A NATIONAL RETROFIT CHALLENGE TO MEET THE PARIS GOAL OF 1.5 DEGREES

RESNET CONFERENCE
FEBRUARY 2019
NEW ORLEANS, LOUISIANA

NRDC

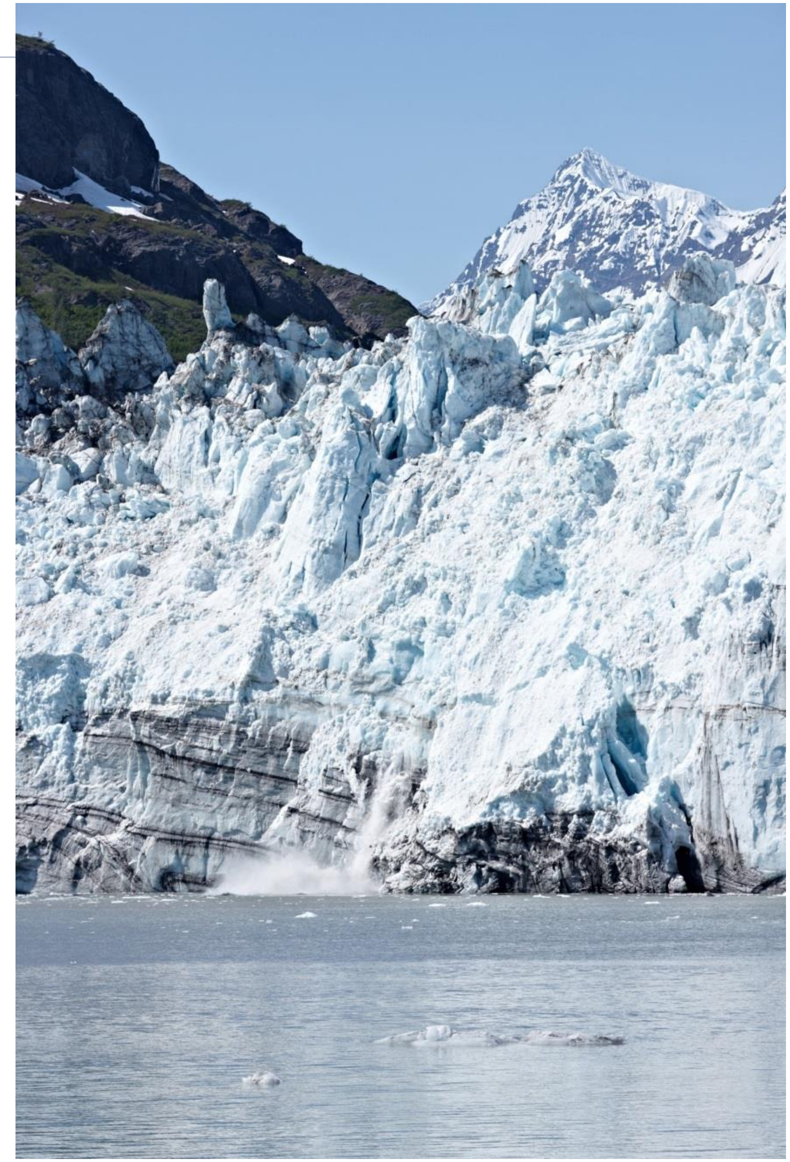
DAVID B. GOLDSTEIN, PH.D.
NATURAL RESOURCES DEFENSE COUNCIL
DGOLDSTEIN@NRDC.ORG

PRESENTATION IS BASED ON A PAPER PUBLISHED IN THE PROCEEDINGS OF THE 2018 ACEEE SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS

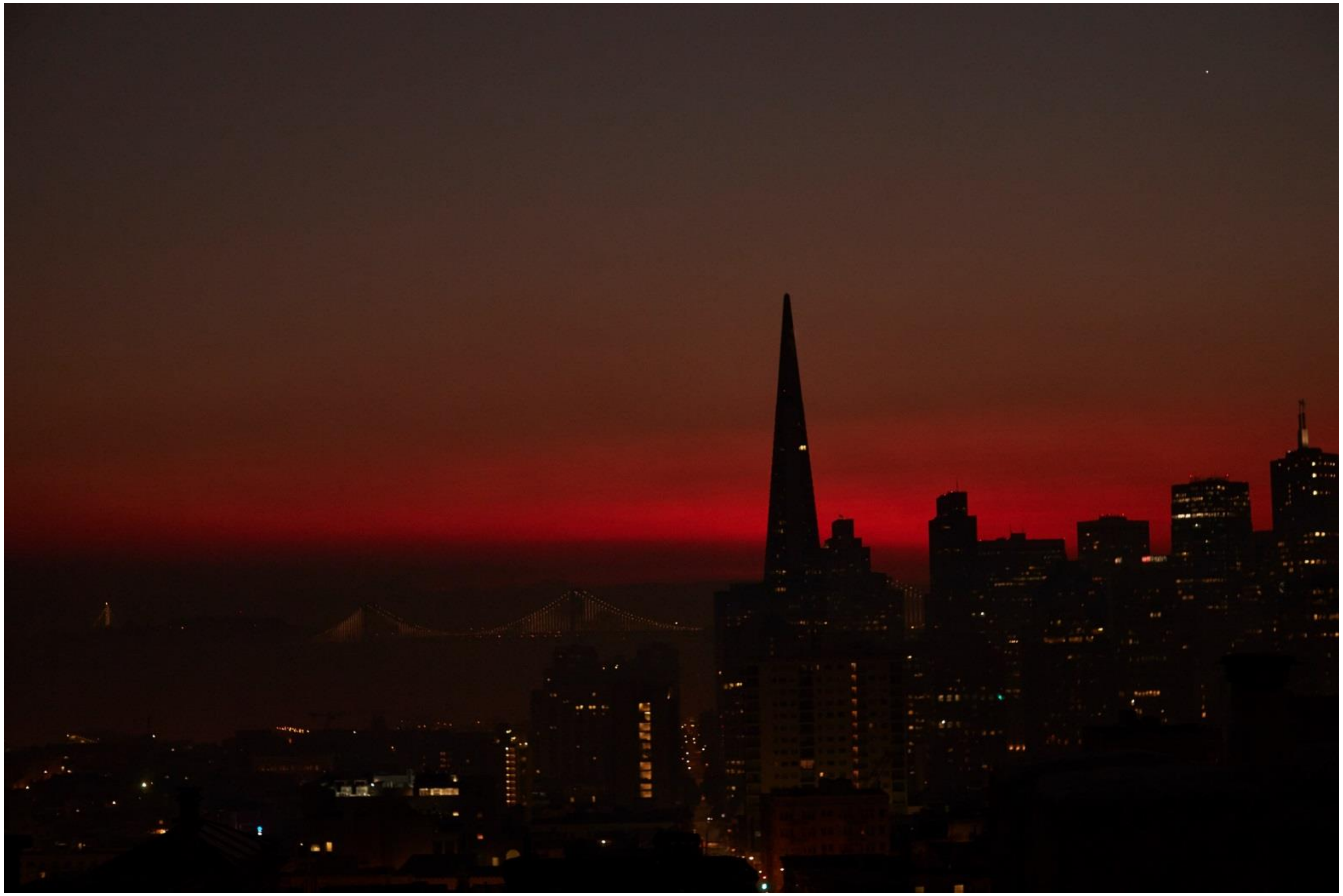
CO-AUTHORS ARE PETER TURNBULL, PG&E, AND CATHY HIGGINS, NBI

HTTPS://WWW.NRDC.ORG/SITES/DEFAULT/FILES/PAPER_A-NATIONAL-RETROFIT-CHALLENGE-TO-MEET-THE-PARIS-GOAL-OF-15-DEGREES_2018-08-29.PDF

Climate Change: Melting Glaciers



Climate Change: Forest Fires



The U.S. and the world can meet the commitments of the Paris Agreement

- The U.S. is still bound by this agreement at least till November 2020
    - The next President could rejoin the agreement
    - States/provinces such as California and the Northwest are accelerating their efforts to cut emissions
    - Canada is part of the agreement
- The Agreement calls for limiting climate change to 2 degrees C and for pursuing efforts to limit it to 1.5 degrees
- There are strategic plans for what government, business, utilities and their regulators, religions, and citizens can do to meet this goal
- The best studies broadly agree: the goals can be met in economically attractive ways

This talk discusses the consequences of a two-step analytic process

- First, model in detail what it takes to limit climate change to 2 degrees

  https://www.nrdc.org/sites/default/files/americas-clean-energy-frontier-report.pdf

- Next, using the model results, estimate what else is needed to meet the stricter 1.5 degree limit

  https://www.nrdc.org/experts/david-b-goldstein/part-2-stopping-15-degrees-what-will-it-take

How can the U.S. achieve a 2-degree scenario?

Decarbonization of the U.S. economy relies on **four *carbon reduction* strategies**, to varying degrees:

- Deploying all cost-effective **energy efficiency** to reduce energy demand in buildings, industry, and transportation;
  - Modest retrofits are part of this scenario
- Deploying significant levels of **renewable and other zero-carbon electric generation**;
- Deploying **broad electrification** of buildings, industry, and vehicles;
- Decarbonizing remaining liquid fuel use through **low-carbon fuels**, such as bio-fuels and synthetic fuels, and carbon capture and sequestration on certain industries.

Additional measures must be taken to reduce non-carbon emissions, such as methane and HFCs. Some modeling also expands and enhances terrestrial carbon sinks (e.g. forests)

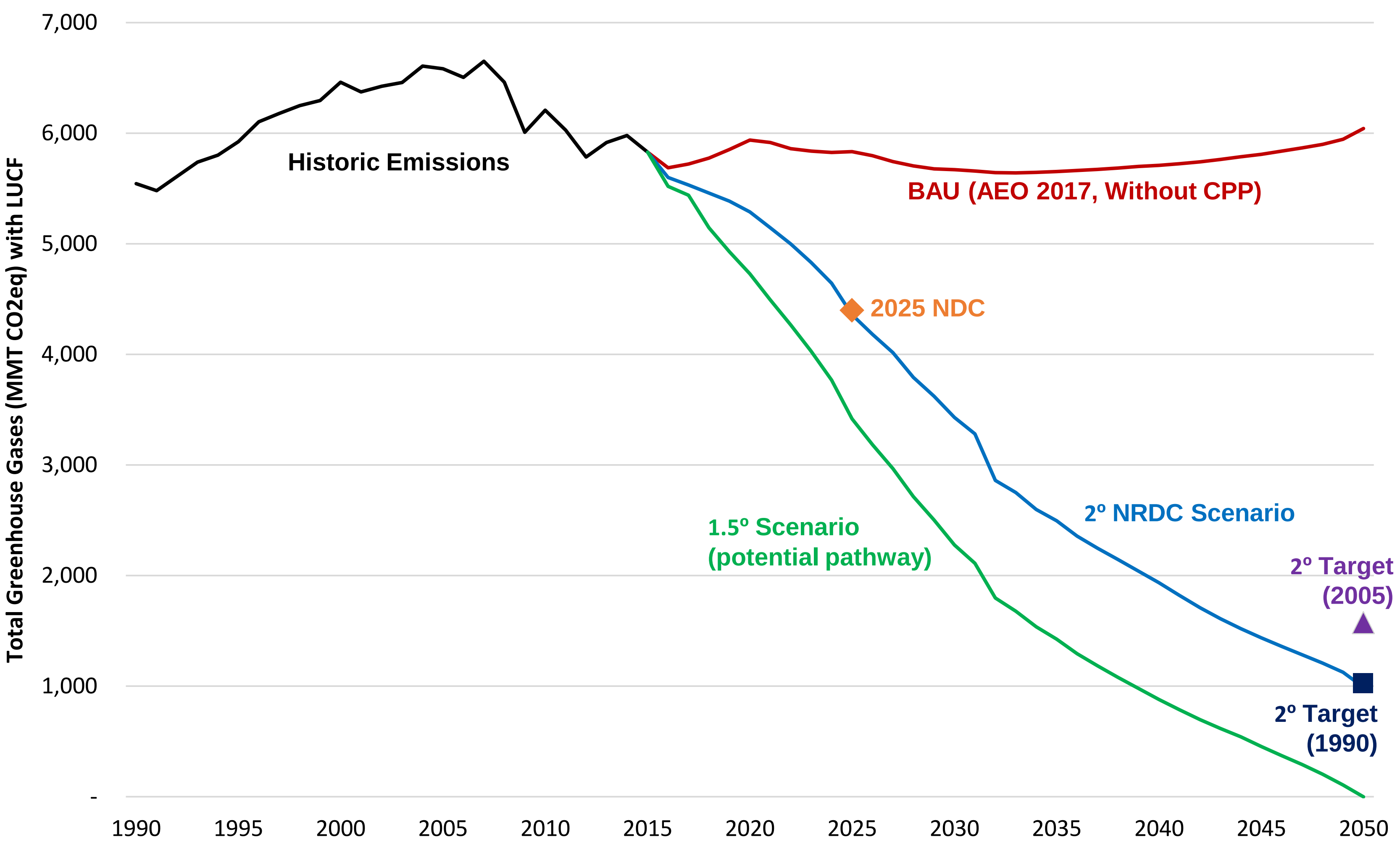
Only 6 key additional policies allow us to nearly meet the 1.5 degree goal

- Fast, deep retrofit of all buildings
- Smart growth and shared mobility
- “Strategic Energy Management” in Industry (ISO 50001)
- Saving energy in the supply chain
- Improved forestry practices
- Reducing methane leaks

This paper looks exclusively at RETROFITS

All of these policies promote job creation at scale, and enhance equitable economic development.

U.S. Pathways to Paris' Long-term Goals



How do we know we can meet the Paris Goal?

- California is already halfway there
  - Without really trying, especially until 2007
  - “LA has built its last freeway”—Executive Director of SCAG
- Countries around the world are finding that they can do much more than they thought once they make the effort
- US climate pollution is dropping about as fast as it would have had to if the 2009 climate bill had passed
- The world agreed to phase out refrigerants that cause climate change, an improvement that modelers didn’t expect

Efficiency is First

- It is the largest resource--even when the analytic assumptions downplay its effectiveness
- It is the cheapest resource; it is the cleanest resource
- In new construction, we know we can get ZNE performance levels with little to no incremental cost. *Existing buildings: the challenge of our times*.
- High performance has side benefits: comfort, health, productivity, job creation, equity
- *However: by calling these "side benefits," we tend to minimize them even though they may exceed—by 2x, 3x or more—the value of the energy savings taken alone*

Energy Savings Alone is Not Enough

On average, the energy cost savings available for most building types at 50% energy savings will not cover retrofit costs

Building Type	Typical Utility Bill	$ Savings at 50% reduction	Present Value of 50% savings*	Available funds for a retrofit	Funds/SF available
Residential	$1.00/sf/yr		$10/sf		$10
SF home, 2000 sf		$0.50/sf/yr		$20,000	
Apartment, 1000 sf		$0.50/sf/yr		$10,000	
Commercial					
School, light load, 50,000 sf	$2.00/sf/yr	$1.00/sf/yr	$20/sf	$1,000,000	$20
Office, moderate load, 30,000 sf	$3.00/sf/yr	$1.50/sf/yr	$30/sf	$900,000	$30

**3% discount rate, 30 project life—more optimistic than usually used in efficiency analyses*

Capturing Value Streams in Commercial Buildings

- In private commercial markets, we are beginning to see *de facto* evidence that the market values non-energy benefits. Consider 435 Indio Way, Sunnyvale, CA—a renovation to ZNE of a common building type from the 1970s
  - Incremental investment: $50/sf
  - Incremental value increase: $75/sf
  - Energy bill savings: ~$1.50/sf
  - Rent premium: ~$4.00/sf (2.7x higher than bill savings!)
- However:

  (1) Value not accessible in public buildings (schools, government, etc.)

  (2) Value not formally recognized by appraisal community

Achieving Scale with Residential Retrofits

- Area-wide demand side programs have been few but have been successful at reaching nearly all customers in an area
  - Delta Project, PG&E, 1990s; PP&L, 1980s
  - Both reached and succeeded with 85% of ***all*** existing customers
- Significant investments in workforce development and training will be required; substantial numbers of jobs will be created from such an effort.

Achieving Scale with Residential Retrofits II

- However, to reach 50% savings levels, entirely new lines of products are needed, requiring manufacturers engagement on space and water heating technologies, especially for heat pumps
  - It will be especially important to limit resistance strip heat for space and water heat to minimize impacts on:
    - Behind the meter electric panel and wiring systems
    - Utility grid capacity and operations

“Industrializing” Retrofits

- Custom field assembly of buildings and component systems is widely viewed as antiquated and inefficient
- Energiesprong, a concept originating in The Netherlands, provides a factory-built whole-building recladding system
  - Covers the full building shell (walls, windows, roof, doors)
  - New mechanical systems integrated into new walls, old systems capped in place
  - Site work in just a few days (minimal disruption to occupants—days not months)
  - Scale of factory enterprise requires access to large pools of capital
- New home builders in the US are experimenting with mechanical “pods” built remotely and shipped to the home site; building design accommodates pod system

Decarbonizing Buildings: Key Issues

- Even with historically low natural gas prices, efficient electric heat pumps can provide water and space heat with little to no energy cost impact to customers.
- Today's heat pumps (water/space) rely on large resistance "backup" heaters which require ~3x the amperage of the actual heat pump
  - Upgrading the panel and wiring to accommodate dwarfs the cost of the appliances.
  - There are impacts to the power grid as well.
  - Resistance strips are unnecessary for the majority of the population by climate
  - Advanced heat pumps (e.g., CO_2 based) could almost entirely eliminate strip heat
- Issue of possibly abandoning gas infrastructure: how to address?

Summary and Recommendations

- Fast, deep retrofits are a critical condition for meeting climate goals.
  - But current programs are as much as ***two orders of magnitude too small***
  - There is good evidence to suggest that scale-up is feasible
  - Advocacy of this outcome turns on the importance of non-energy benefits to the building owner/user and to society
- Large-scale experience must be generated through a variety of retrofit programs that employ different approaches to addressing the issues identified in our paper.

Thank you!

Please contact us at:

David Goldstein dgoldstein@nrdc.org

Cathy Higgins higgins@newbuildings.org

Peter Turnbull PWT1@pge.com

for questions or comments