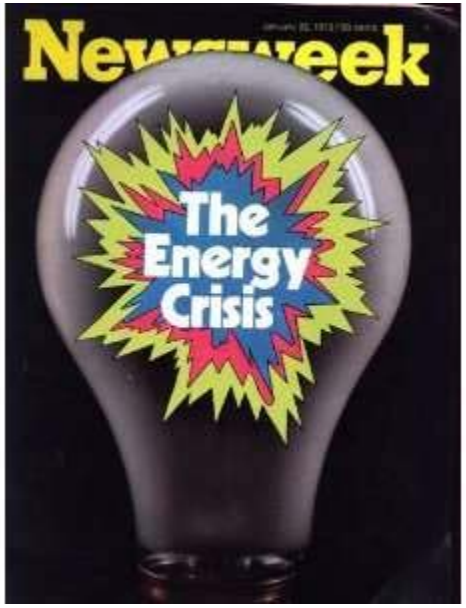
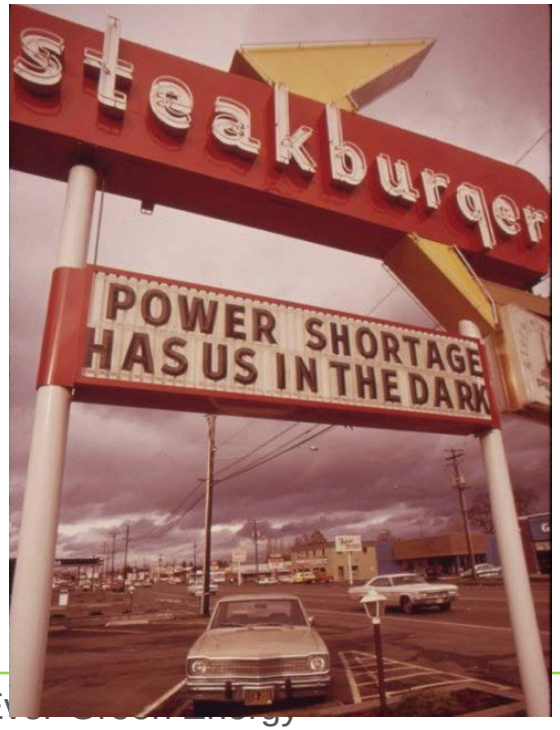
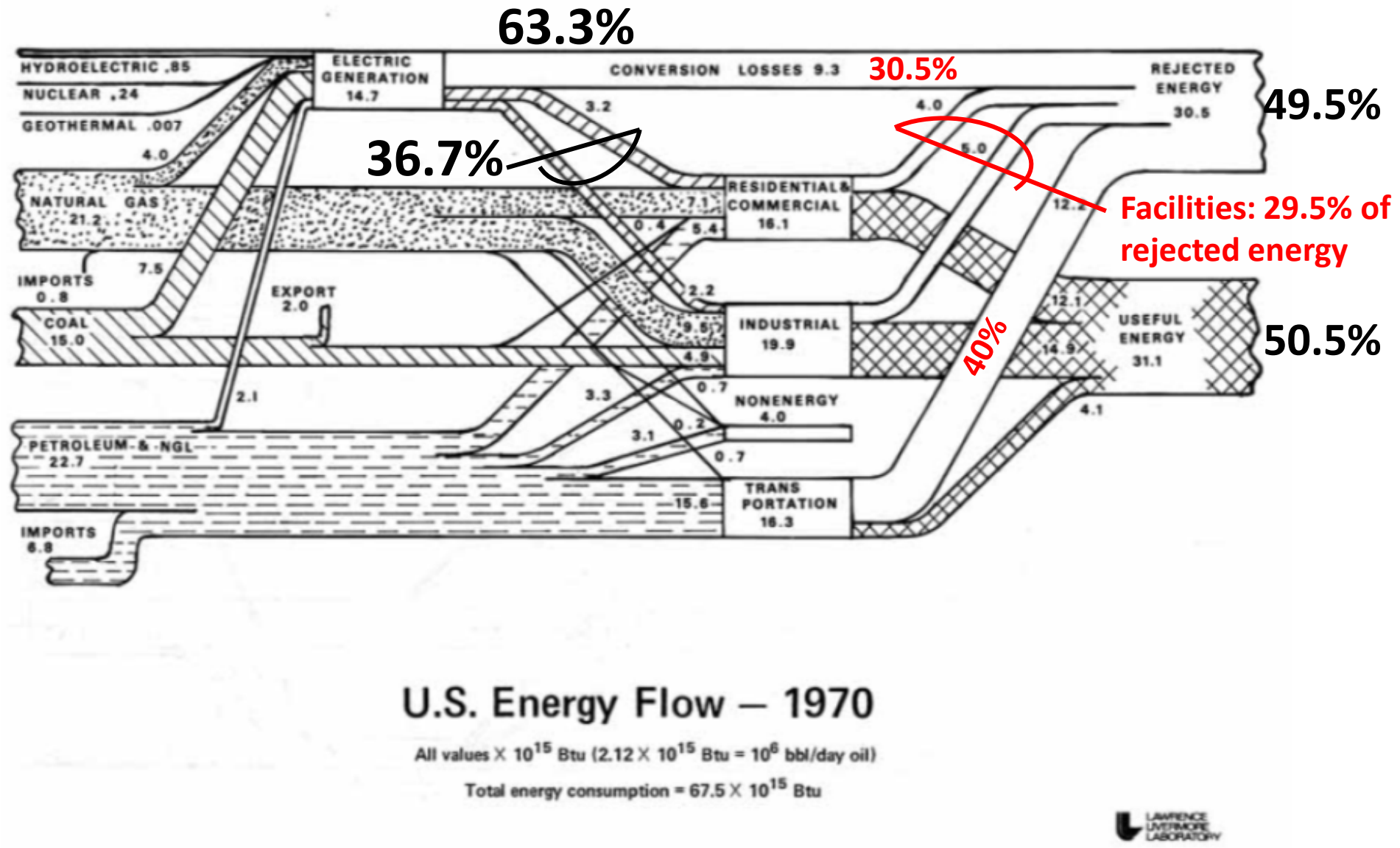
The Evolving Energy System


SPEED
LIMIT
55
It's a law
we can


The
Energy
Crisis


LESS HIGHWAY LIGHTING
DUE TO
ENERGY CONSERVATION
DRIVE CAREFULLY


steakburger
POWER SHORTAGE
HAS US IN THE DARK



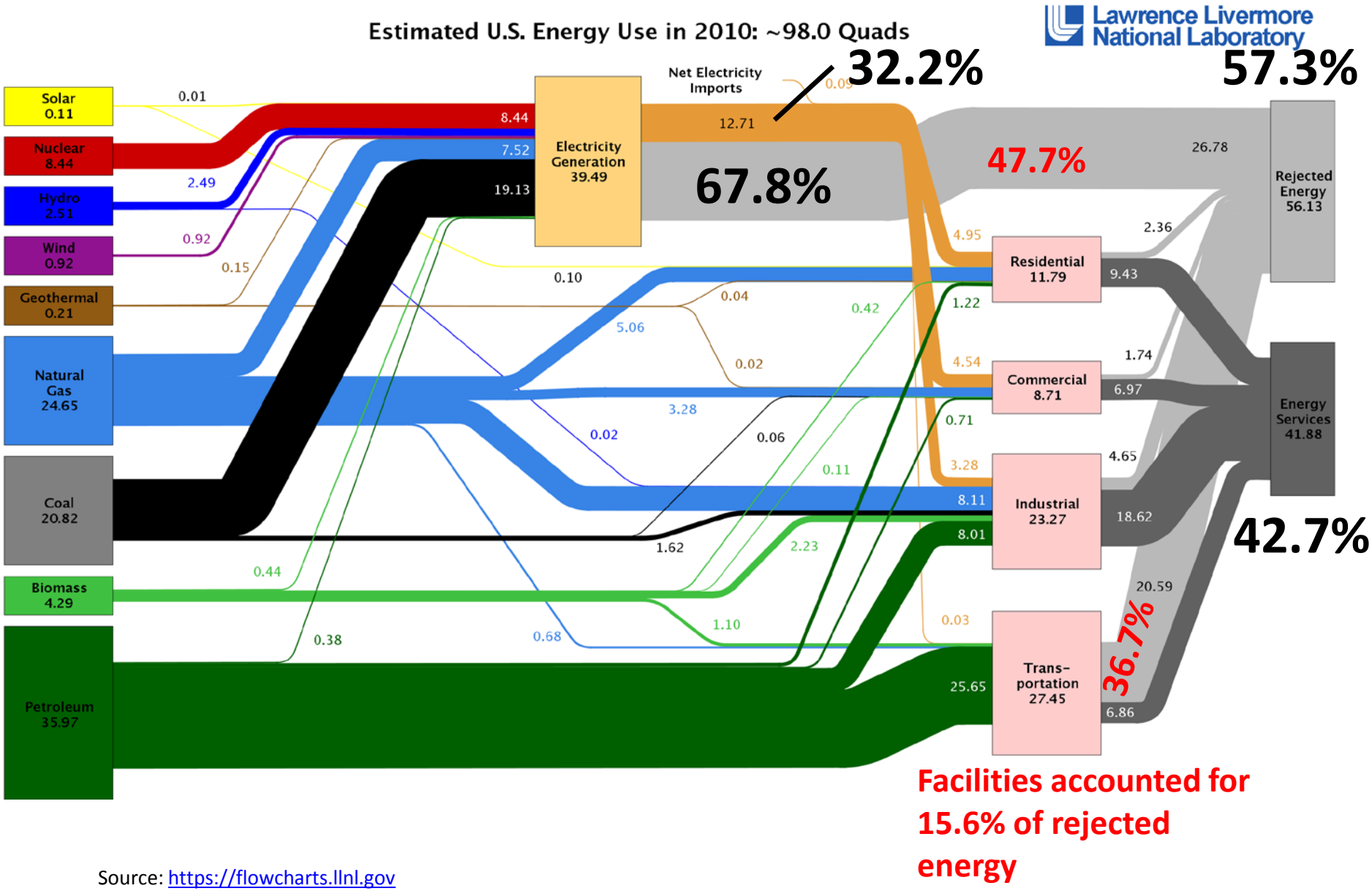
U.S. Energy Flow — 1970

All values X 10^{15} Btu (2.12×10^{15} Btu = 10^6 bbl/day oil)

Total energy consumption = 67.5×10^{15} Btu

LAWRENCE LIVERMORE LABORATORY

Source: https://flowcharts.llnl.gov

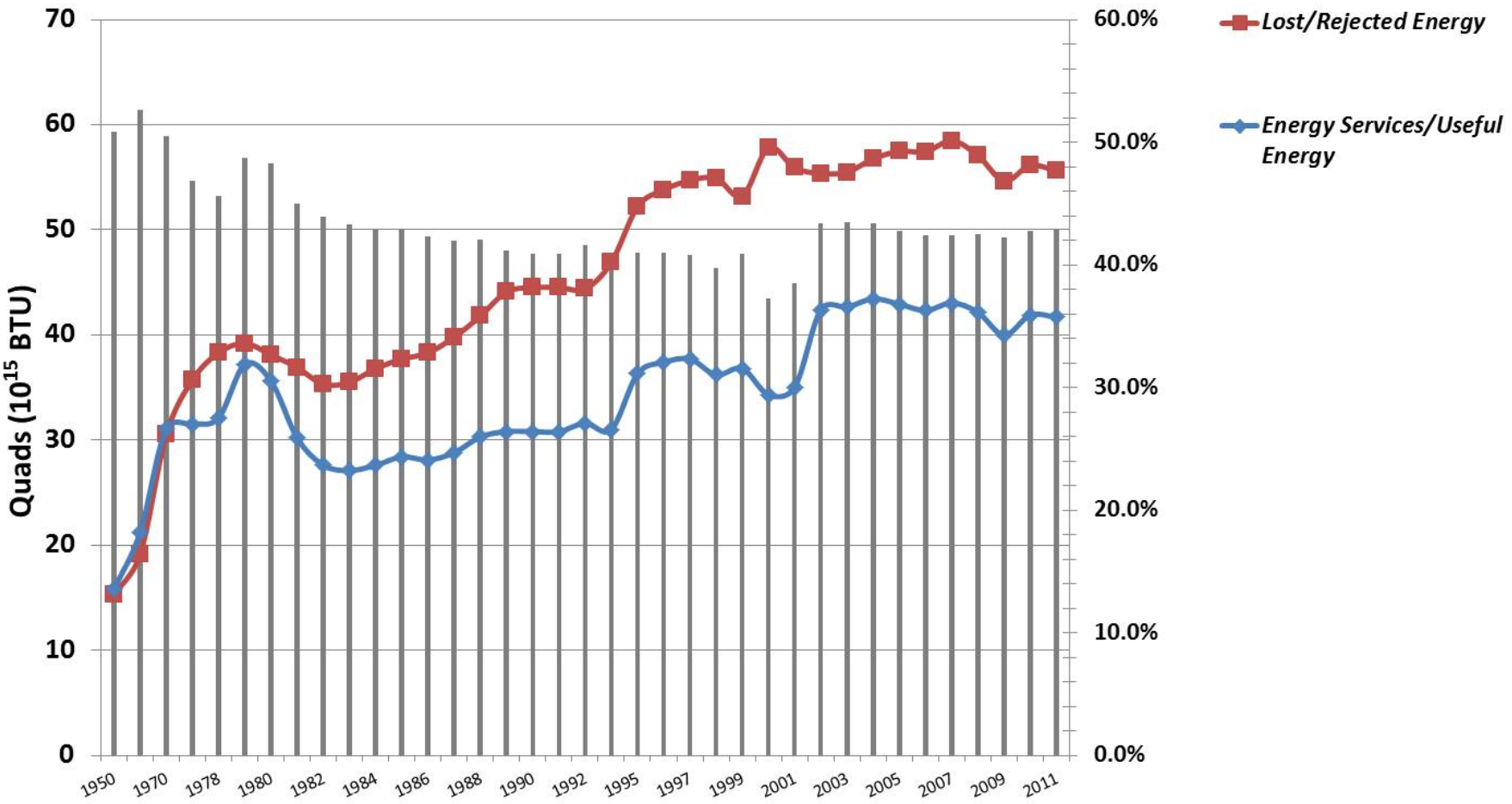


Source: https://flowcharts.llnl.gov

US Energy Usage and System Efficiency

1950 - 2011

Efficiency = Rejected Energy/(Energy Services + Rejected Energy)

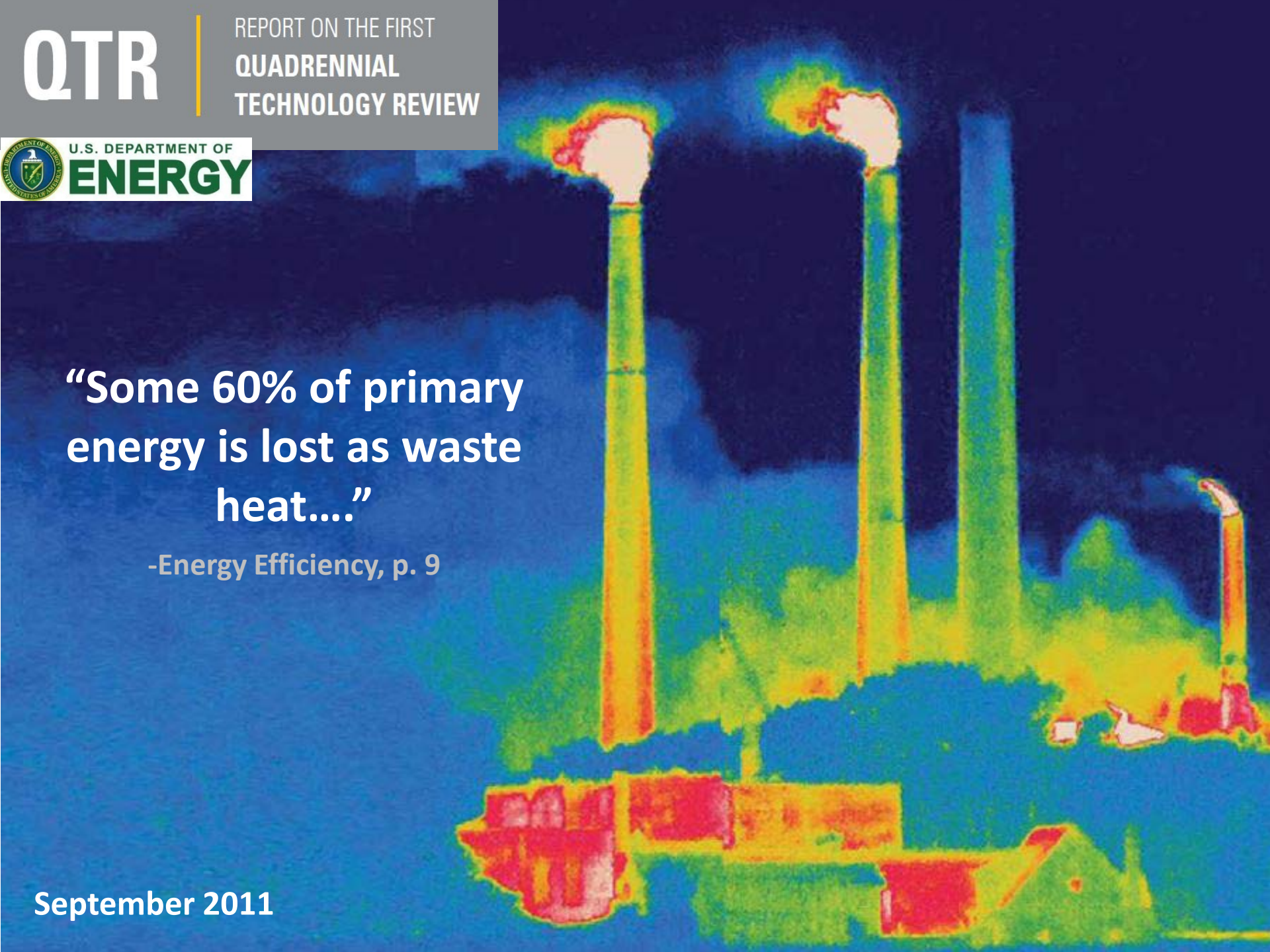


Source: Data from Lawrence Livermore National Laboratory Energy Flow Diagrams
https://flowcharts.llnl.gov/index.html

QTR

REPORT ON THE FIRST
QUADRENNIAL
TECHNOLOGY REVIEW

U.S. DEPARTMENT OF
ENERGY

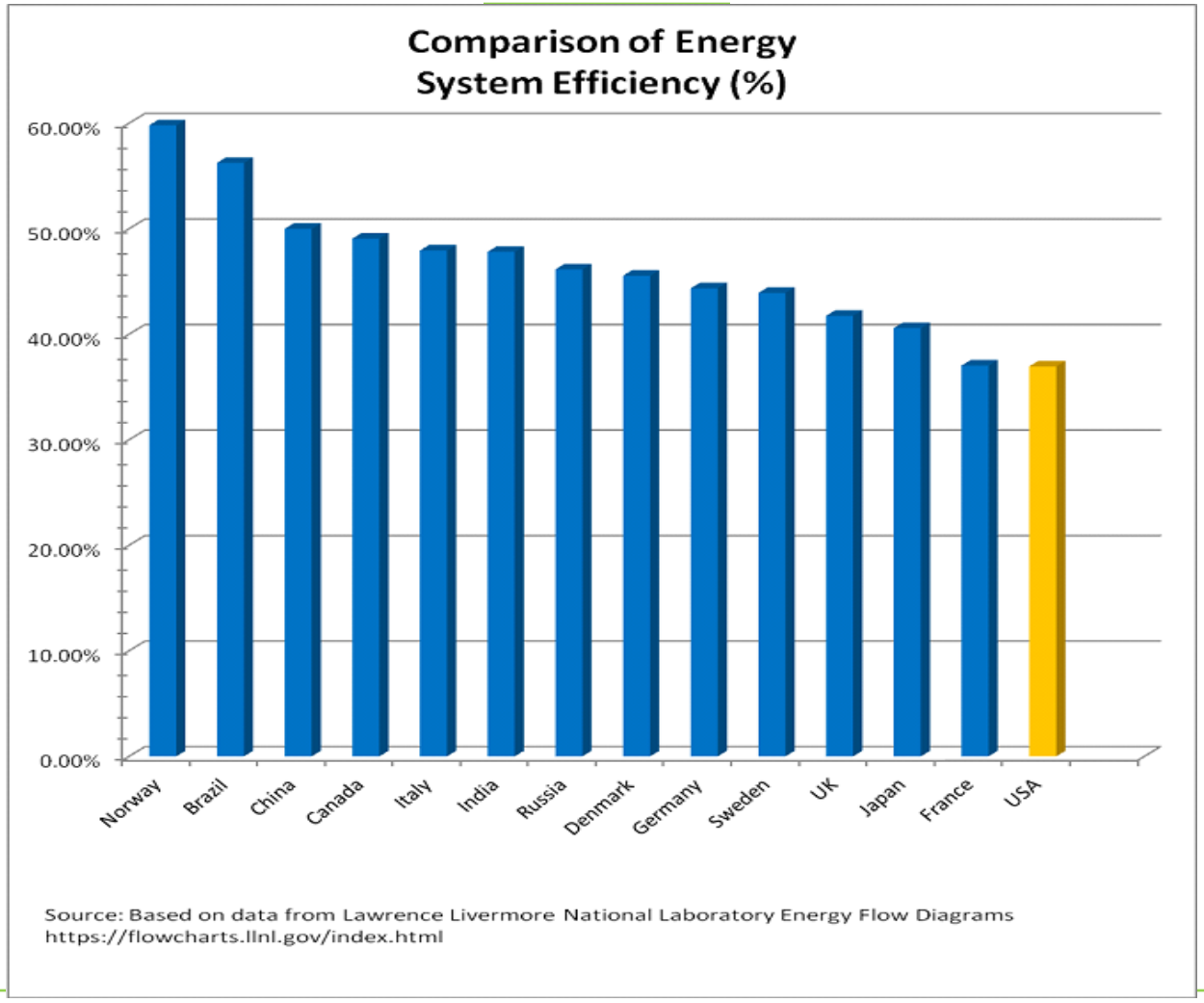


"Some 60% of primary energy is lost as waste heat…."

-Energy Efficiency, p. 9

September 2011

Global Comparison



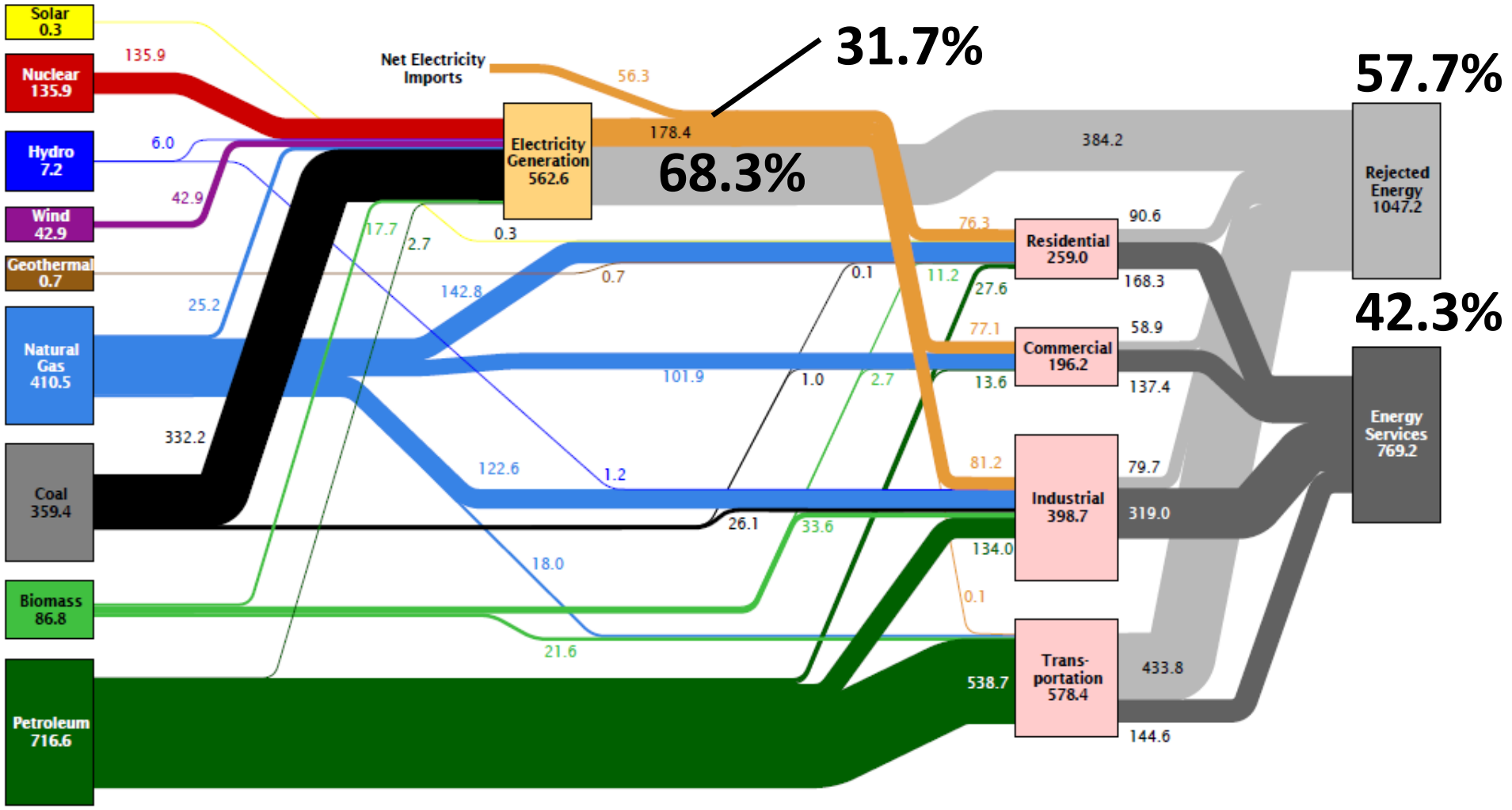
Source: Based on data from Lawrence Livermore National Laboratory Energy Flow Diagrams https://flowcharts.llnl.gov/index.html

Minnesota's Energy Profile

- Over 1,800 Trillion BTU's of primary energy used annually
  - $21 billion spent on energy in 2010
- Minnesota is essentially dependent on energy imported from other states and countries
  - 100% of coal and uranium
  - 100% of oil & petroleum products
  - 100% of natural gas
- Using energy efficiently benefits Minnesota's residents, economy and environment

Estimated Minnesota Energy Use In 2008
~1816.5 Trillion BTU

Lawrence Livermore National Laboratory

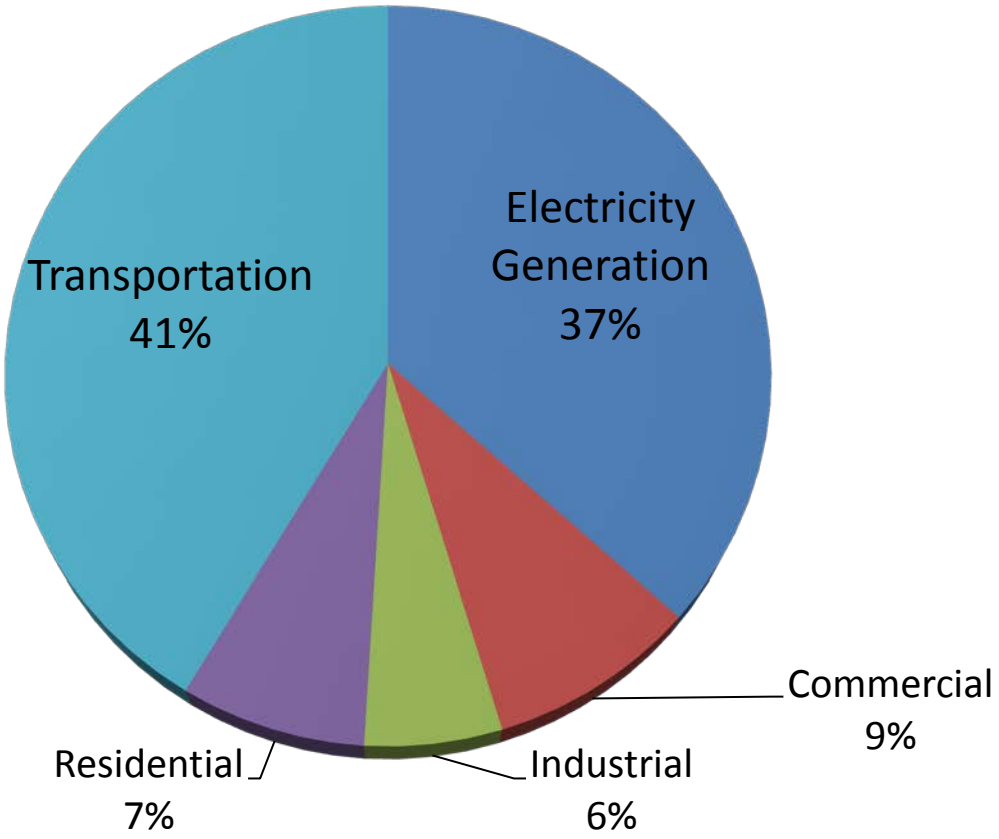


Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) 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. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Source: https://flowcharts.llnl.gov , Issued January 2011

MN 2008 Rejected/Lost Energy

1,047.2 Trillion BTU



Source: Data from Lawrence Livermore National Laboratory Energy Flow Diagrams - https://flowcharts.llnl.gov/index.html

Waste Heat Recovery Legislation

"Waste heat recovered and used as thermal energy" means capturing heat energy that would otherwise be exhausted or dissipated to the environment from machinery, buildings, or industrial processes and productively using such recovered thermal energy where it was captured or distributing it as thermal energy to other locations where it is used to reduce demand side consumption of natural gas, electric energy, or both.

Demand side natural gas or electric energy displaced by use of waste heat recovered and used as thermal energy, including the recovered thermal energy from a cogeneration or combined heat and power facility, is eligible to be counted towards a utility's natural gas or electric energy savings goals, subject to department approval.