Critical Data for Energy Transitions: Lessons from California

Stephanie Pincetl

Director Center for Sustainable Communities, Institute of the Environment and Sustainability, UCLA

ICAE

August 2019

Urban development and digitalization: can being more smart lead to decarbonization and energy use reductions?

Answer: it all depends, and maybe not, it depends on what kind of city and planet we want going forward

Let us look at the California situation and go from there

One Major Data Gap is Building Energy Use: Rarely available at the account level

- Building energy consumption accounts for nearly 40% of city greenhouse gas emissions
- Consumption varies significantly according to:
  - Building age
  - Building size
  - Building use
  - Sociodemographic characteristics
  - Climate zone
- To engage in the energy transition, detailed building energy consumption is critical

California – reputedly one of the aggressive states in the U.S. for GHG emissions reductions

- California's renewable portfolio standards for electricity: 60% renewables by 2030 and the next 40% from zero carbon sources of electricity by 2040
- Legislation mandating building energy use reduction of 50% by 2030
- No state standards to reduce use of natural gas in buildings but a trend toward electrification
- No mandates to track building energy use

Building Energy Data Access is Highly Restricted

- In CA, until 2014, utilities controlled access to data, which they considered proprietary
- But for the energy transition and GHGs reductions, this situation was untenable
- Public Utilities Commission Proceeding led to University researchers authorized to obtain address level data
- But subject to Rule of 15 for disclosure (must mask geographies where one user is responsible for 15% of the energy use or more, or there are less than 15 accounts in the geography)
    - Very constraining when there are high users

CCSC obtains data

- Los Angeles Department of Water and Power, a municipal utility, provides me consumption data (with a non-disclosure agreement)
- We make a map
- We show the geographic variation of building use, and by different types, vintages and sizes
- PUC staff then provides us investor owned utility data (with a non-disclosure agreement) in 2014.

UCLA Energy Atlas

energyatlas.ucla.edu

CCSC at UCLA

Website: ioes.ucla.edu/ccsc
Atlas: energyatlas.ucla.edu
Contact: ccsc@ioes.ucla.edu

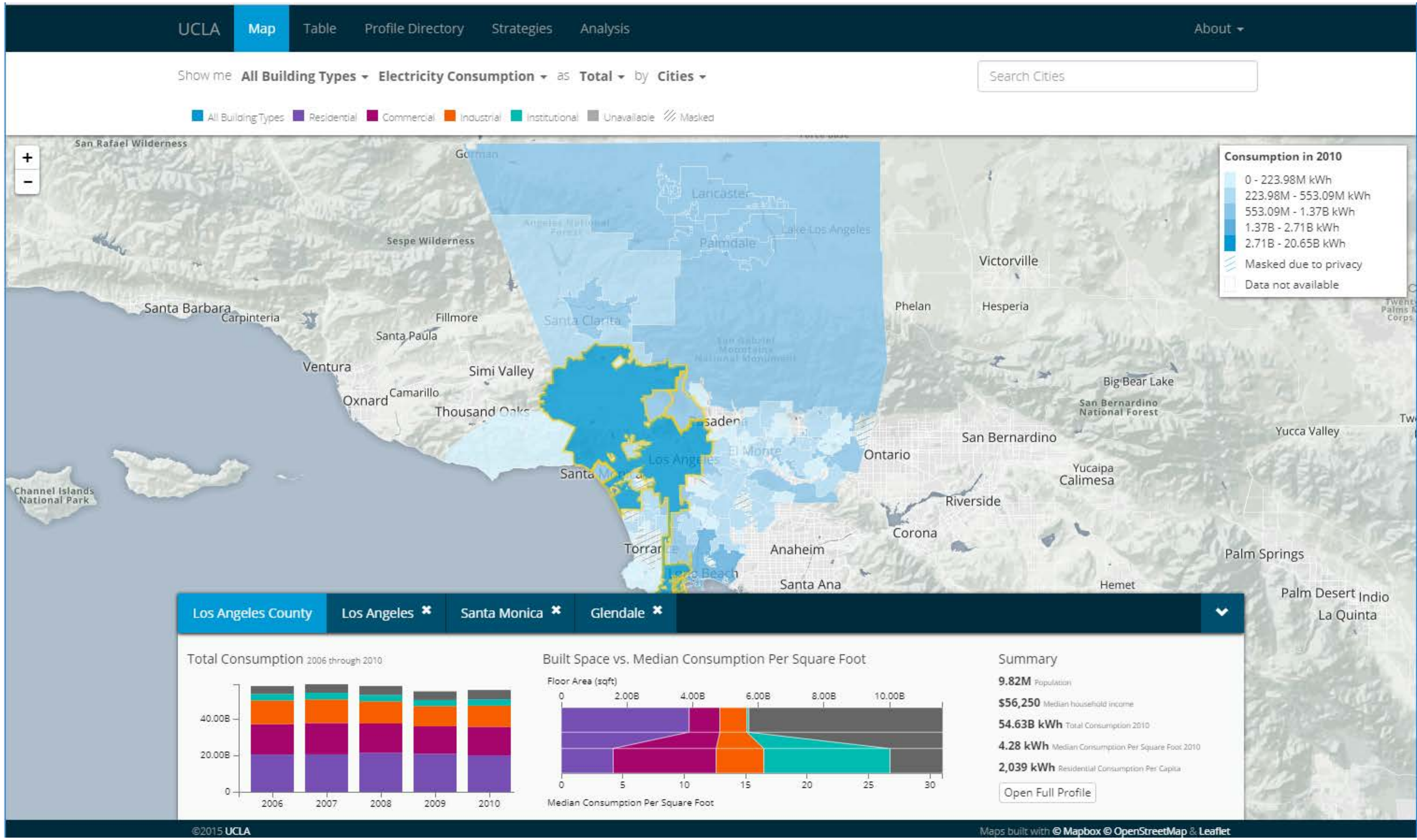
The Atlas was created as a tool for local governments and energy policy planning

- Provides knowledge about building energy use
- Provides ability to quantify use of energy and to target programs, and evaluate results
- Demonstrates a methodology to meet customer privacy
- Potential for determining regional solar generation capacity
- Useful for implementing:
  - state or national legislation
  - local conservation
  - efficiency and GHG reduction goals
  - improving building performance and quality of life
  - environmental justice concerns
- Averages around 500 visits per month

Energy Atlas 1.0

First of its kind interactive web atlas that provided access to the some of the largest and most disaggregated building energy data available in the nation.

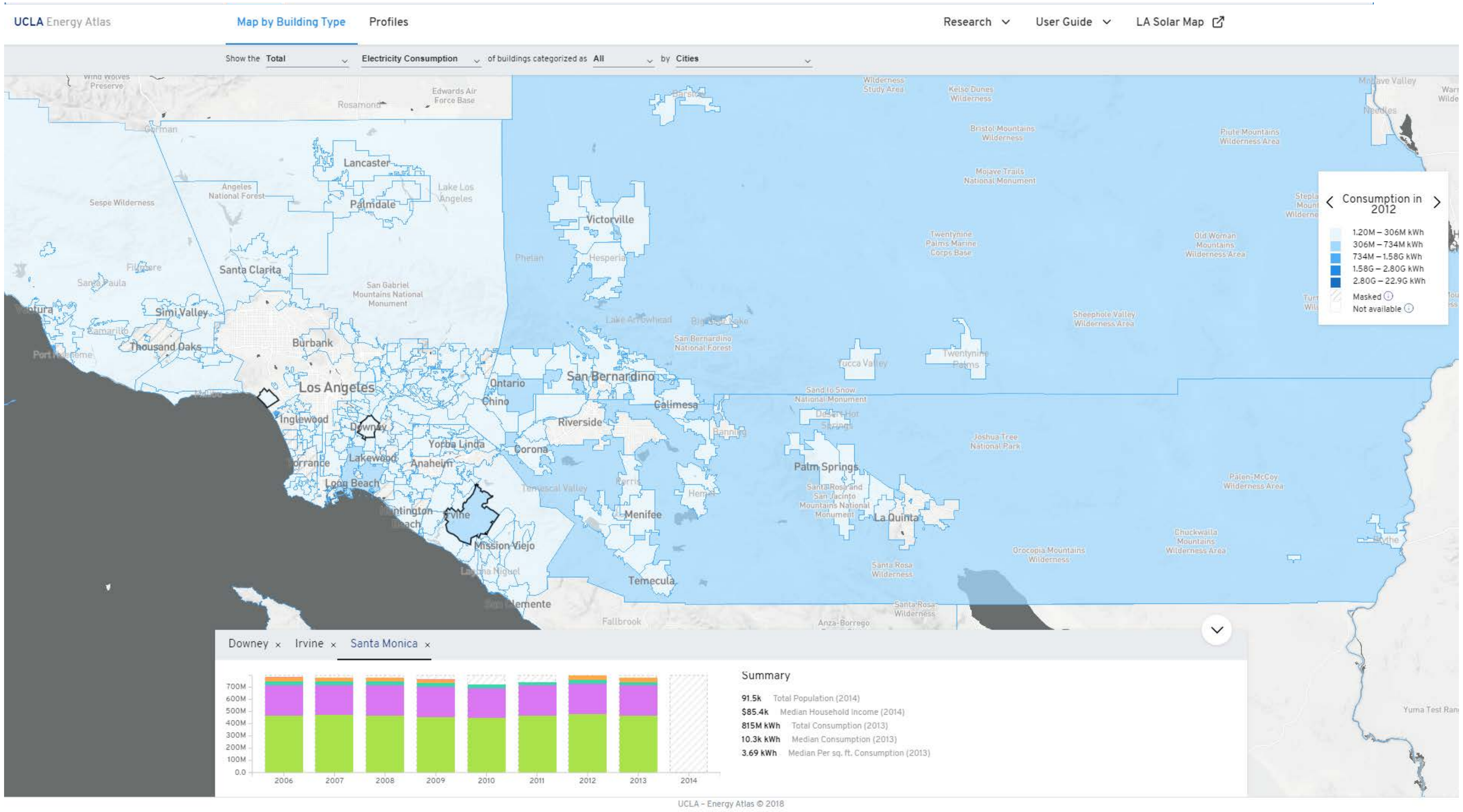
LA County 2006-2010



Energy Atlas 2.0

Expands temporally and geographically, incorporating 6 Counties in Southern California from 2010-2017

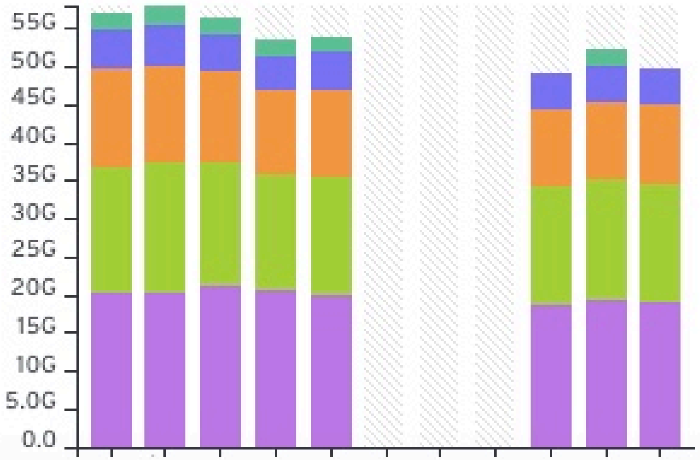
Launched summer 2019



Compare the **Electricity Consumption** of **Counties** in the year ‹ 2016 ›

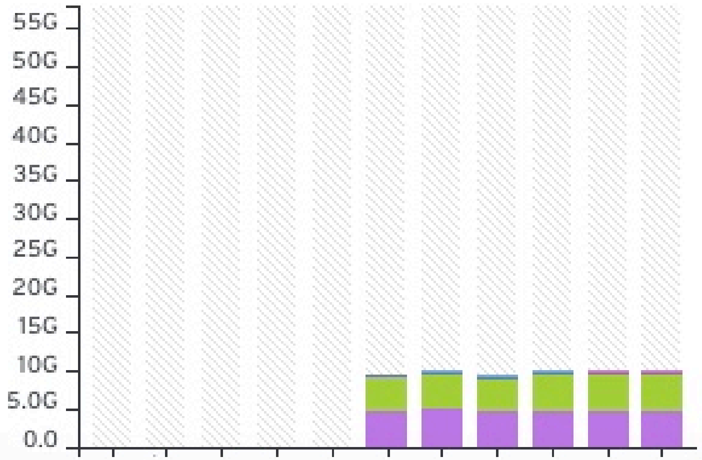
Los Angeles

9.97M Total Population (2014)
1.66k Population per Square Mile (2014)
$57.1k Median Household Income (2014)
47.1G kWh Rooftop Solar Potential (2010)
53.2G kWh Total Consumption (2014)
7.22k kWh Median Consumption (2014)
4.21 kWh Median Per sq. ft. Consumption (2014)
1020 Vulnerable CalEnviroScreen Census Tracts



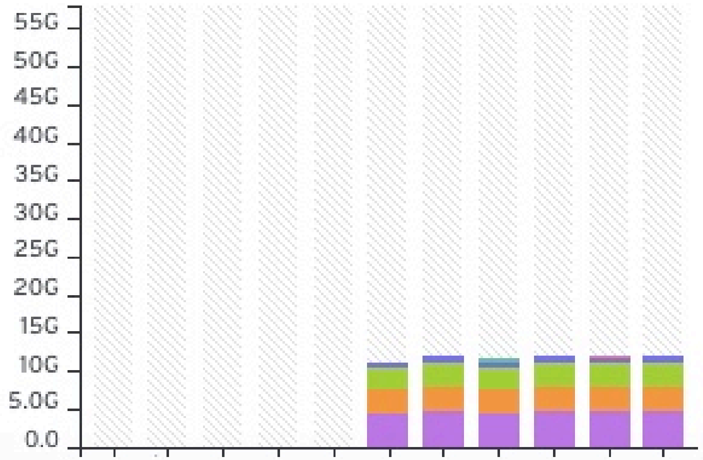
Riverside

2.27M Total Population (2014)
214 Population per Square Mile (2014)
$56.0k Median Household Income (2014)
0.00 kWh Rooftop Solar Potential (2010)
10.2G kWh Total Consumption (2014)
8.50k kWh Median Consumption (2014)
is missing Median Per sq. ft. Consumption (2014)
101 Vulnerable CalEnviroScreen Census Tracts

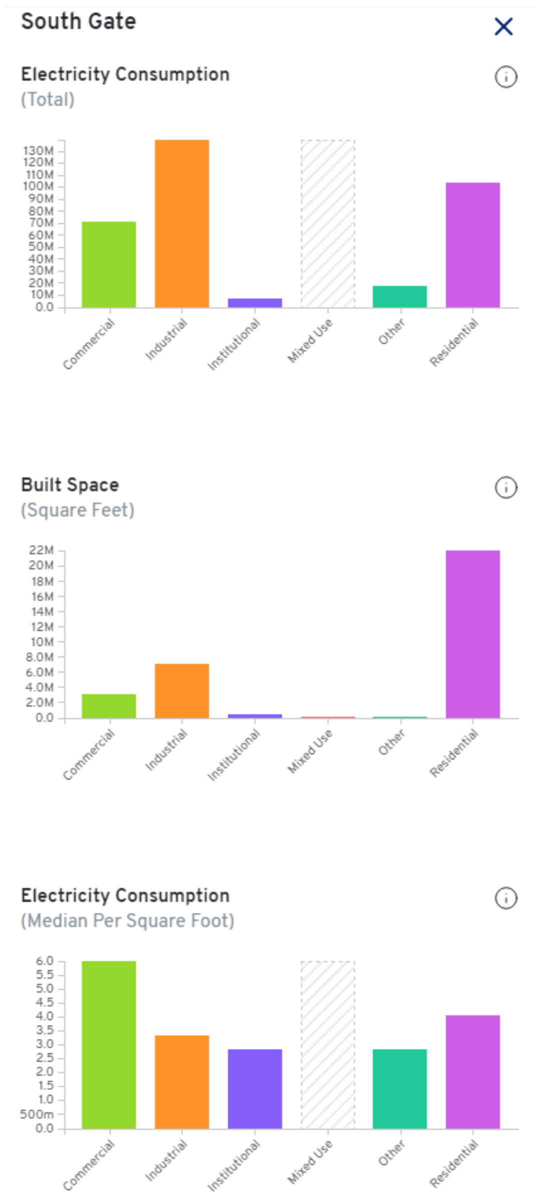


San Bernardino

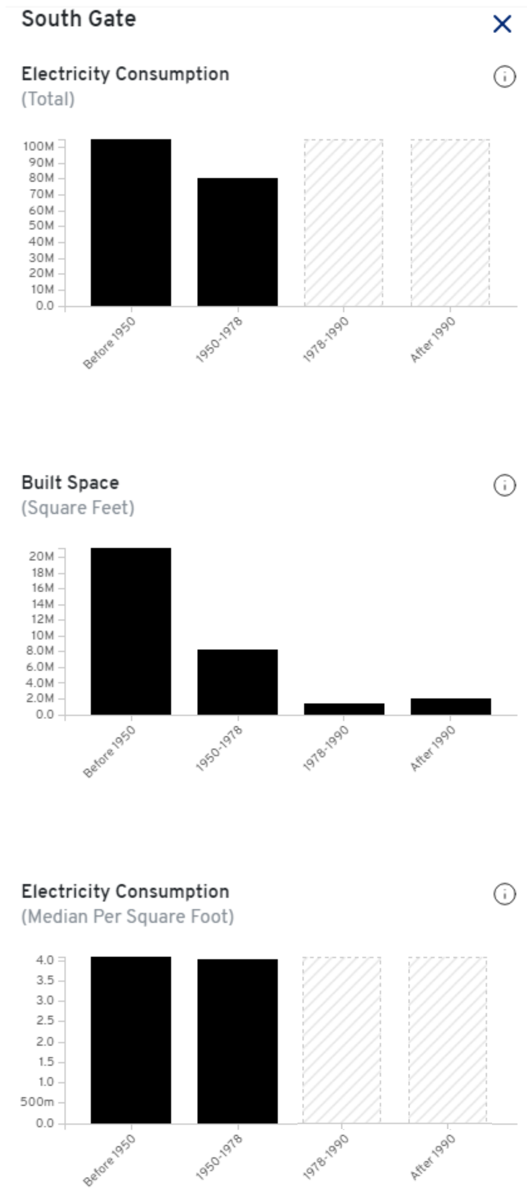
2.08M Total Population (2014)
69.5 Population per Square Mile (2014)
$52.5k Median Household Income (2014)
0.00 kWh Rooftop Solar Potential (2010)
13.1G kWh Total Consumption (2014)
7.86k kWh Median Consumption (2014)
4.75 kWh Median Per sq. ft. Consumption (2014)
156 Vulnerable CalEnviroScreen Census Tracts



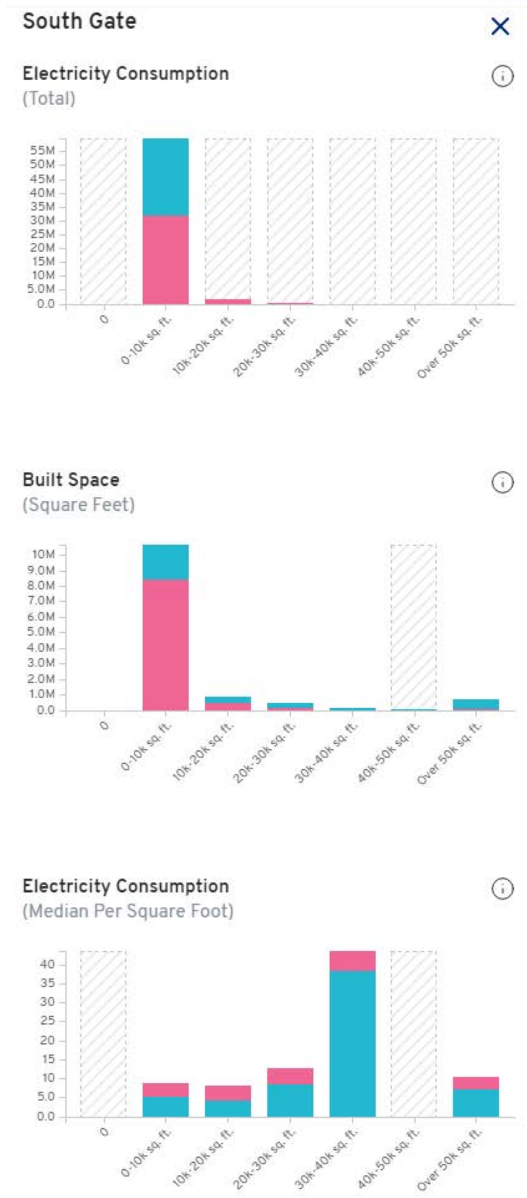
Electricity by Building Type



Electricity by Building Vintage



Electricity by Building Size



Note: Data visualizations for display only.

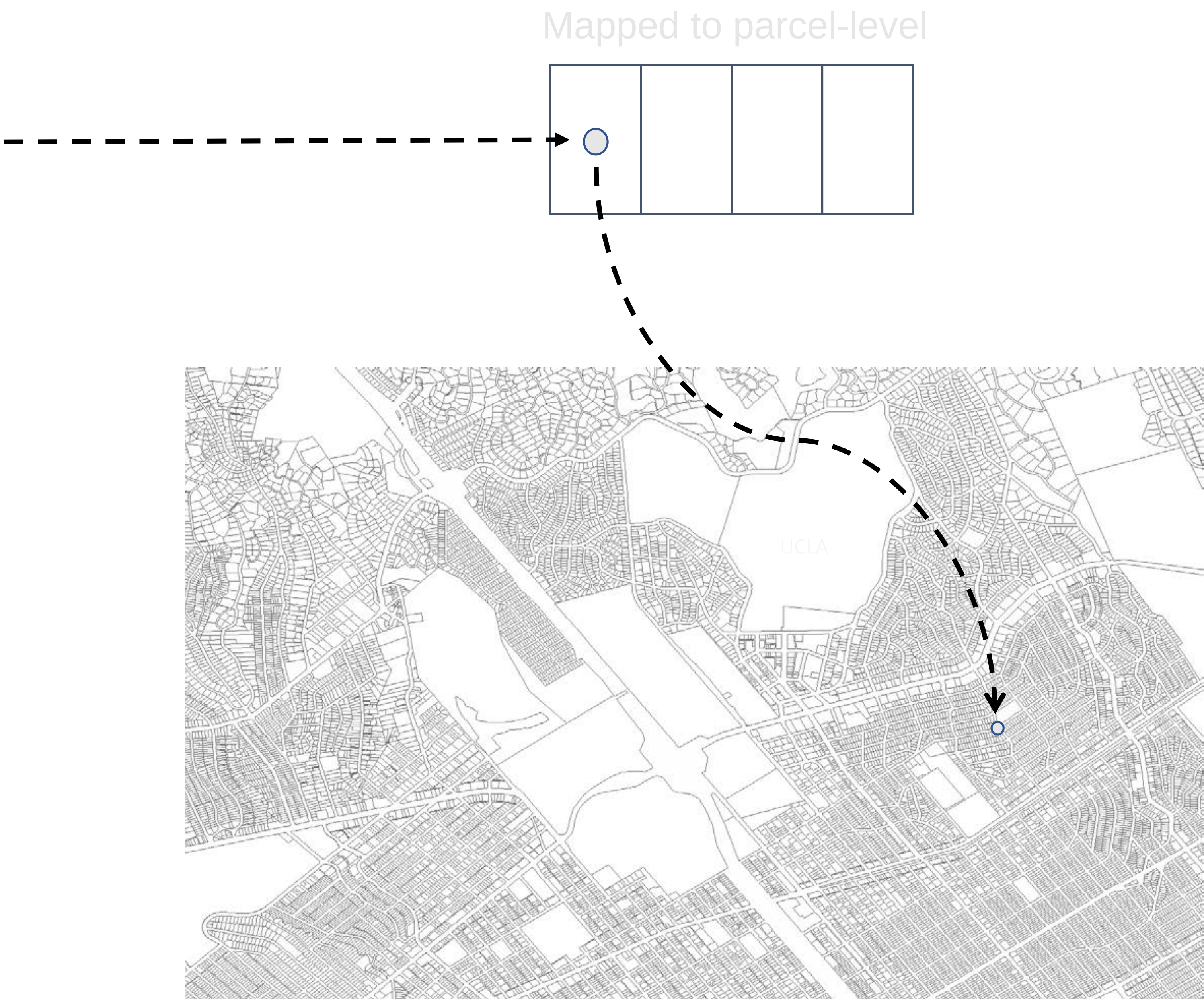
Utility Data Standardization Challenges

- In the US and in California, there are no uniform standards for billing data
- Each utility develops its own, with different billing cycles, categories and more
- To work with the data and to represent it, the first task is to standardize it across the years, across the utilities and the different types of accounts.
- Very laborious

Geocoding – in a sense the heart and soul of the Atlas

Raw Utility Data

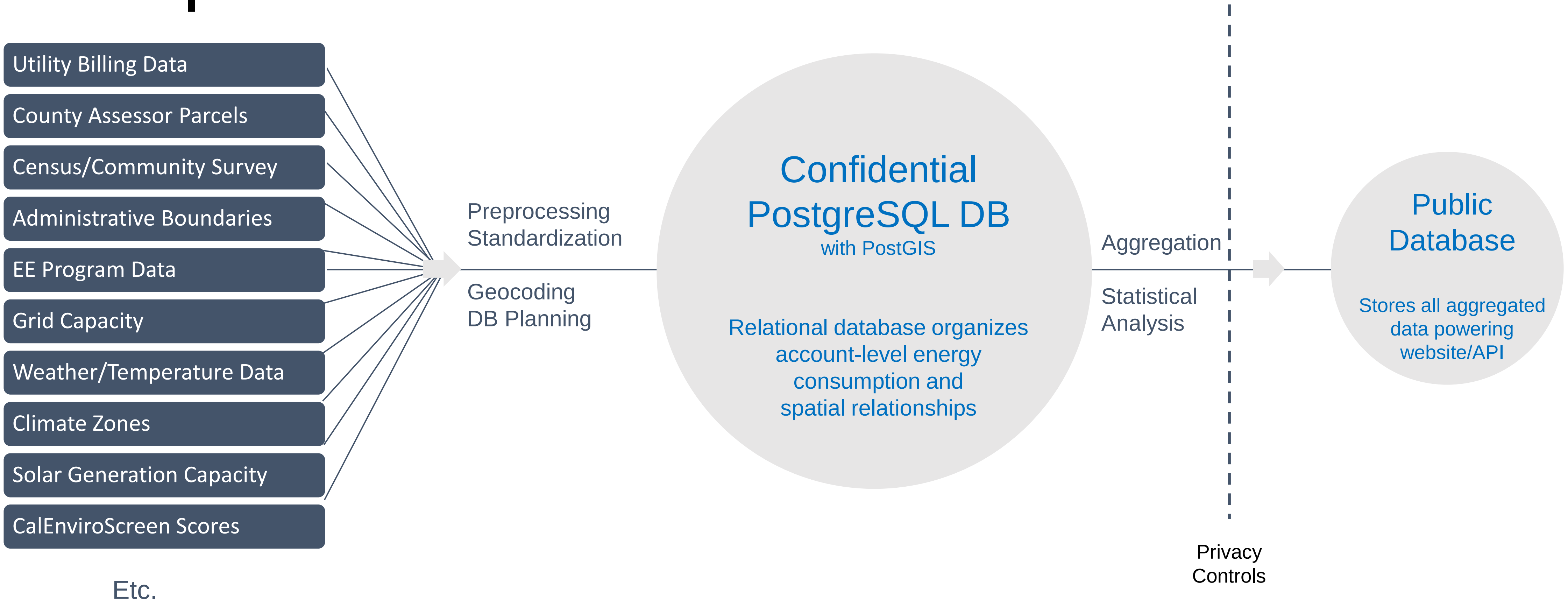
Account ID	Billing Address	Energy Consumption
9876543421	1234 Example St., Los Angeles	xx (kWh & therms)

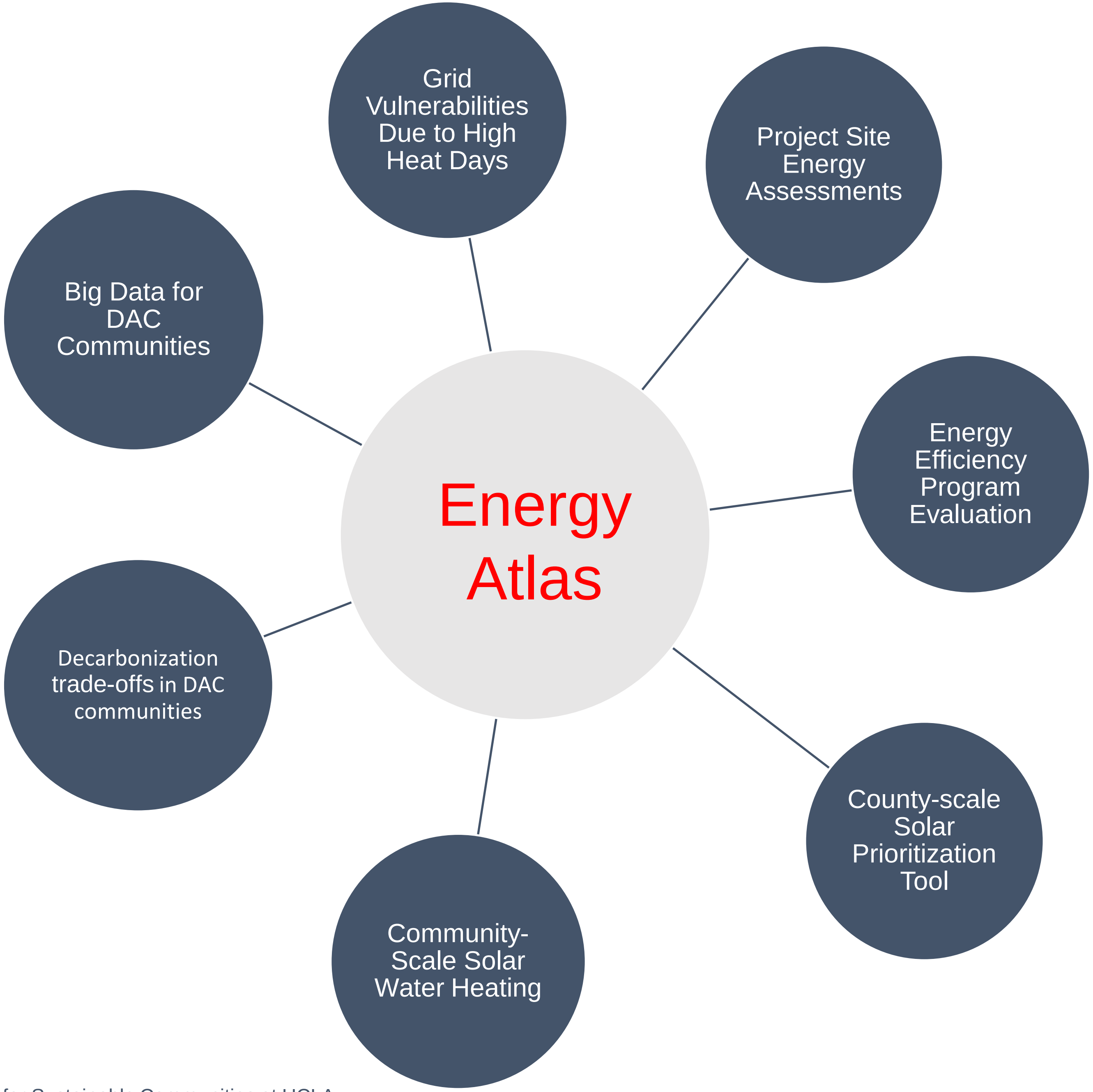


UCLA has mapped tens of millions of raw utility addresses to the parcel/street level. This allows for energy consumption to be analyzed by:

- Parcel data (sqft, vintage, use type)
- Census characteristics (income, population)
- Any geographical aggregation beyond parcel (block groups, neighborhoods, council districts, etc.)

Atlas 2.0 Database Development





The Energy Atlas is a hub for research.

Atlas data is a resource for local governments and community organizations for data-driven planning and implementation.

This work is an in-depth look into a major component of the energy transition – building energy use. Much of the building stock in Ca was built 1950-1975. Cheap construction, poor materials.

Many of the new solar systems as well as electricity billing systems rely on smart inverters, smart controls. They contain an embedded carbon footprint and rely on rare Earth minerals.

The European Environmental Bureau, July 2019

- Finds no empirical evidence of absolute, permanent and enough decoupling of economic growth from critical environmental pressures to ensure the sustainability of the current path
- This is occurring for
  - Materials
  - Energy
  - Water
  - GHGs
  - Land
  - Pollutants
  - Biodiversity loss

Decoupling Debunked, July 2019. European Environmental Bureau. eeb.org/library/decoupling-debunked

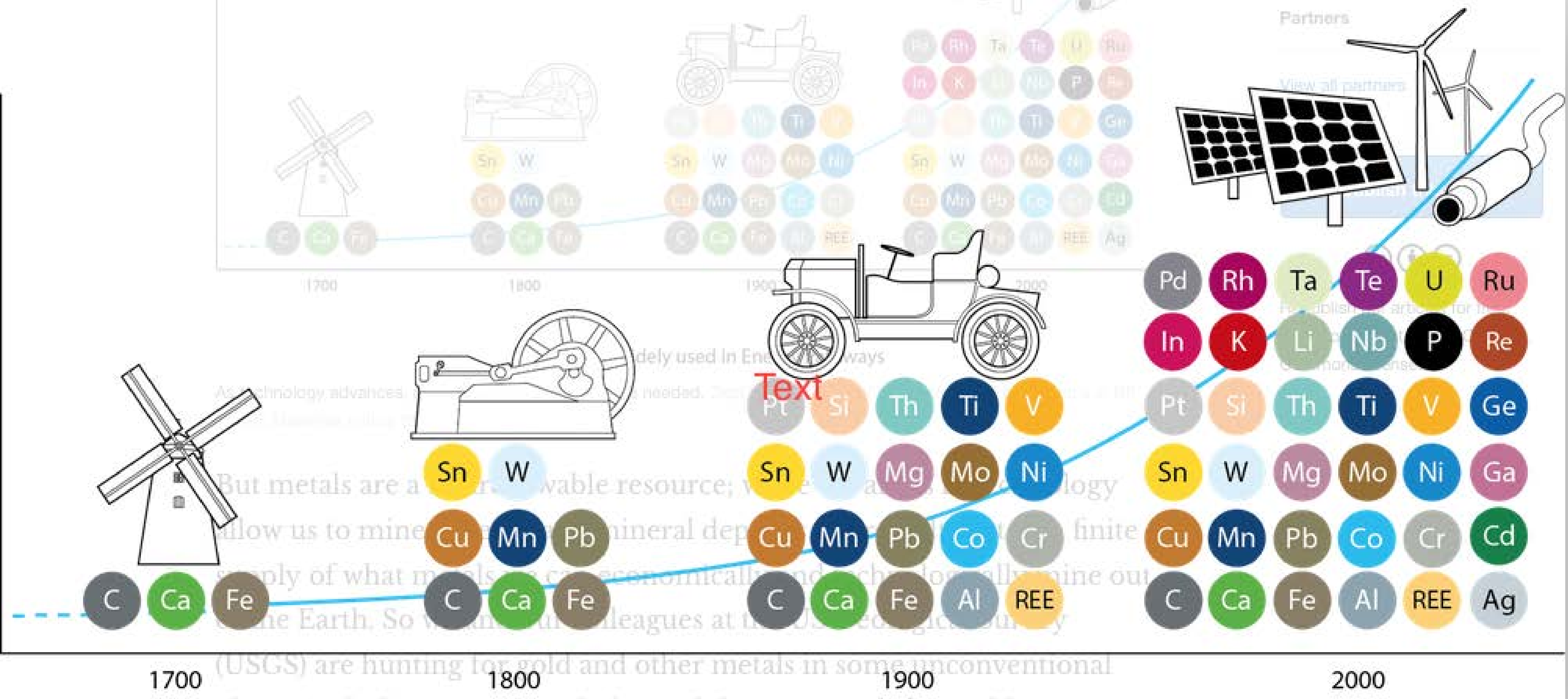
The report lists 7 reasons to be skeptical of decoupling – or smart approaches

- Rising energy expenditures when extracting resources
- Rebound effects in EE
- Problem shifting e.g. EVs need lithium, copper, cobalt. . .
- Over estimated impact of services on reducing impacts compared to goods production
- The potential of recycling
- Inappropriate technological change
- Cost shifting (off shoring production)

There is huge hope pinned on better technologies, better information and data, more efficiencies for reducing GHGs and our impacts. . . .
The International Energy Agency estimates a yearly abatement of 1%/yr. The EEA suggests this needs to be increased 5-fold to meet the -95% mitigation target for 2050.
To achieve the 1.5 C goal, reductions of 13% per year are necessary.

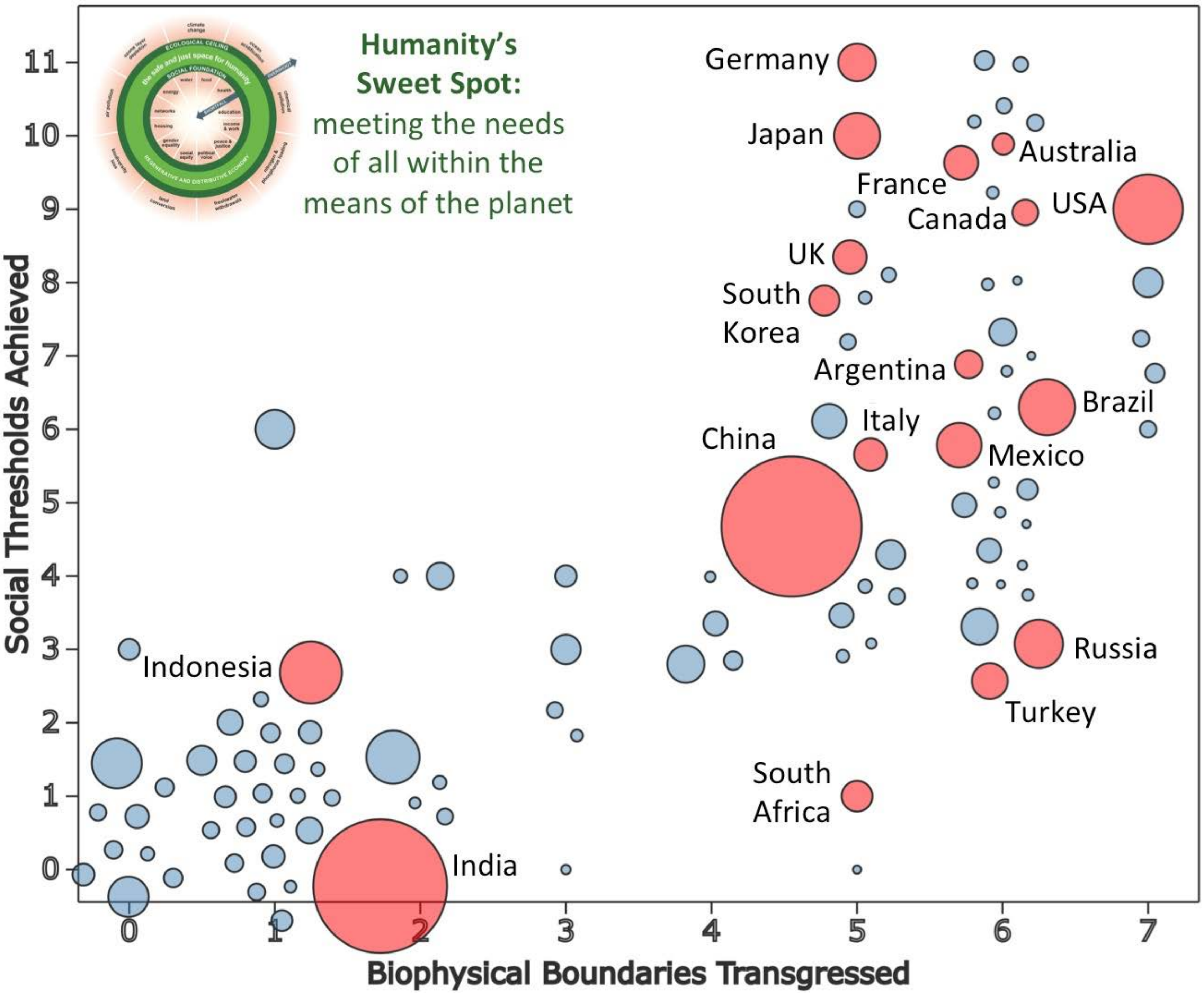
There is little evidence of any genuine success thus far.

Ages of Energy



Elements widely used in Energy Pathways

The energy transition is dependent on Rare Earth minerals: the foundation of smart systems cause new Earth system impacts.



How to achieve human well being without transcending planetary limits remains the challenge.

O'Neill D., Fanning A., Steinberger J., Lamb W. University of Leeds, 2018 https://www.kateraworth.com/2018/12/01/doing-the-doughnut-at-the-g20/

Becoming *smarter* may be more efficient in some ways – better means to ends -- but may not reduce energy flows or materials needed for the systems and energy production. The Jeavons Paradox prevails.
Simply substituting renewably generated electricity for fossil energy does not address a host of deeply interconnected impacts.

- In the last century average resource use per capita doubled
- Energy intensities have not declined
- And relative energy poverty still exists

The fundamental question is what type of urban living we are striving for -?

- More renewables chasing after increasing energy use, but not curbing growth?
- Continuing to extract increasing amounts of materials for the infrastructure to obtain efficiency gains?
- In the U.S. context, same structural inequalities but more renewable energy?
- Notions of frugality, doing with less and redistribution are rarely addressed in the discussions of smart.
- Technoptimism prevails

Toward a Refounding of Civil Society and Politics of Moral Action

- Shifting of norms of behavior toward collaboration rather than competition
- Sufficiency rather than efficiency
- Durability rather than quantity
- An ethics of care and understanding of the great chain of being, based on skill
- A future of low but biophysically sufficient material standards of living sourced primarily from city regions
- Economy to serve human and environmental well-being -- re-embedding the economy in society

Website: ioes.ucla.edu/ccsc

Atlas: energyatlas.ucla.edu
Water: waterhub.ucla.edu

Contact: ccsc@ioes.ucla.edu

California Center for Sustainable Communities at UCLA

Special thank yous to :

Felicia Federico, D. Env., Executive Director

Hannah Gustafson and Dan Cheng, Eric Fournier, PhD and Eric Porse PhD