



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



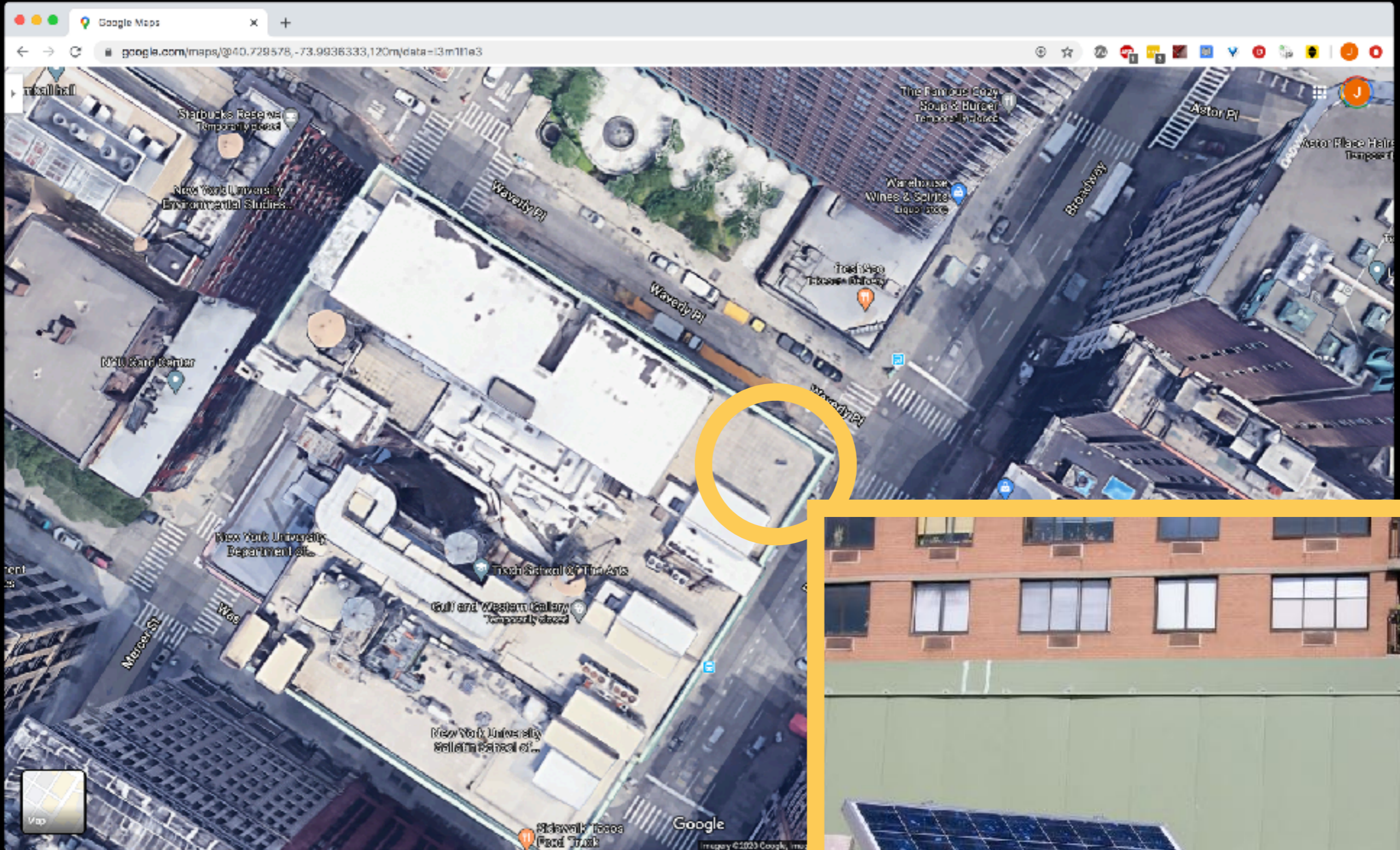
2003 BLACKOUT



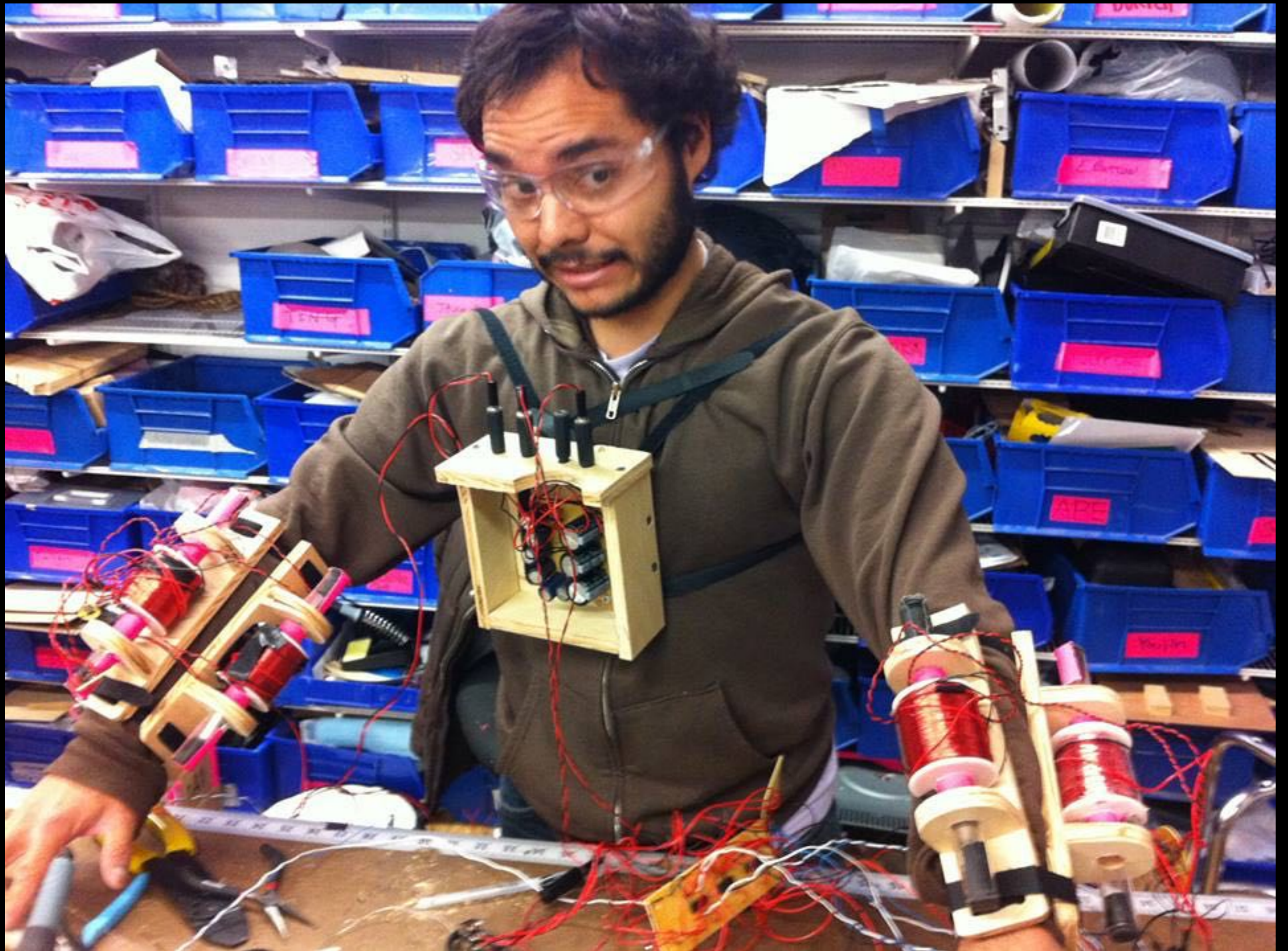
2003 BLACKOUT



NYU's FIRST (?) SOLAR - 2004













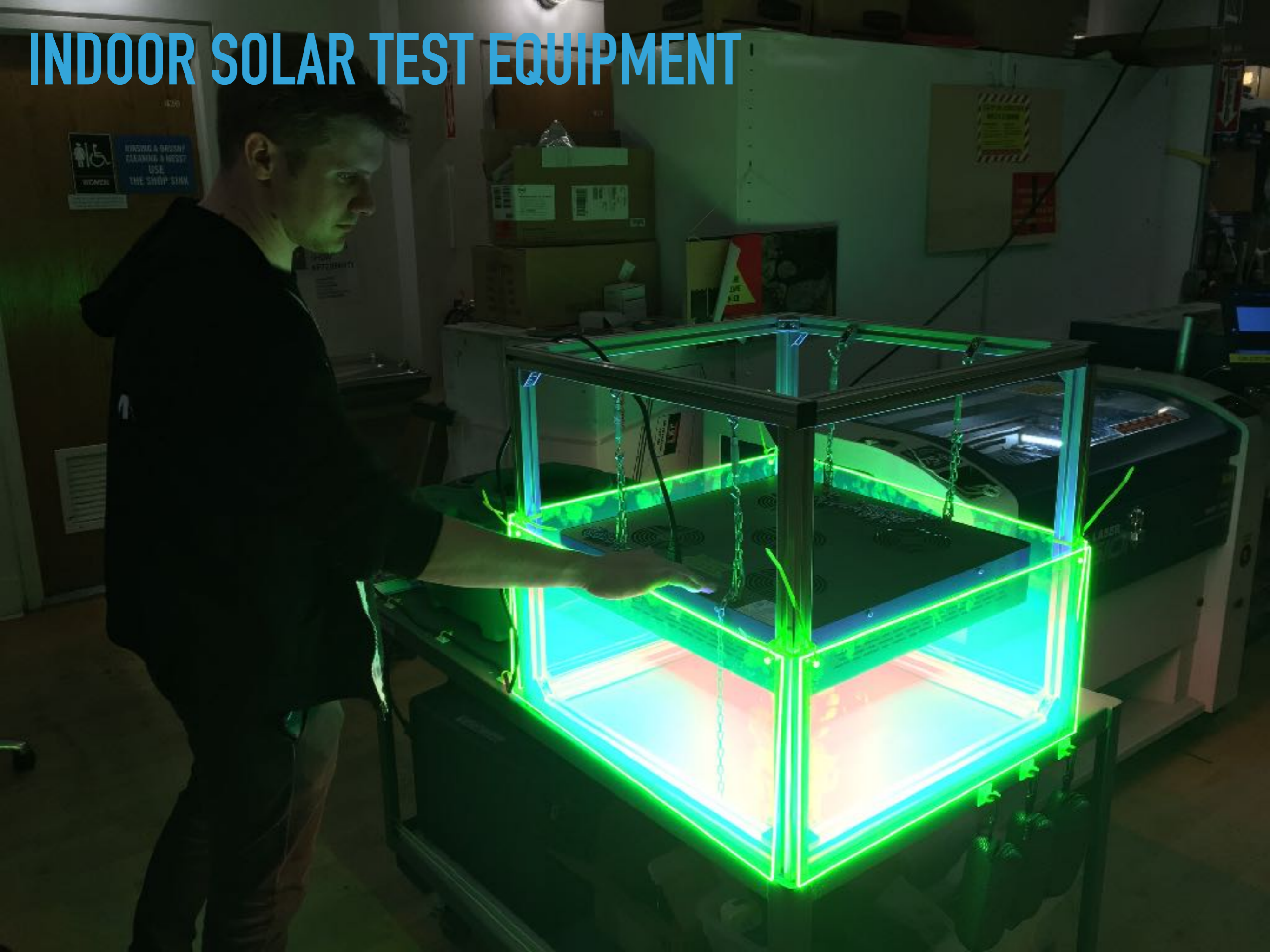
PNC BEACON



2004-2019



INDOOR SOLAR TEST EQUIPMENT





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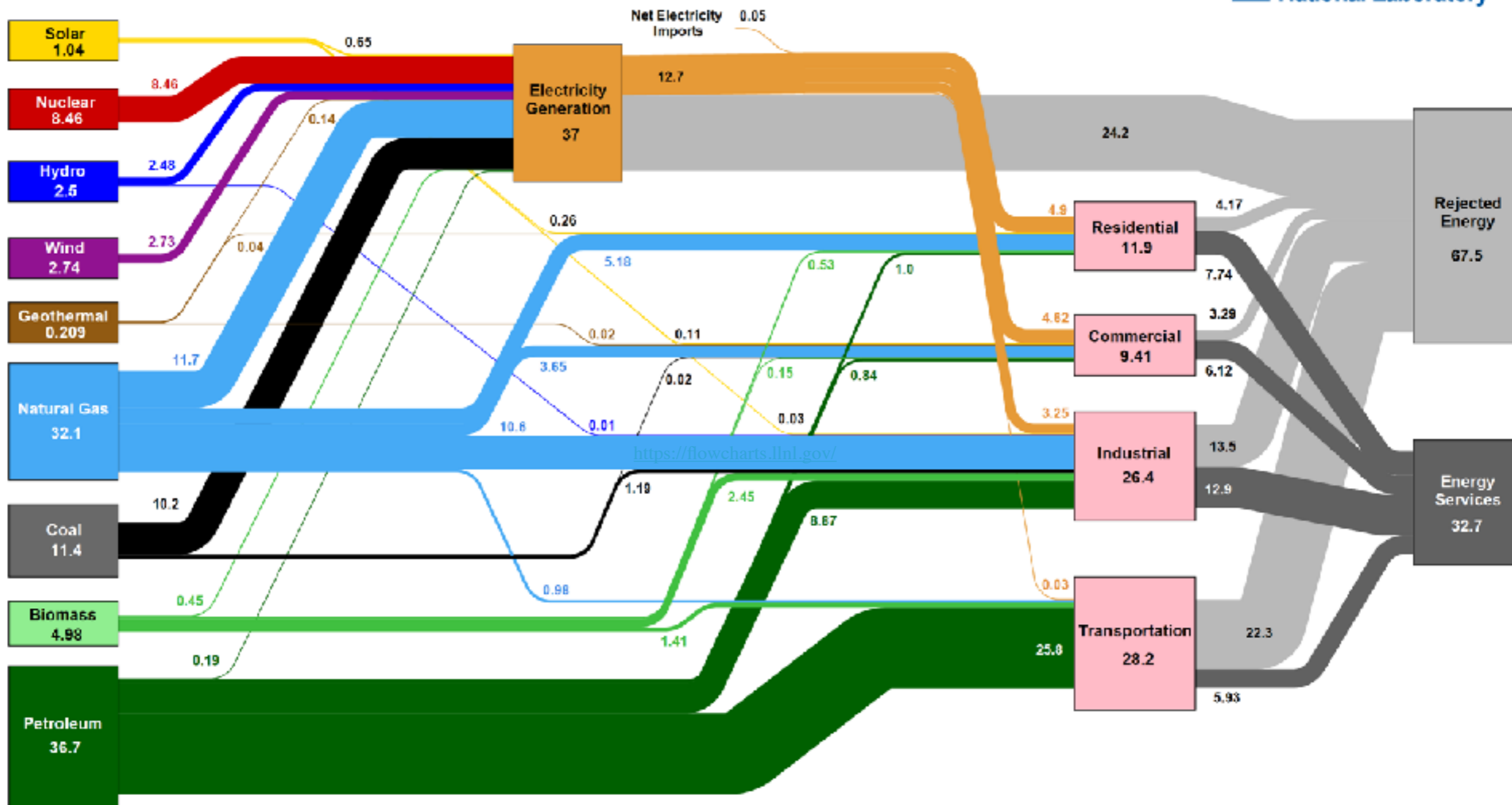
—Vaclav Smil



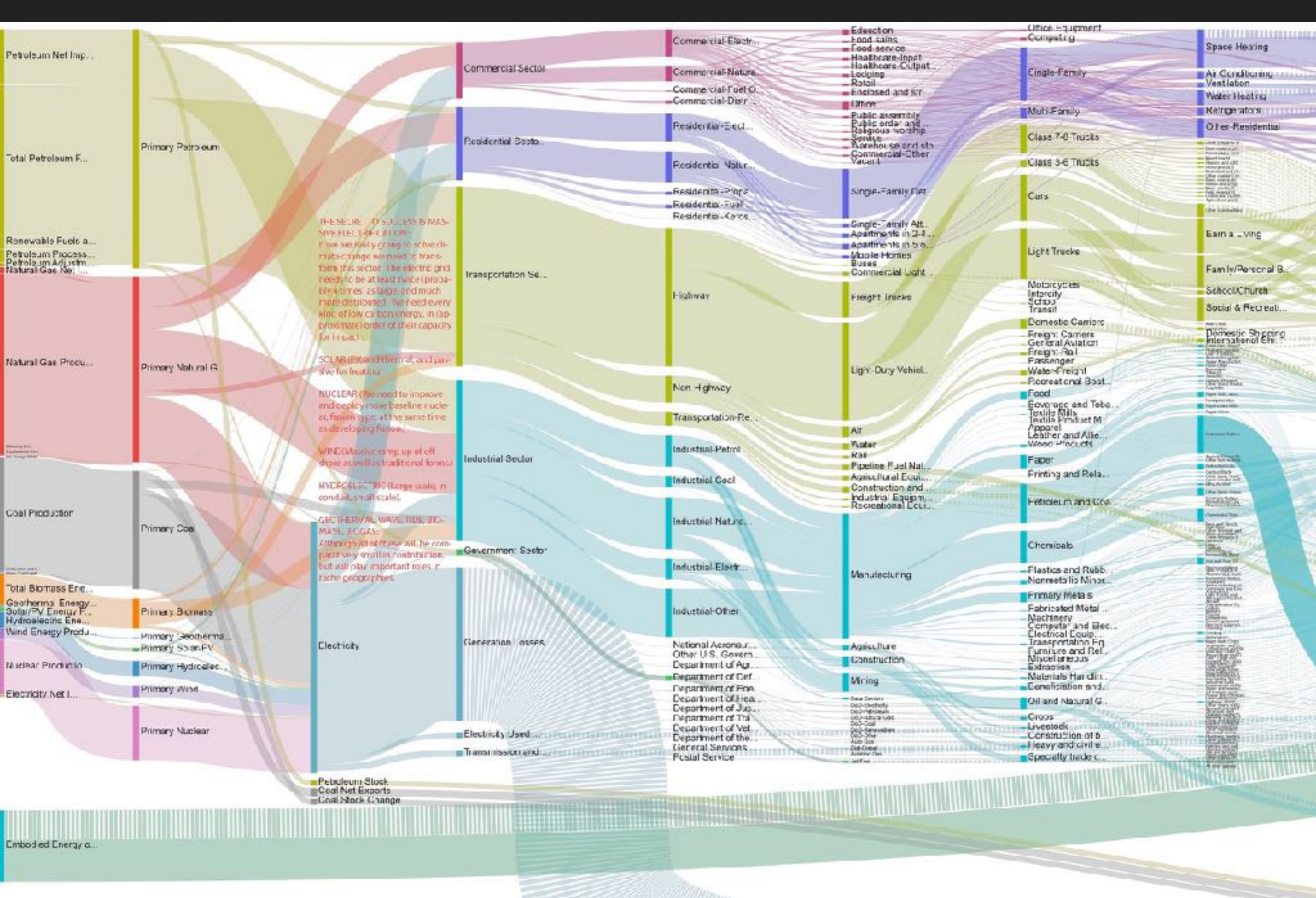
ELECTRIFY
EVERYTHING
DECARBONIZE
ELECTRIC



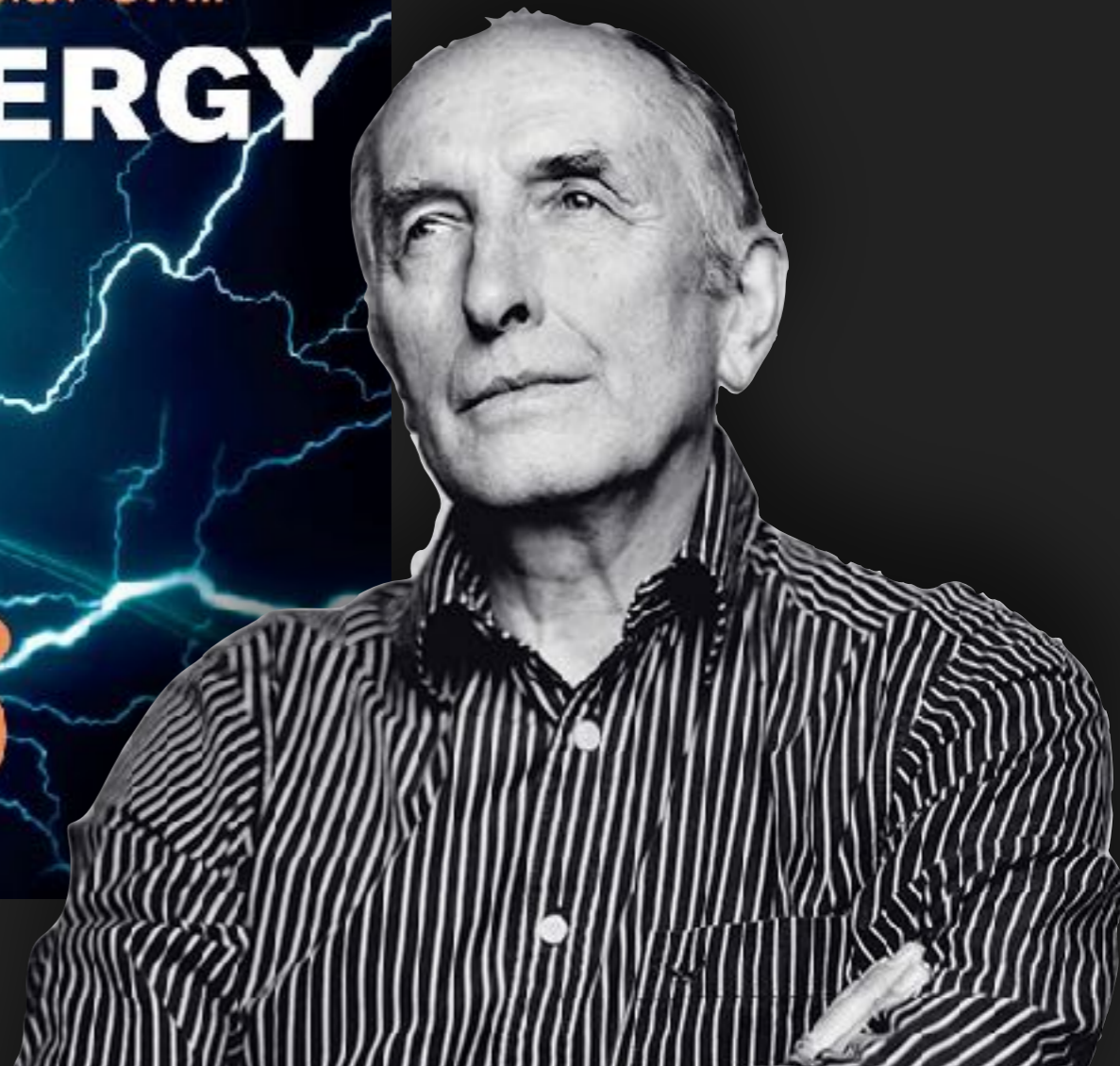
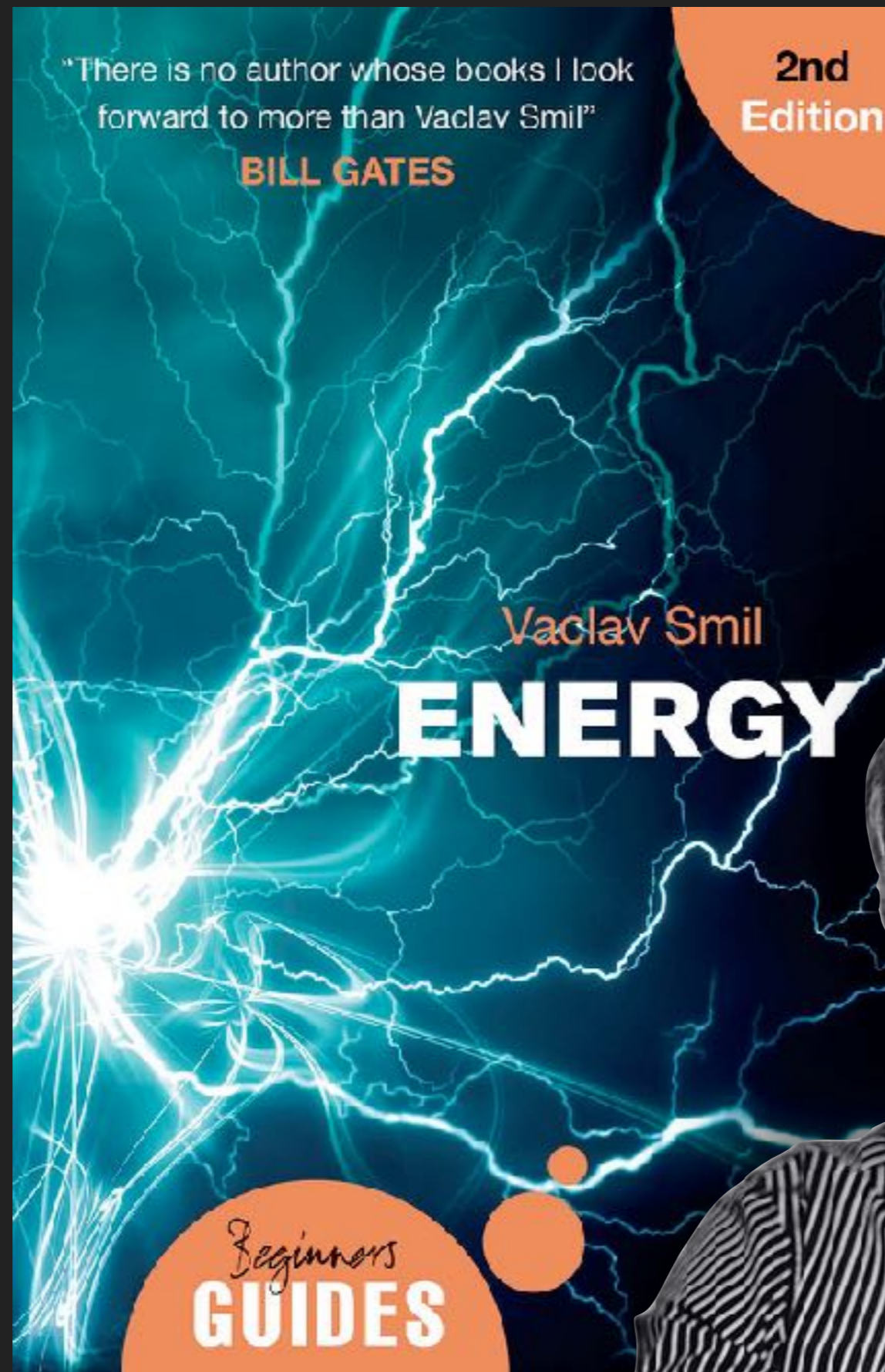
Estimated U.S. Energy Consumption in 2019: 100.2 Quads



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



RECOMMENDED RESOURCES



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

RECOMMENDED RESOURCES



<https://www.greentechmedia.com/podcast/the-energy-gang>

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



THANKS!