

Army Net Zero Workshop
Chicago, Illinois
January 19, 2012

*Advancing Energy Through
Integration*



EVER-GREEN ENERGY™

Kenneth W. Smith P.E., President & CEO

District Energy St. Paul Mission

“Be the preferred provider of community energy services that benefit our customers, the community and the environment.”



First Heating Customers - 1983



First Cooling Customers - 1993



Combined Heat & Power Startup - 2003



Solar Thermal Startup - 2011



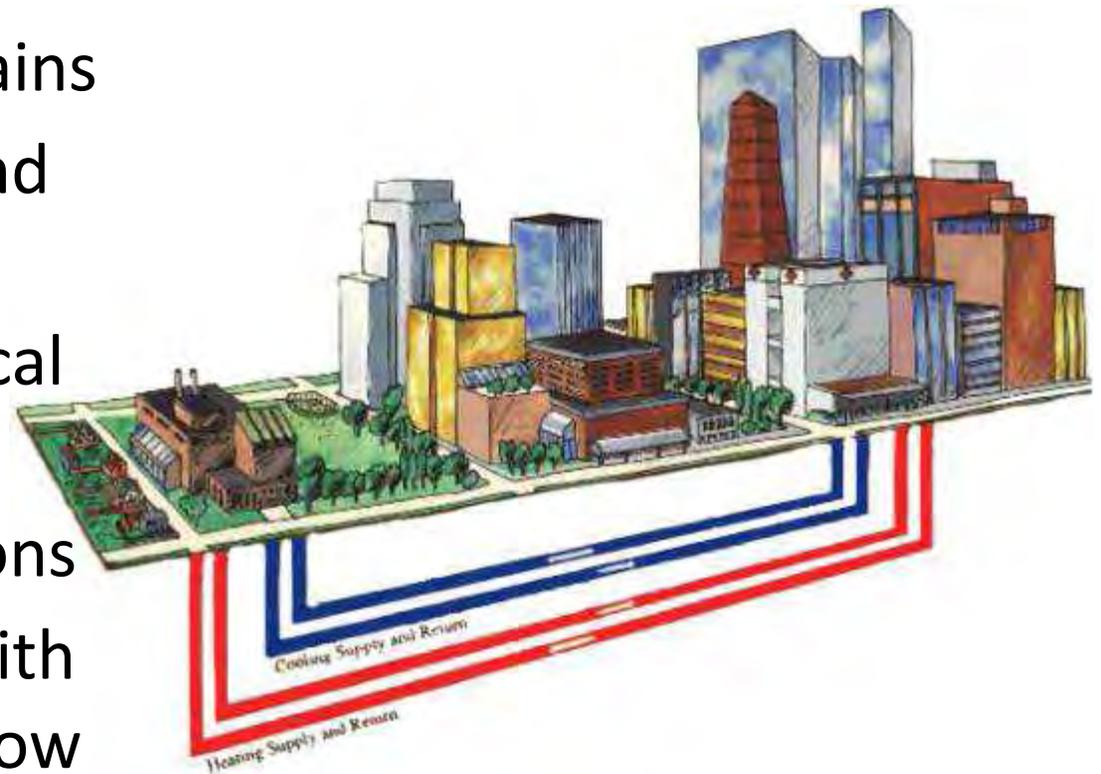
Heating and Cooling Saint Paul



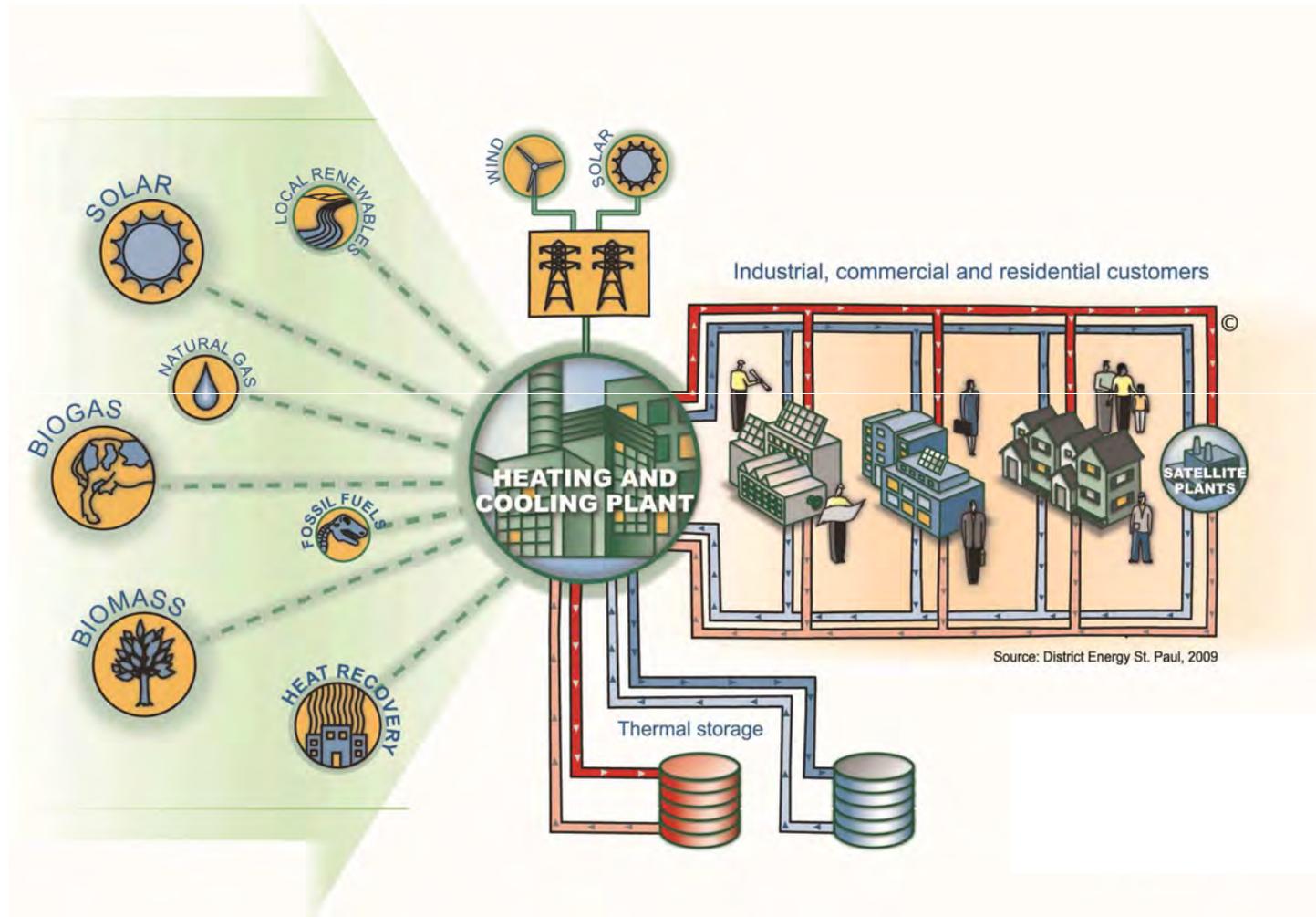


District Energy: Empowering Cities for the Future

- Enables integration
- Unlocks efficiency gains
- Improves security and reliability
- Stable and economical rates
- Reduce GHG emissions
- Solution for today with flexibility for tomorrow



Integrated Energy System



District Cooling

- 30,000 Ton Capacity
- Reduced use of CFC refrigerants or groundwater
- 37,600 feet of twin chilled-water pipelines
- 30 inches in diameter
- Eight electric and two steam-absorption chillers, and several satellite chillers



Thermal Storage

- 6.5 million gallons of storage capacity
- Chilled water storage reduces peak-electric demand
- Firm capacity for weather events



Biomass-Fueled Combined Heat & Power

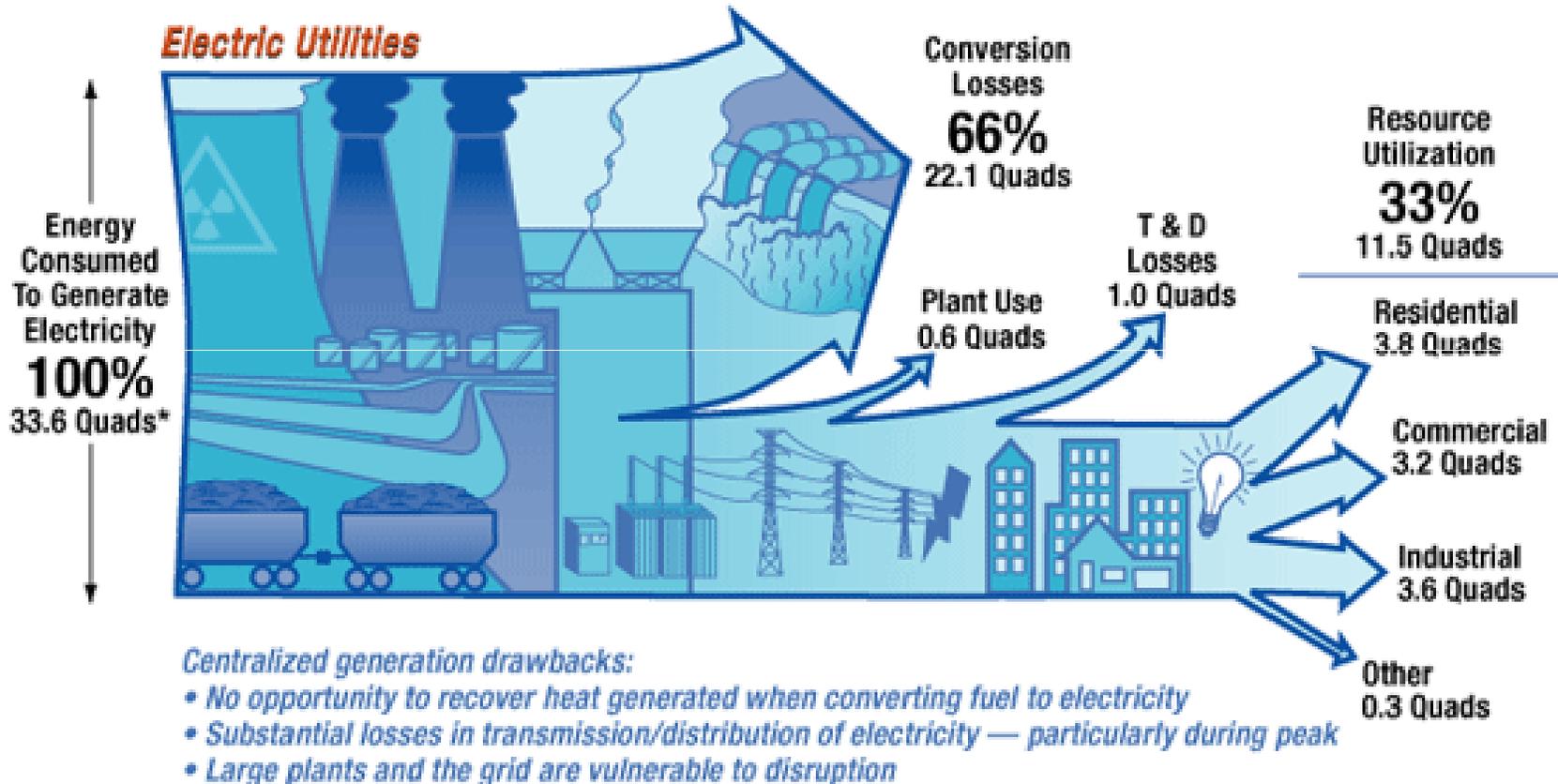


12,000 truckloads of wood waste diverted from the waste stream to create energy.



Current U.S. Electricity Consumption

Opportunity — Useful heat rejected/dumped to the environment



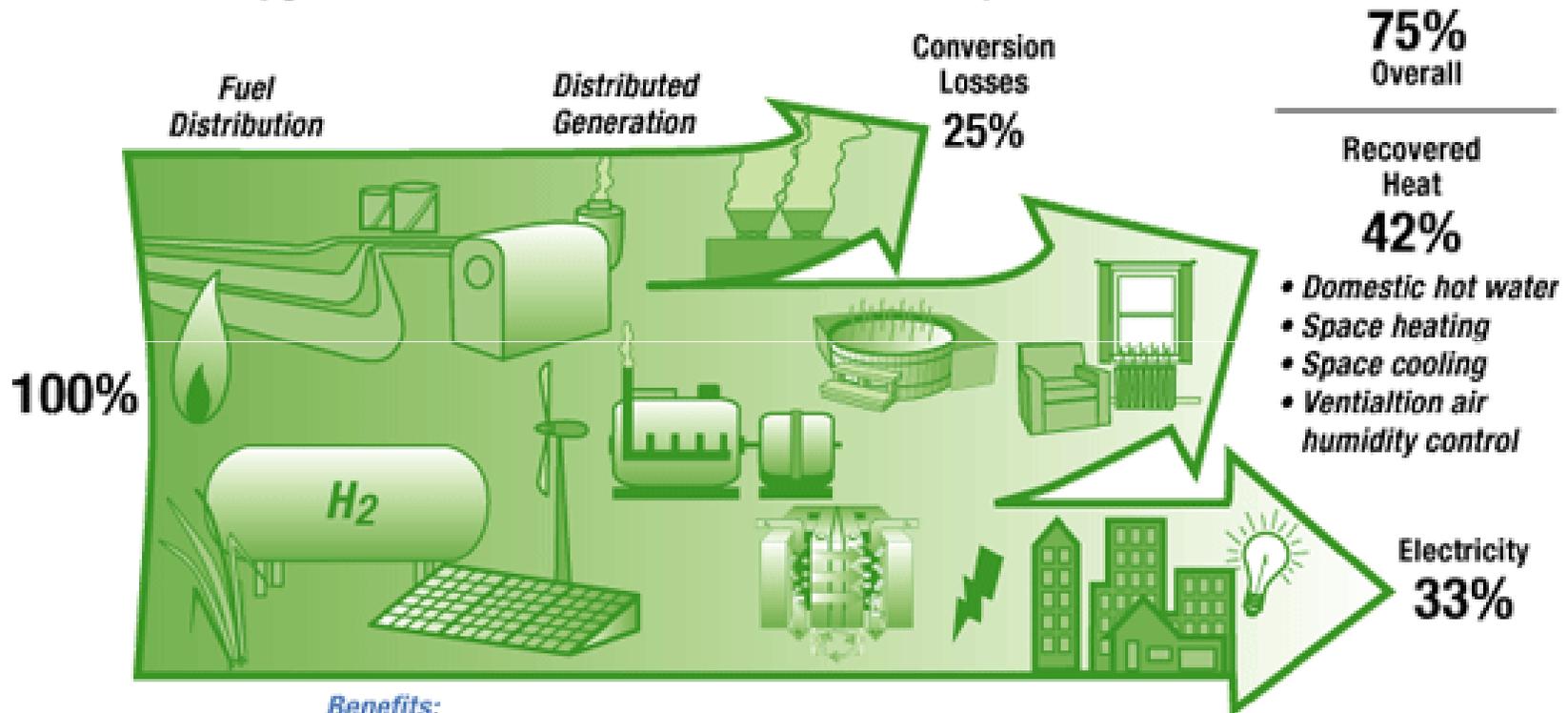
*Quads — Quadrillion Btu's

Source: NREL, <http://www.nrel.gov/dtet/about.html>



Opportunity for Future U.S. Energy Consumption

*Combined heat and power solution to recycling waste heat:
Distribute electricity generation to where waste heat can be recovered and put to use.*



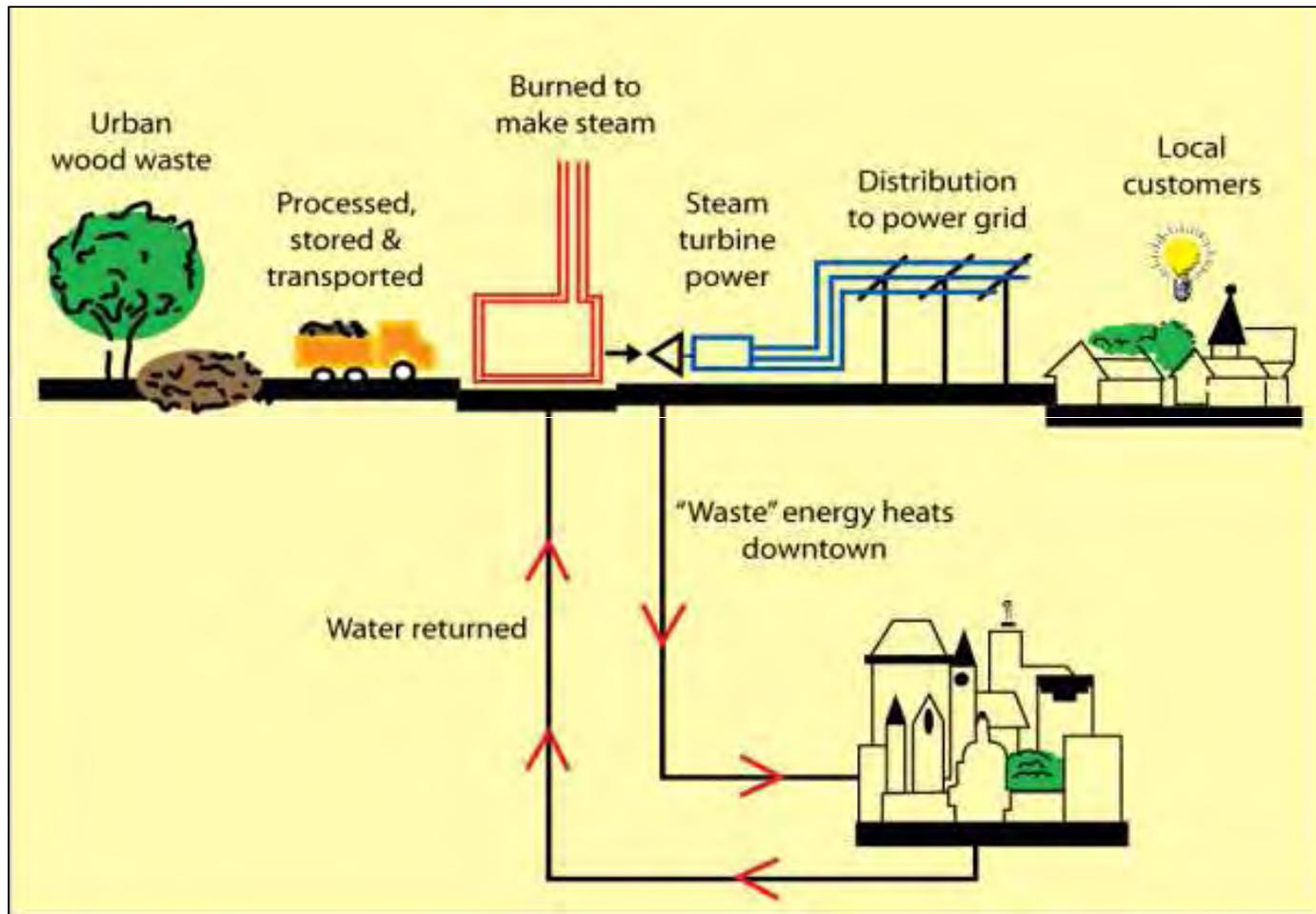
Benefits:

- More efficient use of our natural resources
- More secure against natural and man-made disasters
- Reduced pollution
- Enhanced indoor air quality and comfort

Source: NREL, <http://www.nrel.gov/dtet/about.html>



Integration of Biomass Fueled CHP



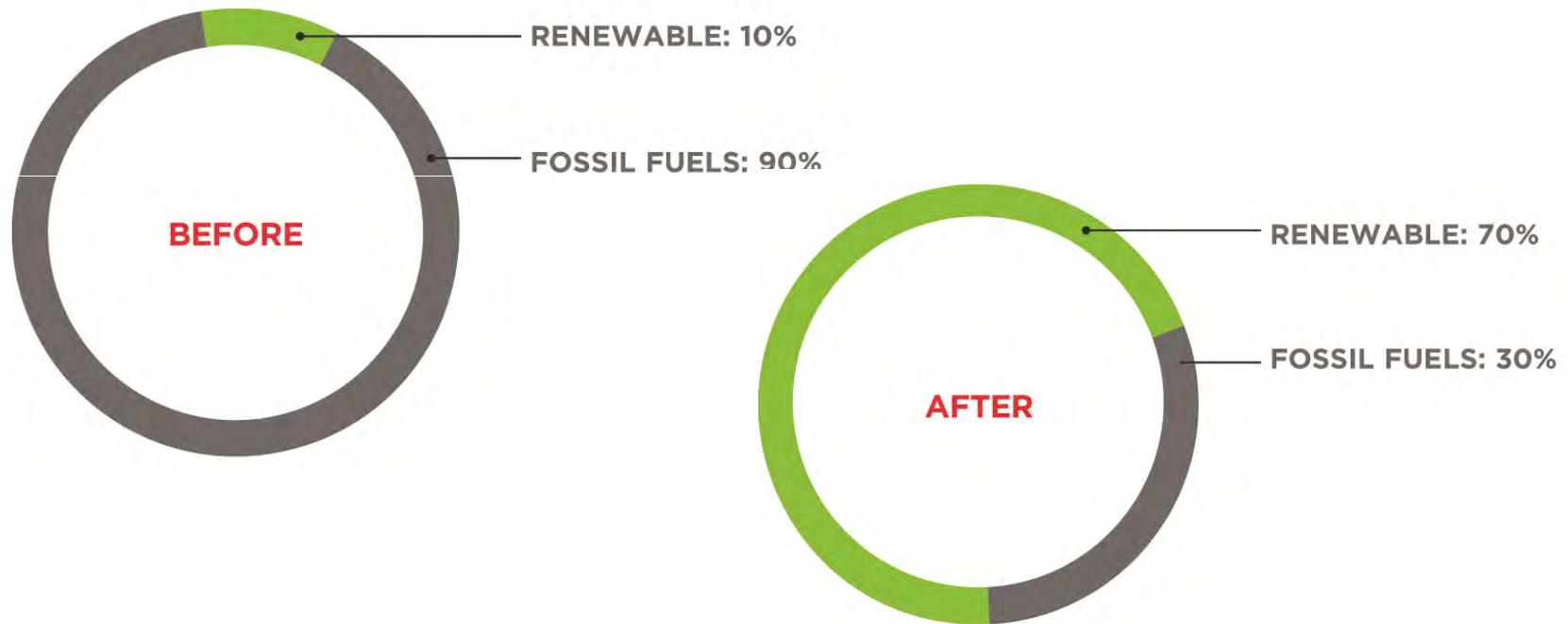
Biomass – Why wood fuel?

- Large quantities in region
- Clean wood waste diverted from landfills
- Created new industry for collecting and processing wood
- Puts up to \$12 million annually into local economy



Fuel Diversification

Before and After Wood-Fired CHP Project



Solar Thermal & District Energy

(A Proven Partnership)



Kungälv, Sweden

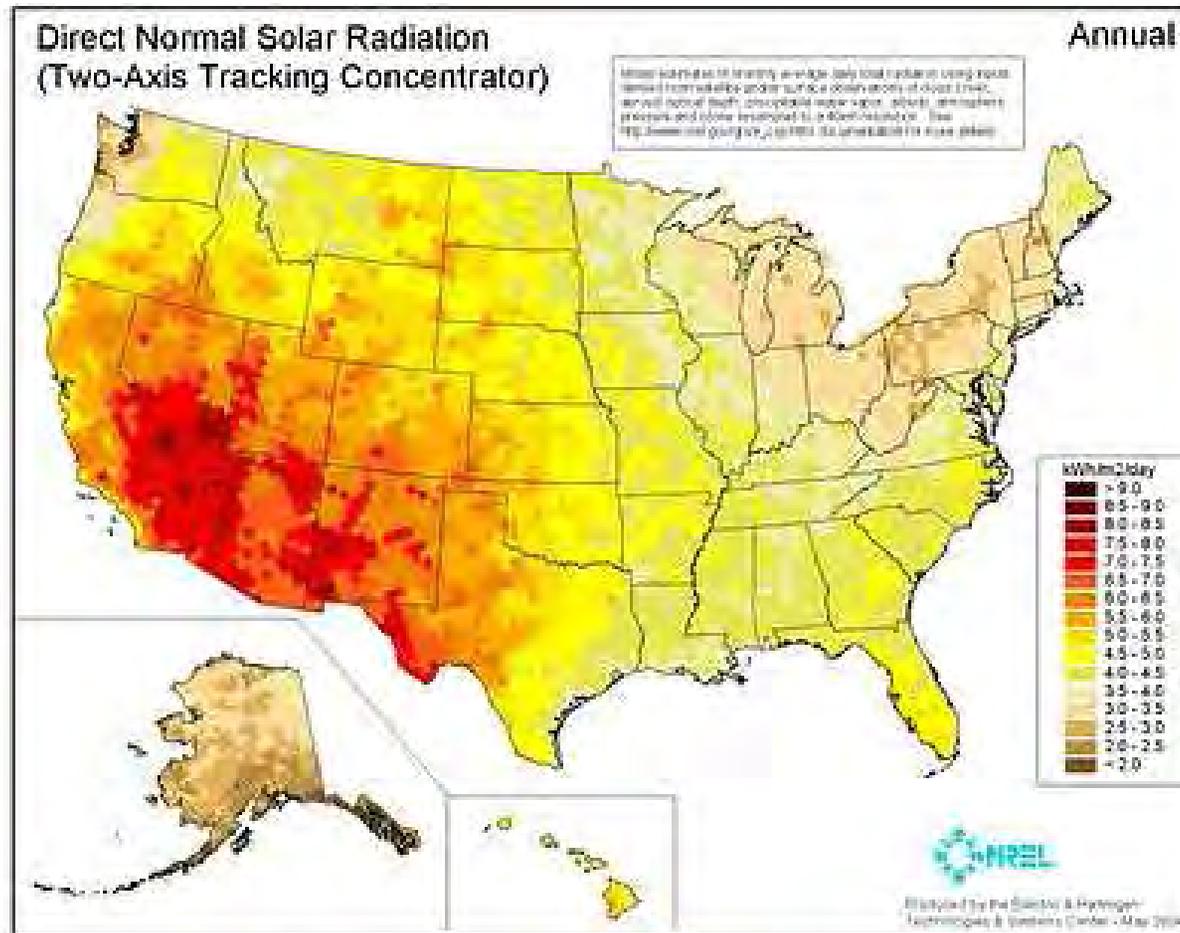


Graz, Austria



Solar Works in Minnesota

(And solar thermal works even better)



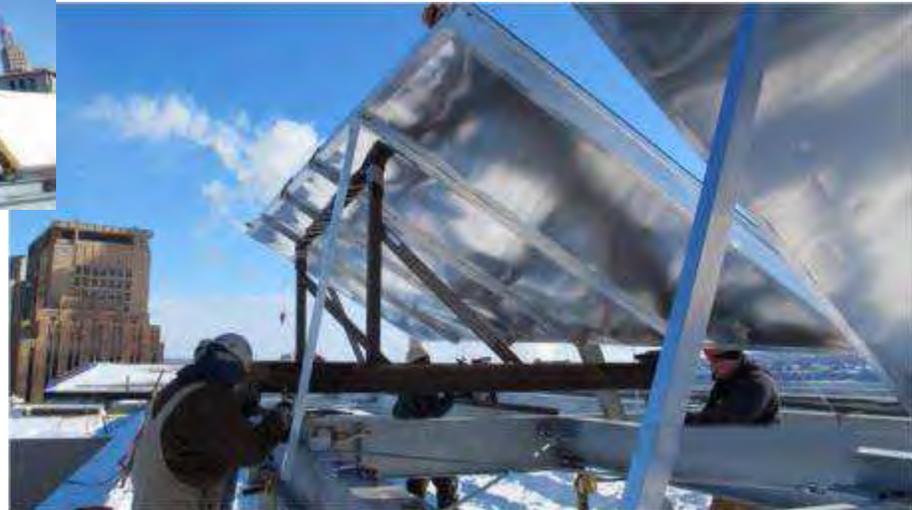
Department of Energy Market Transformation Program

Opportunity

- Showcase large scale solar projects.
- Utilizing one site installation to serve the heating needs of multiple buildings (1st in the U.S.)
- New market for installing and manufacturing solar thermal goods
- Market opportunity for hundreds of North American district energy systems (hot water or steam)



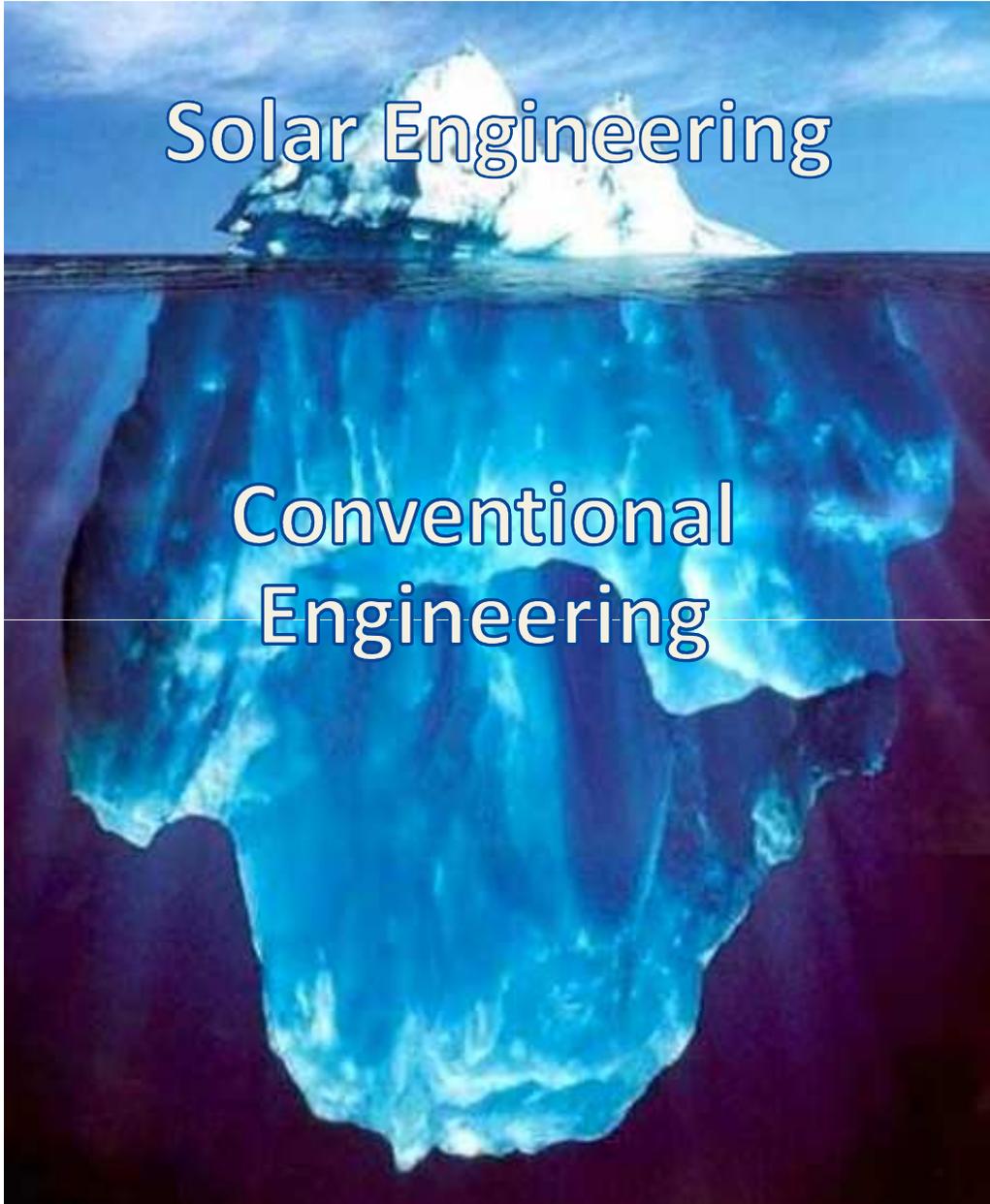
Installation of Nation's Largest Solar Hot Water System





This project was made possible through partnerships with the City of Saint Paul, State of Minnesota, Department of Energy, TKDA, Sheehy Construction, Pioneer Power, and Johnson Controls



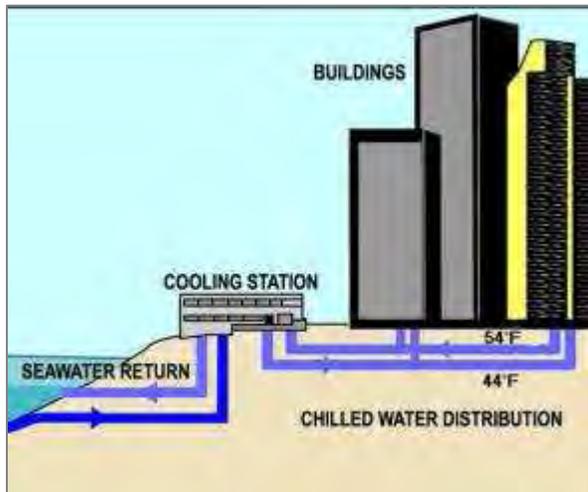
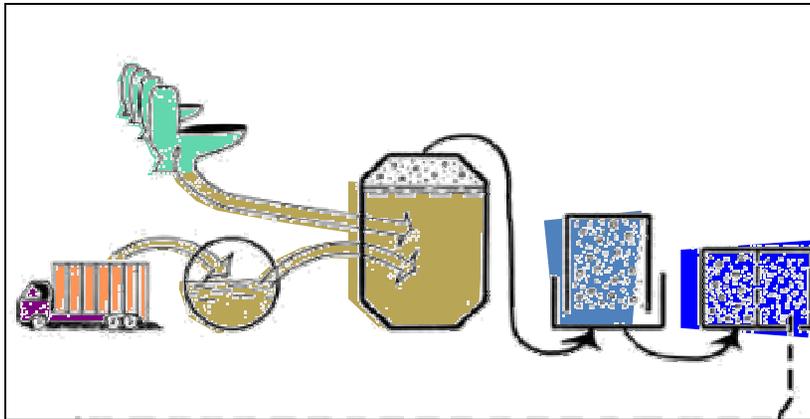


Solar Engineering

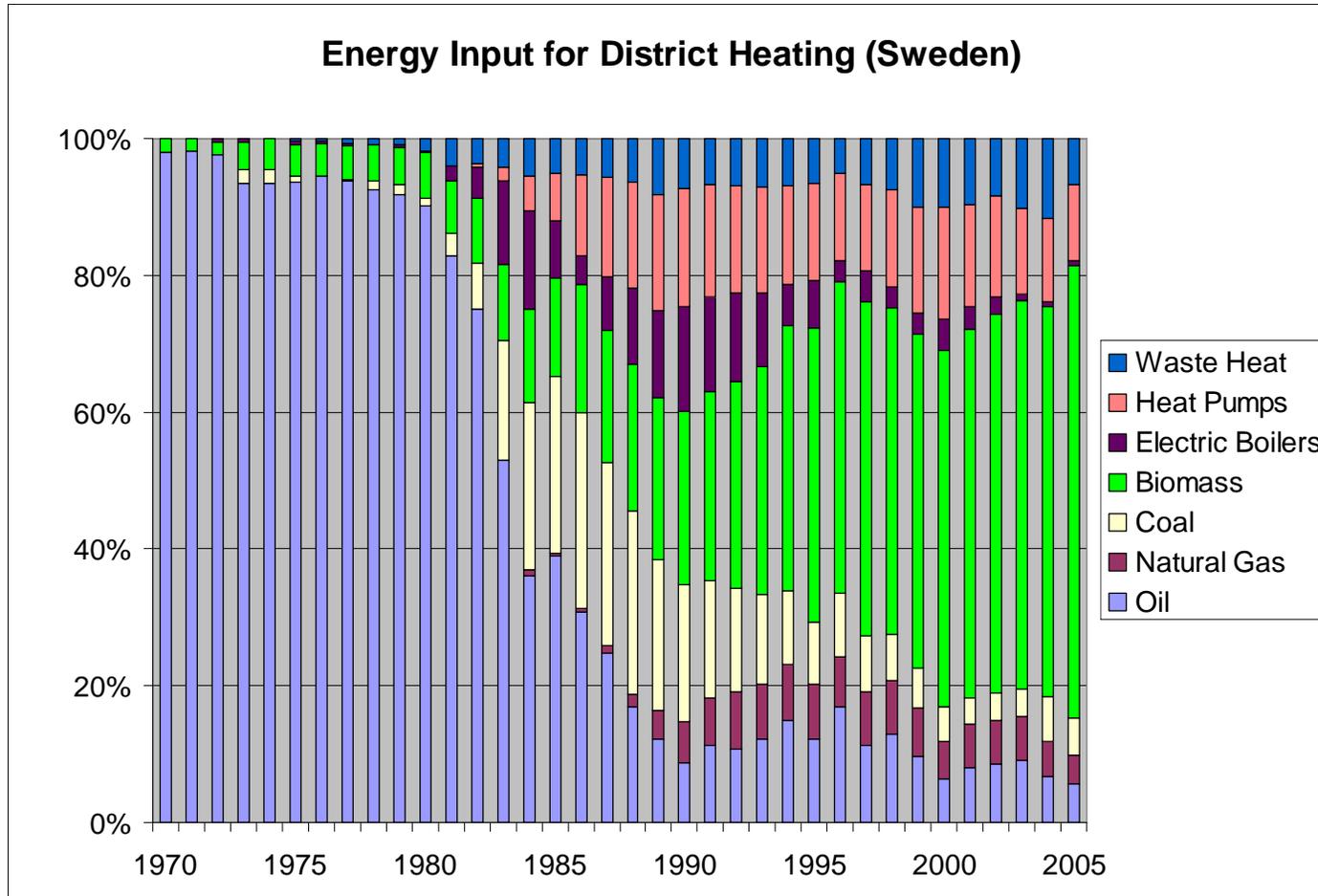
Conventional Engineering



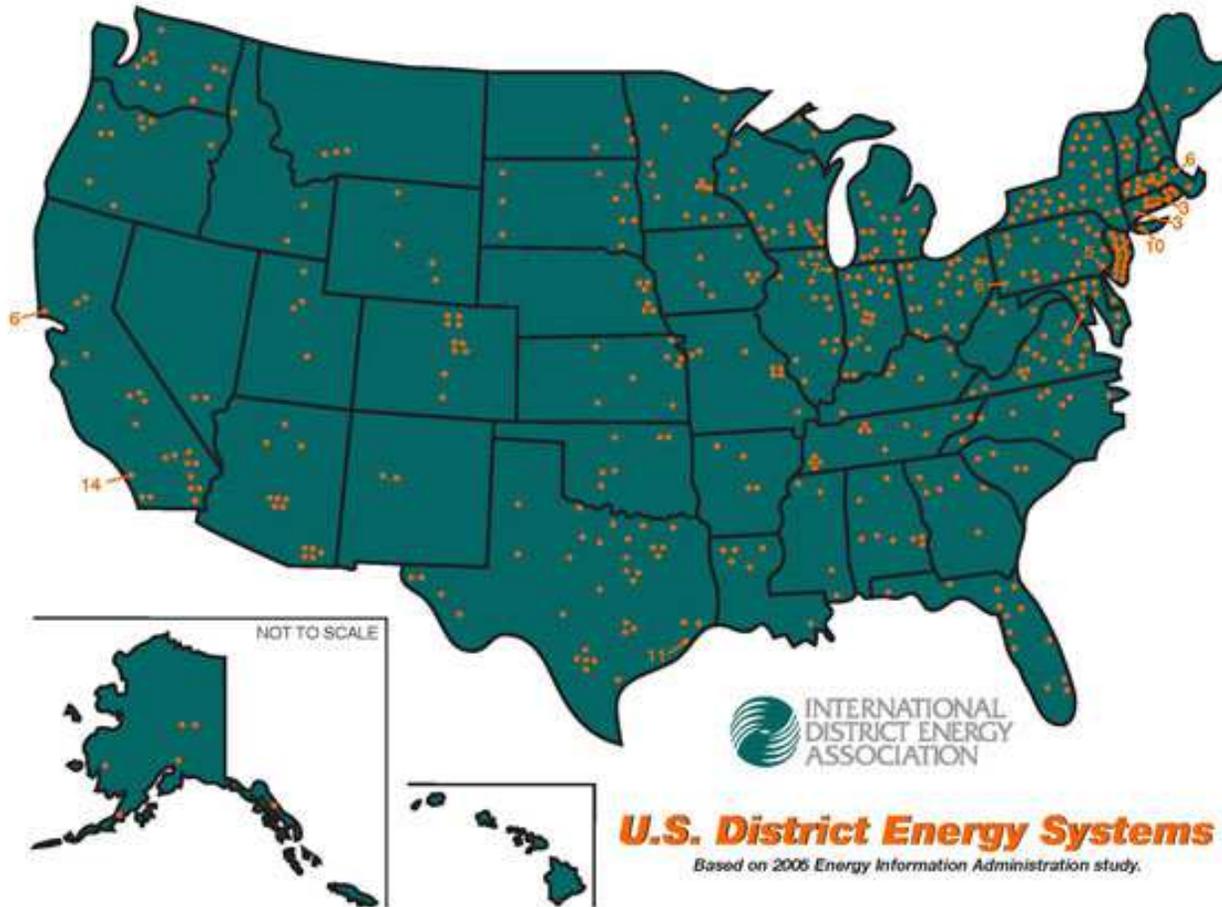
District Energy Enables Integration of Diverse Local Energy Sources



What is possible?



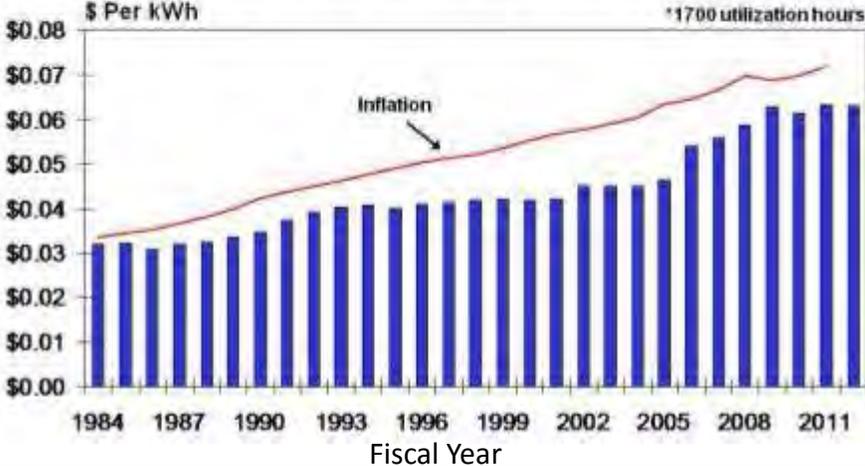
U.S. District Energy Potential



Stable Rates

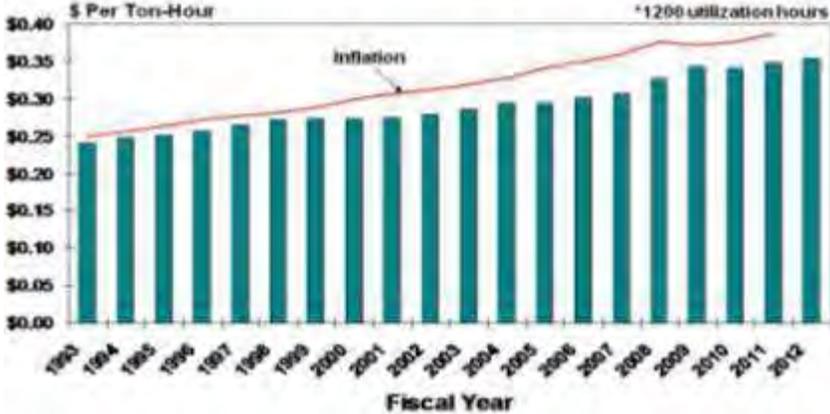
District Energy St. Paul

Combined Rate Summary, 1984-2012



District Cooling St. Paul

Combined Rate Summary, 1993-2012



Satisfied Customers

“District Energy St. Paul's founding principles--energy efficiency, environmental stewardship, stable rates, reliability and customer service--and the company's track record of meeting them day in and day out, allow Travelers to locate many people here in Saint Paul. Because of District Energy's reliability, we can also locate vital information technology equipment operations in downtown Saint Paul where a unique setup allows us to meet our business needs in the most cost-efficient manner.”

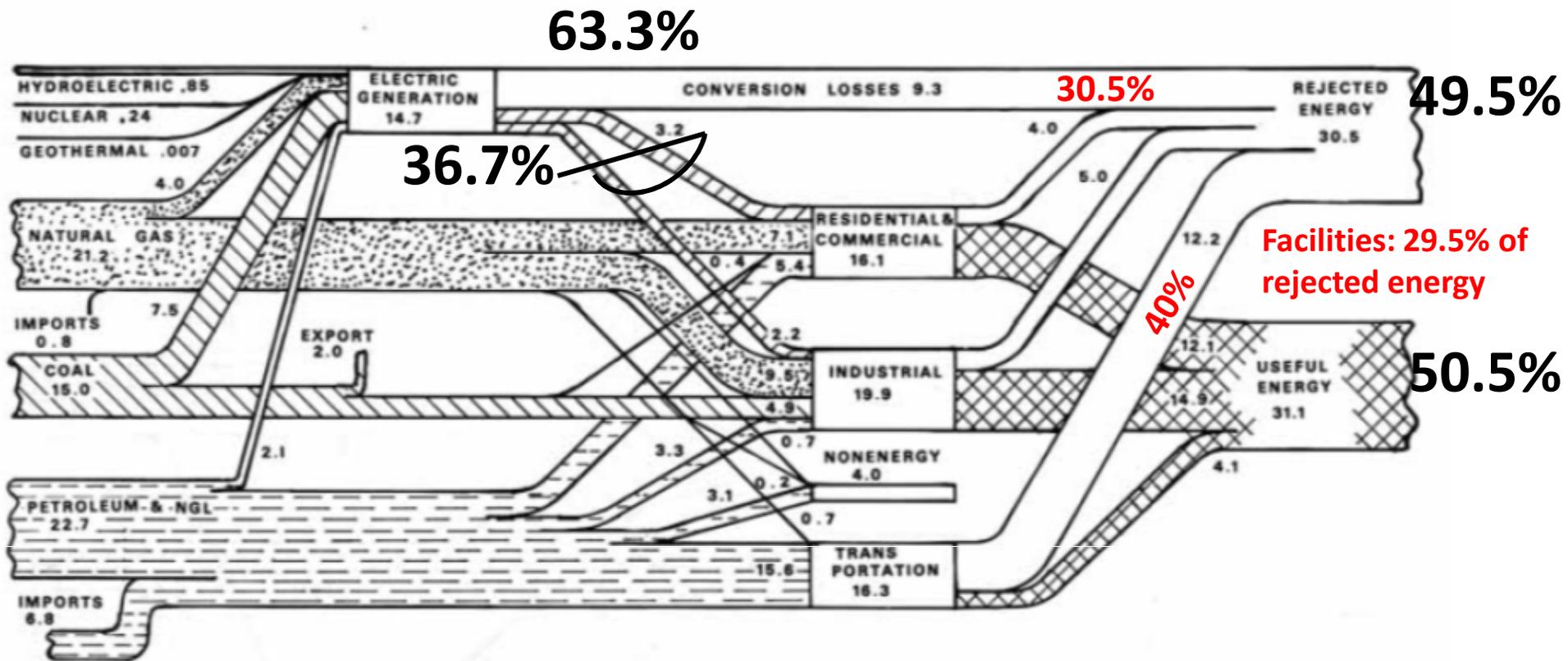
Jim Scannell, Senior Vice President
Administrative Services

—Travelers



*How far has the US progressed since
the energy crises of 1970's?*

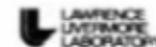




U.S. Energy Flow — 1970

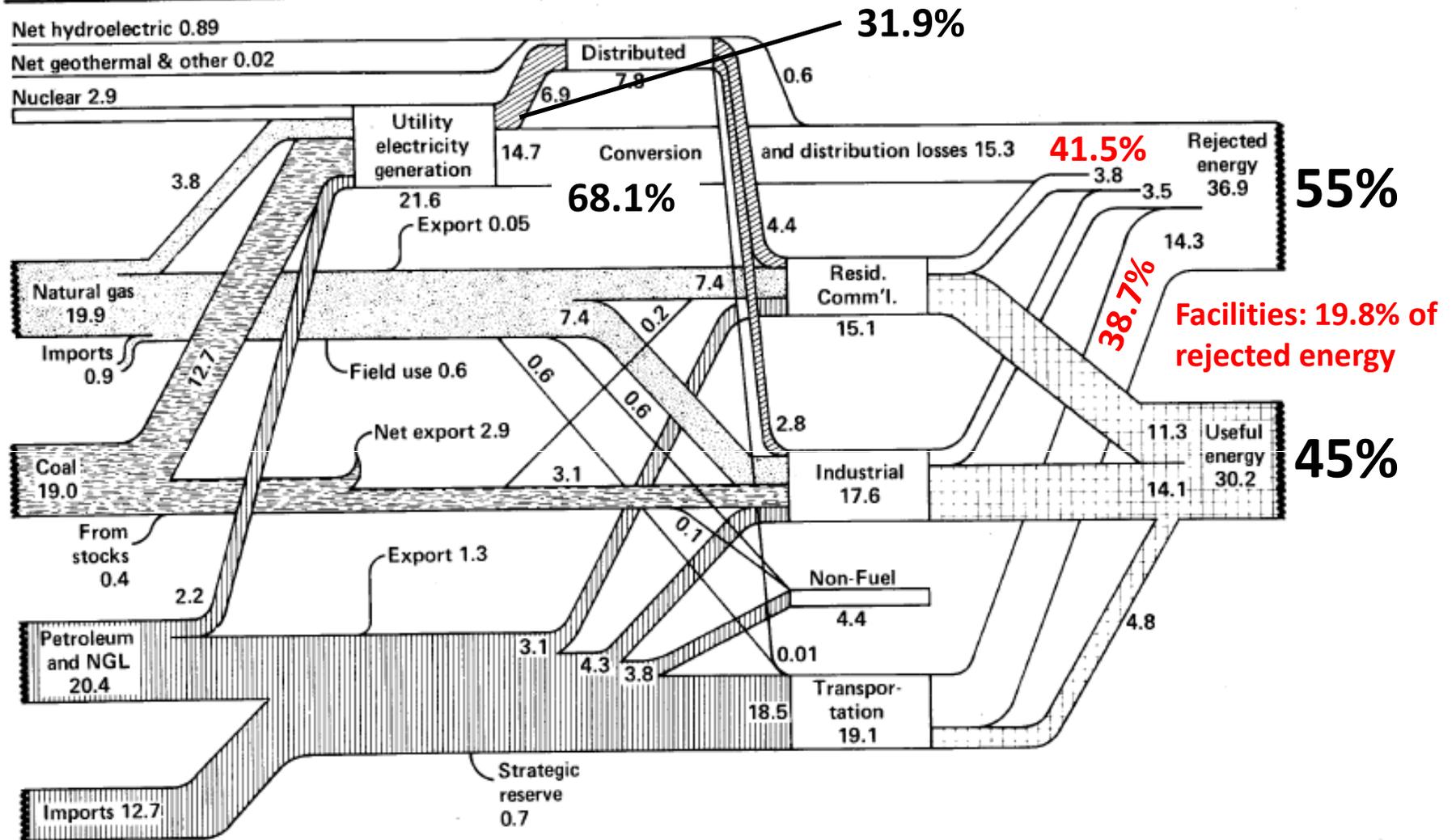
All values $\times 10^{15}$ Btu (2.12×10^{15} Btu = 10^6 bbl/day oil)

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



Source: <https://flowcharts.llnl.gov/>

U.S. ENERGY FLOW – 1981 (NET PRIMARY RESOURCE CONSUMPTION 73 QUADS)



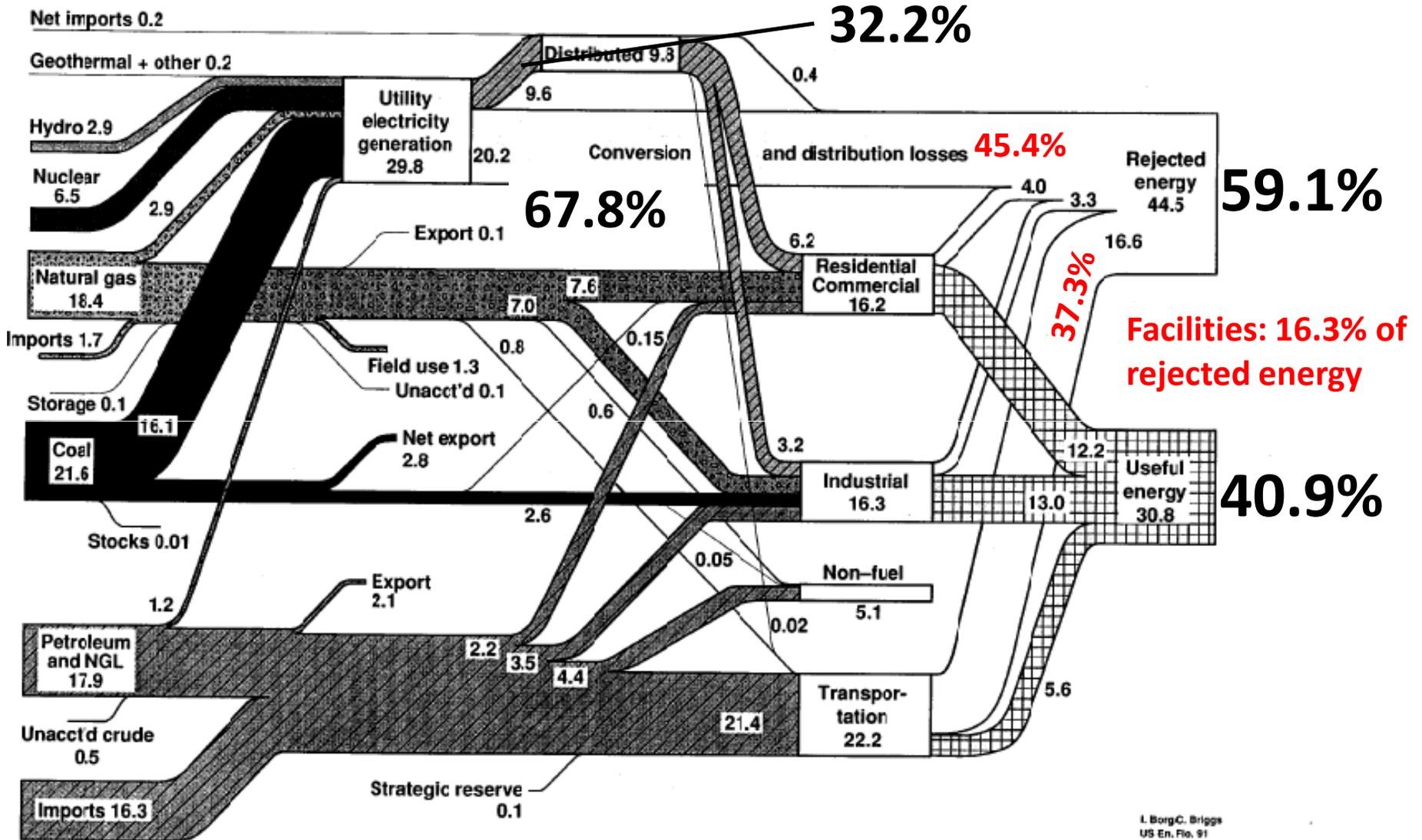
Source: <https://flowcharts.llnl.gov/>

Figure 1



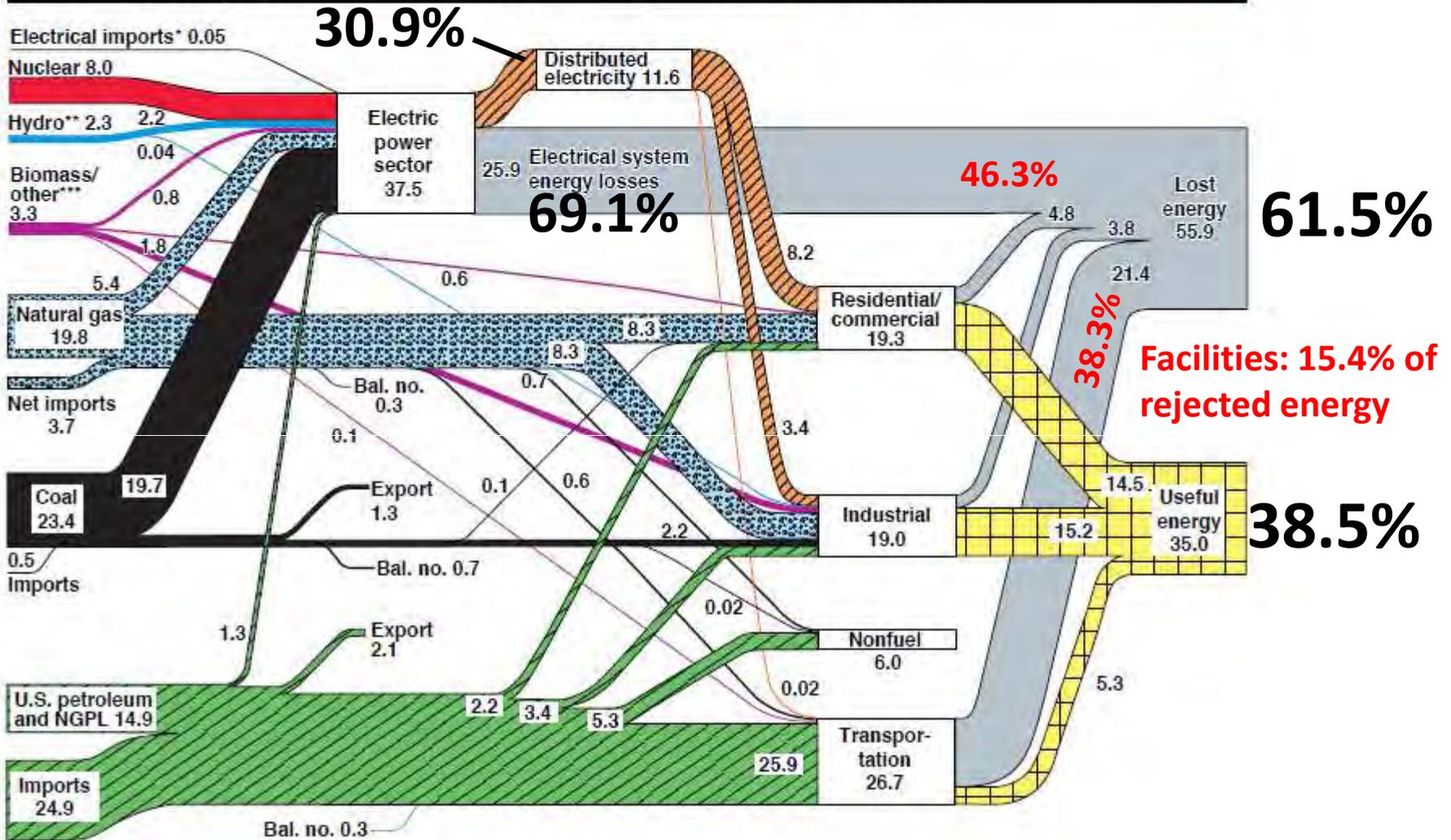
U.S. Energy Flow – 1991

Net Primary Resource Consumption 82 Quads



U.S. Energy Flow Trends – 2001

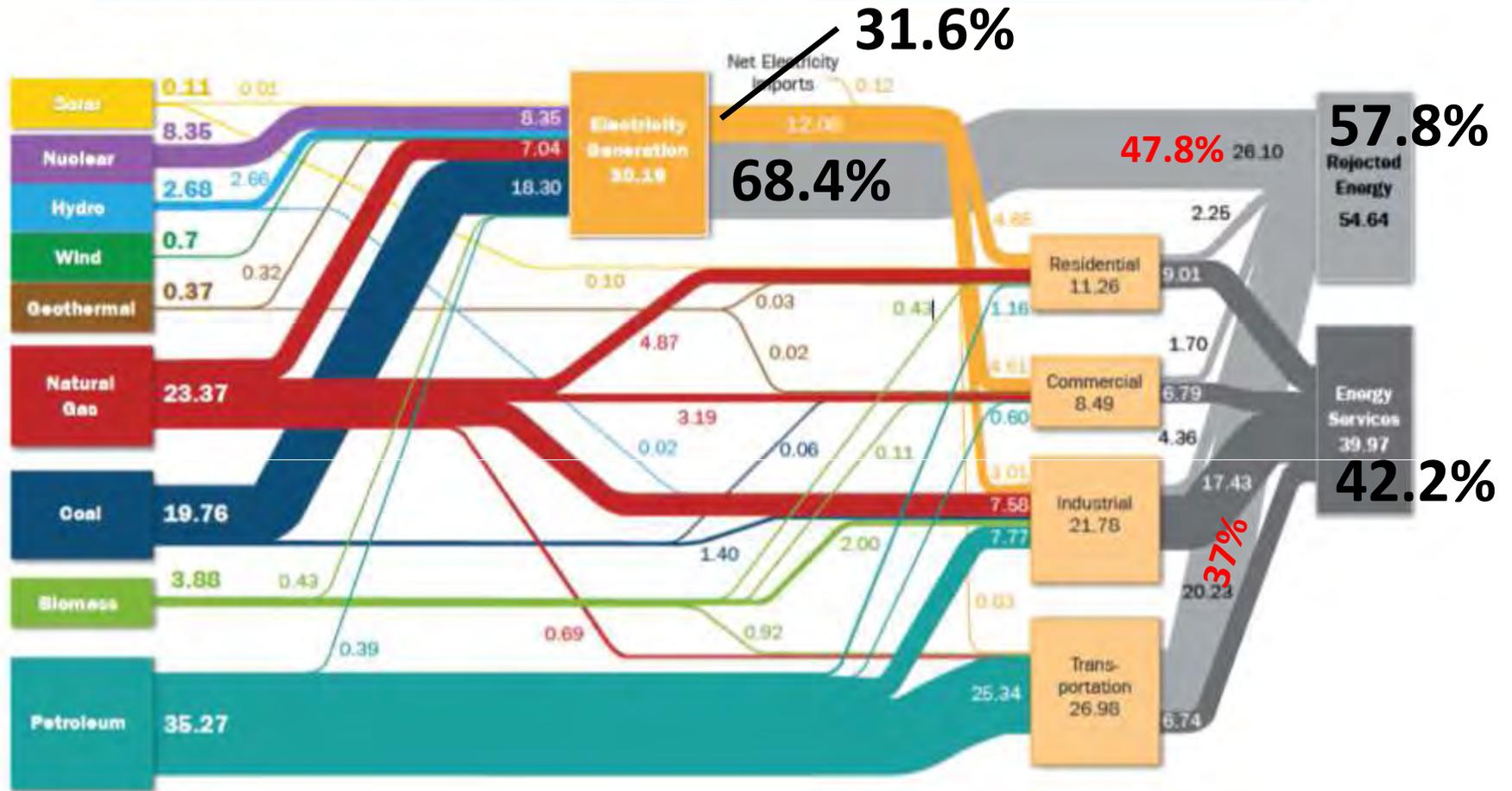
Net Primary Resource Consumption ~97 Quads



Source: <https://flowcharts.llnl.gov/>



Figure 1. U.S. Energy Flows in 2009



Source: DOE Quadrennial Technology Review,
<http://energy.gov/sites/prod/files/ReportOnTheFirstQTR.pdf>

Facilities account for 15.2% of rejected energy



“If you always do what you've always done, you'll always get what you've always got”



District energy infrastructure enables communities to efficiently integrate local energy sources to deliver a more sustainable and secure future.



Thank You!



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