Clean Energy in the Age of COVID-19

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OurEnergyPolicy, April 8, 2020

Resources:

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Carbon Emissions, Air Quality, & the Coronavirus Pandemic: Airborne Nitrogen Dioxide Plummets over China

- Decreases in industrial production + transportation have decreased carbon emissions and air pollution
- Air quality improvements in China may have saved more lives than were lost to the pandemic (Stanford U study, 3/20)

Carbon Emissions, Air Quality, & the Coronavirus Pandemic: N₂O levels down 50%+, CO₂ down 20%+

March 10-22, 2019  March 10-22, 2020
Unemployment to hit 20%?

Sources: US Employment and Training Administration; David Choi, Goldman Sachs
The COVID-19 Crisis Rightly has our Attention Today

But we also know that …  
Climate is COVID-19 on steroids …

Cumulative risks of 3°C warming

Population affected by various risks (millions of people)

- Heatwave exposure: 7,909
- Water stress: 3,920
- Risk to power production: 742
- Crop yield change: 1,817
- Habitat degradation: 1,357

Critical COVID-19 Lessons for the Climate Emergency

• There is no substitute for research & development, and education

• Supply chains are vulnerable on a crowded, denuded, planet

• Tipping points can happen fast

• We are all in this together

• Individual actions matter (infection & education)

• We only as resilient as the most vulnerable (Environmental Justice)
Carbon Emissions, Air Quality, & the Coronavirus Pandemic

What if reductions were achieved sustainably, through increasing efficiency, replacing fossil fuels with clean energy, and drawing down carbon from the atmosphere?

- Pandemic estimated to lead to short-term worldwide reductions in carbon emissions of 10-15%
- Emission pathways to a 1.5°C future require ~40% reductions in carbon emissions by 2030

- If the changes we're seeing today were achieved through energy source switching, we'd already be 25-38% of the way to our Paris target in just a few months.

Energy and Transportation System Transition

Energy system models say we can

The “SWITCH” model, at UC Berkeley finds clean energy solutions in each region studied

- WECC (Western North America)
- Mexico - in progress
- Kosovo
- Chile
- Nicaragua
- East African Power Pool (EAPP):
  1. Kenya
  2. Planned: Uganda & Tanzania
- India & Bangladesh in progress
- China
- Malaysian Borneo

http://rael.berkeley.edu/projet/SWITCH
\[ \frac{C_2}{C_1} = \left( \frac{V_2}{V_1} \right)^b \]
California & Quebec:

$20/t\text{CO}_2$

Social Cost of Carbon:

$50/t\text{CO}_2$
CARBON CRUNCH

There is a mean budget of around 600 gigatonnes (Gt) of carbon dioxide left to emit before the planet warms dangerously, by more than 1.5–2°C. Stretching the budget to 800 Gt buys another 10 years, but at a greater risk of exceeding the temperature limit.

Peaking emissions now will give us 25 years to reduce emissions to zero.

Delivering the peak by a decade gives too little time to transform the economy.

The Green Energy Economy

Global energy savings accelerated (haltingly) after 2010

Annual changes in global primary energy intensity, 1981–2018

IEA’s 2016 2°C warming CO2 scenario called for 2.6%/y energy intensity drop to 2030

IEA’s 2018 2°C warming CO2 scenario calls for 3.2%/y energy intensity drop to 2040

Figure 2 from “Recalibrating climate prospects”

Lovins, Ürge-Vorsatz, Mundaca, Kammen & Glassman


doi:10.1088/1748-9326/ab55ab
California Energy Goals: Aggressive & Evolving

California Senate Bill 100: 100% clean energy by 2045 and 2030 standard now 60% (without nuclear or large hydro)

Evolving California Climate Laws

Assembly Bill 32
Return to 1990 emission levels by 2020

Senate Bill 100:
100% green energy in 2045

Senate Bill 32:
Cap & Trade carbon market
And 35% or more of revenues for marginalized communities

Solar Mandate & EV Mandate:
1 million solar roofs & EVs by 2020

Many other bills pending.
California Energy Efficiency & Solar Policy Drives Innovation

Residential Construction
Zero net energy after January 1, 2020

Commercial New Construction
• All new commercial construction in California will be zero net energy by 2030.
• Leverage opportunities from emerging technologies initiatives, incentive programs, and local initiatives targeting commercial building/property developers.
Communities are changing the way energy is produced and consumed.

Distributed solar to drive global renewable growth 50% by 2024: IEA

Sunrun Lands Another Big Virtual Power Plant Deal, This Time in Hawaii

Aggregated residential solar-storage systems will be used to help meet Hawaii’s unique grid challenges.

Big Win for Local Energy: First Virtual Power Plant Snags Contract in US Wholesale Capacity Auction

This “virtual power plant” made of solar and batteries means Oakland can stop burning jet fuel

The solar panels will power low-income housing—and then fill up batteries to use when demand peaks.

Hollywood's next star could be virtual power plants as LADWP closes out natural gas

Sunrun's 395 MW residential solar-storage VPP proposal for Los Angeles could be proof-of-concept
Many Opportunities: Speed and scale green

https://theclimatecenter.org/our-work/community-choice/
https://cal-cca.org/cca-impact/

Key role in growing Community Choice Energy: 20 CCAs serving 11 million Californians - ¼ of state- with 88% clean energy today!

2006: CA AB32
2009: Federal Stimulus

California business growth vs. rest of US
Yearly rate of change in gross domestic product
Clean Energy Polls Well
March 20 – 25, 2020, n = 4500

Many Opportunities: The Green Stimulus
https://medium.com/@green_stimulus_now/a-green-stimulus-to-rebuild-our-economy-1e7030a1d9ee

Author team:
https://medium.com/@green_stimulus_now/a-green-stimulus-to-rebuild-our-economy-1e7030a1d9ee
The Green Stimulus

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A Green Stimulus package of at least $2 trillion

This is meant to be money for the recovery. The first rounds of stimulus were aimed at addressing the public health crisis and stabilizing the economy - that’s economic relief. But we will need more stimulus to get the economy moving again and get the millions of workers who have been sidelined by this crisis back to work. Stimulus should focus on our most pressing social need: the climate crisis.

This stimulus should be automatically renewed annually at 4% of GDP per year (roughly $850 billion) until the economy is fully decarbonized and the unemployment rate stays below 3.5% for at least three consecutive months.

A green stimulus of shovel-ready projects

https://medium.com/@green_stimulus_now/a-green-stimulus-to-rebuild-our-economy-1e7030a1d9ee

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<th>Labor &amp; Housing</th>
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<th>Energy</th>
<th>Land Use</th>
<th>Financing</th>
<th>Foreign Policy</th>
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</thead>
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<tr>
<td>• Low-income home retrofits</td>
<td>• Public Transit Rescue Packages</td>
<td>• Expand &amp; restore the clean energy tax credits</td>
<td>• Expand food quality programs (TANF, SNAP, WIC)</td>
<td>• National green bank (e.g. NY, CT)</td>
<td>• Fair trade agreements based on worker and environmental protections</td>
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<tr>
<td>• DOE weatherization</td>
<td>• No-interest, no-match loans for local govt. &amp; transit authorities to clear backlogs</td>
<td>• Open to nonprofits and low-income communities</td>
<td>• Classify Farmers Markets as ‘essential’ services’</td>
<td>• Pass a Federal Reserve Bank Act to make green bonds as secure as treasury bills &amp; drive down cost</td>
<td>• Expedite aid including technology transfer for lowest income nations that adopt 1.5 deg C targets</td>
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<tr>
<td>• Native American</td>
<td>• “Fix it First” for infrastructure</td>
<td>• Loan guarantee program for clean energy manufacturing</td>
<td>• Target new and socially disadvantaged farmers, including women and minorities</td>
<td>• Assistance for community &amp; tribal colleges for green jobs training</td>
<td>• Restart Science Envoy program</td>
</tr>
<tr>
<td>• Public housing</td>
<td>• “Fix it First” for infrastructure</td>
<td>• Expand ARPA-E 10x, extend to DoD, DoT, HUD</td>
<td>• Carbon farming</td>
<td>• Restart Science Envoy program</td>
<td></td>
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<tr>
<td>• School Retrofits</td>
<td>• “Fix it First” for infrastructure</td>
<td>• National green bank (e.g. NY, CT)</td>
<td>• Carbon farming</td>
<td>• Fair trade agreements based on worker and environmental protections</td>
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<td>• Preference for Title 1</td>
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<td>• Solar schools</td>
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<td>• Restart Science Envoy program</td>
<td></td>
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Learn from our Mistakes: The need for Environmental Justice

- Lack of solar power and electric vehicle access where the health benefits are highest
- California Green New Deal: Dedicated seed fund of $3.5 billion/yr for disadvantaged areas
- One California proposal (not yet passed): affordable housing at transit hubs.

Opinion
Why Housing Policy Is Climate Policy

In California, where home prices are pushing people farther from their jobs, rising traffic is creating more pollution.

By Scott Wiener and Daniel Kammen
Senator Wiener is the chairman of the California Senate’s Housing Committee. Dr. Kammen is a professor of energy at the University of California, Berkeley.

March 26, 2019

Disparities in rooftop photovoltaics deployment in the United States by race and ethnicity

Deborah A. Sunter, Sergio Castellanos, and Daniel M. Kammen

The rooftop solar industry in the United States has experienced dramatic growth—roughly 50% per year since 2012, along with steadily falling prices. Although the opportunities this affords for clean, reliable power are transformative, the benefits might not accrue to all individuals and communities. Combining the location of existing and potential sites for rooftop photovoltaics (PV) from Google’s Project Sunroof and demographic information from the American Community Survey, the relative adoption of rooftop PV is compared across census tracts grouped by racial and ethnic majority. Black- and Hispanic-majority census tracts show on average significantly less rooftop PV installed. This disparity is often attributed to racial and ethnic differences in household income and home ownership. In this study, significant racial disparity remains even after we account for these differences. For the same median household income, black- and Hispanic-majority census tracts have installed less rooftop PV compared with no majority tracts by 69 and 30%, respectively, while white-majority census tracts have installed 21% more. When correcting for home ownership, black- and Hispanic-majority census tracts have installed less rooftop PV compared with no majority tracts by 61 and 45%, respectively, while white-majority census tracts have installed 37% more. The social dispersion effect is also considered. This Analysis reveals the racial and ethnic injustice in rooftop solar participation.
Large Racial disparity in solar – even at same income

Solar Installations by Racial Composition in Identified Tracts
Thank you & Extra Slides:

http://rael.berkeley.edu

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Appendix 2: Green Stimulus Contact Information

https://medium.com/@green_stimulus_now/a-green-stimulus-to-rebuild-our-economy-1e7030a1d9ee

- Johanna Bozuwa, Co-Manager, Climate & Energy Program, The Democracy Collaborative (@johannabozuwa), jbozuwa@democracycollaborative.org
- J. Mijin Cha, Assistant Professor of Urban and Environmental Policy, Occidental College; Fellow at Cornell University Worker Institute; Senior Fellow at Data for Progress, (@jmijincha), jmijin@gmail.com
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- Billy Fleming, Wilks Family Director of the Ian L. McHarg Center (@mchargcenter), University of Pennsylvania; Senior Fellow at Data for Progress, (@joobilly), billy.fleming3@gmail.com
- Jim Goodman, Food Sovereignty Advocate, r.j.goodman@mwt.net
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- Thea Riofrancos, Assistant Professor of Political Science, Providence College; Senior Fellow at Data for Progress; Faculty Collaborator at Socio-Spatial Climate Collaborative, or (SC)2, (@triofrancos), thea.riofrancos@gmail.com
EcoBlock Vision: A Multi-Customer Microgrid Solution

Electrical system combines DER

- Communal rooftop solar PV
- Communal energy storage system (flywheel and/or battery)
- Intelligent loads and electric demand response
- Shared Electric vehicle (EV) charging
- Smart controls in a direct-current (DC) microgrid infrastructure

behind a single interconnection with PG&E
Electricity

• System Architecture
  ➢ ~200 kW PV DC microgrid based on utility backbone with single inverter connection to the grid
  ➢ Charging stations for shared EVs – or Individual charging stations
  ➢ 10 x 25 kWh/10 kW flywheel storage
• Estimated ~250 to 300 MWh/year PV production.
Led by Dr Cheng Zheng, CEO, Aspiring Citizens Cleantech (ACC), Chengdu, China & Gordon Bauer & Daniel Kammen (ERG, UC Berkeley)

100% EV taxi fleet in Shenzhen, China (25,000+ vehicles)
24 month fleet conversion

California Advancing Energy Efficiency

Figure 2: The duck curve shows steep ramping needs and overgeneration risk

Net load - March 31

- Overgeneration risk
- Ramp need ~13,000 MW in three hours
California Advancing Energy Efficiency

Min. Gen. 15 GW

New Max. Gen. 21,740 MW


Christopher Jones\textsuperscript{m+f} and Daniel M. Kammen\textsuperscript{n+f+k,8}

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http://coolclimate.berkeley.edu/maps
Household GHG emissions in New York Metro Region

Energy  Transportation  Consumption  Total