Land System Pathway for Localized Carbon Emissions Mitigation by Architects, and Its Potential for PDE

by

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Public Health, Safety, and Welfare: Reframing the Role of Architects & Design Professionals

Saturday, June 28, 2014

CHICAIAGO!

AIA Convention 2014
June 26–28, Chicago

AIA

Architects, Planners and Health Professionals Collaborating to Promote Public Health, Safety, and Welfare

October 2014 DE/MD Conference of American Planning Association, Newark, DE

Land System Mitigation of Climate Change

…and Licensed Architects

“Architects Pollute”

-headline, 2003 Metropolis (New York architectural magazine)

Architect's Work:

less spaceship, more planet-like:

Shift focus from primarily technology (lightbulbs, cars, appliances, buildings)

to making natural processes visible in daily life routines…
connect human behavior to carbon outcome—and transformation.

50% Sprawl

Declining US density:
Outward expansion 50%
faster than population expansion

negates efficiency gains

Settlement, Infrastructure & Spaitial Planning

+

Non-carbon energy

"Climate action plans…largely focused on energy efficiency, rather than broader land-use planning strategies…to reduce sprawl and promote transit-oriented development." –IPCC 2014

Ditto --US National Climate Estimate 2014

21st c Architecture:

Carbon-Neutral Urbanism

Land system investment + Efficiency + Decarbonization of energy (RE) + Urban ecology + Social co-benefits + Resiliency =

Safe Operating Space

to protect the
public health, safety and welfare

Ecological Urbanism + Resiliency + Efficiency = Biopolis

Grow a complex, adaptive self-organizing, self-reliant "scale-free network"

mimic natural systems

integrated habitat

Delink Urbanization from Motorization

Walking & Staying-in public space revolution.

Rediscover Public Realm Quality

Street Scale

-scale-up: economies at scale
-most opportunity for carbon mitigation is in public infrastructure
-avoid carbon-infrastructure lock-in
-thermal capacity, albedo, dry, dead
-observe behavior/lifestyle change
-quality of life change— “progress”

Window of **Opportunity**

Next 20 years before Infrastructure lock-in:

- High fixed costs
- Increasing returns
- Network externalities
- Long lifespan
- Political resistance

The Great Lock-in

By 2030 **900 Billion** SF
new & rebuilt buildings worldwide

Build wrong, locks-in carbon
Build right, locks-in carbon-neutral

80 yrs buildings, global aver life

120 yrs infrastructure aver life

Less Demand & RE Mix

By 2030, **40-90%** of emissions reductions through energy demand savings. -IPCC

Small remaining demand permits flexible **RE** supply for last **10%**.

Flexible RE Portfolio

"The projected deployment of renewable energy technologies is **well within** estimated global technical potentials."

"In 2050 Global technical potentials for wind, solar, geothermal & ocean are often **more than an order of magnitude larger** the the projected deployment." -- IPCC (7/558)

Land system investment
&
RE pay for themselves

…and then
co-benefits pay for themselves again.

Proof-of-Concept:

Between 2005 and 2013 US added

20 Billion SF to building stock yet

total emissions are **LOWER**

from only low-hanging efficiency.

More efficient stock saved

16.8 Quadrillion Btu
(energy of 620 power plants)

$560 Billion avoided by 2014
$4.61 Trillion avoided by 2030
(EIA projection)

Best Available Technology

avoid **ANOTHER 6-7 Quads** and
another **$1.94 Trillion** energy costs

total potential saving by 2030
using “best available technology”

$6.55 Trillion

Carbon Neutral
Is
New Norm
in Architecture

US is de-carbonizing:

2007 US Energy Independence and Security Act

Fossil Fuel Reduction Schedule for federal buildings (Sect 433):

65% 2015

80% 2020

90% 2025

100% 2030 non-carbon energy

Federal projects 100% non-carbon energy by 2020

President Obama EO #13514

"Net-Zero Energy is the New Normal"

--NESEA , 2015

California

Zero Net Energy

(8th largest economy in world)

Zero net Energy by code

ALL residential by 2020

commercial by 2030

Tipping Point: Does US Architect Licensure now require carbon neutral building as the legal "standard of care" to protect the public health, safety, welfare in the era of climate change?

http://www.intechopen.com/source/html/18723/media/image6.jpeg

Why We Need To Do This

Public Demand

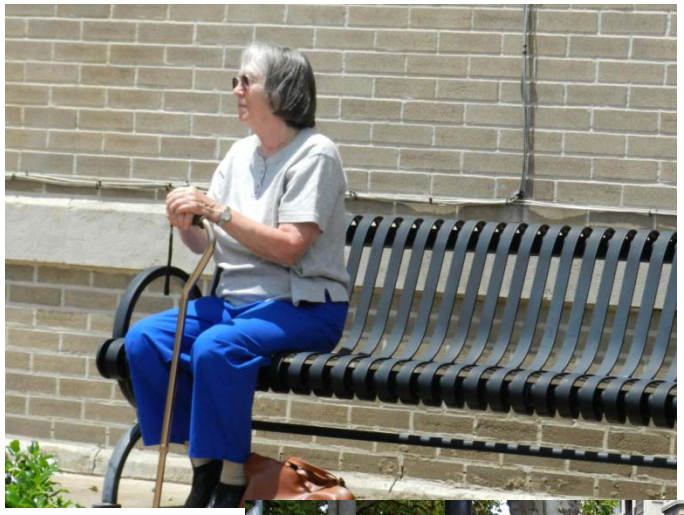

Photo credits: morguefile.com

Boomers & Millennials:

- Both want: compact, walkable, tree-lined, urban, mixed-use neighborhoods
- Seniors want Aging-in-Place and social life of the street.

Science Reports it.

Photo credit: morguefile.com

Health, Climate & Planetary Boundaries

America's Climate Choices, 2013

- IPCC 2014
- US National Climate Assessment 2014
- CDC
- Resilience Alliance

2015

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Physics of earth requires a new paradigm:

Reflectables

Renewables

Greenables

Walkables

Photo credits: morguefile.com

ARCHITECT'S TOOLKIT

#1 Design to mitigate both **constructed climate** & **constructed disease**

Photo credit: James Wilson

- Healthcare starts in neighborhood
- Climate mitigation starts in neighborhoods
- Design for health is design for climate

#2 Expand to other co-benefits:

convergent sustainability

- Economic development
- Health
- Social vitality
- Seniors aging in place
- Resiliency
- Biodiversity
- Natural hydrology
- Safety
- Equity
- Energy security

Photo credits: morguefile.com

#3 Target the community scale.

- Neighborhood scale efficiencies
- Neighborhoods as mini-utilities (walk/bike system, energy, greenwater/ bluewater, waste energy capture)
- Natural ecosystem services
- Neighborhood shops and food
- Social network
- Whole system linkage

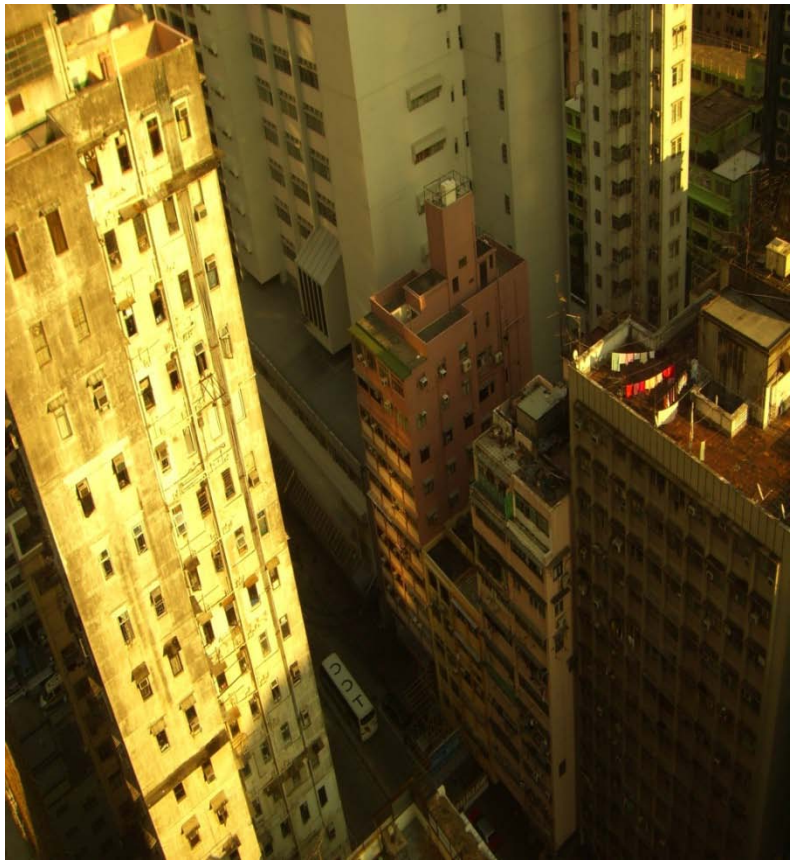
#4 Neighborhood-scale mitigation can empower behavior or lifestyle change. Focus on human capital as the key change agent of the city:

Neighborhood initiative, habitat, lifestyle

"The City is you--and you."

--Jane Jacobs

#5 Create urban morphology that promotes urban cooling, low



Key areas for architecture in climate adaptation:

Lock–in a mobility pattern:

walkability, bike, transit

Urban ecosystem services:

- Narrow width (W/H)
- Shade
- Form for turbulent cooling
- Form for directed ventilation

#6 Focus on the physics of energy

“

One gallon gasoline=
2500 kilocalories of use v.
100,000,000,000 of negative use.

Photo credit: A. Trabelsi

ratio 1:40 million

+social costs from
US 9,000+ VMT mi/yr =

22.5 trillion kilocalories of negative use/ yr.
--David Archer, U of Chicago

#7 Restore the urban energy balance, regenerate the urban ecology

- Water: green water& soil, blue water & aquatic system
- Un-pave, vegetate, ventilate roofs & pavements
- Restore nature for livable human habitat

#8 Incorporate ET and Shade

Photo credit: Philadelphia Water Department

25% more trees = 33-50% saving in energy for cooling

- 70-90% increase evapotranspiration
- 10-30% increase shade
- reduced direct solar gain & diffuse radiation

#9 Mitigate the urban heat island effect

Photo credit: Morguefile.com

- Surface thermal properties
- Urban geometry (evening)
- Alteration of water balance
- Little vegetation (ET)
- Urban GHG from pollution
- Anthropogenic waste heat
- Reduced turbulent transfer in wind (daytime)

#10 Use cool roofs, walls, pavements

Solar Reflectance (SR)	
Portland cement	35-50%
Light-colored cement	70-80%
Black roof	10-20%
White coating	60-75%

Photo credit: morguefile.com

#11 Re-balance toward the other system: Let nature do it.

Photo credit: A. Trabelsi

- Self-organized
- Self-reliant
- Urban services via nature's system (ecosystem services)

And within nature's limits

Solar :100 X US demand

All RE: **129 X**

#12 Think **whole-systems**

The architect/PDE as:

- system-manager
- wealth manager

- Build coalitions to reach majority support

- Architects & PDE are natural partners on the up-stream stressors on the Delaware Estuary.

Environment & Policy Committee members collaborate on a walkability assessment

Thank you.

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