



ENERGY



“Energy is a very subtle concept... very, very difficult to get right... we have no knowledge of what energy is.”

—Richard Feynman

“Energy is the only universal currency.”

—Vaclav Smil

2020 COVID



2003 BLACKOUT



AUGUST 2003



#1 Song: Beyoncé's "Crazy in Love"

On TV, "CSI" and "Arrested Development" debuted, "Colombo" ended, "Girlfriends" was midway through its run.

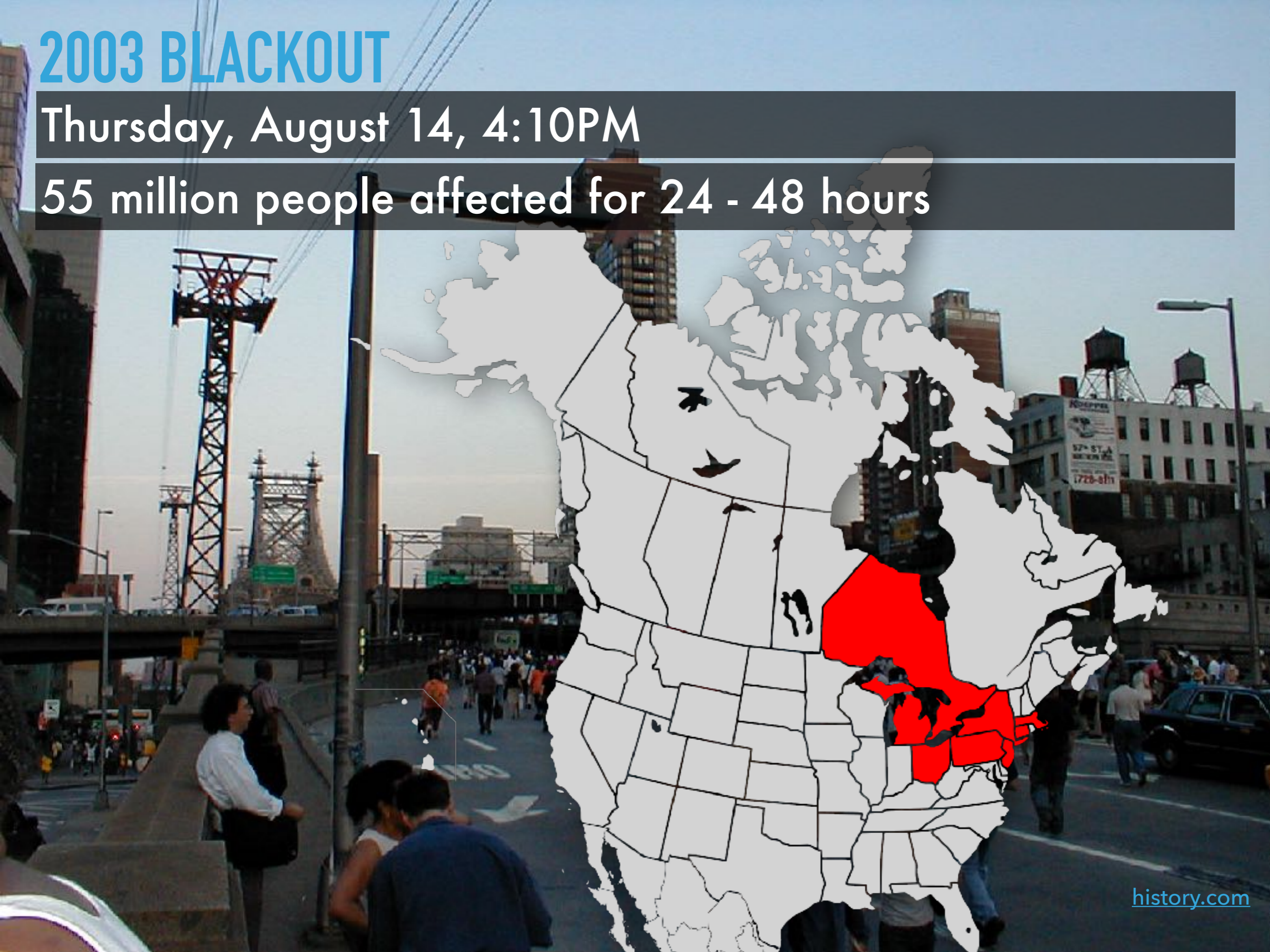
Top movies included the first Pirates of the Caribbean, the second Matrix, and the third Lord of the Rings.

September 11th 2001 was a close memory.

2003 BLACKOUT

Thursday, August 14, 4:10PM

55 million people affected for 24 - 48 hours



2003 BLACKOUT



2003 BLACKOUT



2003 BLACKOUT



ARE YOU READY?



THURSDAY NIGHT SEPTEMBER 4
NFL KICKOFF LIVE! 8 PM
JETS vs REDSKINS 9 PM

MONDAY NIGHT SEPTEMBER 8
BUCS vs EAGLES 9 PM



MYSTIC RIVER

Tim ROBBINS

Kevin BACON

Laurence FISHBURNE

Marcia Gay HARDEN

Laura LINNEY

A FILM BY CLINT EASTWOOD

TOYOTA
THE ALL-NEW SIENNA.

1500

WRIGLEY'S

2003 BLACKOUT



2003 BLACKOUT



2003 BLACKOUT



2003 BLACKOUT

Third-largest power outage when it happened.

AVAILABLE FOR FURTHER INFORMATION: 212.894.70 00

Largest [\[edit\]](#)

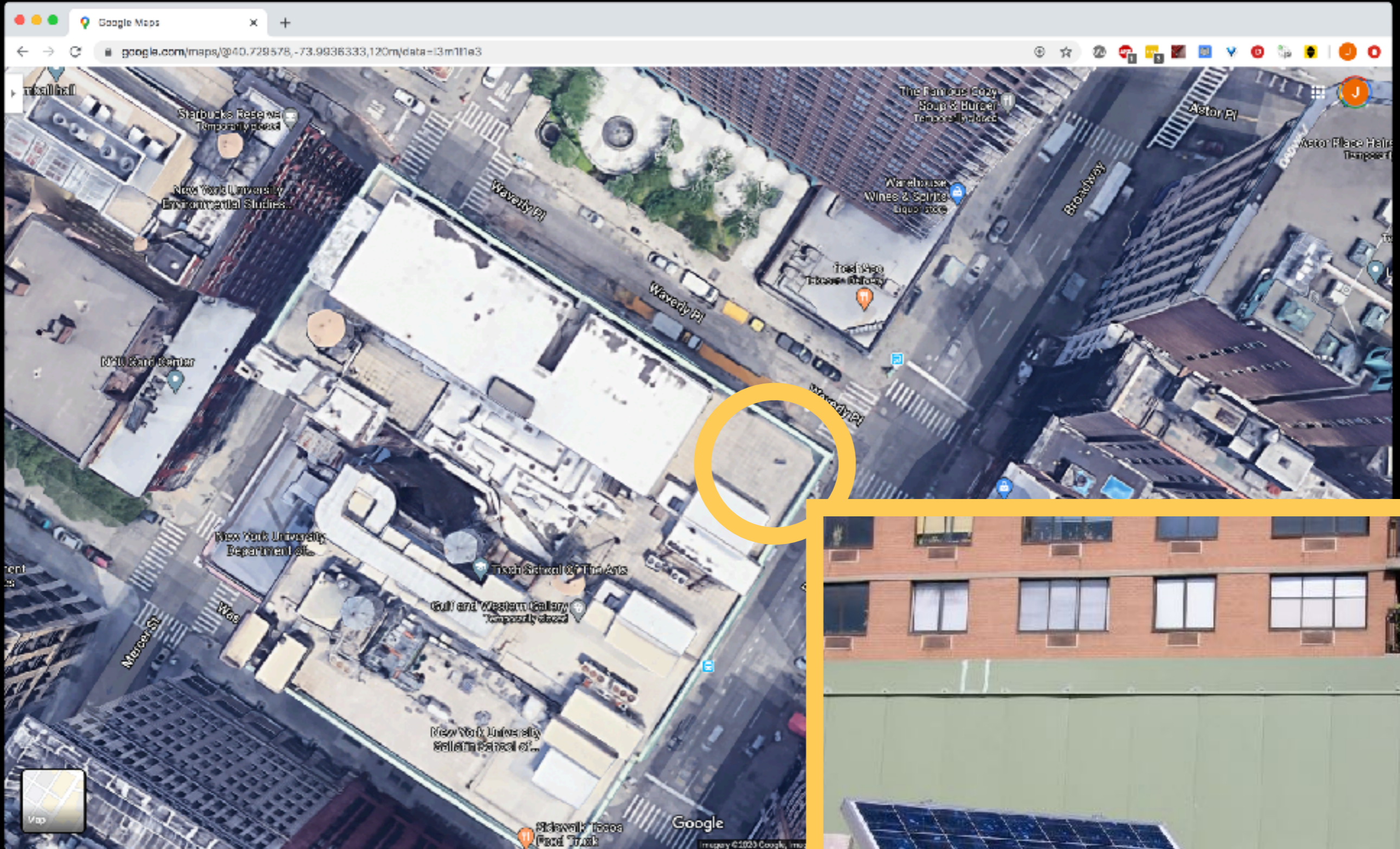
Article	People affected (millions)	Location	Date	References
2012 India blackouts	620	India	July 30–31, 2012	[1] [2]
2023 Pakistan blackout	230(99% of population)	Pakistan	January 23, 2023	[3]
2001 India blackout	230	India	January 2, 2001	[4]
2022 Pakistan blackout	200	Pakistan	October 13, 2022	[5]
2021 Pakistan blackout	200 (90% population)	Pakistan	January 9, 2021	[6]
2014 Bangladesh blackout	150	Bangladesh	November 1, 2014	[7]
2015 Pakistan blackout	140	Pakistan	January 26, 2015	[8]
2019 Java blackout	120	Indonesia	August 4–5, 2019	[9] [10] [11] [12] [13]
2005 Java–Bali blackout	100	Indonesia	August 18, 2005	[14]
1999 Southern Brazil blackout	97	Brazil	March 11–June 22, 1999	[15]
2015 Turkey blackout	70	Turkey	March 31, 2015	[16]
2009 Brazil and Paraguay blackout	60	Brazil, Paraguay	November 10–20, 2009	[17]
2003 Italy blackout	56	Italy, Switzerland	September 28, 2003	[18]
Northeast blackout of 2003	55	Canada, United States	August 14–28, 2003	[19]
2019 Argentina, Paraguay and Uruguay blackout	48	Argentina, Paraguay, Uruguay	June 16, 2019	[20]
2002 Luzon blackout	40	Philippines	May 21, 2002	[21]
2001 Luzon blackout	35	Philippines	April 7, 2001	[22]
Northeast blackout of 1965	30	Canada, United States	November 9, 1965	[23]
2019 Venezuelan blackouts	30	Venezuela	March 7, 2019–July 29, 2019	[24] [25] [26] [27]
2020 Sri Lankan blackouts	21	Sri Lanka	August 17, 2020	[28]
2016 Sri Lanka blackout	21	Sri Lanka	March 13, 2016	[29]

HAPPENING NOW

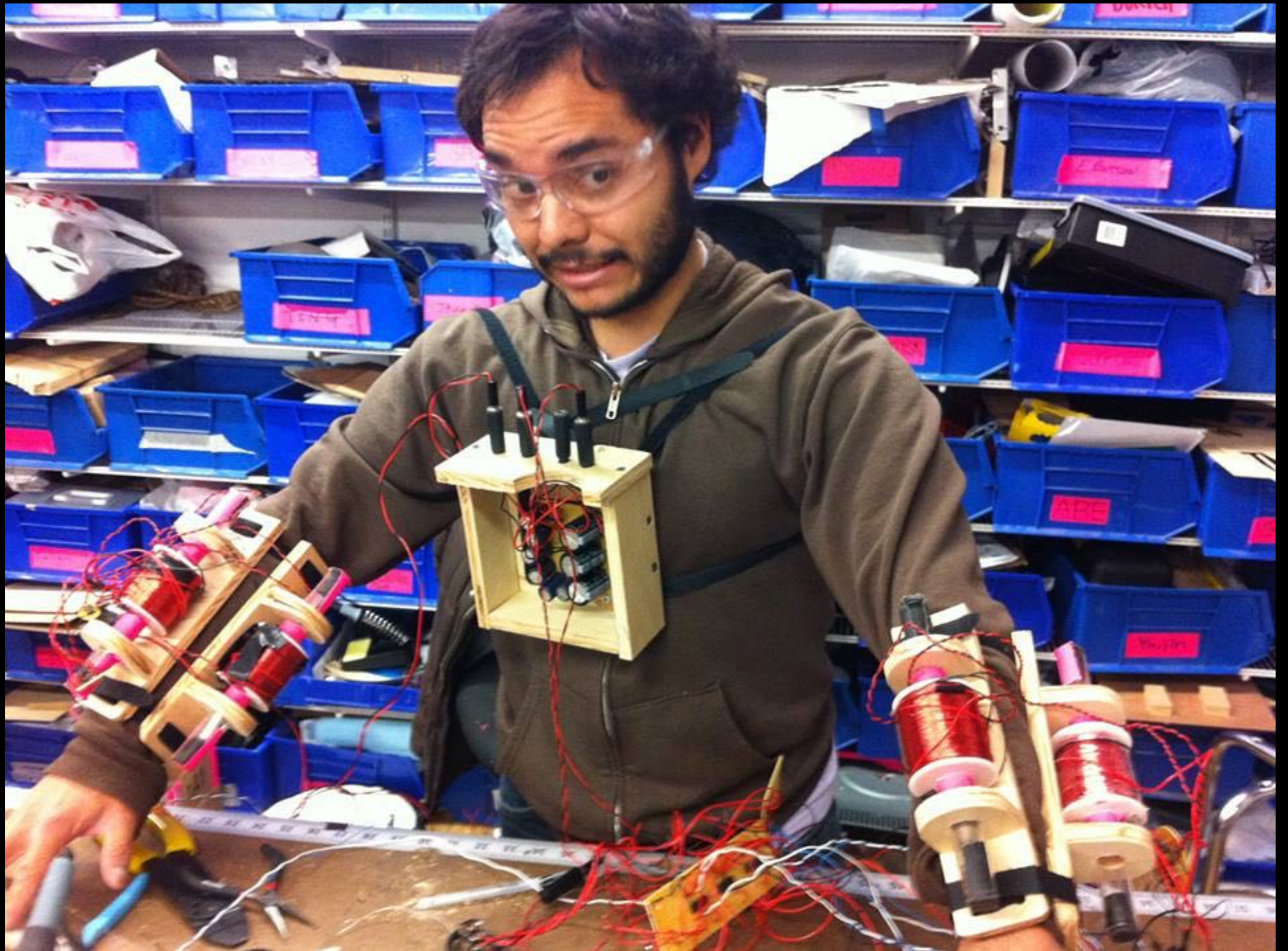
14TH

> |

NYU's FIRST (?) SOLAR - 2004













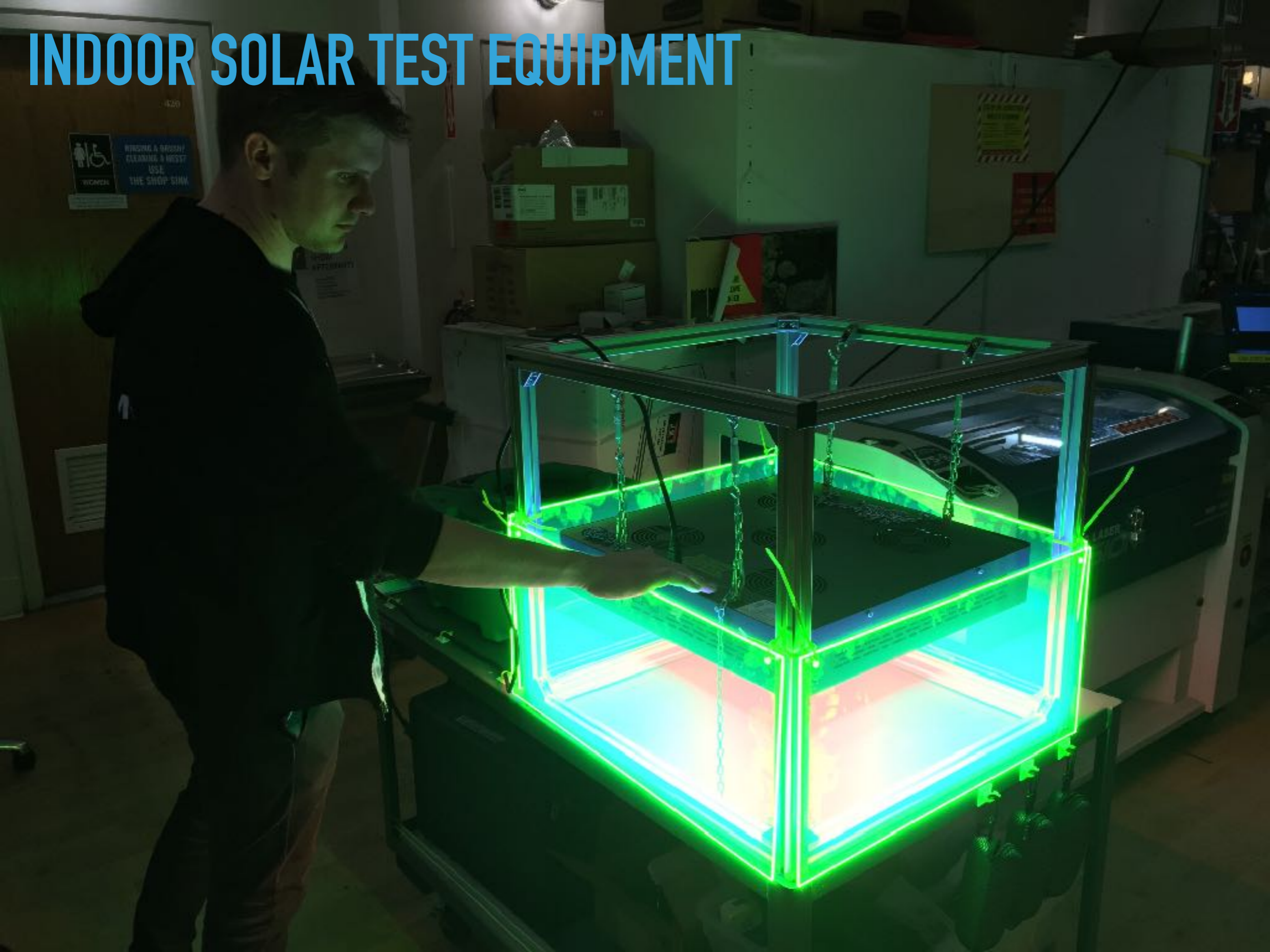
PNC BEACON



2004-2019



INDOOR SOLAR TEST EQUIPMENT





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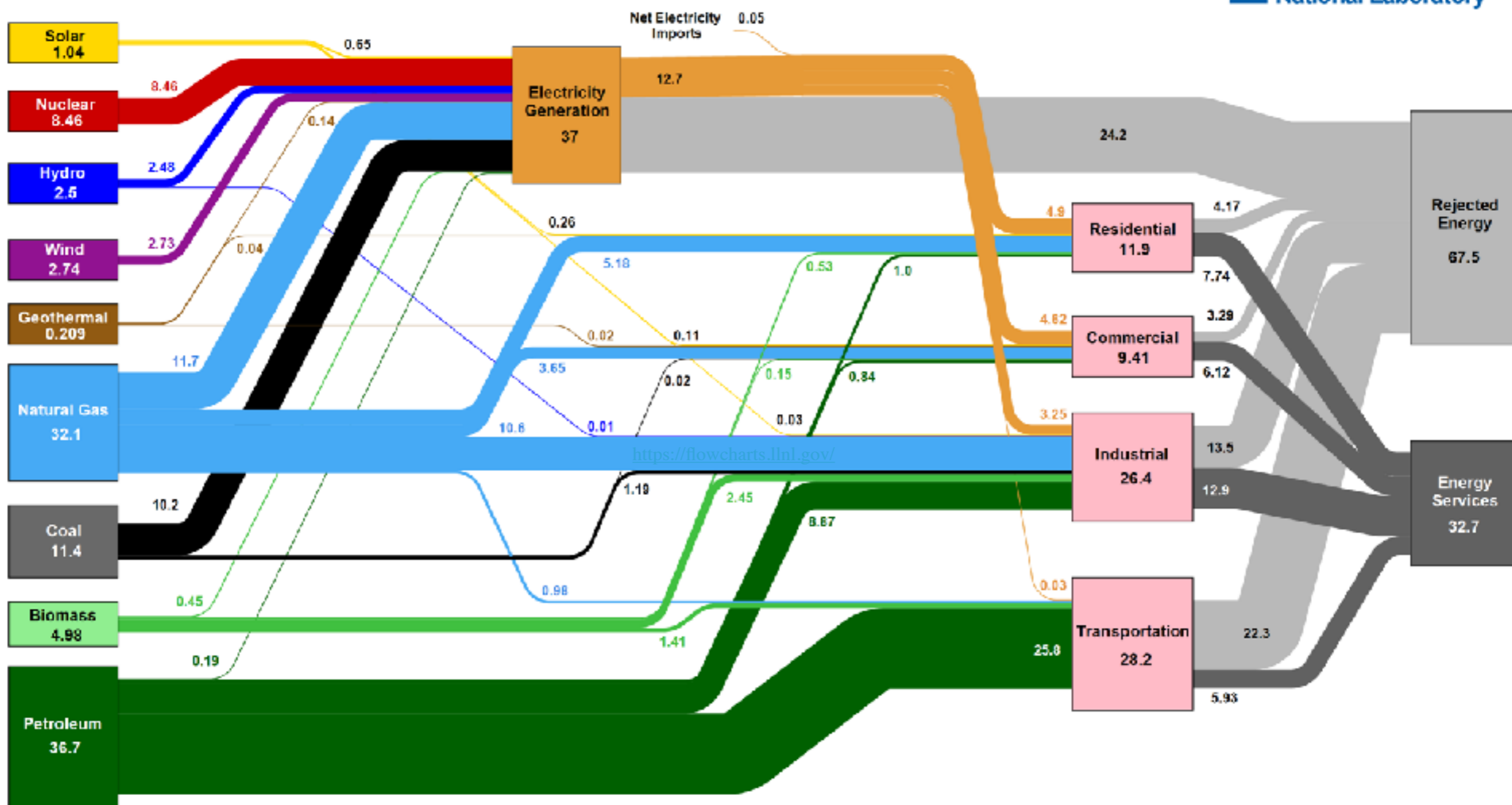


180TW

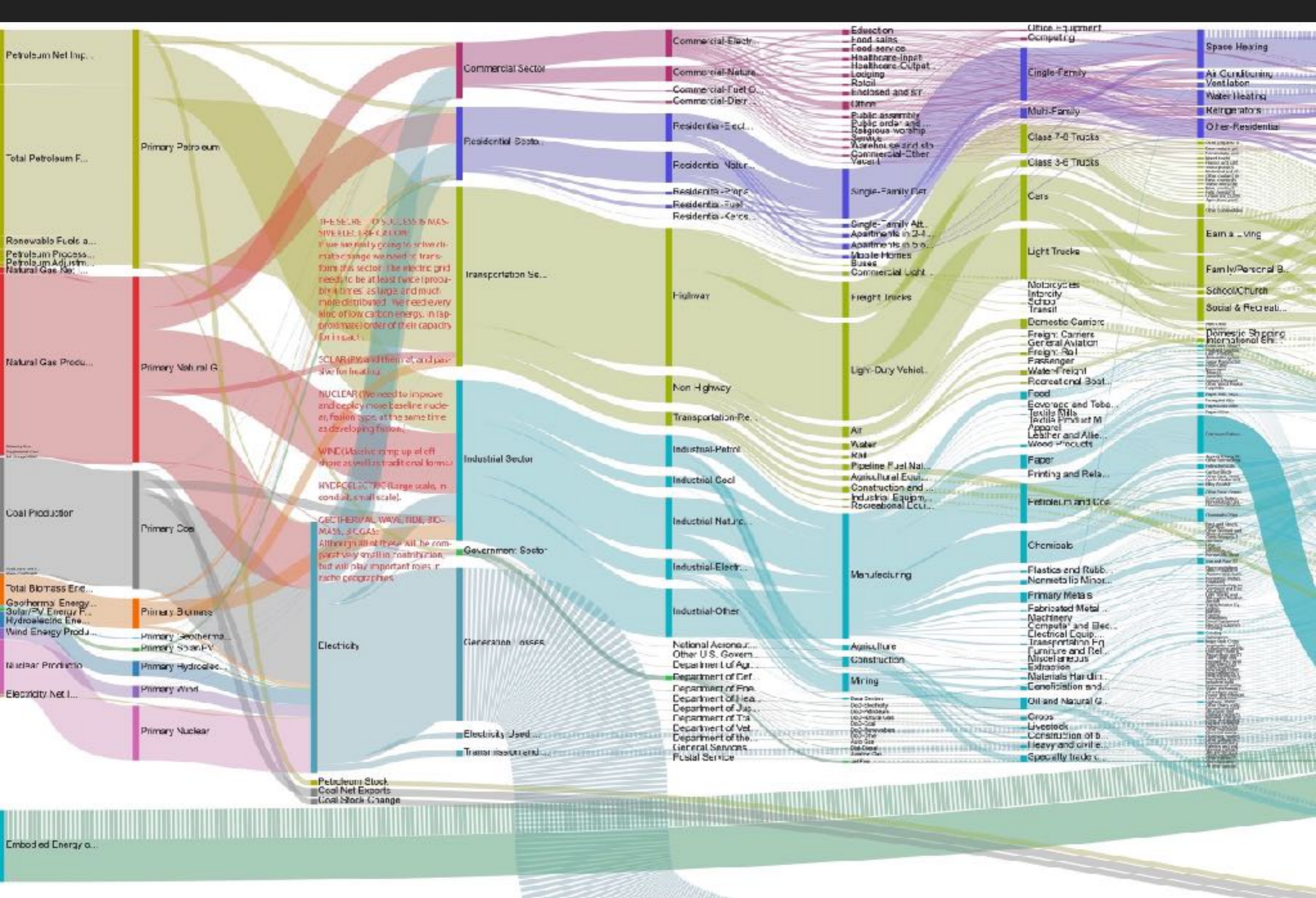
ELECTRIFY
EVERYTHING
DECARBONIZE
ELECTRIC



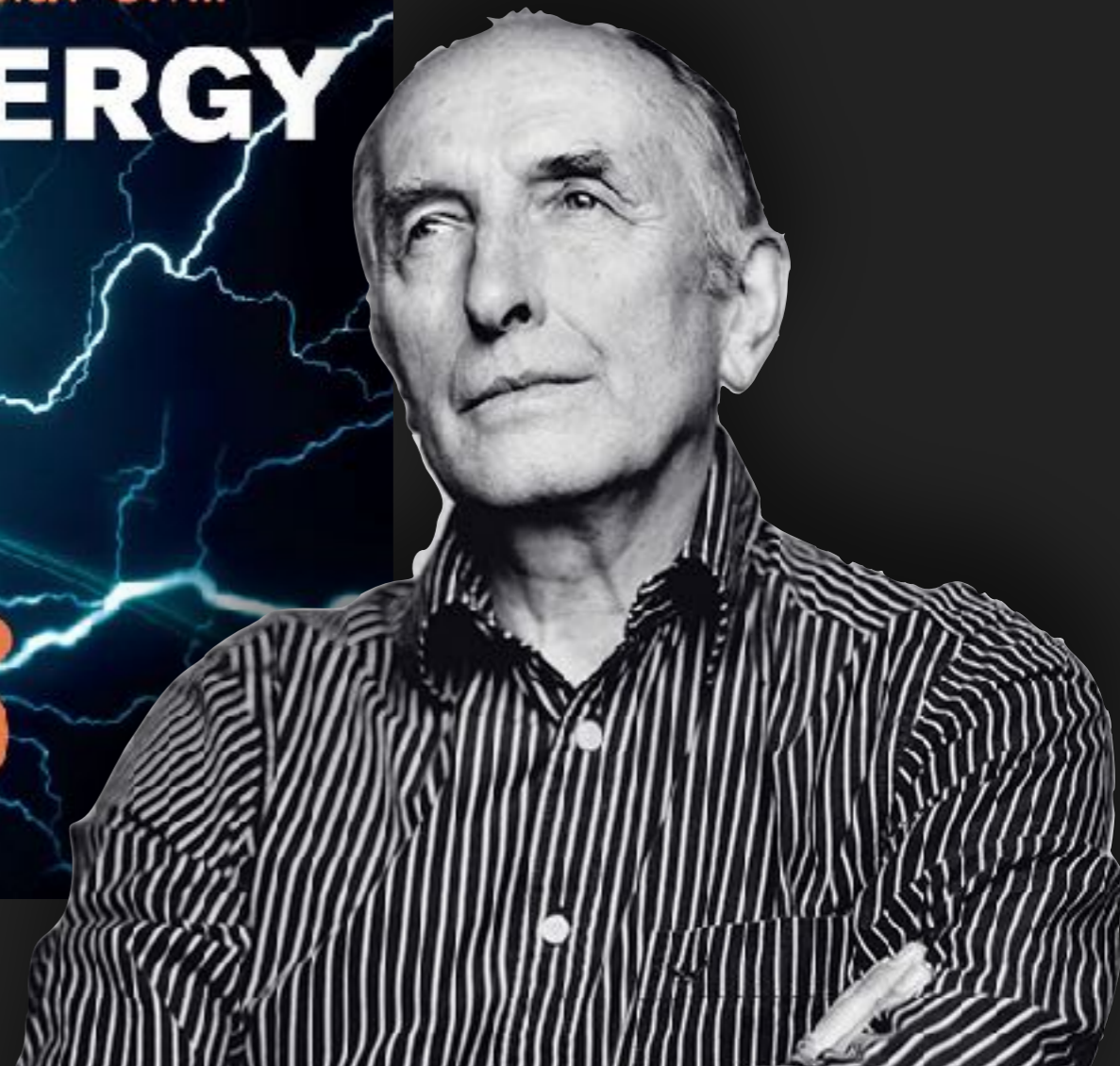
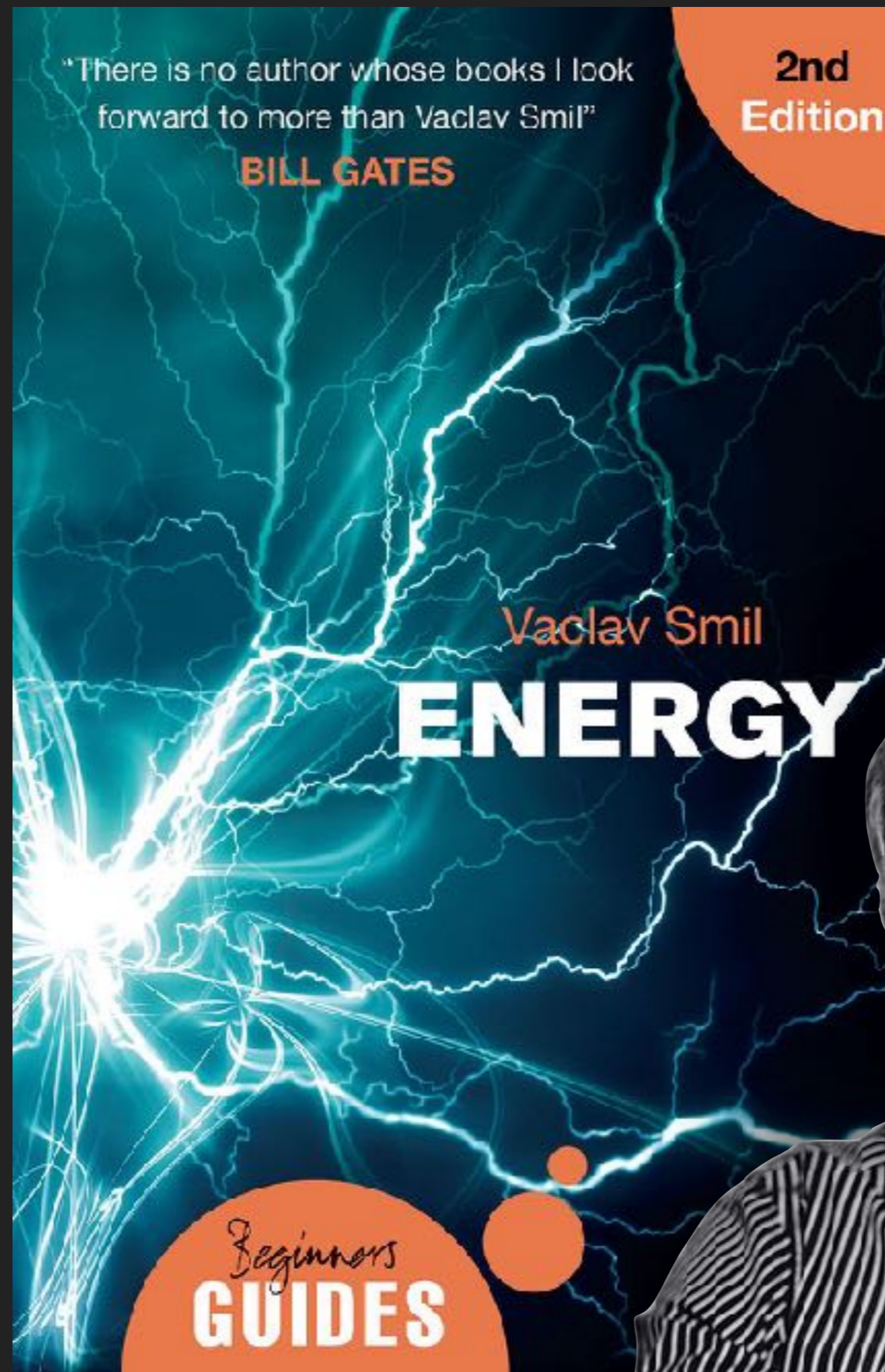
Estimated U.S. Energy Consumption in 2019: 100.2 Quads



Source: LLNL March, 2020. Data is based on DOE/EIA NER (2019). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 21% for the transportation sector and 49% for the industrial sector, which was updated in 2017 to reflect DOE's analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527



COURSE TEXT



More here: <https://www.fddrsn.net/teaching/energy/resources>



THANKS!