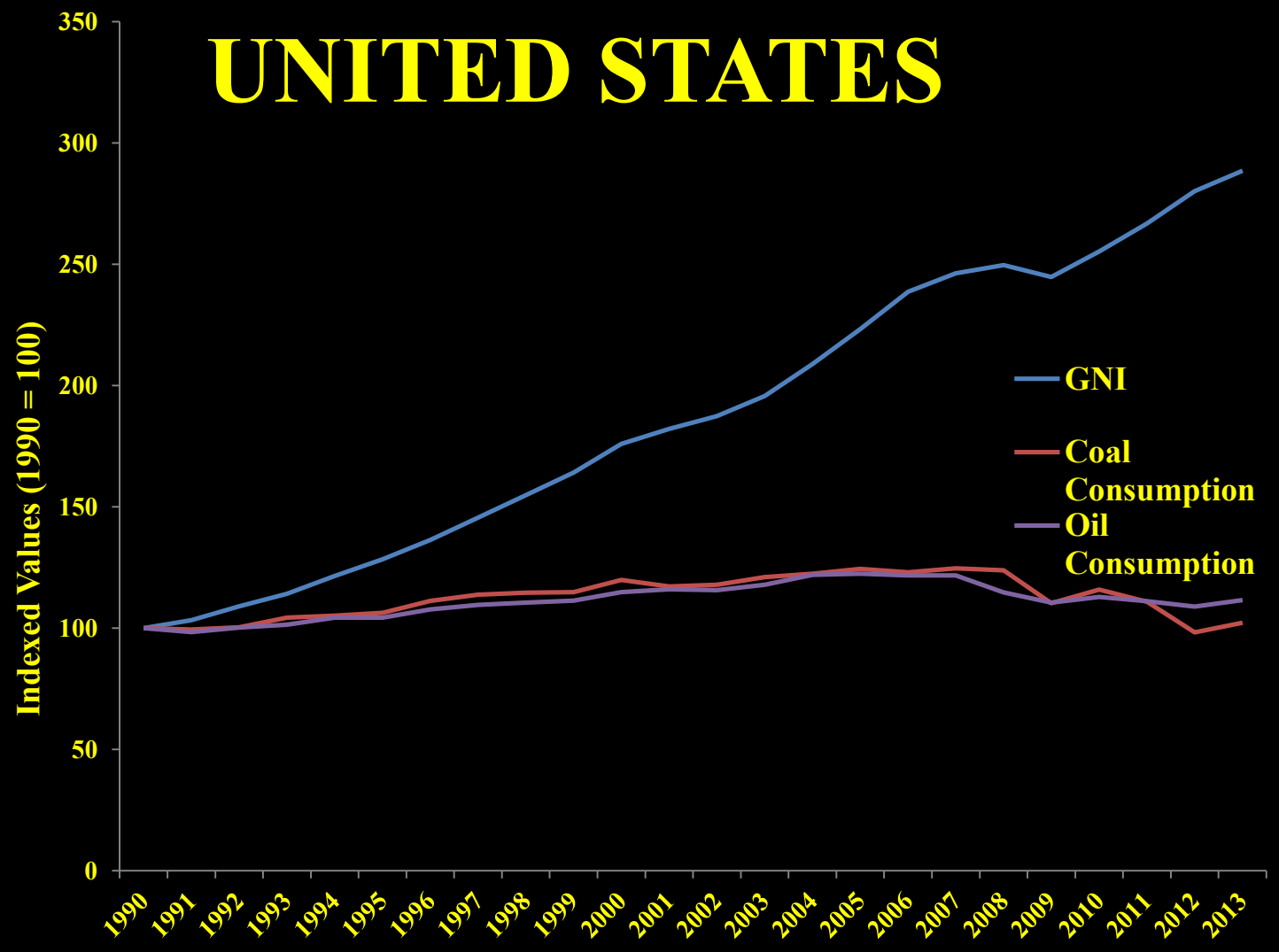
Oil Consumption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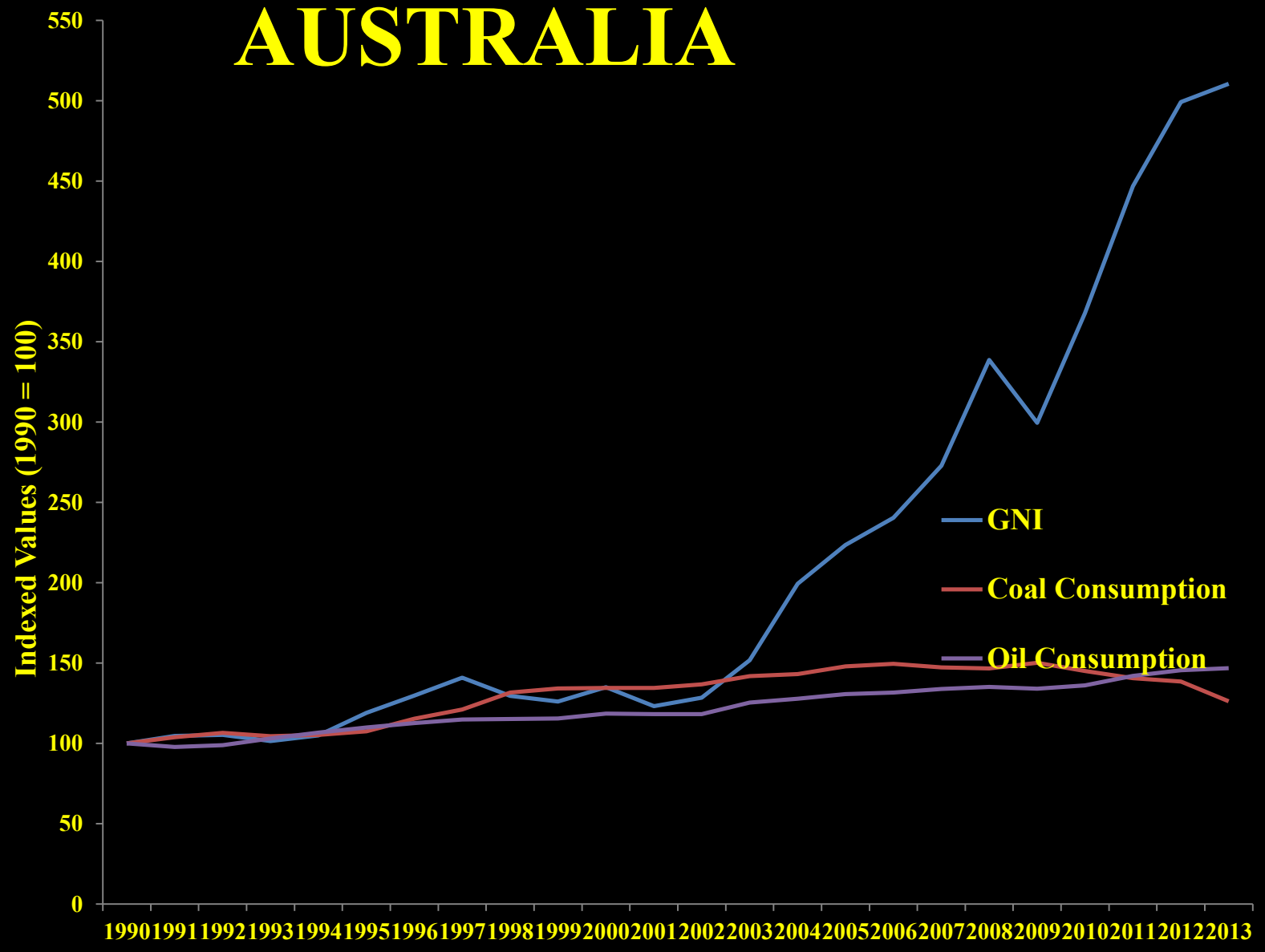
AUSTRALIA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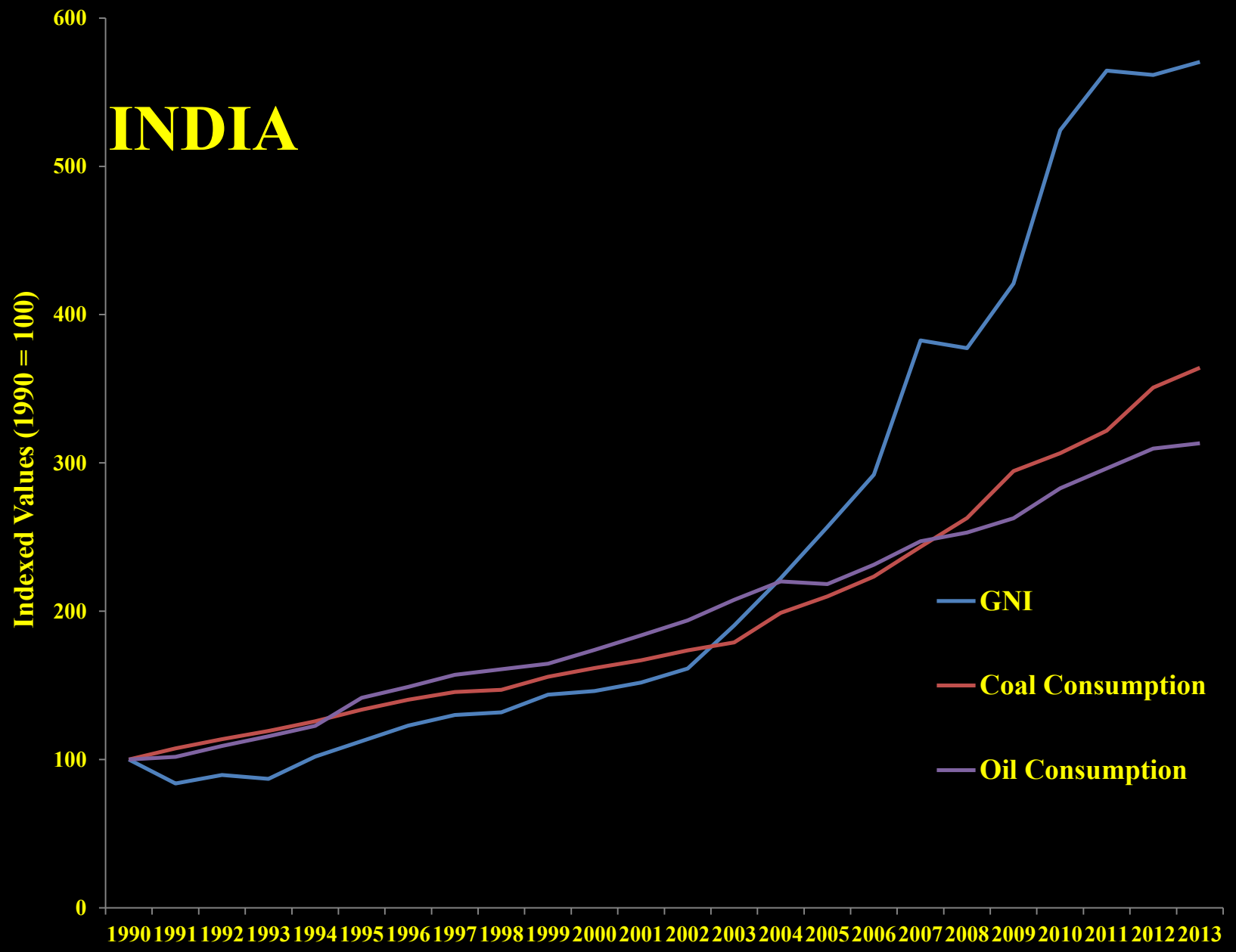
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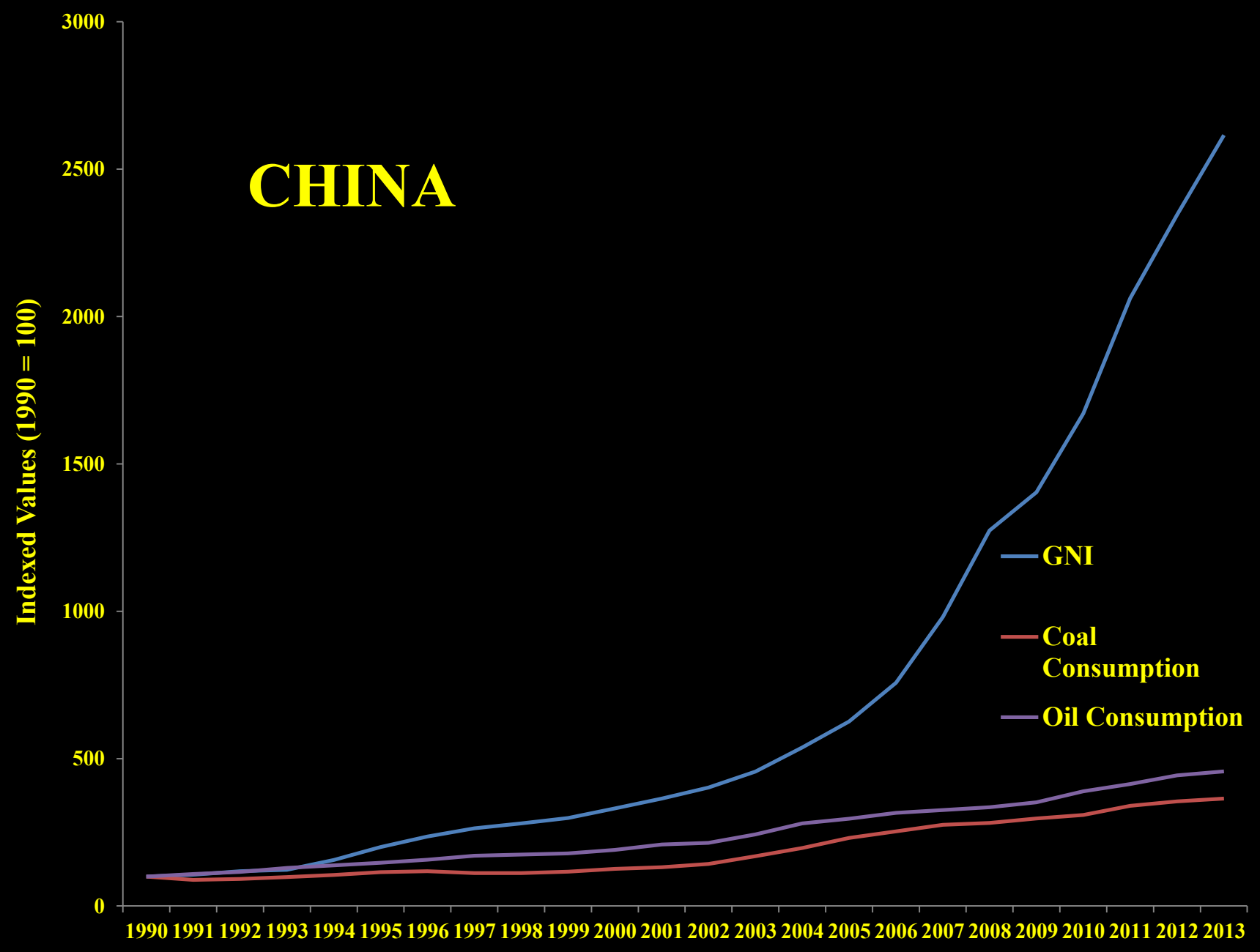
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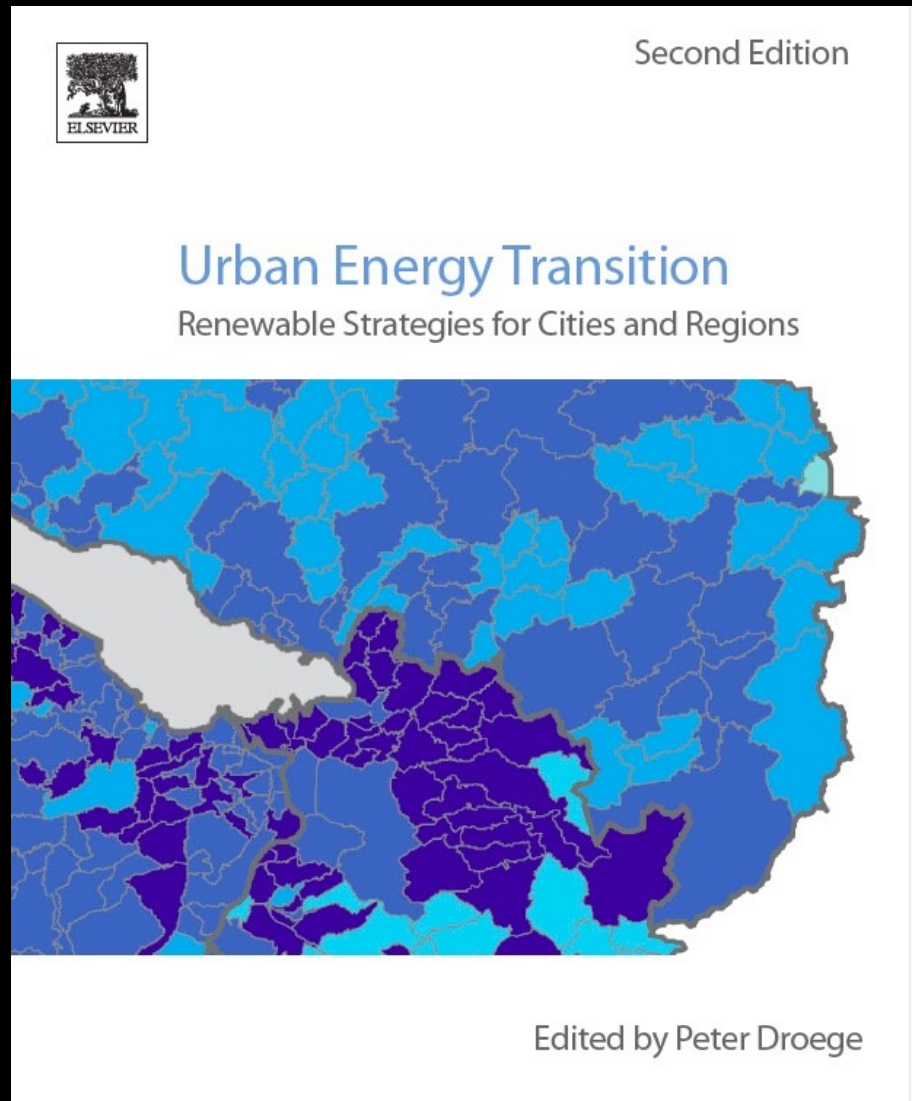
GNI
Coal Consumption
Oil Consumption

Disruptive innovation and the rise of the renewable city

Green J & Newman P (2017): Disruptive innovation, stranded assets and forecasting: the rise and rise of renewable energy, **Journal of Sustainable Finance & Investment** 7(2): 169-187

Newman P (2017) The Rise and Rise of the Renewable City, **Renewable Energy and Environmental Sustainability,** 4(2)

Green J and Newman P (2017) Citizen Utilities: The Emerging Power Paradigm, **Energy Policy, 105: 283-293**



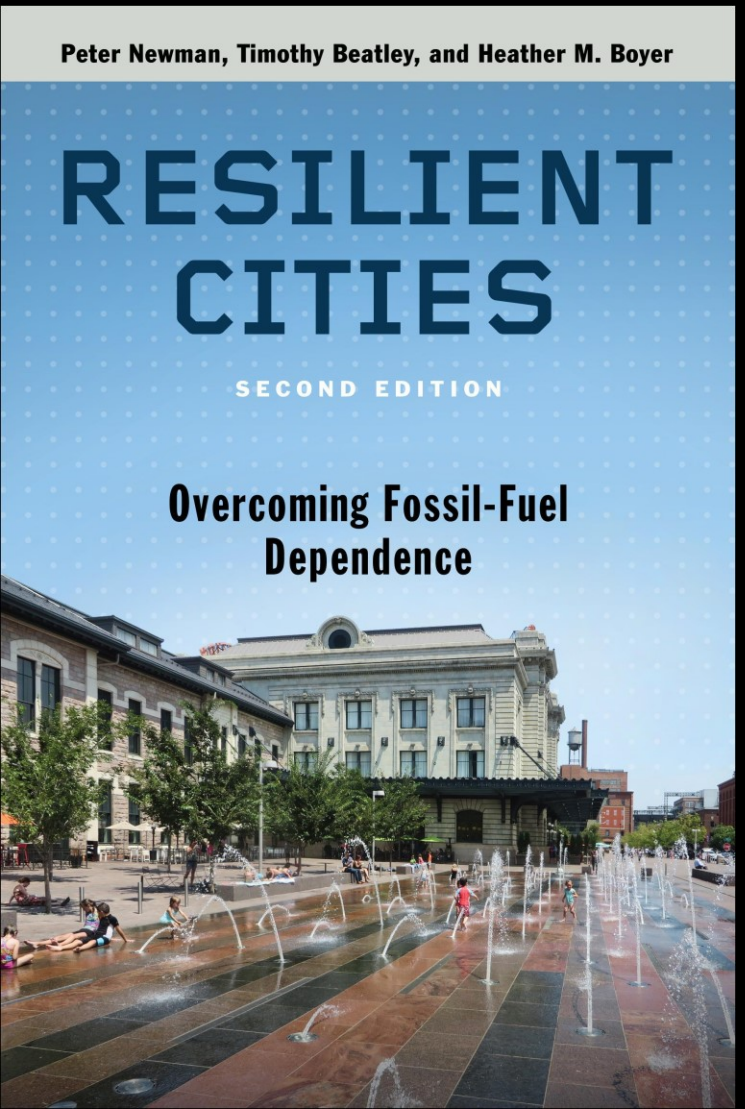
New understanding of innovation… DISRUPTIVE INNOVATION

- Came from Clayton Christensen at Harvard.
- Found that the adoption of 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!
- Mainstream finds it hard to see innovation as they are looking at supply price…so they ignore it. The ‘Kodak effect’. STRANDED ASSETS.

Disruptive technologies for climate change…

- Solar-batteries-blockchain LOCAL SHARED RENEWABLES SYSTEMS
- Electric cars, Electric bikes and Electric Transit LOCAL SHARED MOBILITY SYSTEMS

The New Energy Megatrend….



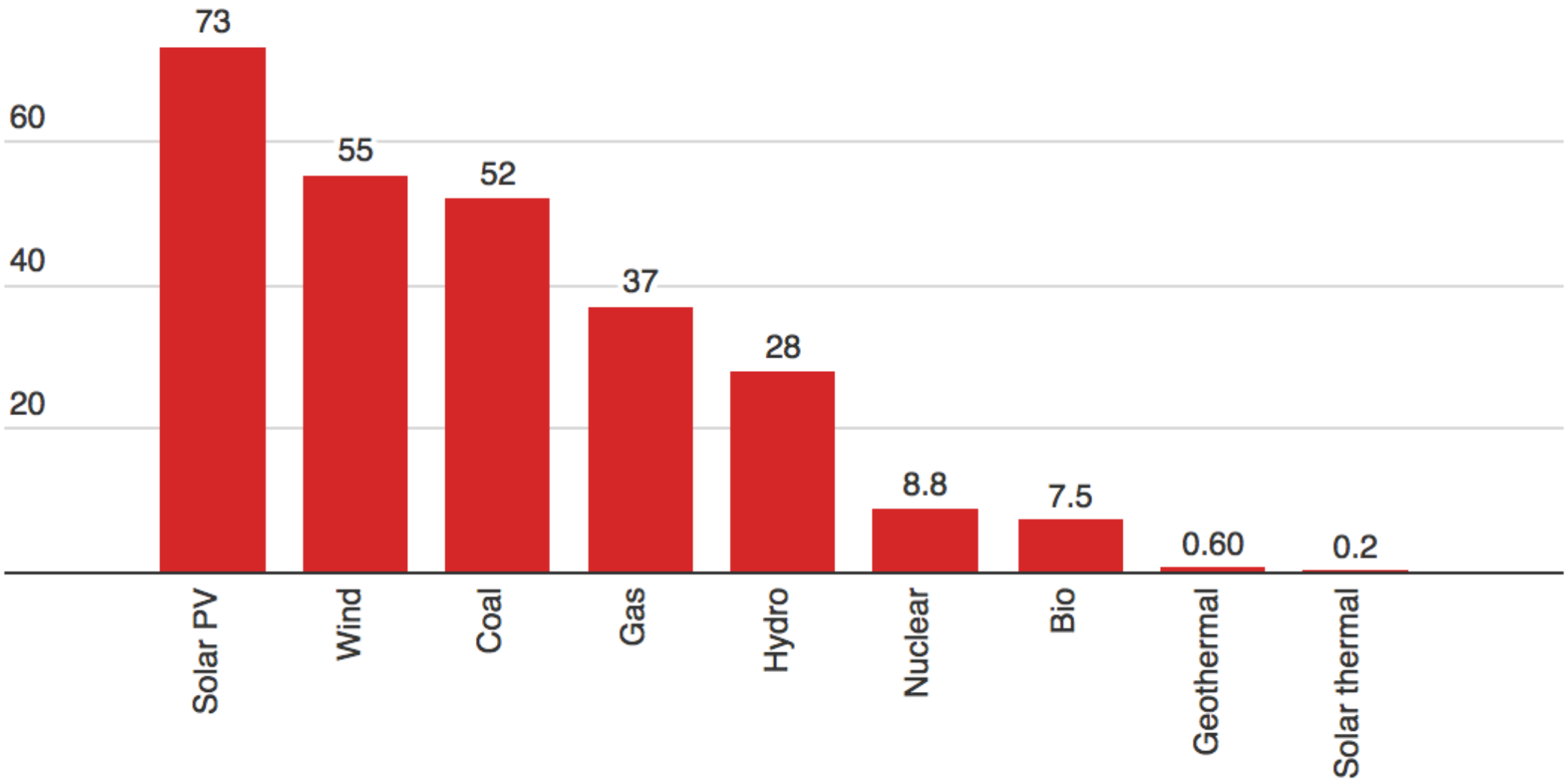
2010 to 2016….according to IRENA

1. Solar grew by 66%
2. Wind grew by 30%
3. Batteries grew by 50%

And the annual rates keep going up…

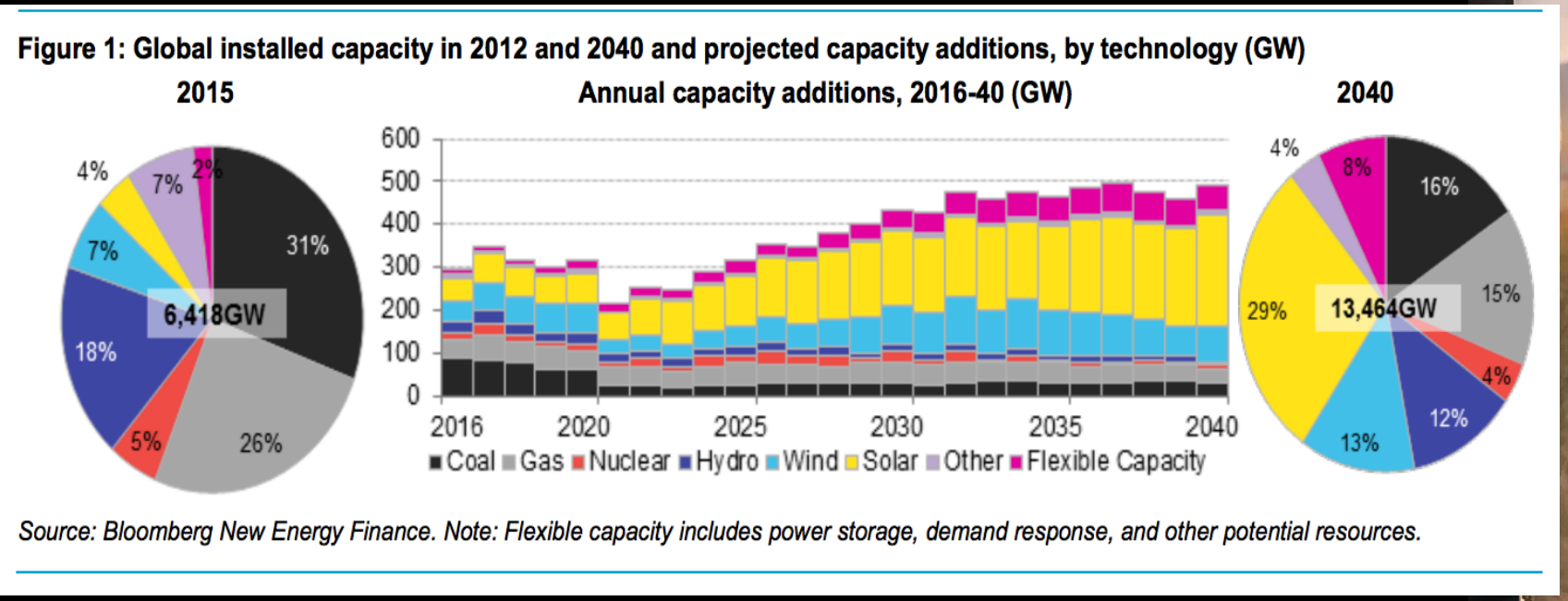
New energy build in 2016

Net addition (in gigawatts) of electricity generation capacity



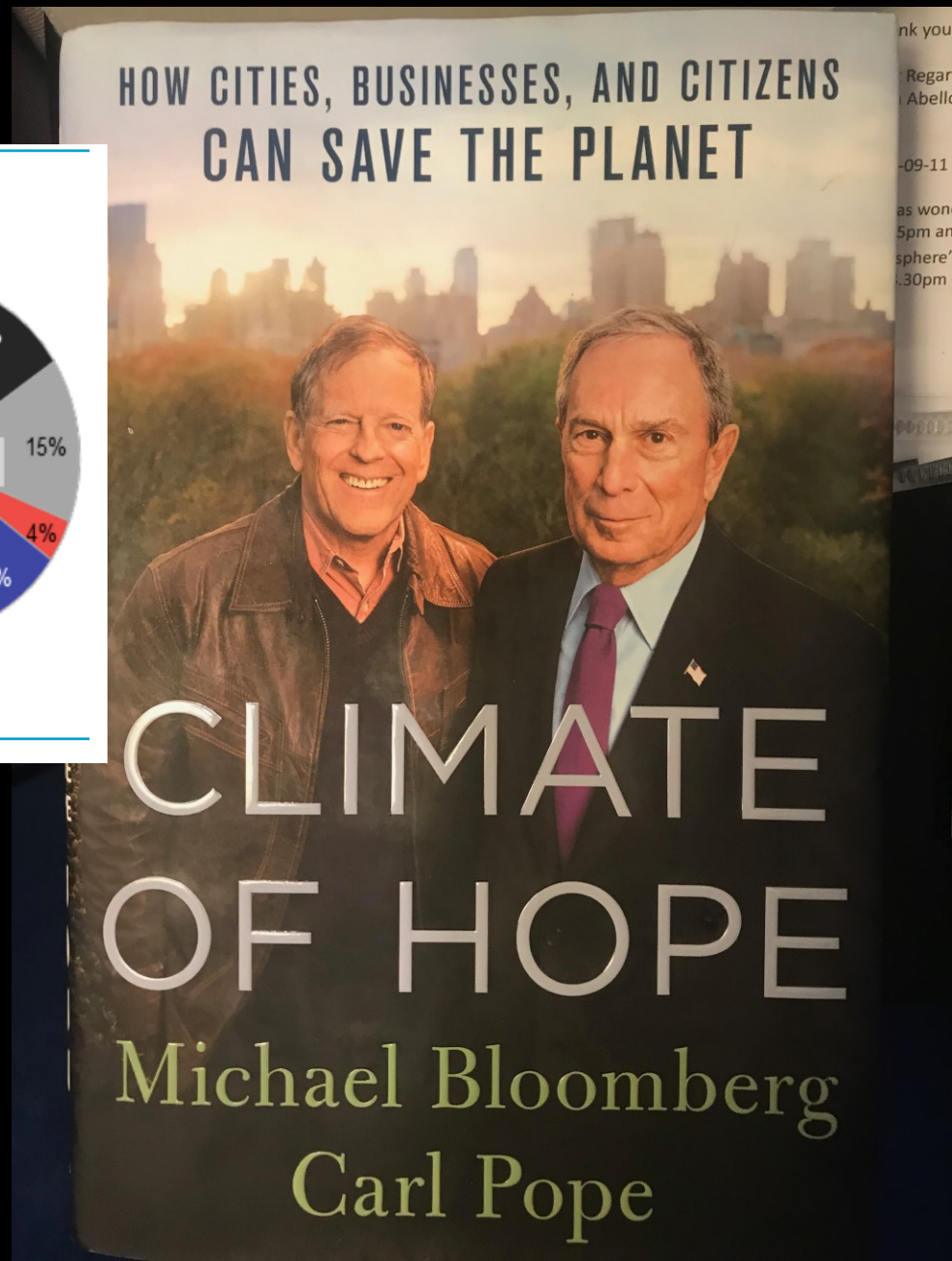
Source: REN21/IRENA/WNA

Bloomberg New Energy Finance



Solar….From 4% to 29%.

Coal from 31% to 16%.



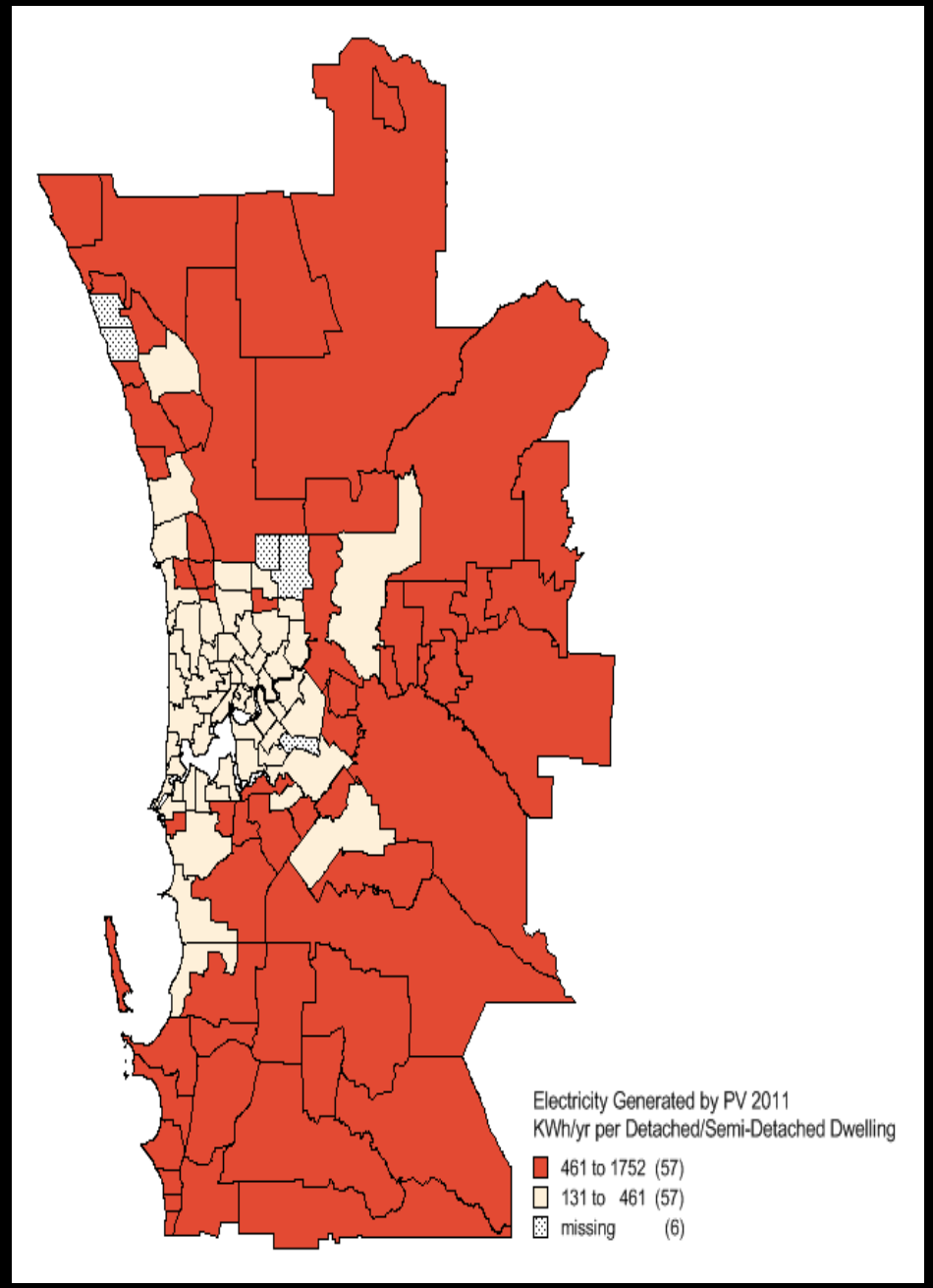
In some cities the transition is even quicker…

Solar power (PV)

30% of Perth homes
1000 MW in 7 years…
Largest power station in WA

70% by 2025
‘It is inevitable…’
Minister for Energy.

How do we manage the grid?



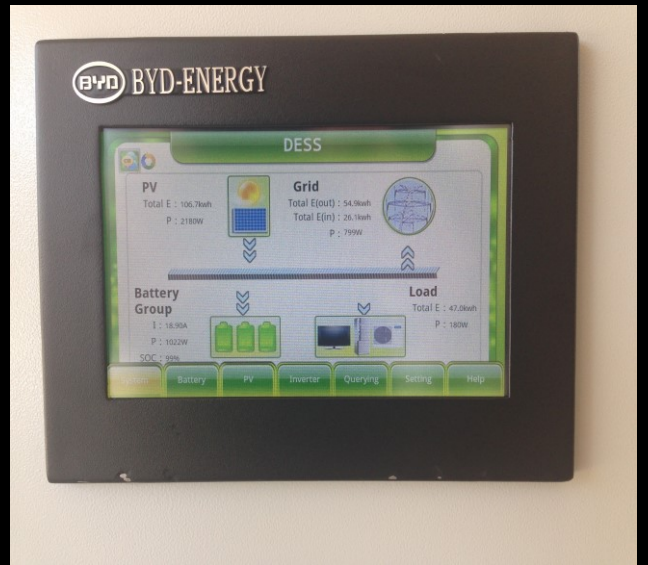
Josh's House

Solar-
Batteries

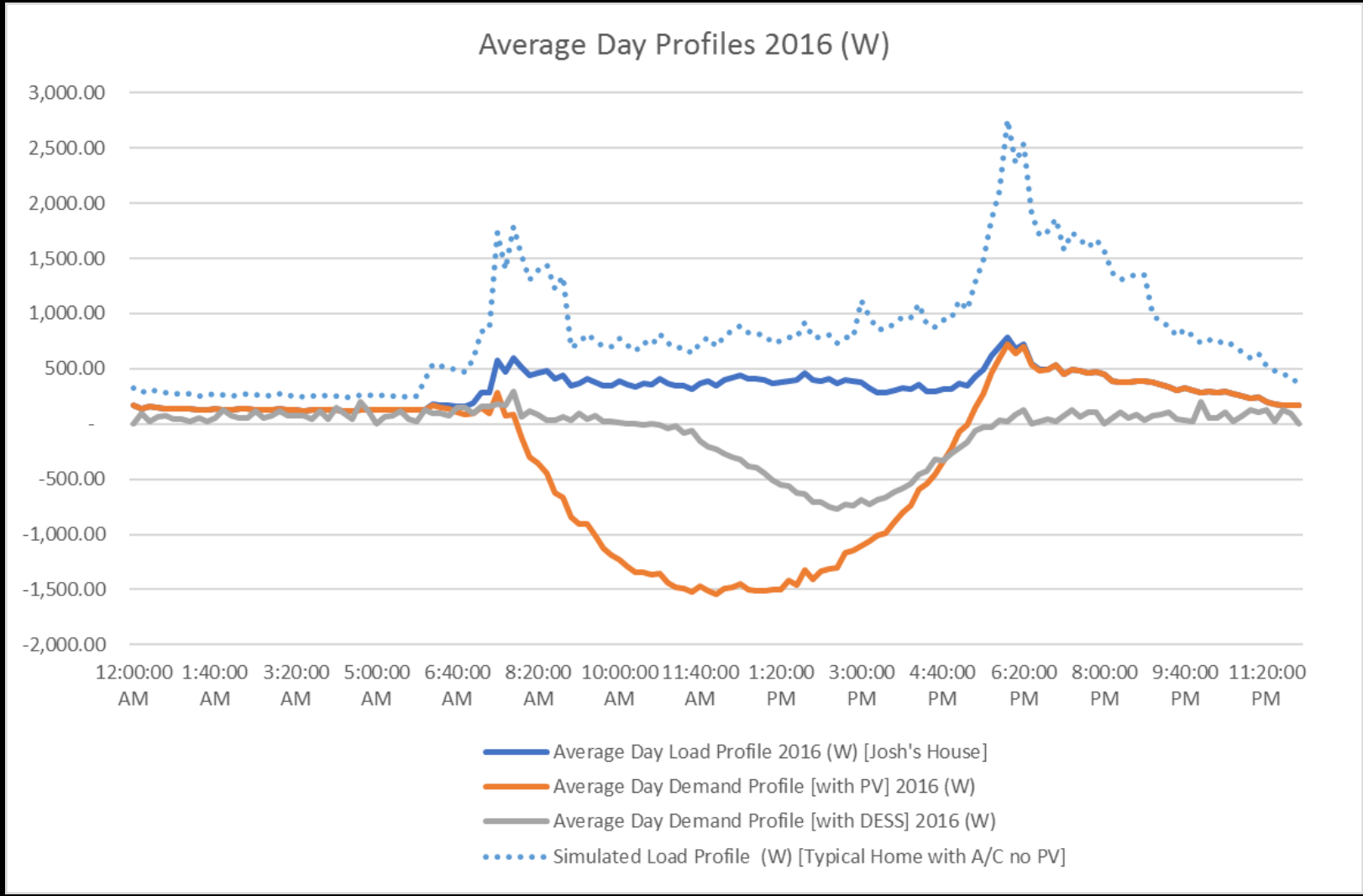
70 channels of monitoring

Joshshouse.com.au

The holy grail arrives



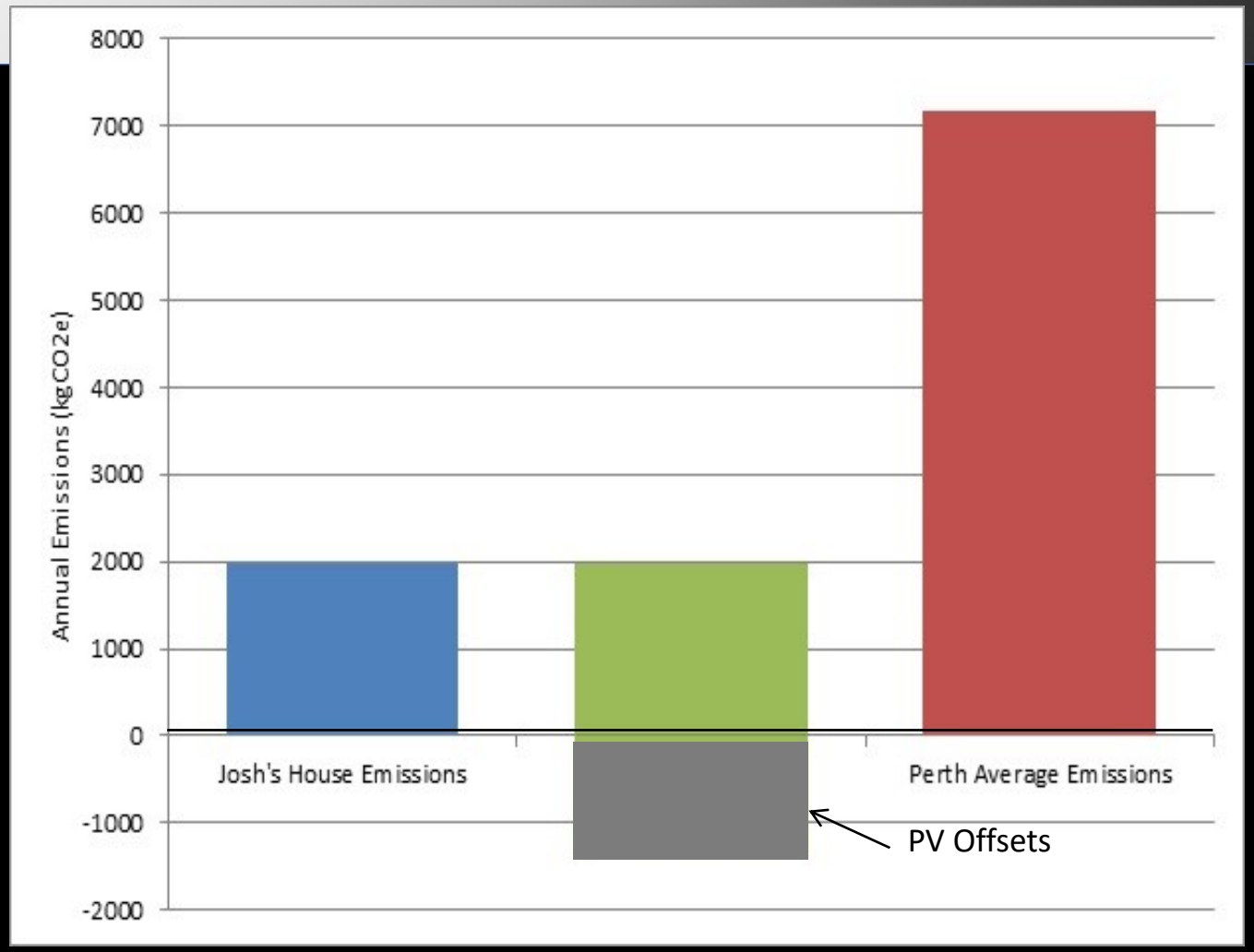
Solar Design + Solar + Battery STILL NEED THE GRID to share excess renewable power….



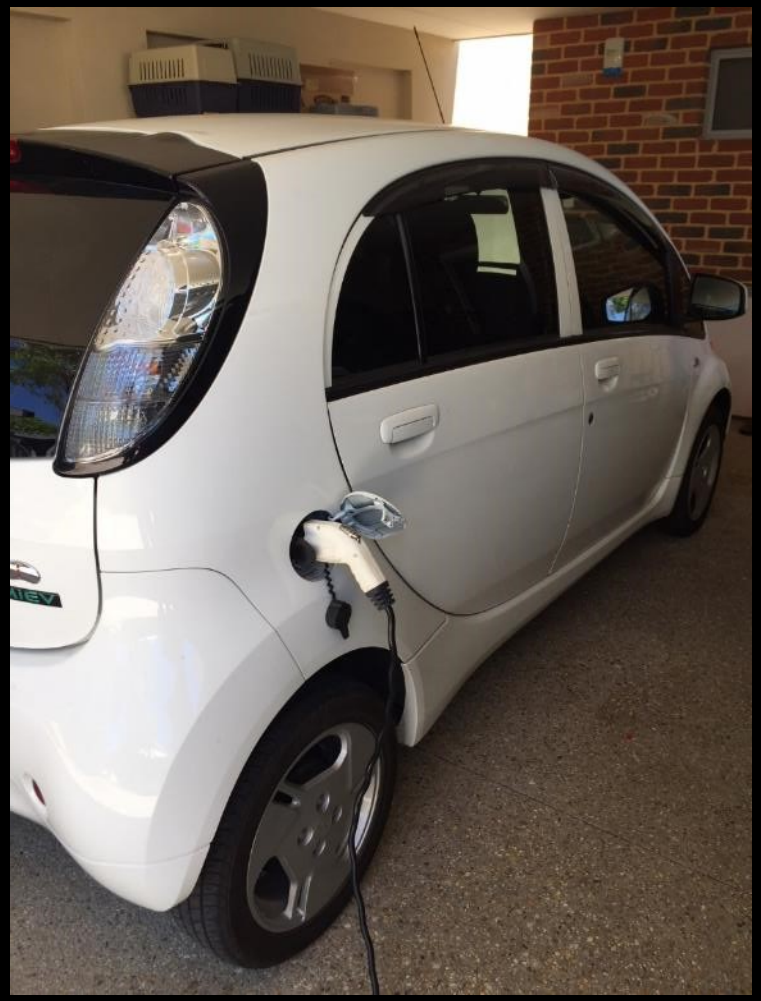
It's carbon positive!

HOW CAN IT BEST BE SHARED?

JOSH'S HOUSE



Partly into an Electric Vehicle.....



What about sharing into a local grid that is managed locally?

Like a shared medium density precinct?

Scaling up….. SHARED SOLAR & BATTERIES

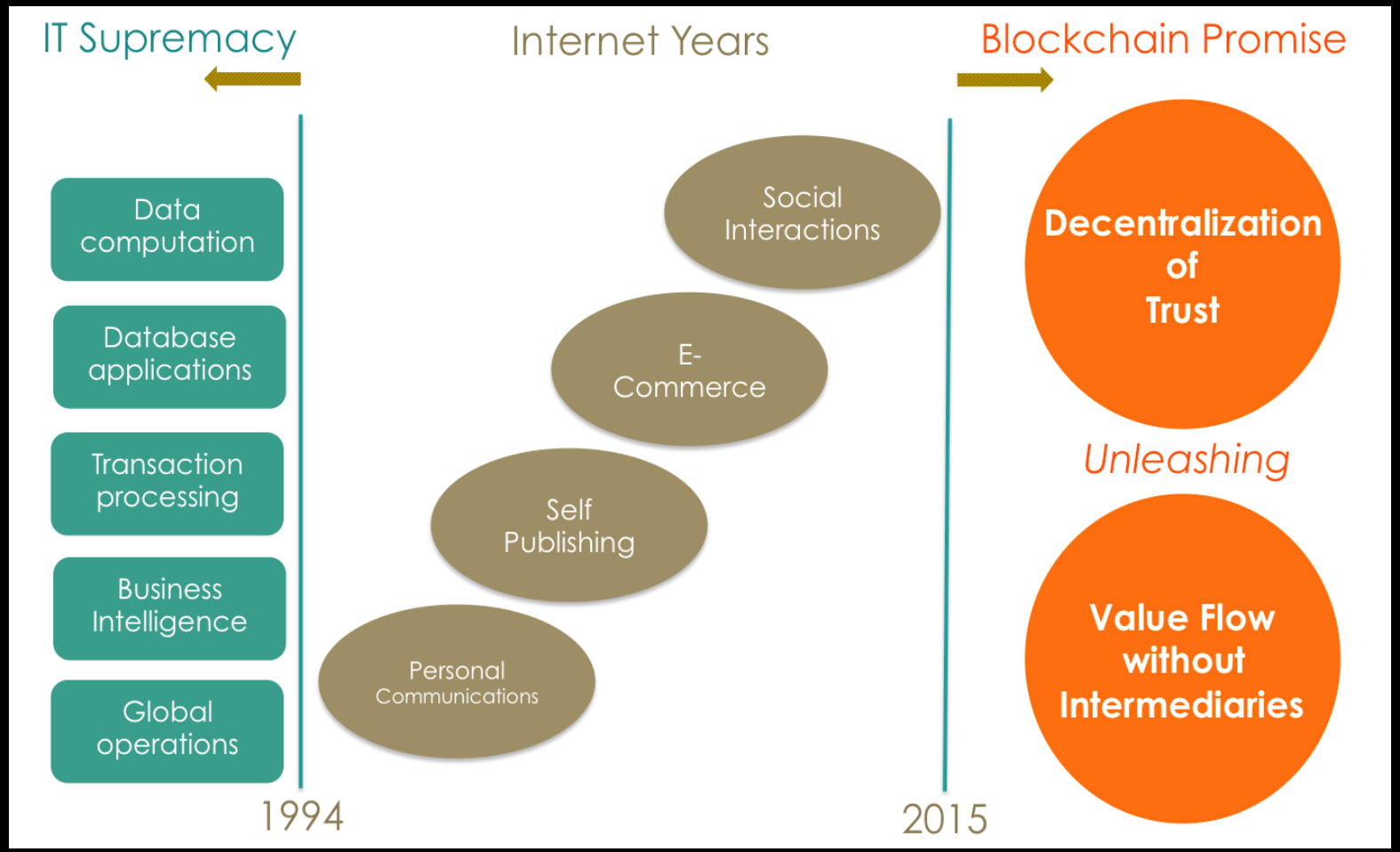
‘Citizen Utilities’ with social housing….P2P

WGV

Shared EV…

Blockchain enables ‘citizen utilities’… microgrids for P2P trading.

Power Ledger Pty Ltd



Multiple other benefits…

Sump into park

One Planet Living National Certification for WGV

- 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

Planning’s role?

- Enabling innovation – take a risk!
- Community engagement…from NIMBY to PIMBY
- Accreditation vision….One Planet Living
- Structure Plan to mainstream
- Showing that it sells!
- Establishing a Local Utility for shared energy and water through partnership?

Next stages…

1. 1000 unit development
2. Whole local government of Fremantle with PV's **sharing community batteries**…
3. Whole city…? Utility says: ITS POSSIBLE WITHIN 5 YEARS

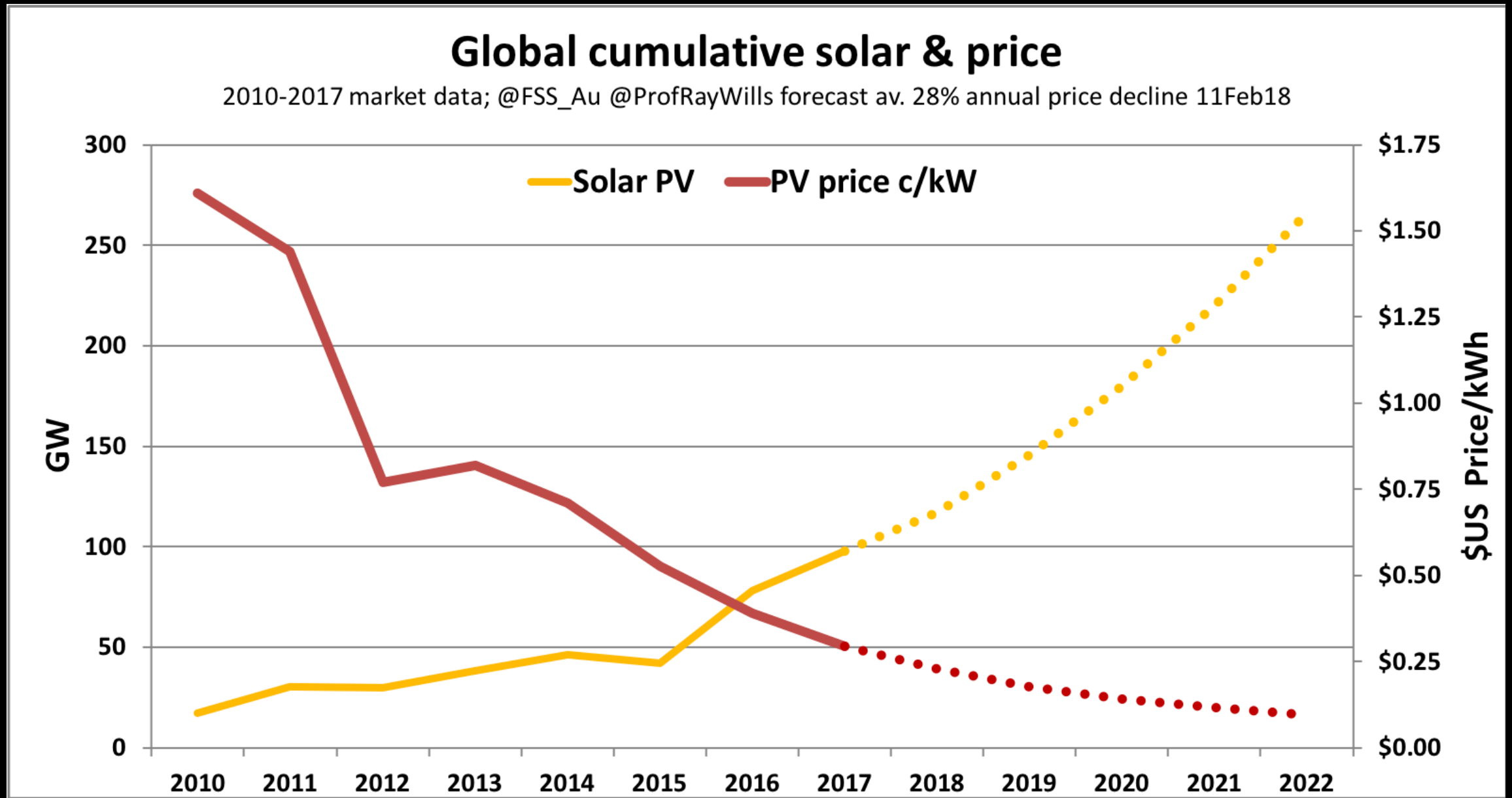
Can informal settlements leapfrog into using new local energy, water systems and be managed locally?

Will there be more “splintered urbanism”— slum neglect combined with elite ‘green’ enclaves

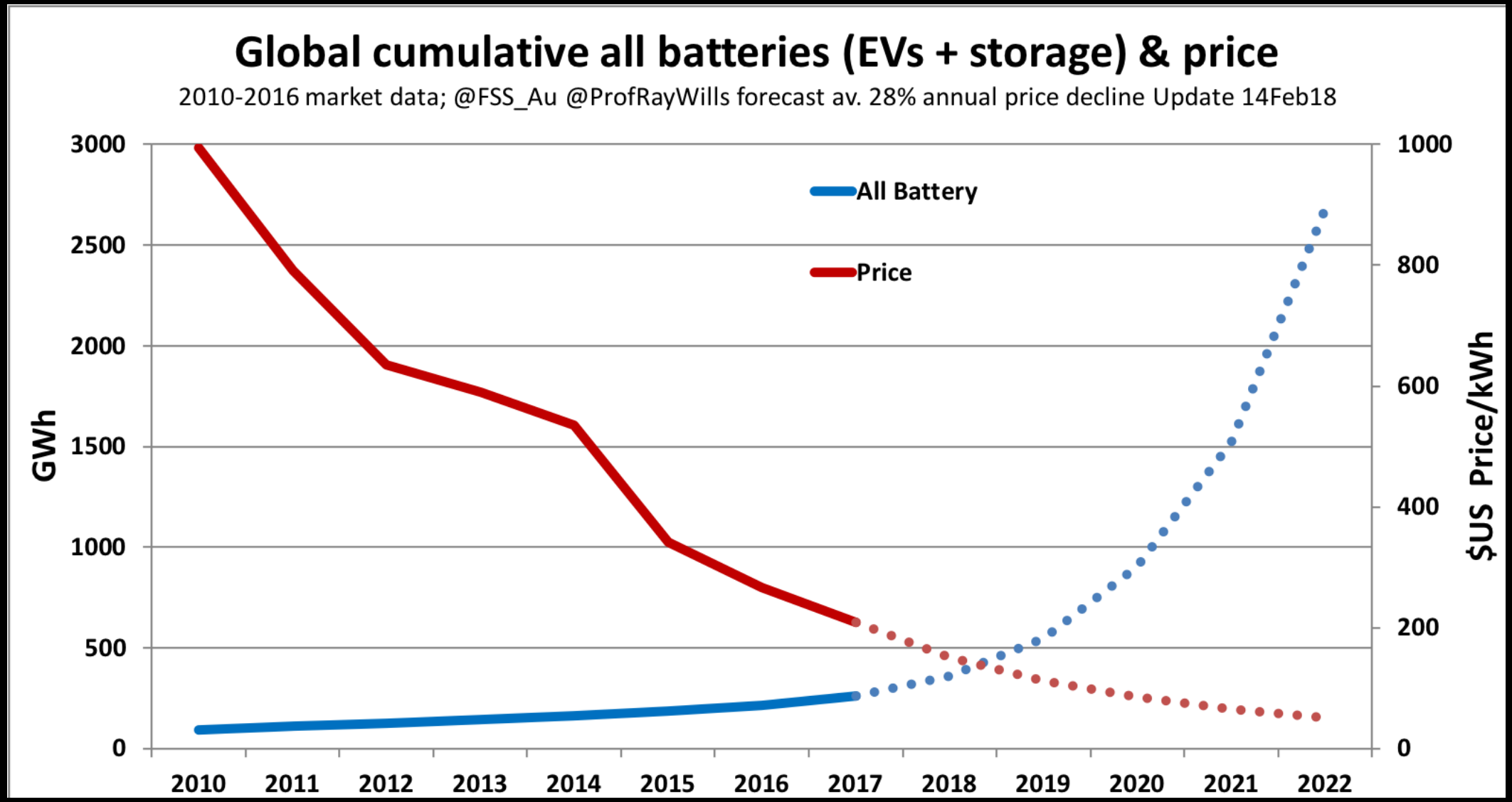
Slum housing Addis Ababa - a case study in providing distributed infrastructure to maintain the strong community bonds central to the urban fabric.

How is the global response going?

Solar growth as cost drops– mass production China

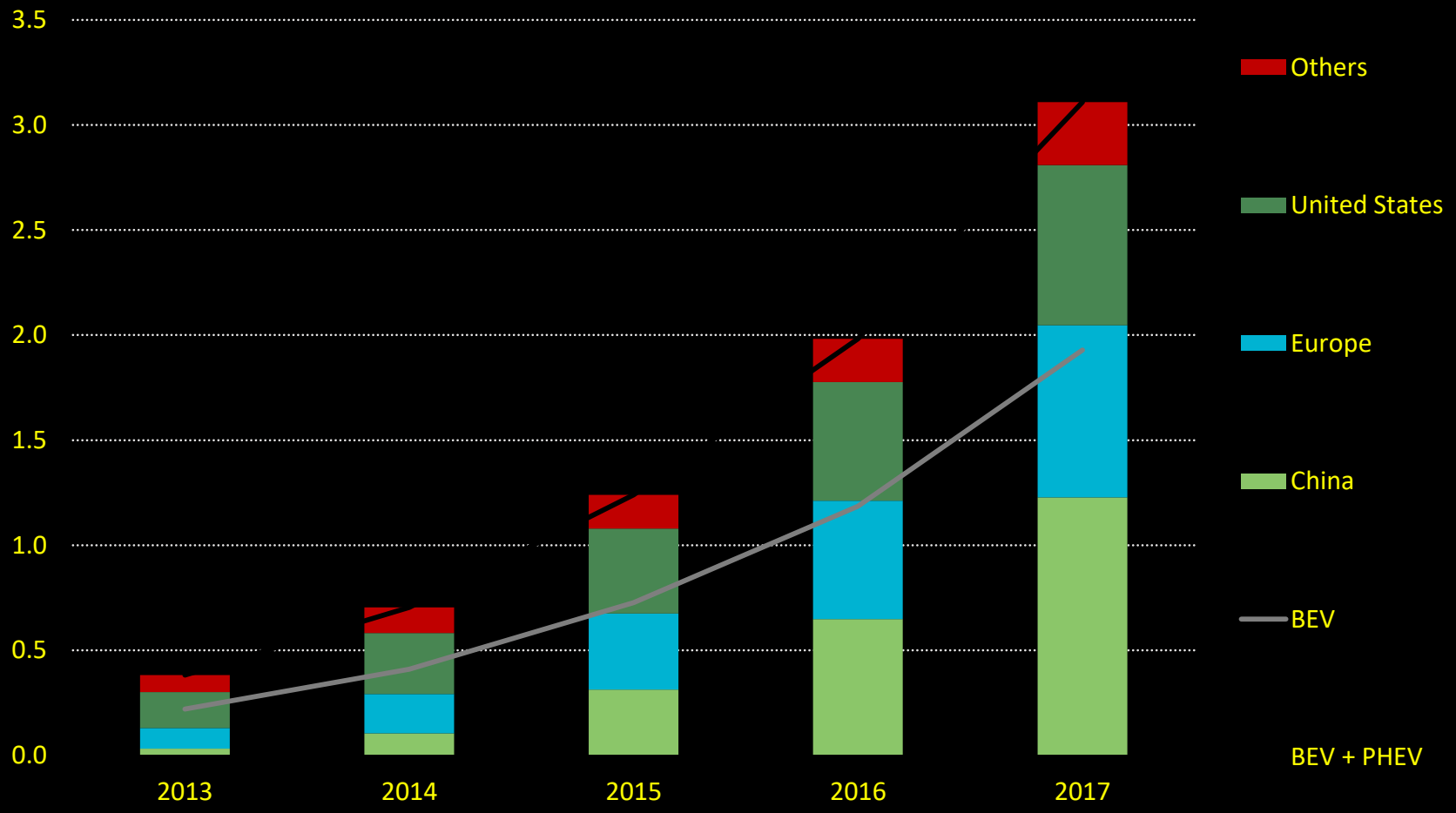


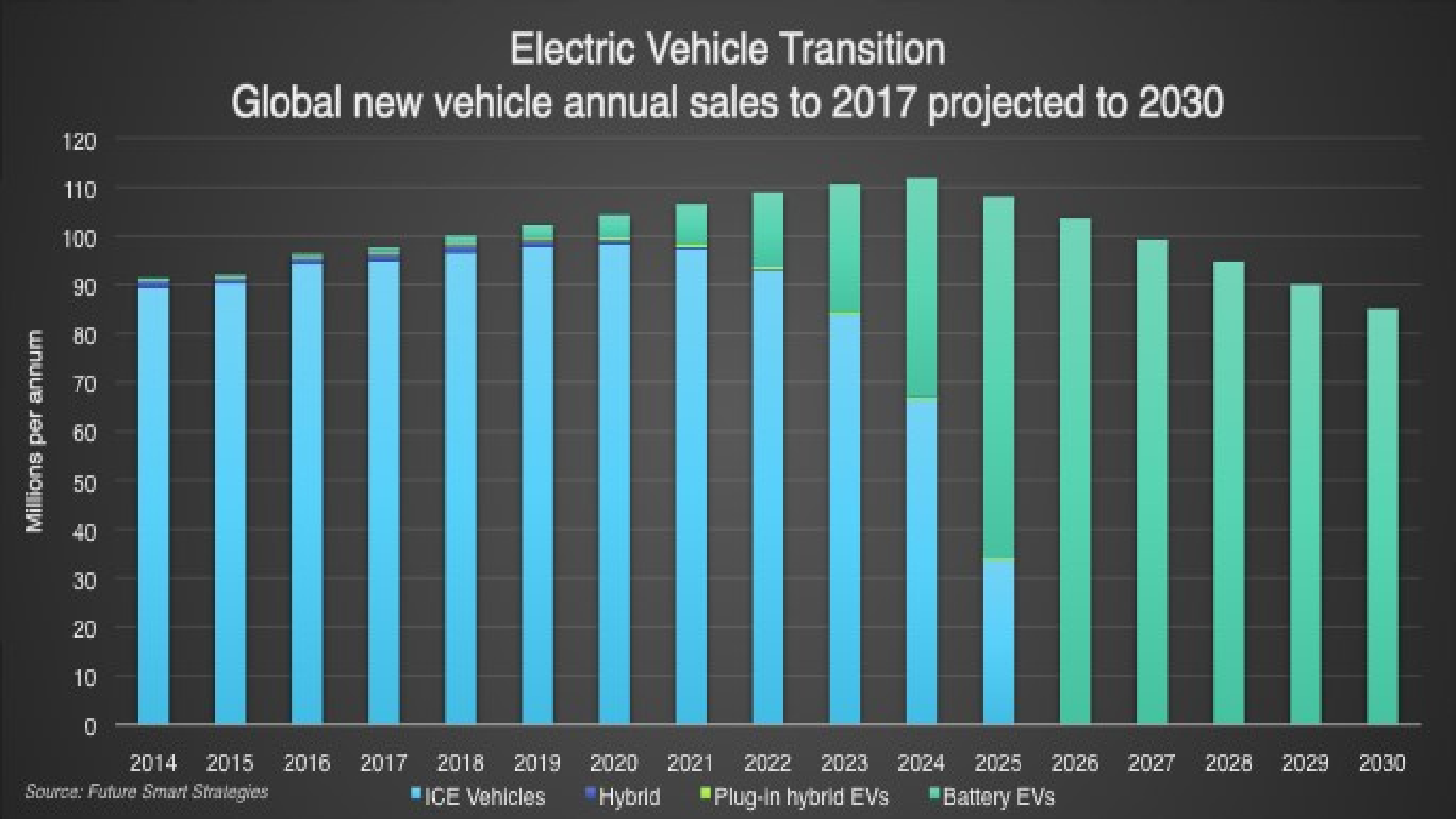
Battery growth as cost drops….



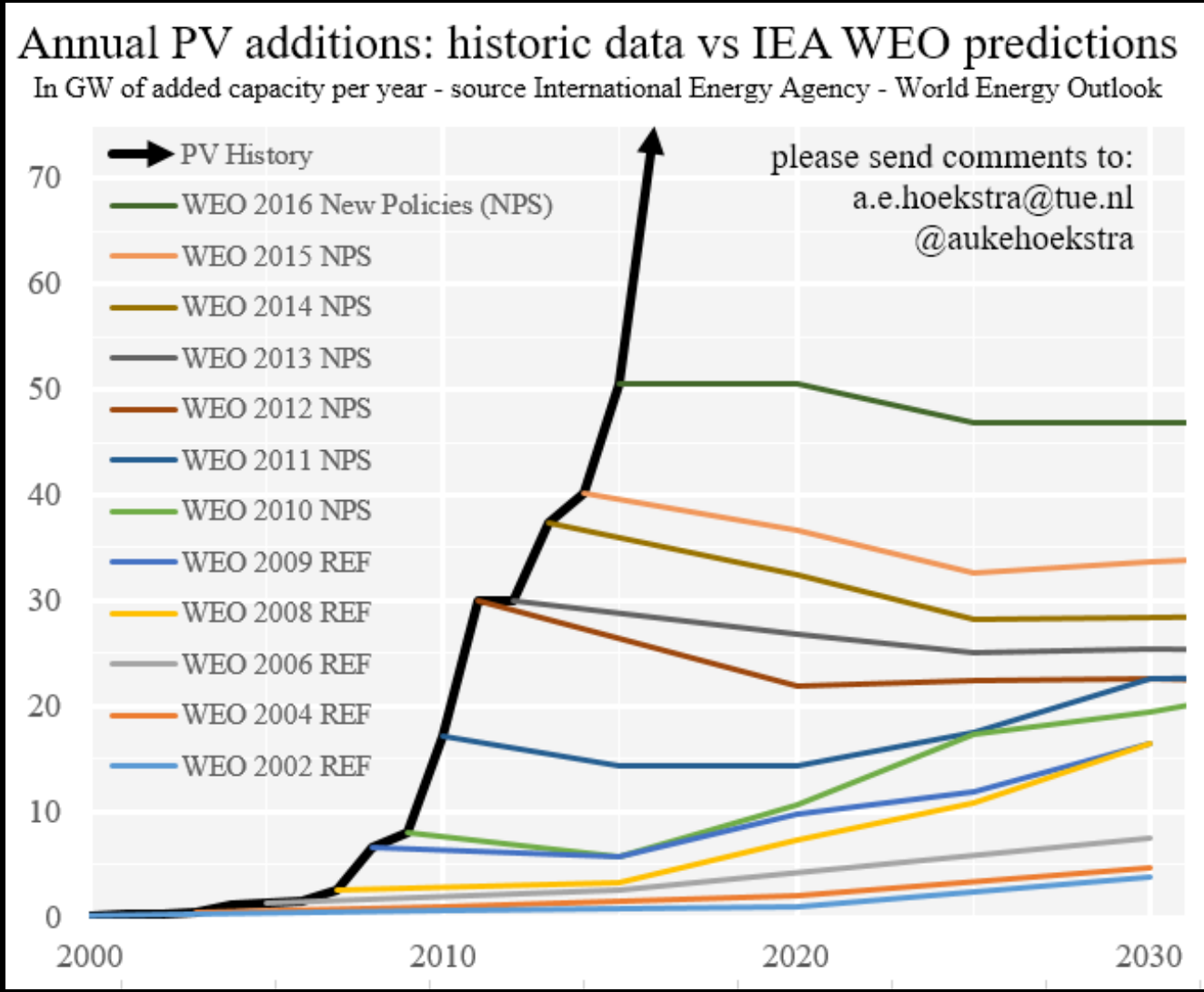
Electric vehicles are growing globally at over 40% per year …

Honda Zero Carbon Home

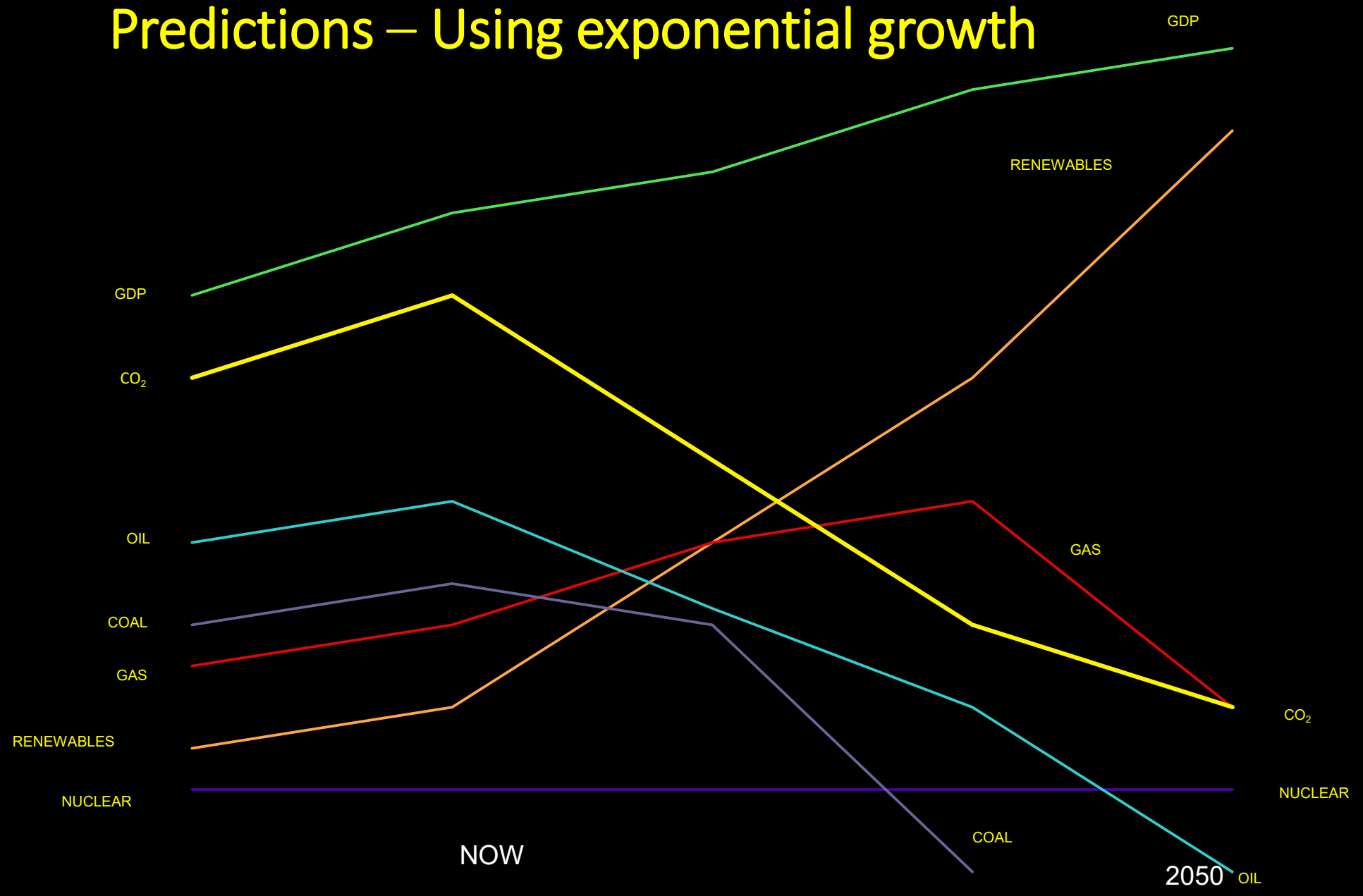


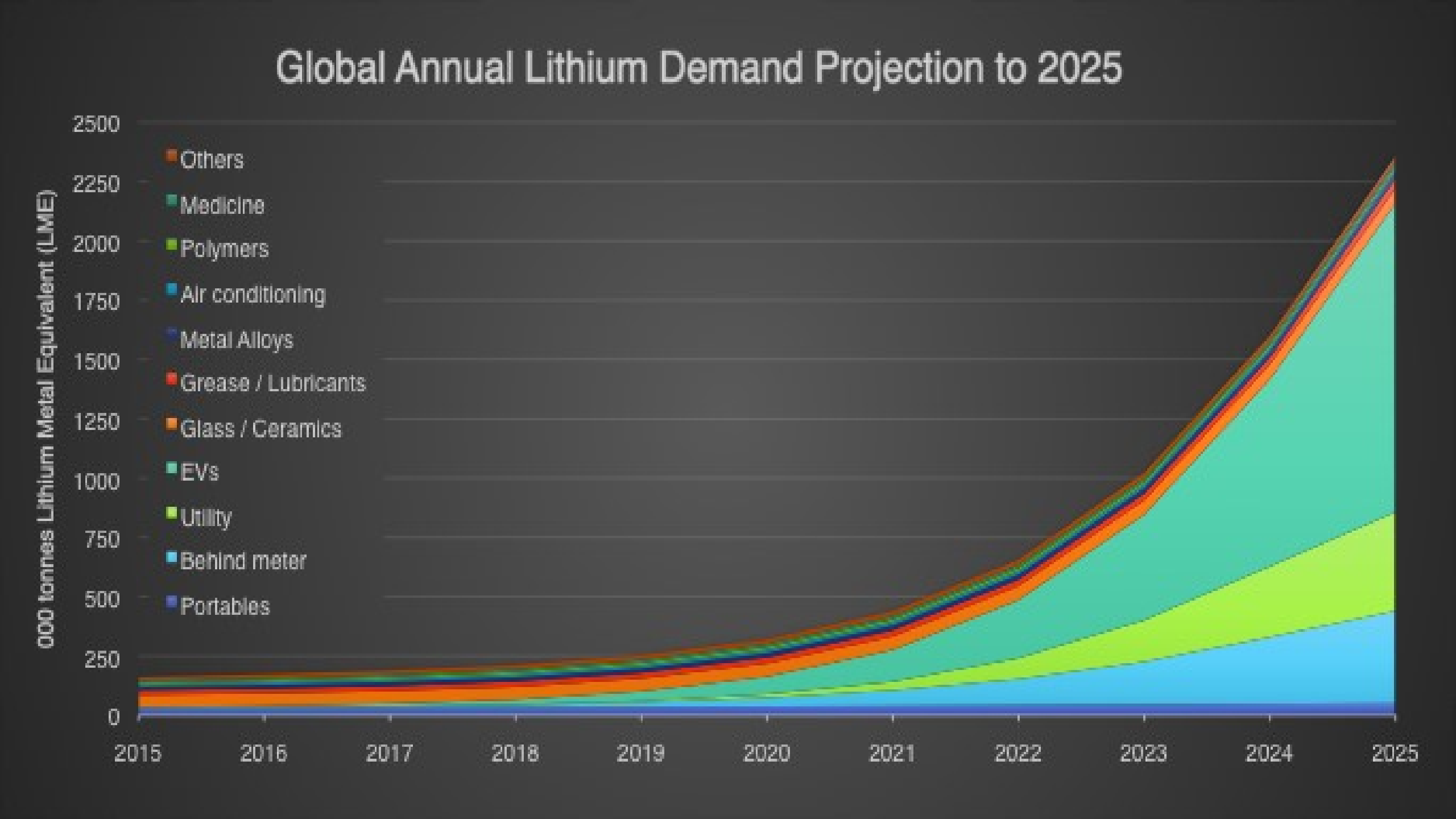

Electric Vehicle Transition
Global new vehicle annual sales to 2017 projected to 2030
Millions per annum
120
110
100
90
80
70
60
50
40
30
20
10
0
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Source: Future Smart Strategies
ICE Vehicles
Hybrid
Plug-in hybrid EVs
Battery EVs

Disruption defies projection modelling…



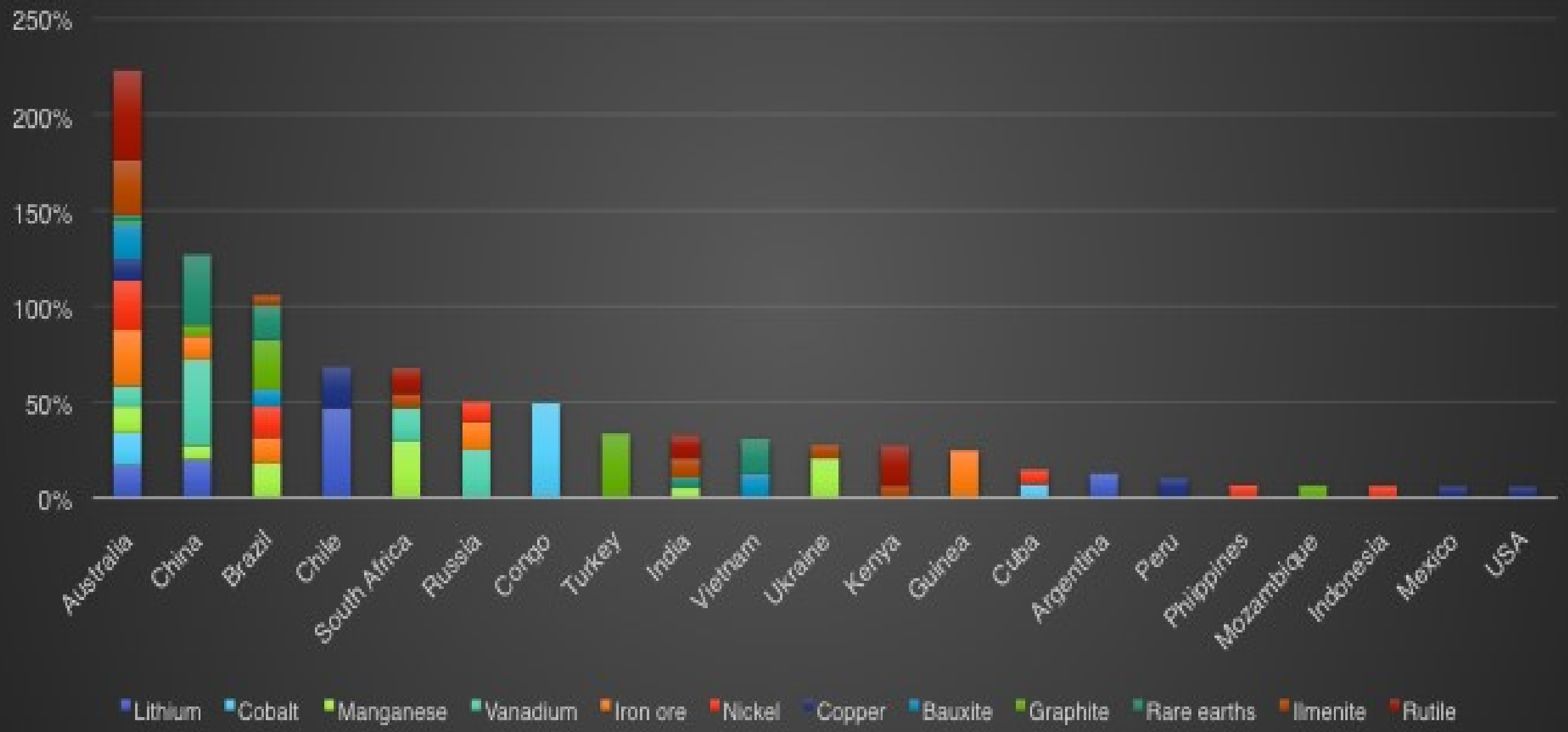
Predictions – Using exponential growth




Global Annual Lithium Demand Projection to 2025
000 tonnes Lithium Metal Equivalent (LME)
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
Others
Medicine
Polymers
Air conditioning
Metal Alloys
Grease / Lubricants
Glass / Ceramics
EVs
Utility
Behind meter
Portables
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025

Will we run out of Lithium and other battery minerals?

Country reserves of key battery materials as a percentage of known global reserves



The New Energy economy needs metals…

Australia has a big role…

Photo: NASA

How we are taking this seriously….
Lithium Valley:

To become the California of the New Energy Economy

Curtin University

What is *not* disruptive innovation?

Autonomous vehicles and Big Data

- Clever technology but not making better cities
- Probably little change to the system
- Autonomous vehicles could just extend car dependence and sprawl…

Autonomous vehicles take up the same 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

Autonomous transit technology is being applied to buses, trains and for local shared mobility – this is transformative….

- Immediate Trackless Trams in every poorly serviced corridor
- Make trains operate at 100,000 passengers per hour due to superior signaling
- Local shared electric bikes and AV-Shuttles

So how do we plan for these disruptive transit technologies?

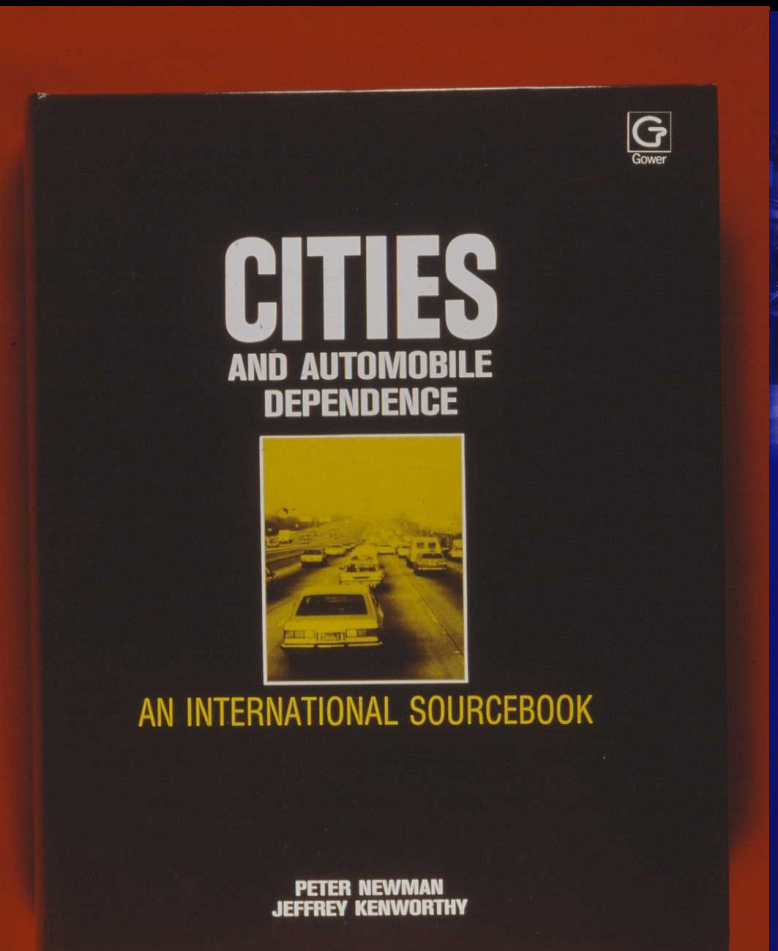
What parts of the city do they work in best?

5. Can the Theory of Urban Fabrics help?

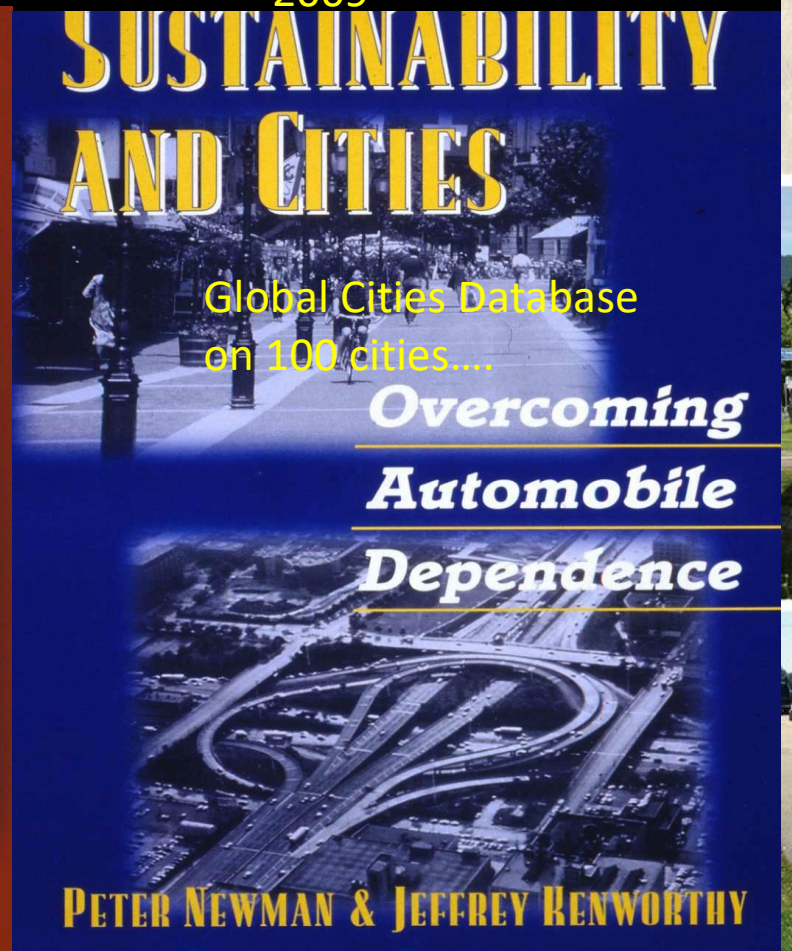
The Rise and Fall of an Empire – a Trilogy

The theory emerged….

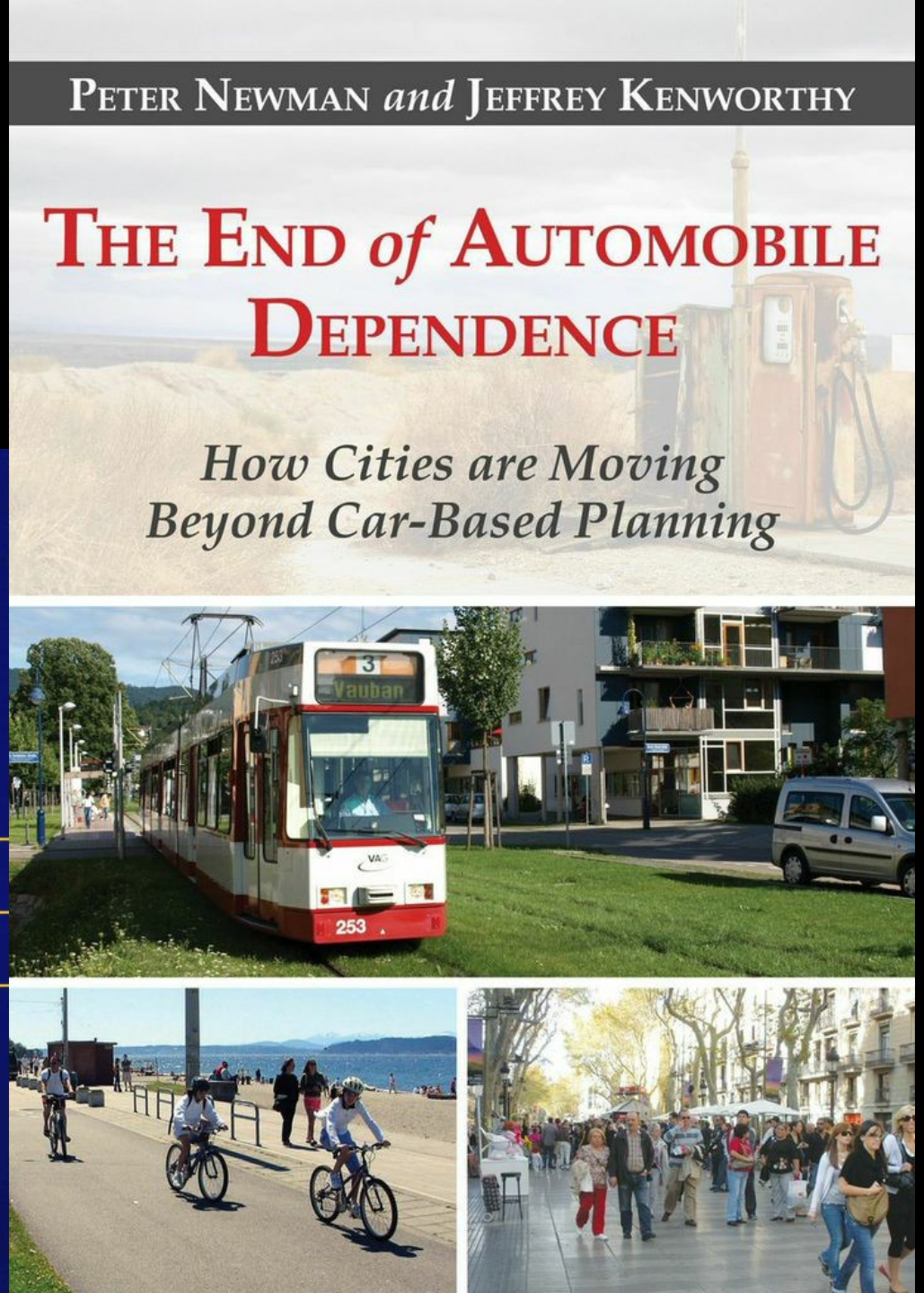
1989



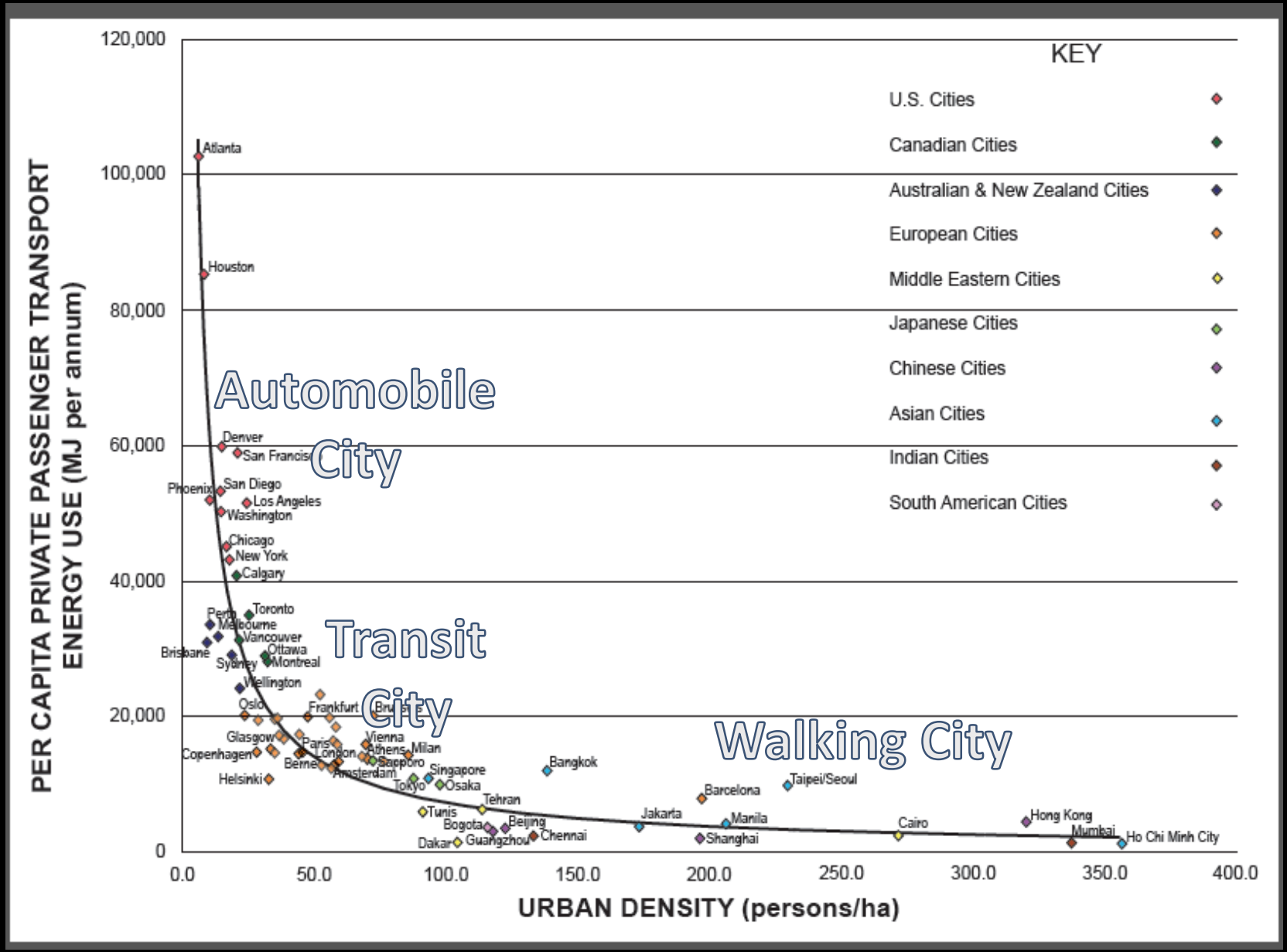
2009



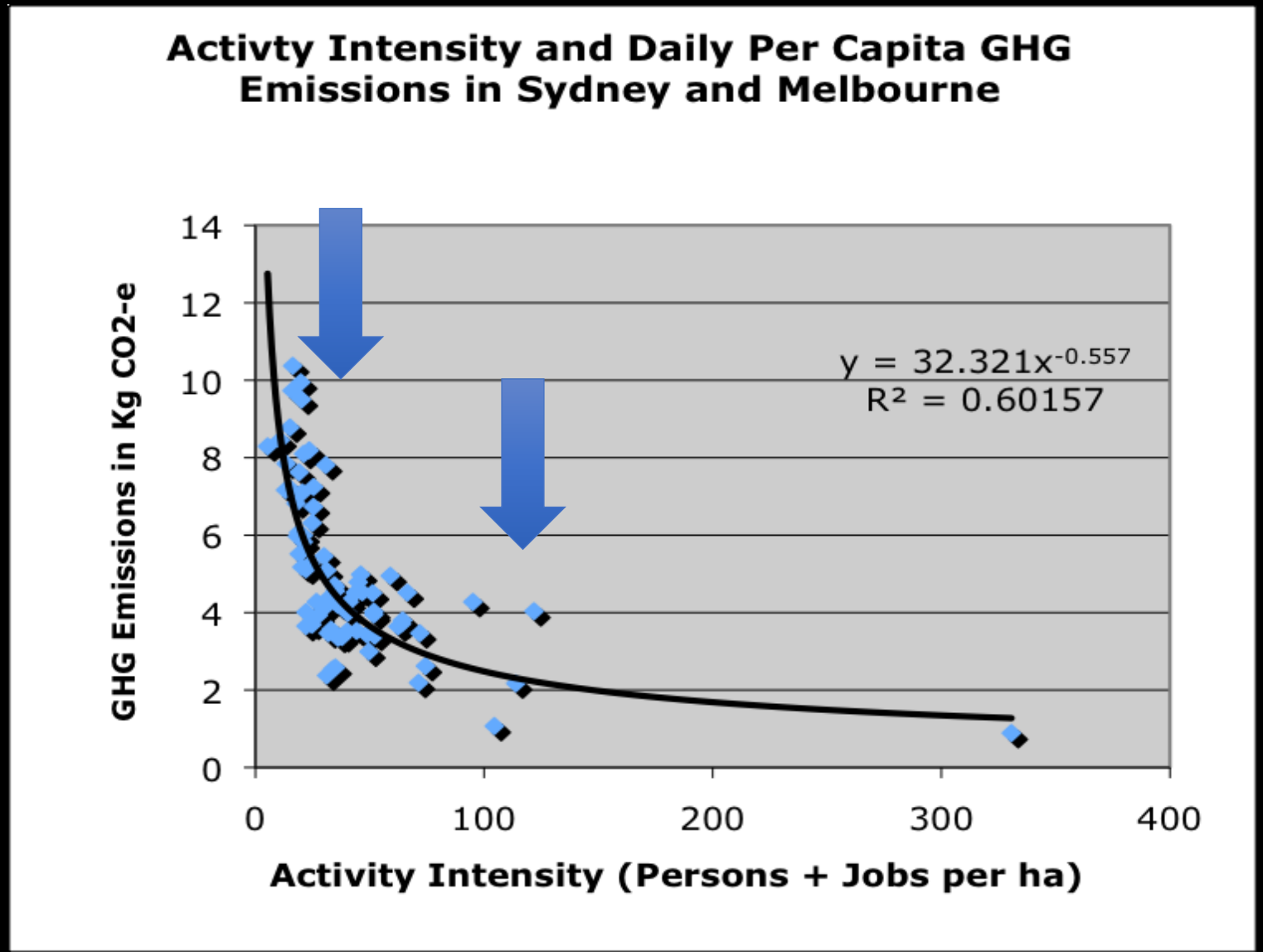
2015



Transport and density shape the city…there seemed to be three different city types

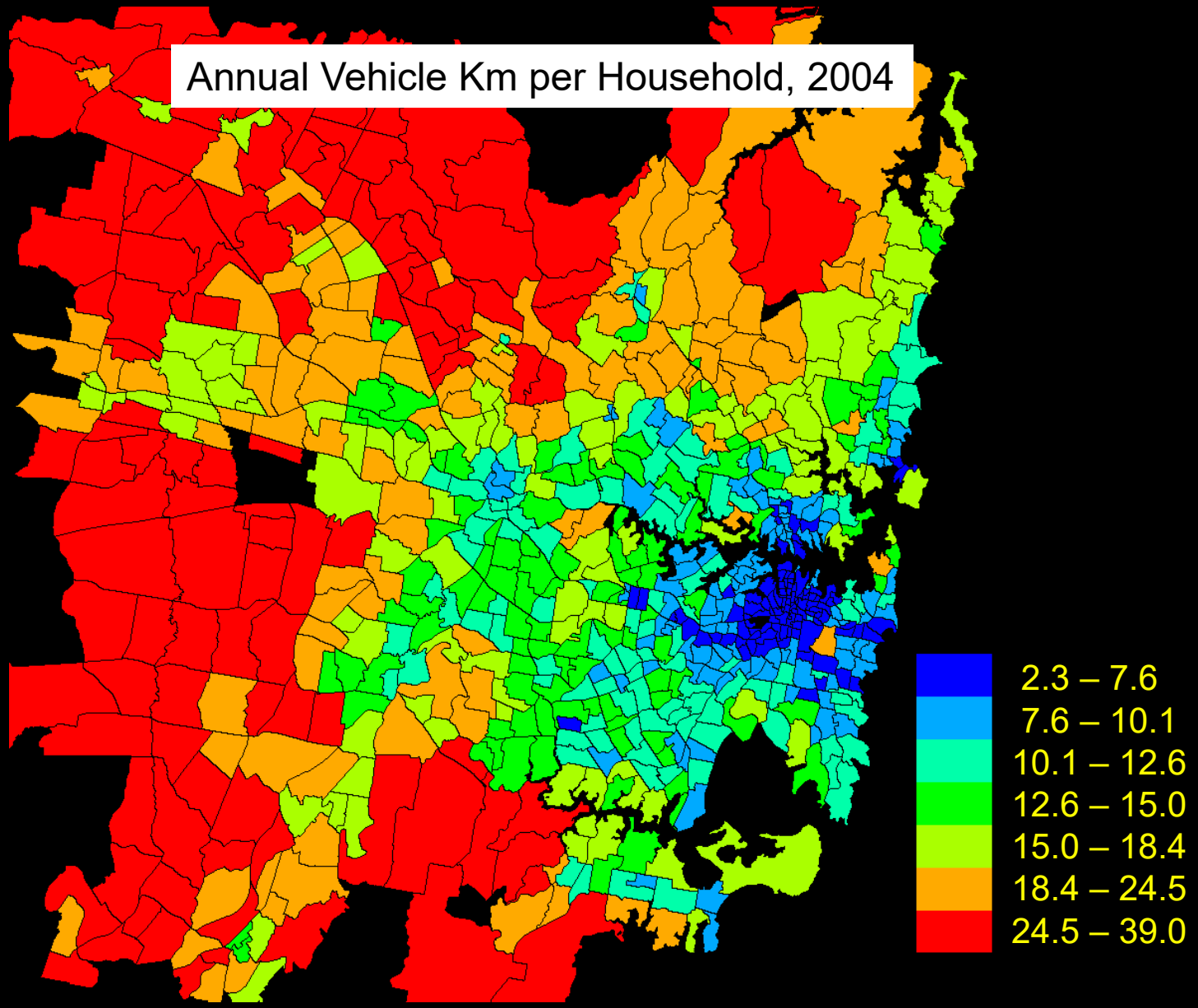


Different parts of the city have very different transport fuel use….three different cities inside also



Sydney….three different cities

Outer suburbs residents, particularly those away from rail lines, drive much more than inner suburbs residents.

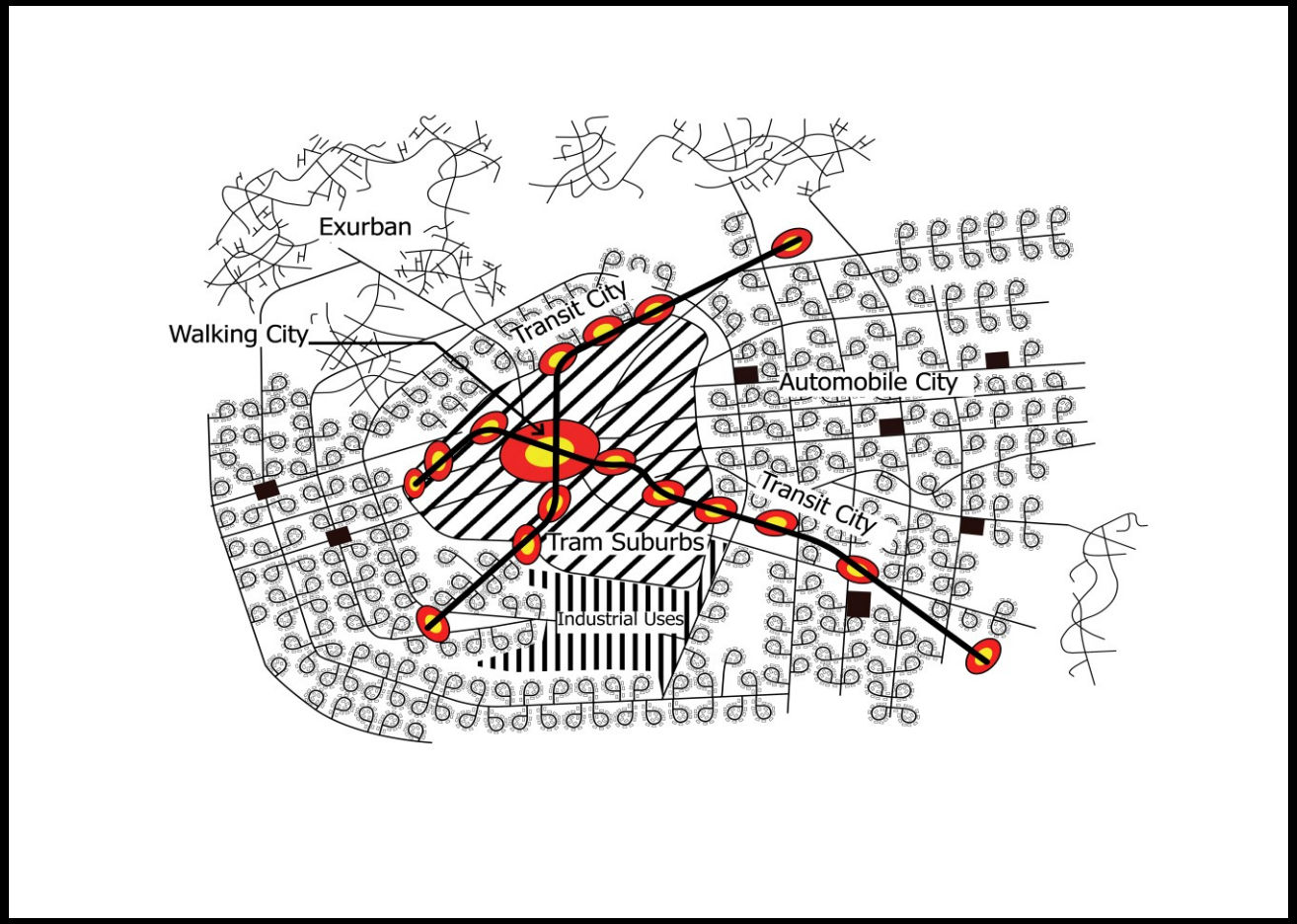


Enter the Finn…..Leo Kosonen
30 years applying the ‘theory’ in Kuopio

Newman, Kosonen and Kenworthy (2016)
The Theory of Urban Fabrics,
Town Planning Reviews 87(4):429-458
doi:10.3828/tpr.2016.28

Architecture and planning took a wrong turn when Le Corbusier and CIMM created ‘modernism’….Clean up the old and create a future around cars with buildings in space that did not relate to the street….

Theory of urban fabrics – three cities exist in all cities. Need to respect and rejuvenate all three…



Walking City Fabric

Tram city fabric

Train City Fabric

Bossley Park

Automobile City Fabric

New estates hugging the freeway – big homes, no trees, not much permaculture, possibly PV's…

How do such places regenerate?

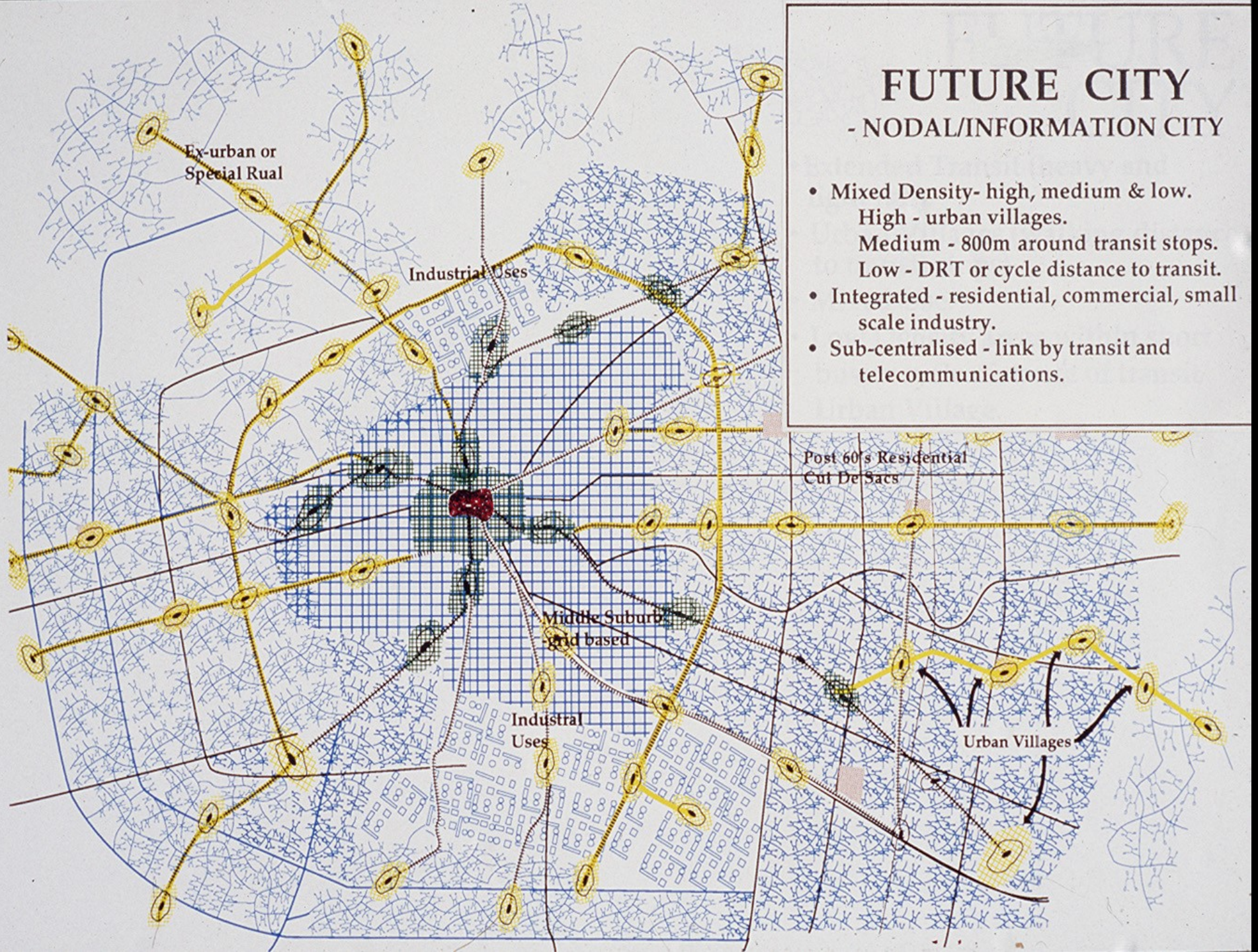
Most now want ‘Rail’ Transit Fabric……. With walkable centres

How do you get it?

FUTURE CITY

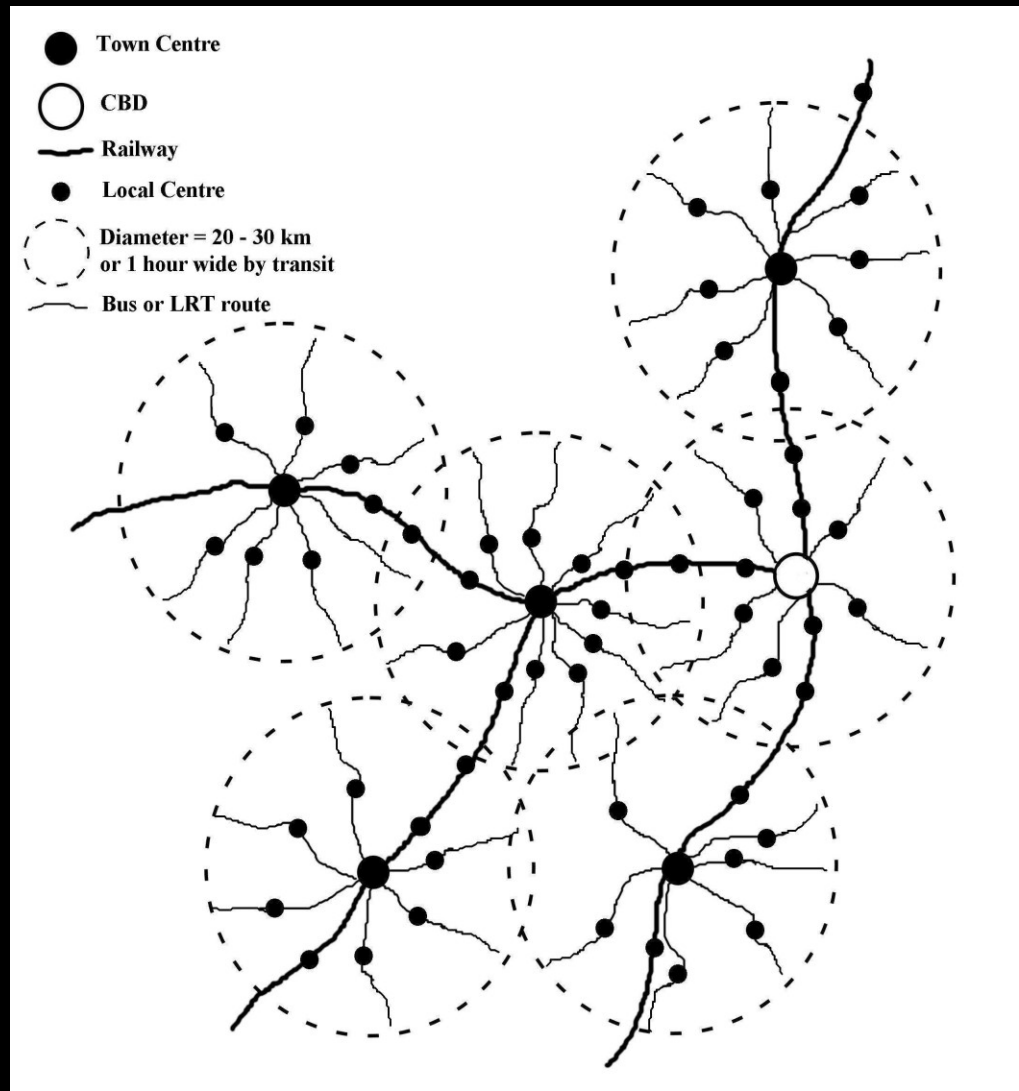
- NODAL/INFORMATION CITY

- Mixed Density- high, medium & low.
  High - urban villages.
  Medium - 800m around transit stops.
  Low - DRT or cycle distance to transit.
- Integrated - residential, commercial, small scale industry.
- Sub-centralised - link by transit and telecommunications.



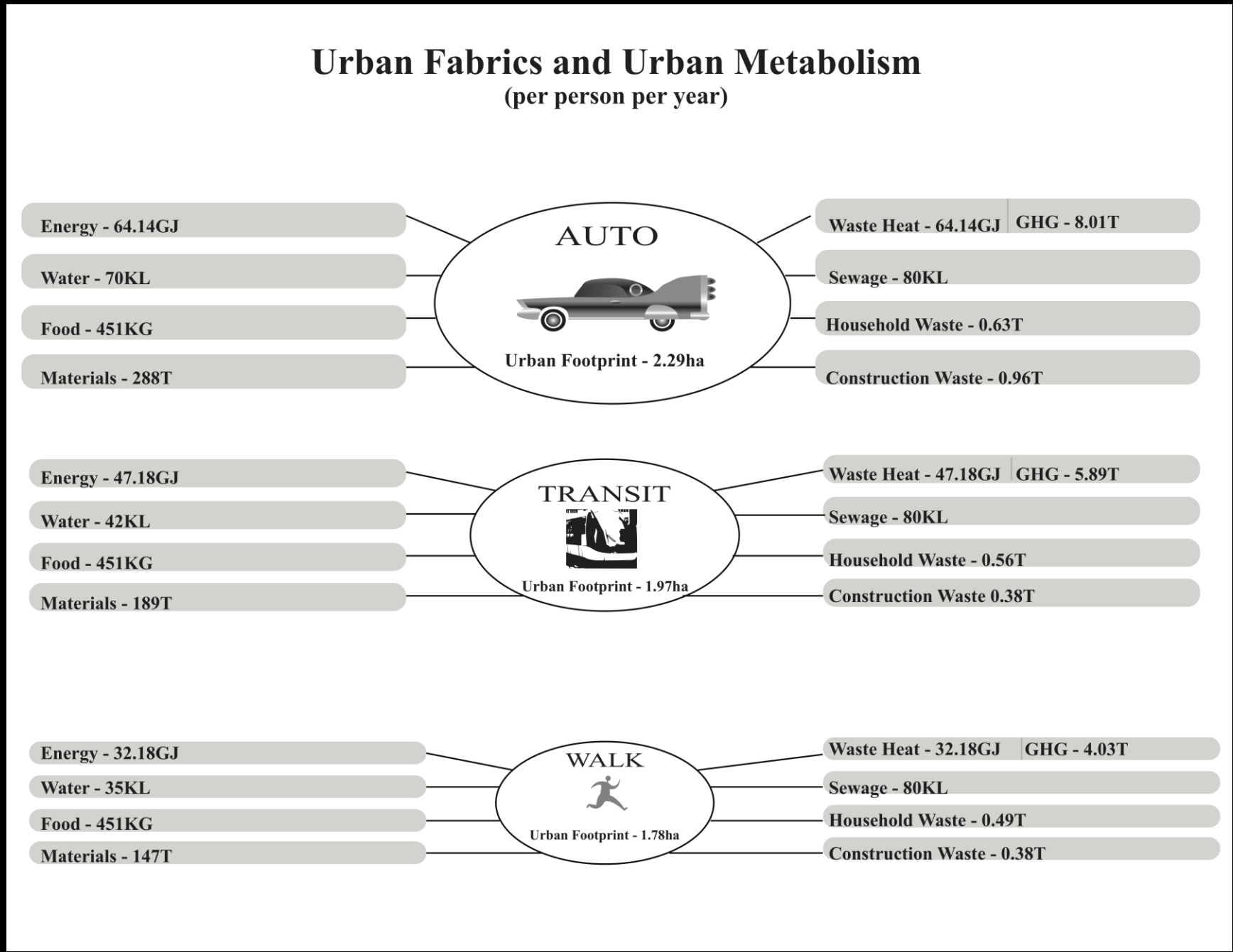
The future city will also be shaped by transport priorities…

- Walkable CBD
- Transit Corridors with CENTRES linked like pearls on a string…
- LOCAL AV-EV shuttles feeding into centres.
- Middle and inner CONNECTORS by Trackless Trams creating new walkable sub centres



Disruptive technology meets urban planning

Thomson G and Newman P 2018 Urban Fabrics and Urban Metabolism: From Sustainable to Regenerative Cities, **Resources, Conservation and Recycling,** 132: 218-229



Regenerating the walking city…

Respect for the walking city…

22 cities have removed freeways…

Cheonggyecheon River in Seoul,
buried under freeway

Curtin University

2003

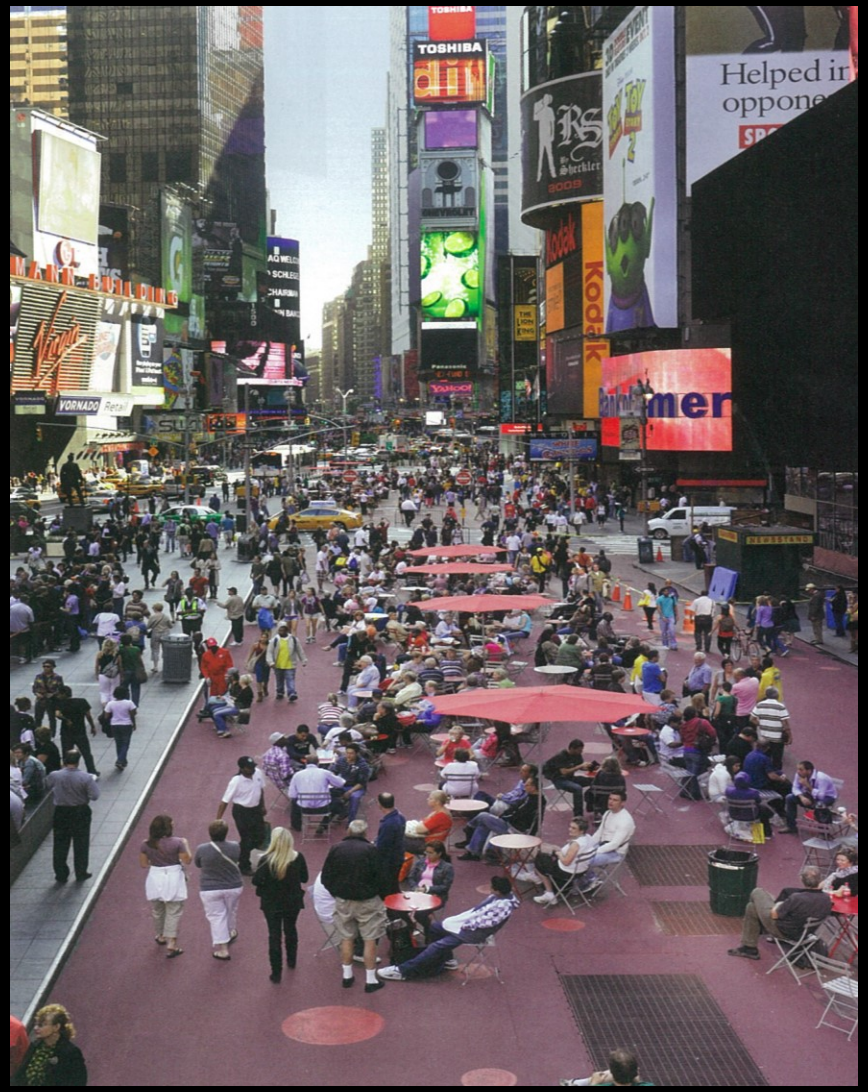
Not only has the greenway become a well-loved part of the city, it has proven to benefit the city in many different ways. The temperature of the inner city has dropped several degrees, and birds, fish and other wildlife have returned to the urban core. Also, since the freeways were removed, fewer people are driving into the city, choosing to take public transit or other options.

‘Cheonggyecheon – symbol of the green economy’

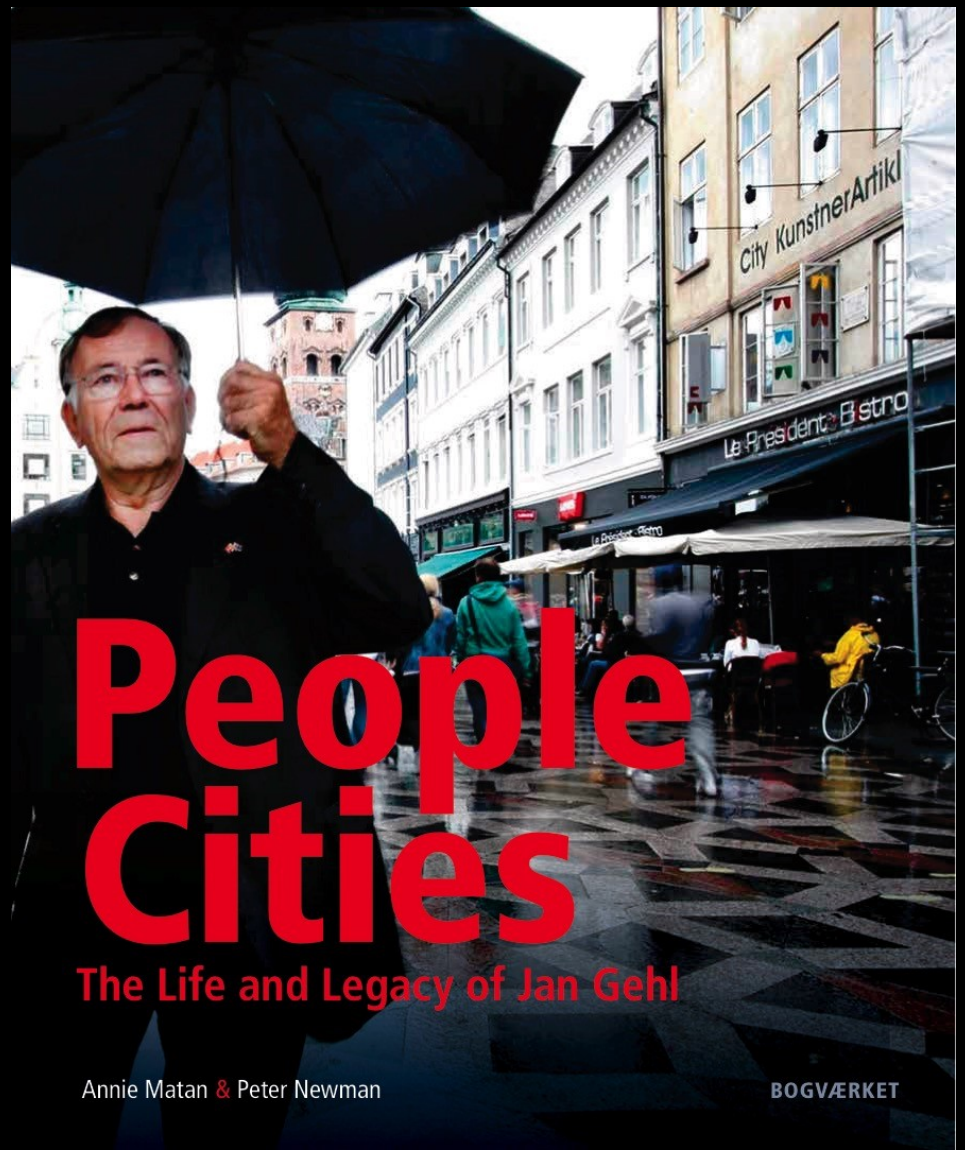
President Lee

The traffic just disappeared….

New York City transformation



The attractions of dense urbanism in walkable TOD's….



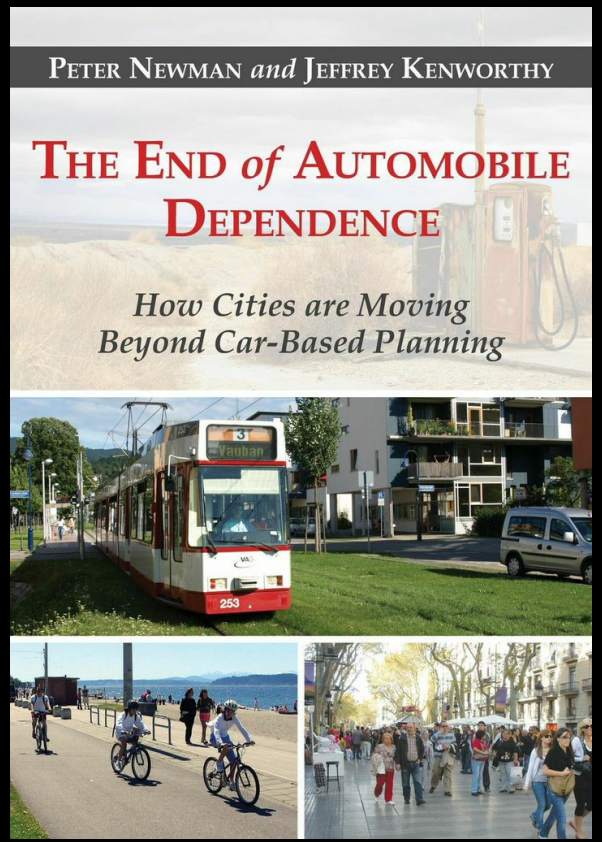
Rejuvenating Copenhagen…by reducing demand for cars.
30 year campaign to create people-oriented streets.
Reduced car parking 2%/year

Economic and social attractions of walkable urban design...each step saves large amounts of carbon emissions

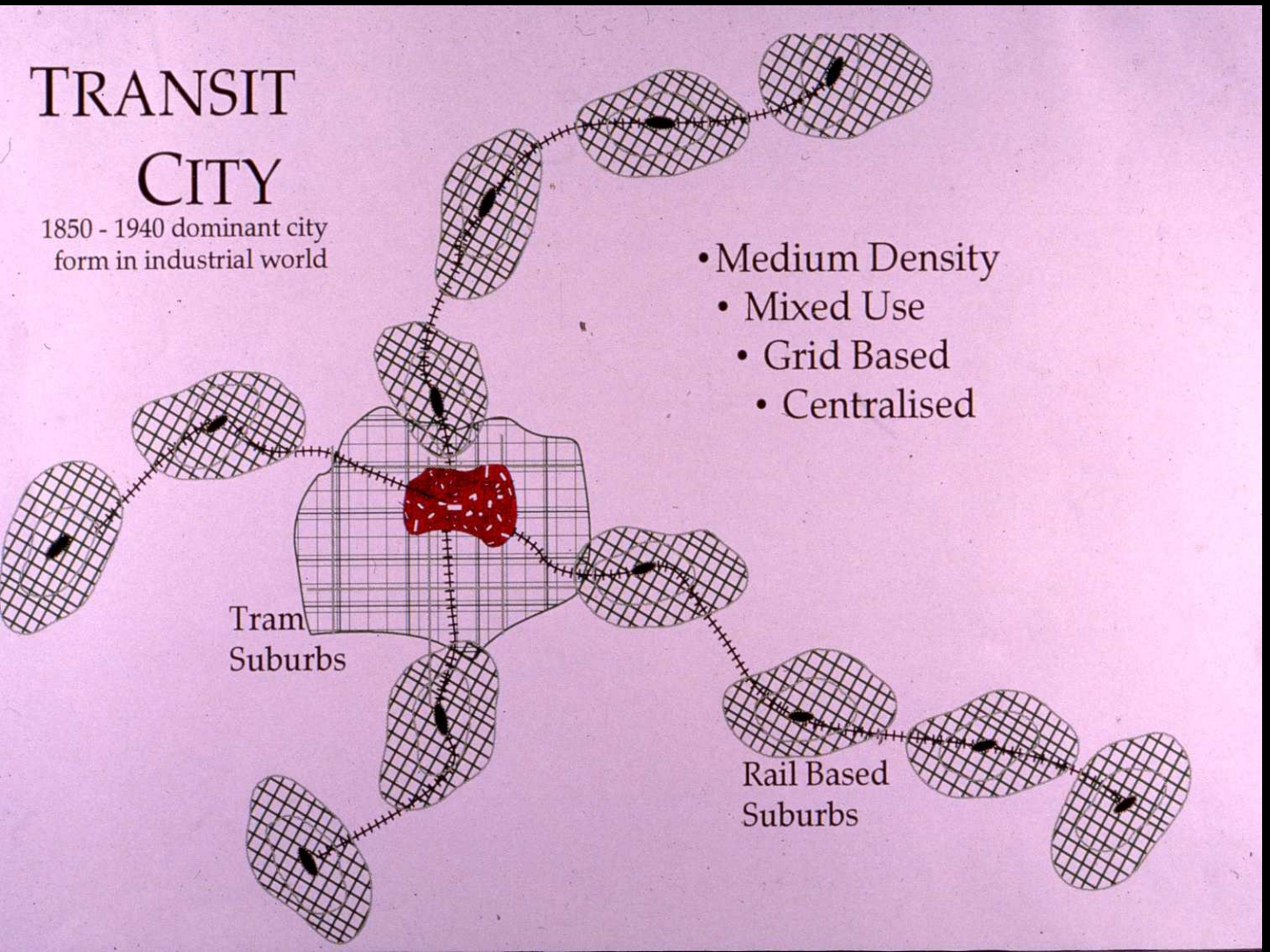
Ed Glaiser and Richard Florida were right…

The top 6 most walkable cities in the US have 38% higher GDP.

70% of knowledge economy workers in Boston live in walkable areas.



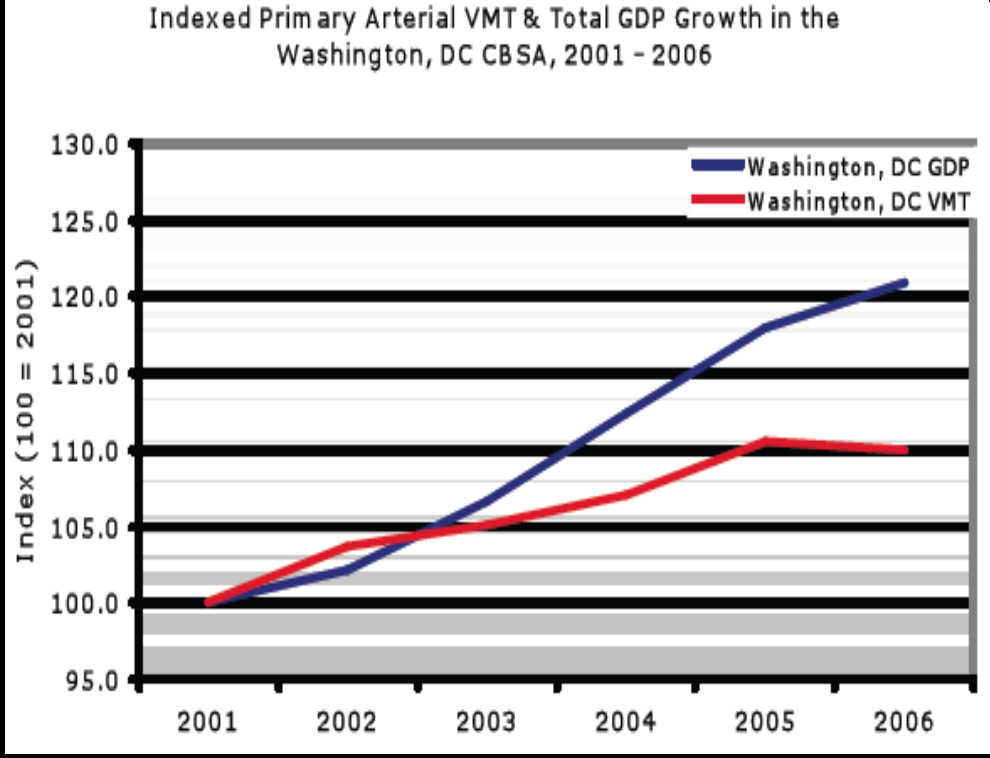
Rejuvenating the Transit City

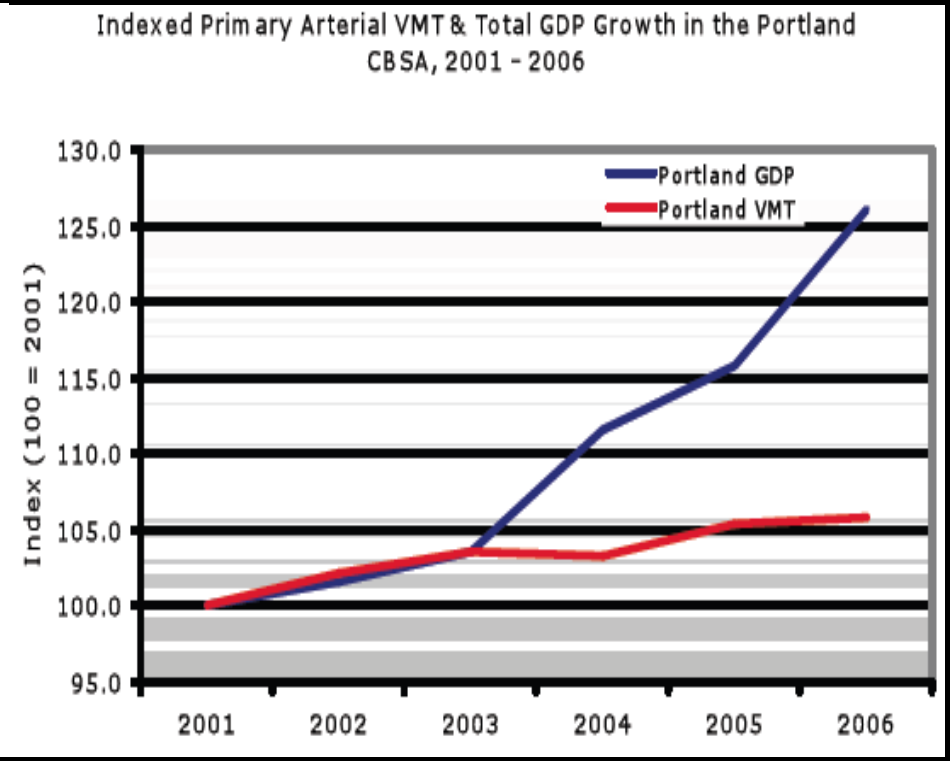


Tysons Corner – four TODs replacing an Edge City car-based development, one heavy rail line and two light rail lines…

TYSONS

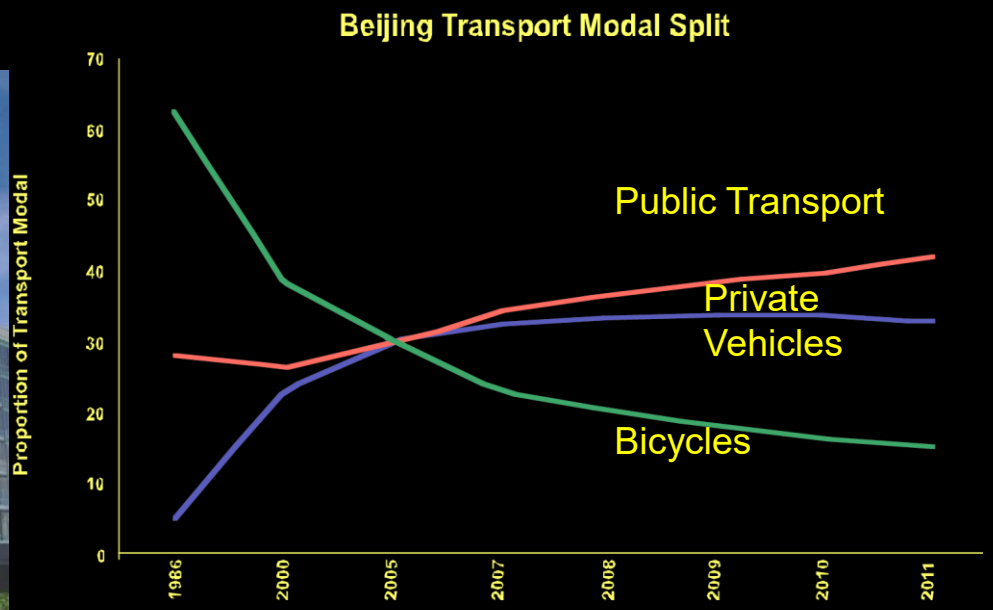
Core issue is decoupling wealth from car use…mostly in the cities with rail investment and great centres, eg Washington DC and Portland





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



TRACKLESS TRAM – EV

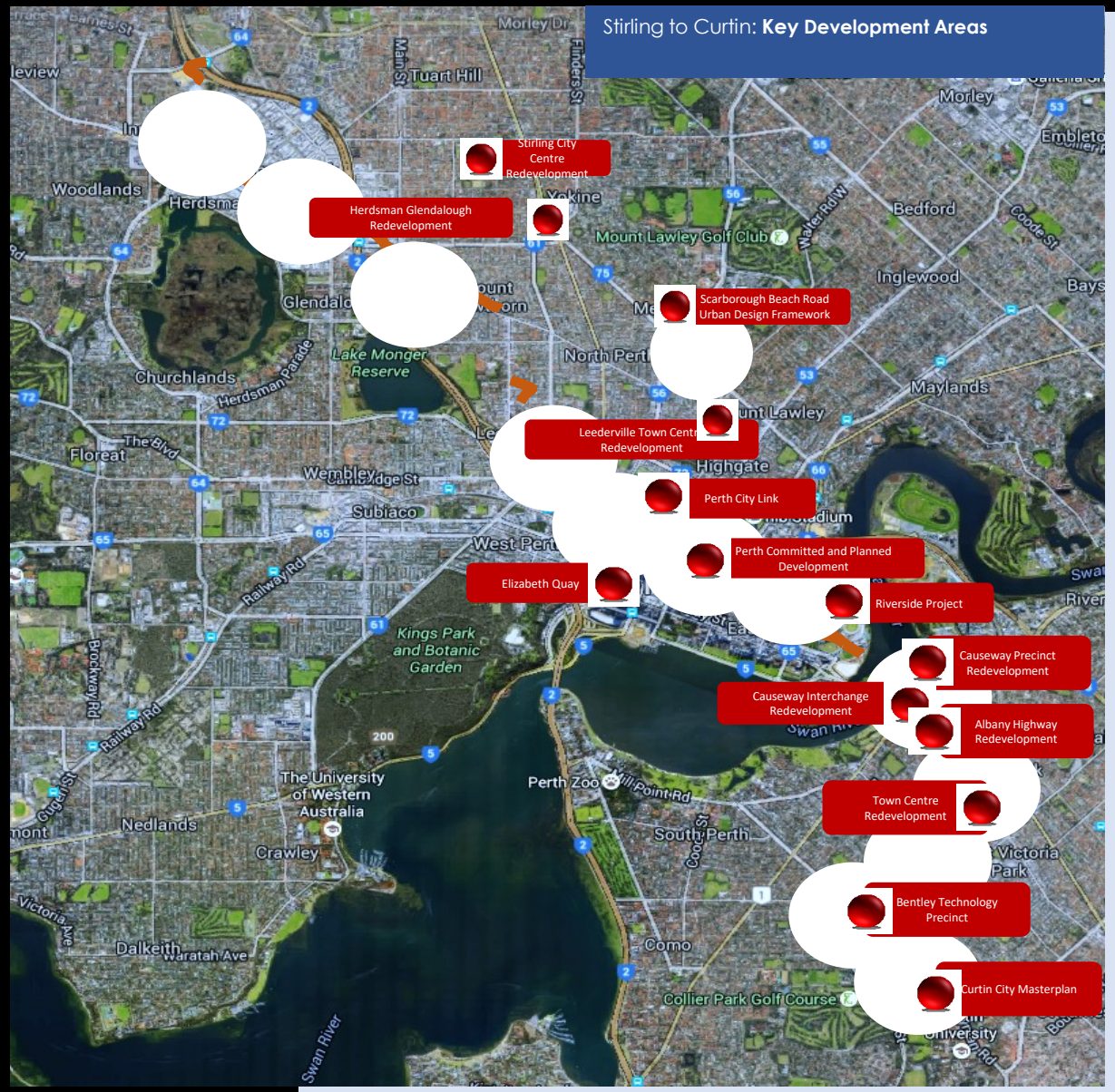
https://www.youtube.com/watch?v=bXB87NWHvDg

Electric and cheap as no tracks.
70 kph carries 300 people

COST is 1/10th of
Light Rail
and
No Disruption
in construction

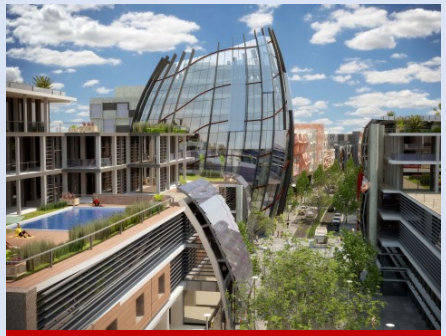
MOTOROLA
USB

FUNDING?
TRANSIT ACTIVATED CORRIDOR…. paying for train from land development.



Stirling City Centre

Riverside Project



Bentley Technology Precinct

FEBRUARY 2016

ENTREPRENEUR RAIL MODEL

A DISCUSSION PAPER

Tapping Private Investment for New Urban Rail

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

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

From TFL to LFT….

Characteristics of transit systems

The table summarises the key characteristics of Bus Rapid Transit (BRT), Light Rail Transit (LRT) and Autonomous Rail Transit (ART, or trackless tram) systems.

Characteristic	BRT	LRT	ART
Speed and capacity	✓	✓✓	✓✓
Ride quality	✗	✓✓	✓✓
Land development potential	✗	✓✓	✓✓
Cost	✓	✗	✓
Disruption to services and local economy in construction period	✓	✗	✓✓
Implementation time	✓	✗	✓
Overall	✓	✓✓	✓✓✓

Source: Author provided

Automobile City needs

- Respect for freight-related activity and manufacturing areas, the consumption economy. BUT…..
- Fast rail in each corridor to go around the slow freeways and highways….efficiently. Metros and Trackless Trams…
- Shopping centres into city centres. Polycentric city.
- Electric buses, bikes, EV’s and AV’s to enable the local linkages….

Imagine the Possibilities

Transformation of a city…

6. What are the areas in climate change policy that still need big changes?

The industry systems that lead

- Solar-batteries-blockchain systems applied to shared housing, utilities and businesses
- Smart technologies applied to energy savings and renewables
- Niche biofuel products…eg Brazil.

The industry systems that are laggards:

- International Transport and Freight – trucks, ships, planes.
- Industrial production of cement and steel.
- Processing of metals from minerals to quality purified products.
- LNG…..no longer able to hide as better than coal.

The Land Systems all needing to regenerate…as carbon sinks

- Bioregional and Peri-urban Systems – natural processes around and in cities. Biophilics, WSUD, waste recycling, recreational and natural ecosystems.
- Agricultural Systems – farming, esp livestock.
- Pastoral Systems – grazing natural bush.
- Forestry Systems – native forests and plantations.
- Agroforestry Systems – plantations on farms.
- Marine and River Fishing Systems
- Coastal Systems – land-water interface
- Natural Systems – managed just for their biodiversity and ecosystem health.

Boulder: bioregional and local community strategic planning. Now the US ‘most desired city’ to live in.

Gondwana Links Project – regenerating a songline

Carbon Neutral funding from the city

Saving forests and saving carbon…

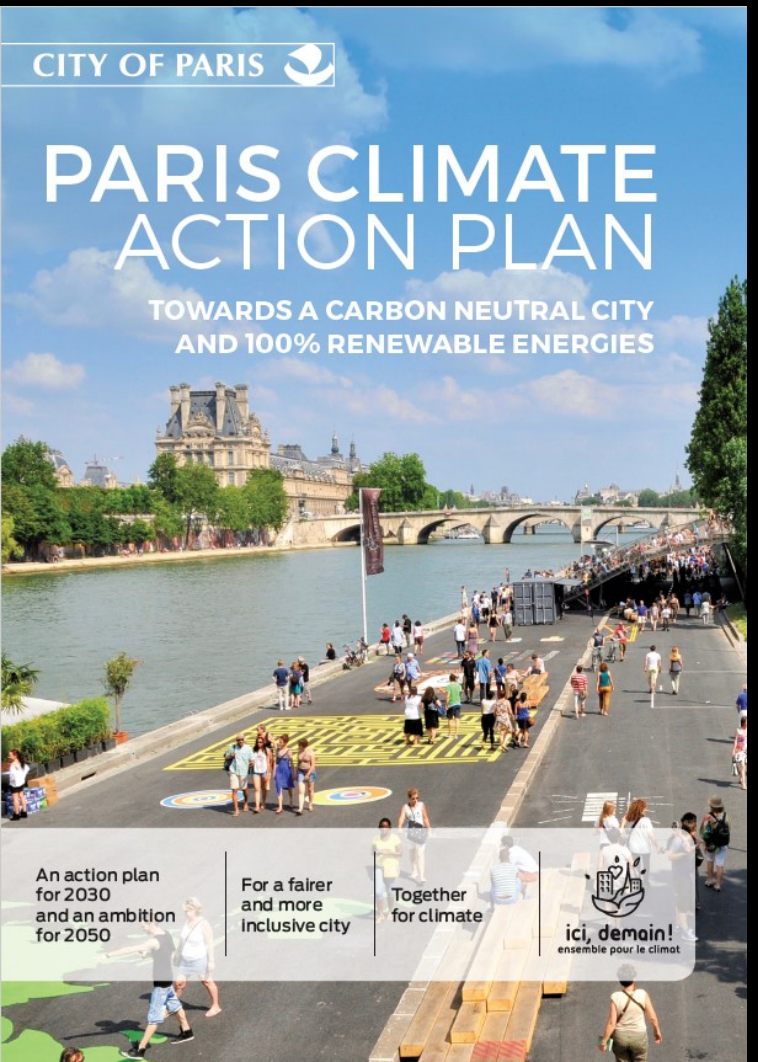
Oil Mallees – burying carbon and rebuilding the landscape…improves agricultural productivity

Oil Mallee ASSOCIATION

Why not make cities into carbon sinks….

Next we will begin to work on songlines in the city….planting them as carbon sinks

Cities and organiztions can become carbon neutral and rebuild their bioregional fabric….

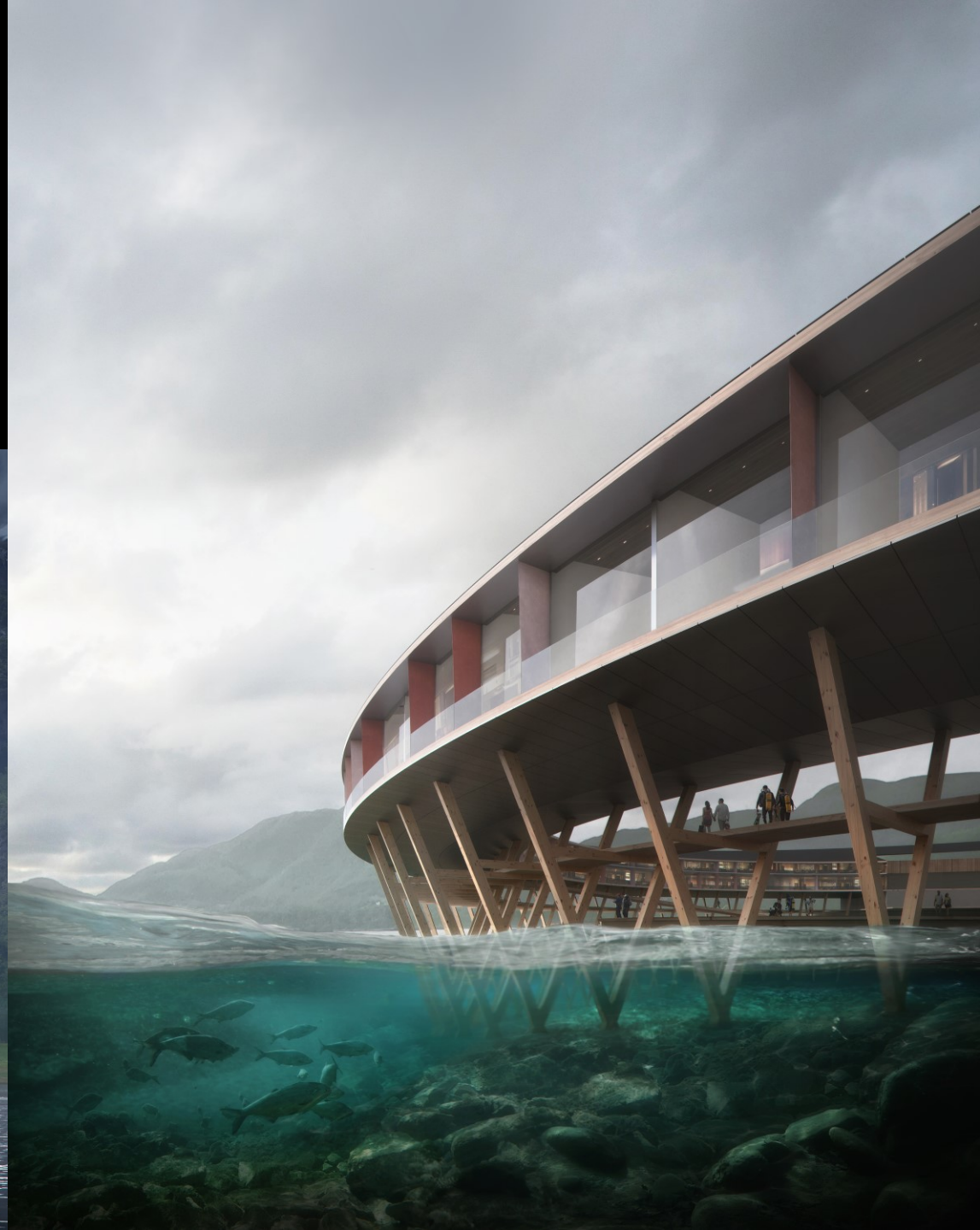


Oslo – city and its bioregion…

And into the Deep North…where zero carbon demonstrations are easy…

Adaptation and mitigation are united…and are now being scaled up to a city….SPARK

Geir Nystrand MISIR



Innovations in cooling the planet that lead to a better future can be done anywhere….this is the **hope** that we can give our grandchildren.