Incenting Clean Household Transportation

An Independent Report to the
Technology, Energy & Communications Committee
WA State House of Representatives
Rep. John McCoy, Chair
Rep. David Frockt, Vice Chair
Rep. Deborah Eddy

21 October 2011, Interim Draft

Possible amendments to WA SB 5101 renewable energy incentives that can sustain declining sales tax revenue by enabling households to invest in clean, low cost energy for transportation - their largest source of carbon emissions (~50%)

Distributed Energy – Household Transportation

Washington enjoys the lowest electric utility rates in the US

The advent of Electric Vehicles and West Coast charging infrastructure can substantially reduce transportation costs, making a strong market for EVs

- **Cost per mi for EV:** $0.02 (Electricity @ 8 c/kWh)
- **Cost per mi,** *gasoline:* $0.12 (30 mpg @ $3.50/gal)

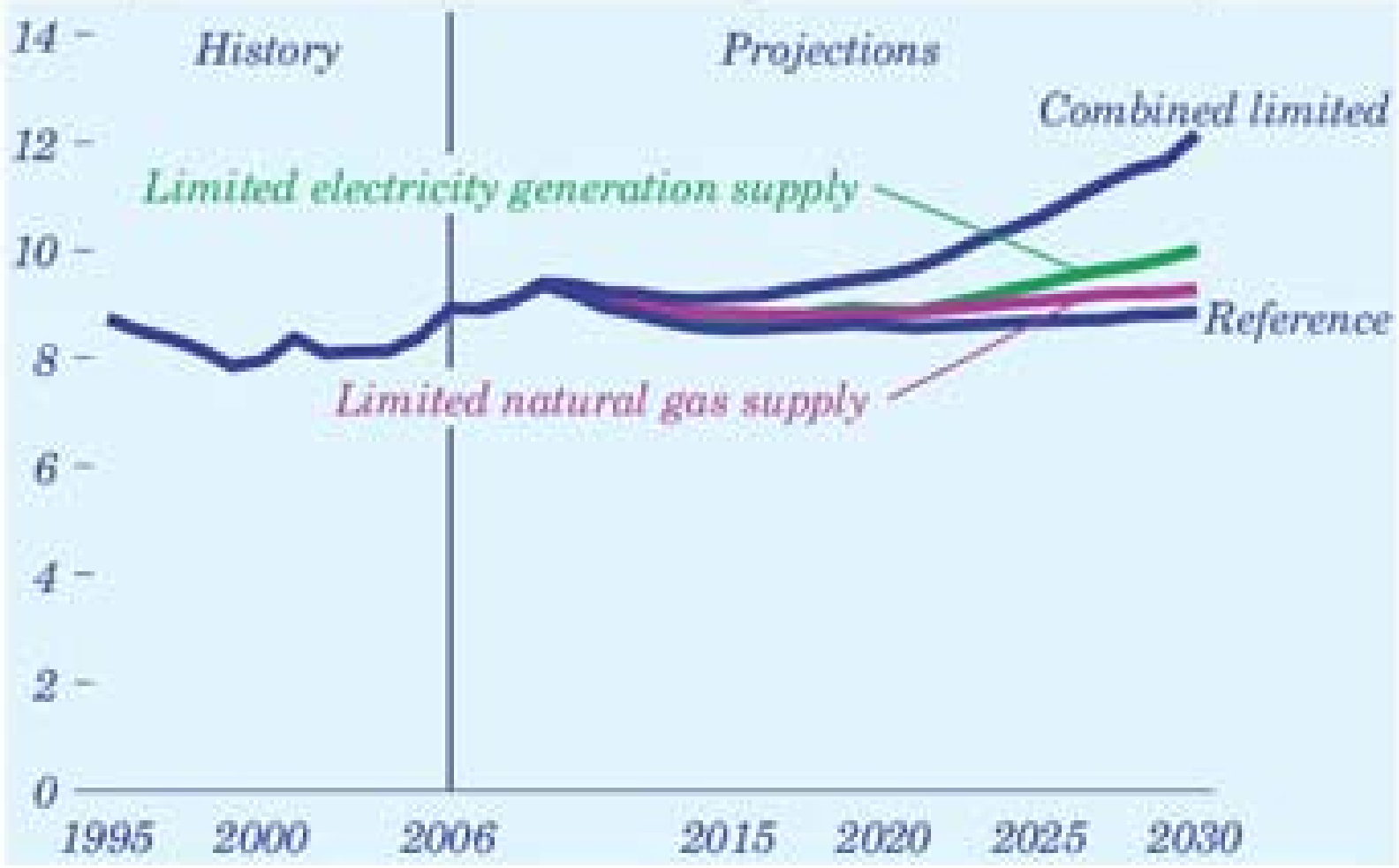
Buyers of newly available EVs gain lower cost of household Transportation, while yielding WA sales tax revenue

Sales indicate that Federal incentive of $7,500 per EV is not sufficient to motivate many EV buyers

WA energy feed-in tariff can also increase sales of household rooftop solar to charge EVs, increasing sales tax revenue

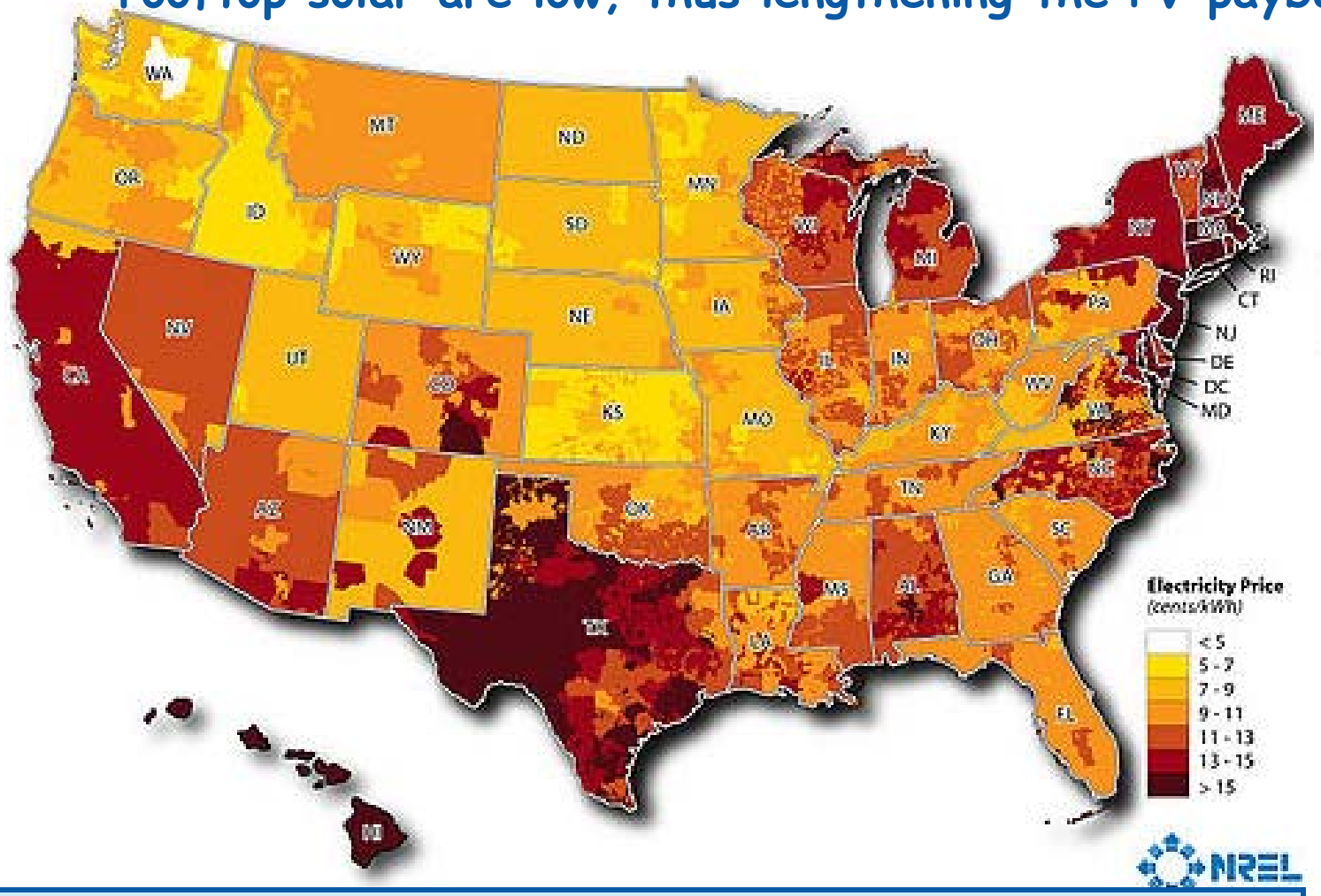
US Energy Information Administration

Figure 20. U.S. average electricity prices in four cases, 1995-2030 (2006 cents per kilowatthour)



Electricity Price Map

Low cost of electric power means that power savings from rooftop solar are low, thus lengthening the PV payback time



Low cost of electric power means low cost transportation

Leveraging Energy Cost

Low cost of electric power means low cost "fuel" for Electric Vehicles

Apply fuel savings achieved from EV operation to contribute to earlier rooftop Photovoltaic (PV) payback time

- Since households have never been able to depreciate the cost of household vehicles, EV's should not now suddenly be expected to achieve payback for EV cost
- After PV payback, "fuel" is free for at least 20 years
- Increases disposable income to stimulate local economy

Assures energy security, clean city air, climate relief, and can be designed for zero grid energy annually per EV

Household Energy for Transportation

Average Home consumes 11,000 kWh per year.
http://www.eia.doe.gov/emeu/reps/enduse/er01_us_tab1.html

This is 60% of total energy footprint for the home. Accounting for space heating, total annual home energy need is 18,400 kWh

Assume 2 household vehicles, 25 mpg each, for 25,000 total annual miles traveled.

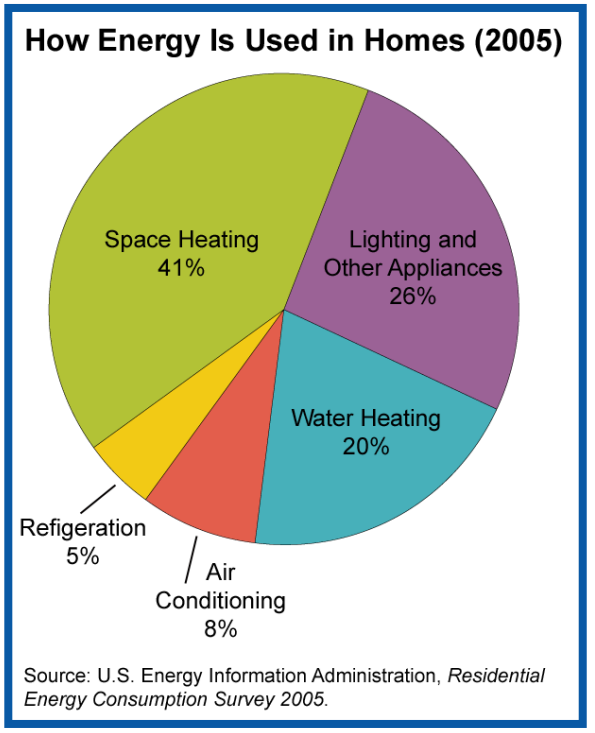
Fuel needed: 1000 gal for 2 cars

(US average for 2 cars/household: 1,158 gal

See Report Table 5.50 at http://www.eia.doe.gov/emeu/rtecs/toc.html)

Energy in 1 gal gasoline is 125,000 Btu

At 3413 Btu/kWh, 1 gal gas = 36.6 kWh Annual transportation energy is 36,600 kWh



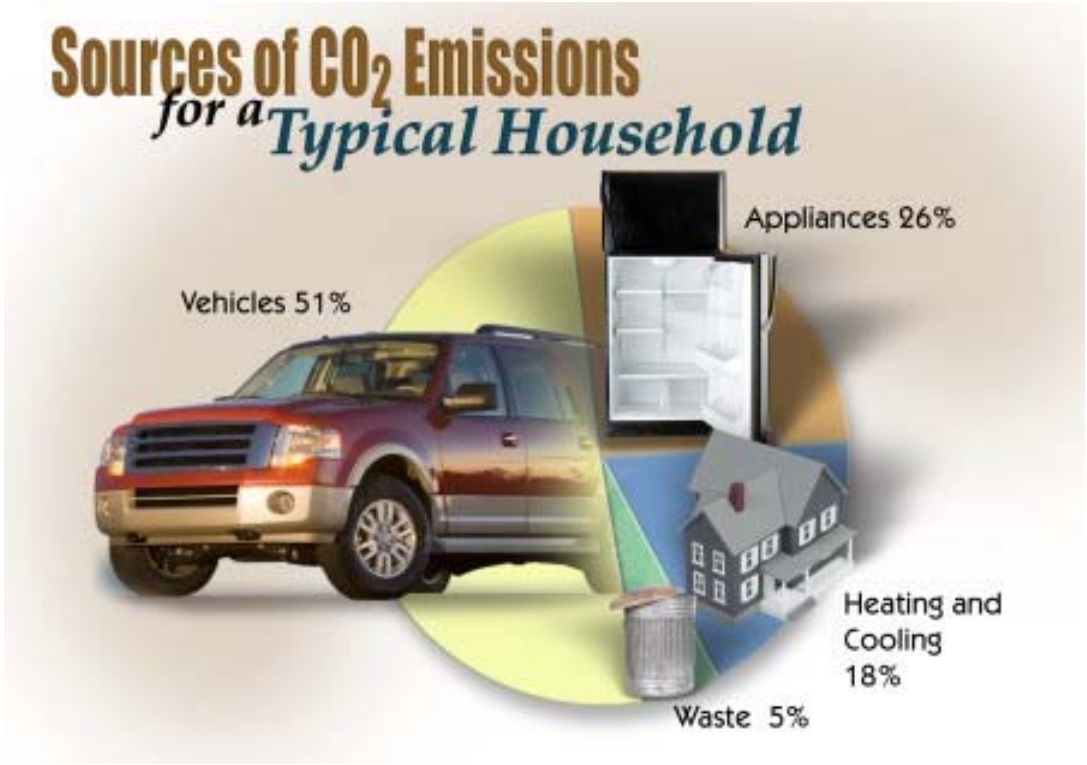
http://www.eia.doe.gov/kids/energy.cfm

Transportation consumes about 66% of household energy

Household Carbon for Transportation

Household carbon footprint for Transportation is 51%

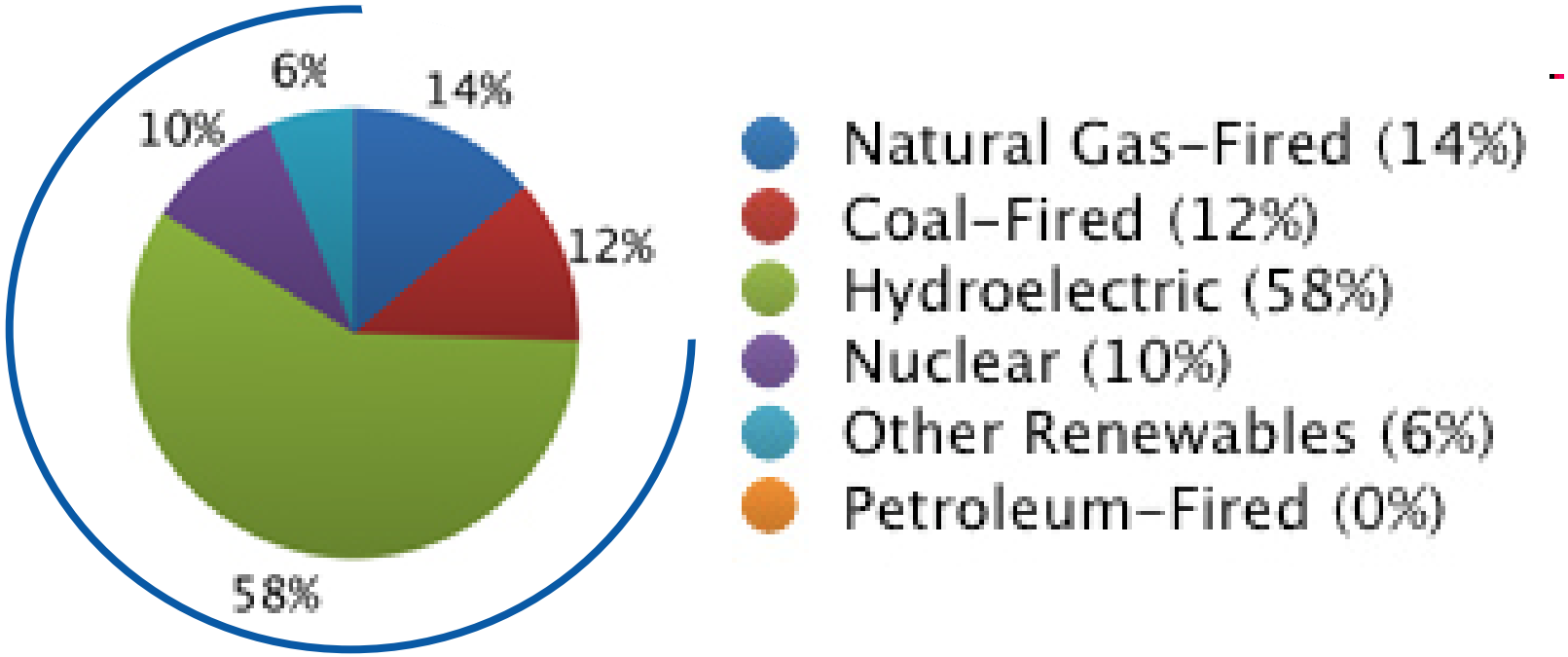
- Solution - Transition to an Electric Vehicle



Source	*%*
Appliances	26
Heat & Cool	18
Waste	5
Total	49

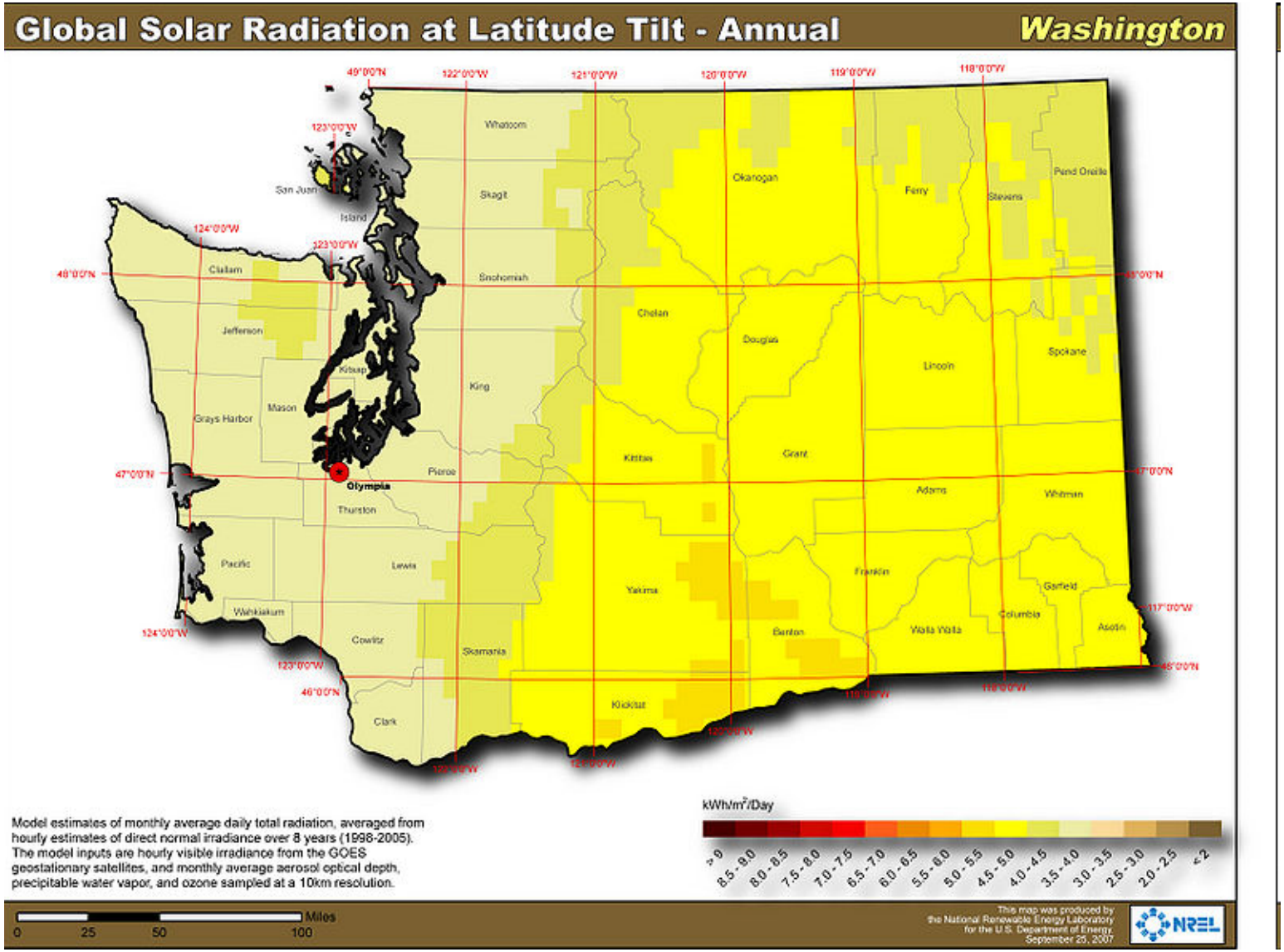
DOE Link
http://www.fueleconomy.gov/feg/climate.shtml

Washington's Electricity (2010)



74% Non-carbon Energy

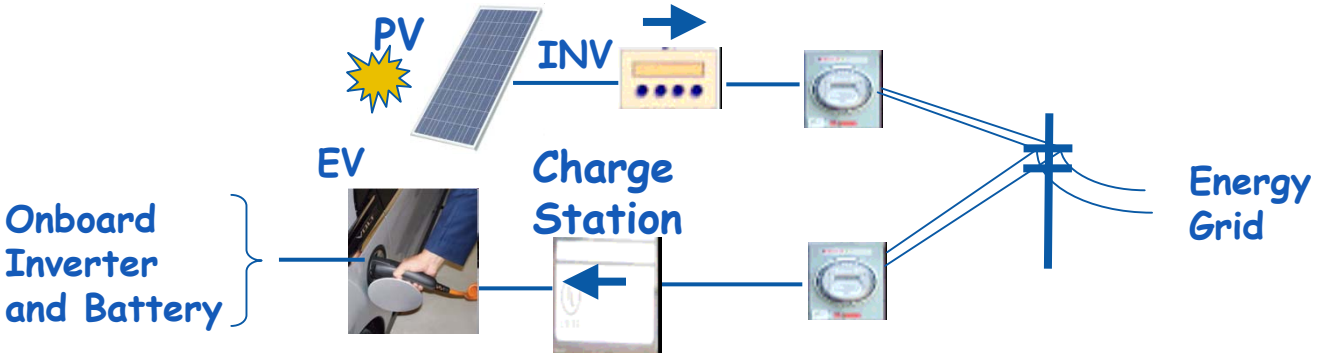
WA Solar Productivity



Household Distributed Energy

Panel to Vehicle (P2V)

Home, Apartment, Business, Parking Lot



- Clean energy
- No fuel cost (after PV payback)
- Charge anytime from grid
- Isolated from utility rates
- Utility uses PV energy
- Energy Feed In Tariff pays off home PV installation costs
- Fossil fuel cost savings pays off home PV installation costs
- Uses standard Charge Station
- No Petro CO2 footprint

What the "Primary" Incentive will do

Current SB 5101 incentive awards homeowner $0.54 /kWh for energy generated and sent to the energy grid

- Solar PV panels are manufactured in WA ($0.36 /kWh)
- Rooftop power inverter is manufactured in WA ($0.18 /kWh)

What Feed-in Tariff is generated from annual charging of an EV?

- EVs achieve 4 mi/kWh
- For 12,000 miles annually, energy consumed is 3,000 kWh
- When produced by the rooftop*, earnings are $0.54 /kWh and homeowner receives $1620 annually (zero grid energy annually)

With the "Primary" incentive in place, adding $0.30 /kWh for PV producing grid energy for an EV, total earnings are $0.84 /kWh and homeowner earns an additional $900 annually

*In Seattle, a 1 kW PV panel produces 970 kWh so the EV needs a rooftop installation designed to produce 3.1 kW

Typical Payback in Seattle

At $6 /watt installed, homeowner investment for 3.1 kW installation depends on PV design point.

- Assume delivery from rooftop to grid is 90% efficient
- PV design point becomes 3.1/0.9 = 3.5 kW

Total rooftop cost is 3,500 x$6 = $21,000.
Cost of power inverter is $1,500, for total of $22,500
With 30% tax credit, expense is $22,500 x0.7 = $15,750

PV Payback

Current earnings from SB 5101 feed-in tariff: $1,620
Savings of $0.12 -$0.02 = $0.10 x12,000mi = $1,200
Annual cost recovery $2,820

Years for PV payback, $15,750/$2,280 = 5.6 years

Early Payback with Primary incentive

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PV Payback

Primary earnings from SB 5101 feed-in tariff: $2,520
Savings of $0.12 -$0.02 = $0.10 x12,000mi = $1,200
Annual cost recovery $3,720

Years for PV payback, $15,750/$3,720 = 4.2 years

Early Payback with Primary incentive

Energy loans are broadly available for projects with a 4 year payback

Financing PV capital adds cost, which adds a delay in reaching cost recovery.

With a 4% clean energy loan, payback is still under 5 years

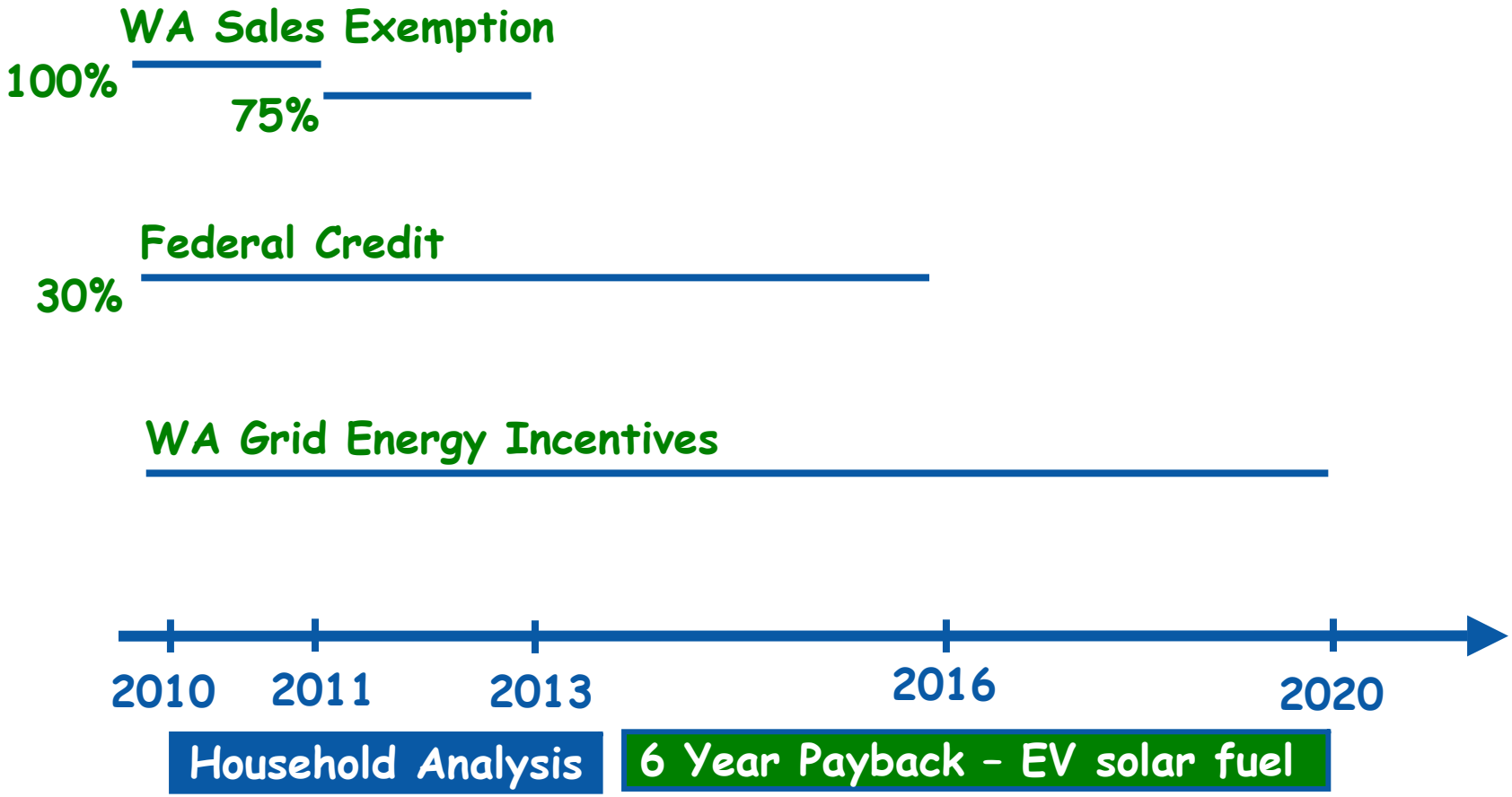
	Accountant's line items	Annual credits toward PV payback	Annual Total	$15,750 Break-even after .....
1	WA Feed-in Tariff (Current SB 5101)	$1,200	$1,200	13.1 years
2	Plus WA savings from solar fueling	$1,620	$2,820	5.6 years
3	Plus WA "Primary" incentive (to-be-ammended SB 5101)	$900	$3,720	4.2 years
4	Minus cost of 4% financing for capital cost of PV	-$630	$3,090	4.8 years

Advantages of "Panel to Vehicle"

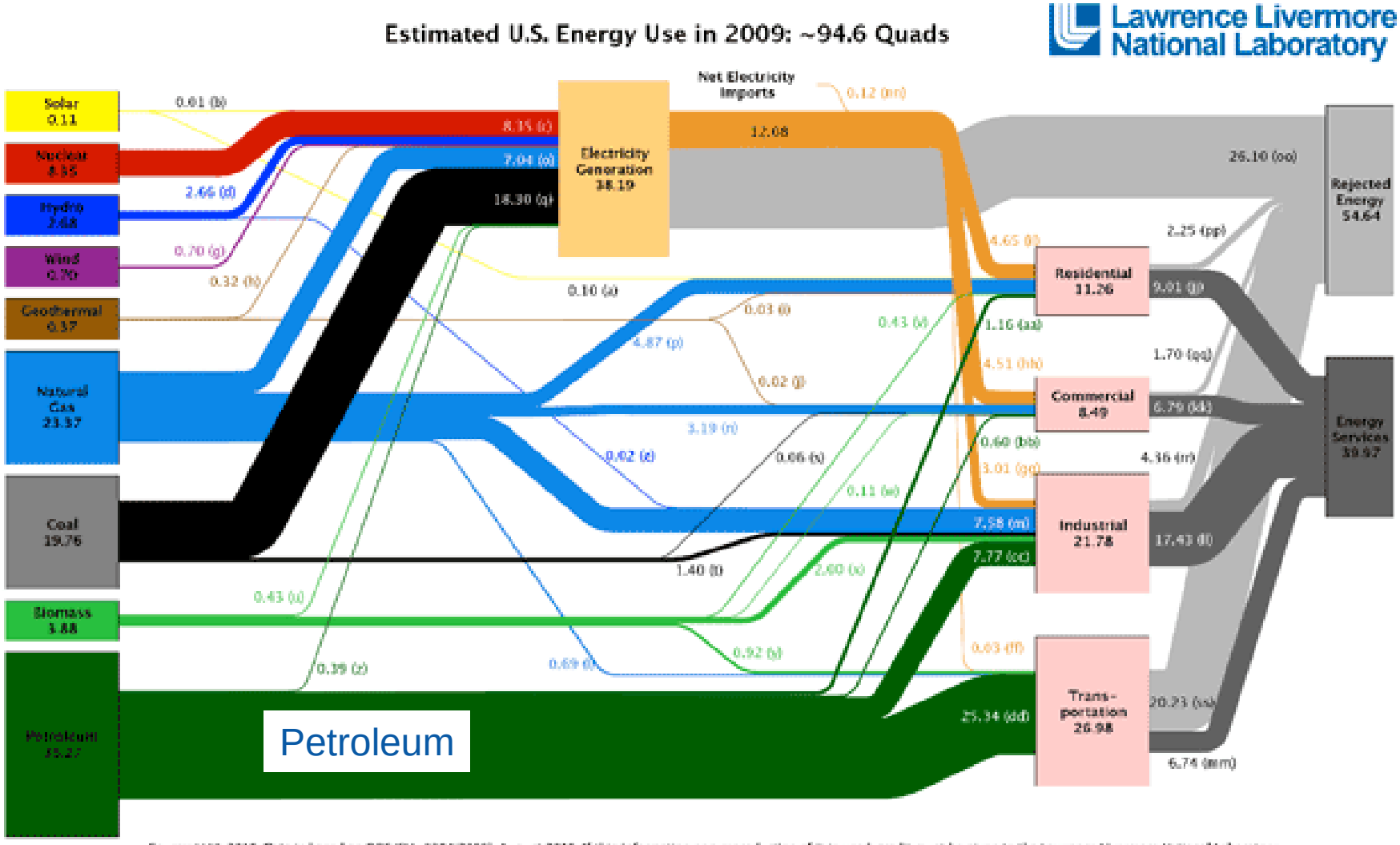
Once the homeowner transitions to EV transportation, many economic and environmental advantages are achievable

- Clean energy for 66% of annual household energy needs
- No Petro fuel consumption - or cost
- "Refuel" from home anytime
- No Petro CO2 footprint – reduction of 6 to 9 tons of CO2 per year (50% of household footprint)
- Isolation from Petro fuel cost increases
- Isolation from utility rate increases (not serious in WA)
- Utility re-sells PV energy
- Energy Feed In Tariff pays off home PV install costs
- Petro fuel cost savings pay off home PV install costs
  - Payback after 4 years
  - Panels last 30 years: 20 years of free clean fuel
  - Return on net assets is very favorable
- Uses standard Charge Station

Incentives Don't Last Forever

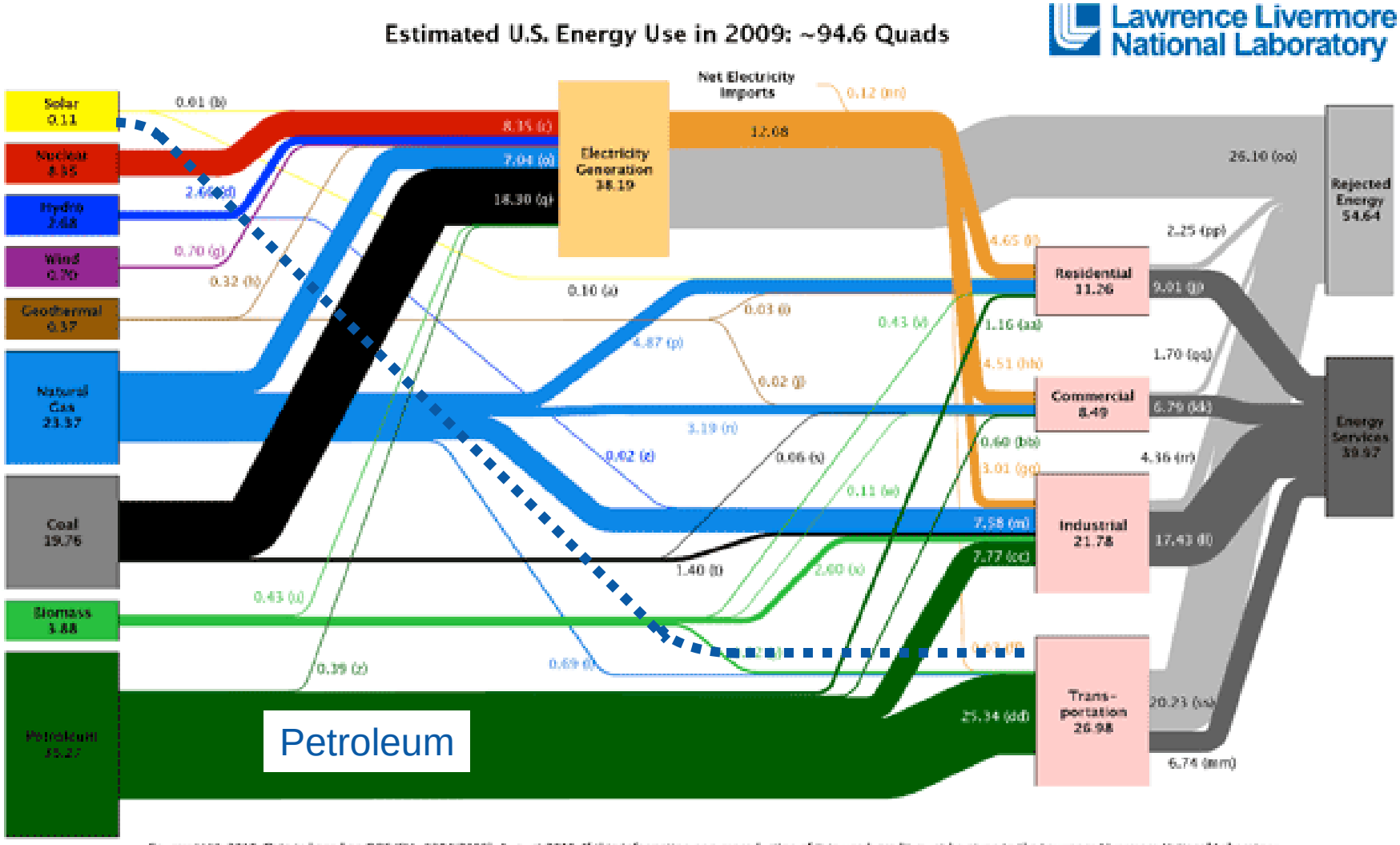


Fossil Energy Demand Annually



Source: LLNL 2010. Data is based on DOE/EIA-0384(2009), August 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. End use efficiency is estimated as 80% for the residential, commercial and industrial sectors, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Economic Design for a Solar Alternative Fuel



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Additional work needed:

Impact on Washington State economy
- State revenue/jobs forecast

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Better Energy LLC

Mission:

Advocate for early adoption of clean energy and sustainable transportation for homes and businesses. Assist evolution of solar economy by researching cost models for early payback.

www.better-energy-LLC.com