SUPER SANKEY SCENARIOS

With powerful tools and comprehensive data we make it simple to model and imagine new energy economy scenarios and the impacts of deployment of one or more existing or emerging technologies.

EXAMPLE SCENARIO: Massive Decarbonization by electrification.

This scenario looks at how to deliver all of the existing services of the US economy. This requires no behavior change, just the shift to electric technology. This eliminates the approximately 10% of the energy economy that currently exists to find, produce, and deliver fossil fuels, and replace it with nuclear and wi awables. Thermoelectric losses go to almost zero; we see a hur er the same lifestyle Americans enjoy today, but with far less air polu zero carbon dioxide emissions - improving the lifestyles of a



industrial sector : 25.03

residential sector : 11.34

transportation sector : 27.65

ndustrial-natural o

highway: 21.29

non-highway : 4.07 transportation-related fuel o

residential-natural gas : 4.6

residenția - electrici

commercial-electricit

agriculture : 1.1 data centers : 0

light trucks : 2.61

cars : 2.37

class 7-8 truc

water-freight : 0.73 recreational boats :

office (passthrough1): education (passthrough1): 0.74 lodging (passthrough1): 0.52

d service (passthroug varehouse and storage (pa

energy services :

closed and strip malls (passthro

Jious worship (passthrough1) : 0.15 d.sales (passthrough1) : 0.26 blic order and safety (passthrough1) : 0.12 cant (passthrough1) : 0.03

freight-rail: 0.47

Treight trucks : 5.52 water : 0.97

rail: 0.52 construction and mining eg agricultural equipment: 0.60 industrial equipment: 0.35 recreational equipment: 0.19

apartments in 5 or more unit apartments in 2-4 unit buildi single-family attached : 0.55 education : 0.84 lodging : 0.57 enclosed and strip malls : 0.65 healthcare-inpatient : 0.55 public assembly : 0.48

od service : 0.51 warehouse and storage : 0 retail (other than mall) : 0.3

ards : 0.00 estrian signals : 0.00 orn arrows : 0.00 viline lights: 0.00 'runway edge lights: 0.00 'n lights: 0.00 vstems: 0.00 hting (passthrough2): 0.1

other basic organic chemicals

plastics materials and resins : 1.85 synthetic rubber : 0.03 artificial and synthetic fibers and fila... : 0.04 narmaceuticals and medicines : 0. notographic film, paper, plate, and iron and steel mills and ferroalloy : 0.06 essed and blown glass and glassw... : 0.0 ntainers : 0.06 oducts from purchased glass : 0.02

earn a living : 1.73 family/personal bus social & recreational : 1.21 freight-rail other : 0.23 office (passthrough2) : (air conditioning

space heating water heating : 2.30 other-residential :

energy services : 3.65

waste : 6.90

/ trade contractors : 0.08 foundation and structure... : 0.04 street, and bridge construction : rrazzó contractors : 0.01 ors : 0.01 l civil engineering constr... : 0.03 l institutional building co... : 0.10 odelers : 0.05 ly housing construction (... : 0.03 r sale builders : 0.03 5-19 miles : 1 9-20-50 miles : 1.38 50+ miles : 1.28 0-5 miles : 0.48 ventilation : other appliances

energy services : 7.79

ghost quads : 8.45 Most of this energy doesn't exist. The pieces that come from Solar, Geothermal, Hydro and Wind are reverse calculated from the delivered electricity cost and don't represent a true physical unit of energy. The portion that comes from Nuclear is waste heat, but doesn't include the large portion of fissile material that is not utilized for it's potential energy. In a world where we are not concerned with comparing or baselining these energy technologies against a "primary energy" metric that is more suitable for thinking about fossil fuels we do not need this energy to be considered in planning a US energy economy.
residential electricity loss : 5.65 This is the thermo-electric losses due to using inefficient combustion (and the Carnot limit) while burning fossil fuels. If the future source is renewables and nuclear this number will not be meaningful and isn't necessary.
commercial electricity loss : 5.48 This is the thermo-electric losses due to using inefficient combustion (and the Carnot limit) while burning fossil fuels. If the future source is renewables and nuclear this number will not be meaningful and isn't necessary.
industrial electricity loss : 3.87 This is the thermo-electric losses due to using inefficient combustion (and the Carnot limit) while burning fossil fuels. If the future source is renewables and nuclear this number will not be meaningful and isn't necessary.
electricity used in generation : 0.74 This is entirely reduced if sources are renewables and nuclear. government electricity loss : 0.22 This is thermoelectric loss as above. transportation electricity loss : 0.03 This is thermoelectric loss as above. petroleum stock : 0.79 With total decarbonization we do not need this.
 coal net exports : 1.23 With total decarbonization we do not need this. coal stock change : 0.89 With total decarbonization we do not need this. pipeline fuel natural gas : 0.87 With total decarbonization we do not need this.
eliminated by light truck electrificatio: 5.23 Moving to fully electrified light trucks (things like the F150), we could eliminate about 2/3 of the energy currently consumed in this part of the transportation sector.
eliminated by car electrification : 4.74 Moving to fully electrified cars (things like the Chevy BOLT, TESLA, FIAT 500e), we could eliminate about 2/3 of the energy currently consumed in this part of the transportation sector.
eliminated by freight truck electrification : 2.76 Moving to fully electrified trucks we could eliminate about 1/2 of the energy currently consumed in this part of the transportation sector.
fossil mining equipment : 0.24 With complete decarbonization this will be nearly completely eliminated. freight-rail coal : 0.23 No need to move no coal. petroleum refineries : 3.37 This is the oil that is used to make diesel and gasoline. It is replaced by electric transportation.
oil and natural gas extraction : 1.83 No longer the need to extract oil and gas.
energy materials in products : 4.53 Very likely we will still use oil and natural gas in products such as asphalt, plastics, and others, but a lot will also be replaced by biologically sourced equivalents.
eliminated by high COP heat pumps : 5.37 Reasonable electric heat pumps of COP 3 could conservatively eliminate half of the energy in refrigeration, airconditioning, and water and space heating without changing temperatures, behaviors or building designs.
eliminated by leds : 1.35 With ubiquitous LED's and their inherent efficiency we save a lot of energy.

There is still waste that can be targeted through efficiency technologies, but we see electrification has the bigger impact.



The whole economy is now around 40 quads, and the useful energy services around 30. That's a big discount from 100.

