TRANSPORTATION WORKSHEET

CRP 470.004/570.004, Spr 2015

1. Policies for reducing use of cars

Policy	Examples
Fuel Switching	• Using electric or hybrid automobiles, provided that the energy is generated from lower-carbon or non-fossil fuels. • Using renewable fuels such as low-carbon biofuels.
Improving Fuel Efficiency with Advanced Design, Materials, and Technologies	• Developing advanced vehicle technologies like hybrid vehicles and electric vehicles • Reducing the weight of materials used to build vehicles. • Reducing the aerodynamic resistance of vehicles through better shape design.
Improving Operating Practices	• Car pooling • Avoiding rapid acceleration and braking, observing the speed limit. • Reducing engine-idling. • Improved voyage planning for ships, such as through improved weather routing, to increase fuel efficiency.
Reducing Travel Demand	• Building public transportation, sidewalks, and bike paths to increase lower-emission transportation choices. • Zoning for mixed use areas, so that residences, schools, stores, and businesses are close together, reducing the need for driving.

(Source: www.epa.gov/climatechange/ghgemissions/sources/transportation.html)

2. Energy/Emission data

Fuel	Emissions (kg CO2/gallon)	Emissions (kg CO2/liter)	Energy density (kWh/liter LHV)	Emissions (kg CO2/kWh)
gasoline	8.887	2.348	8.7	0.27
diesel	10.18	2.690	10	0.27

3. US transportation statistics

- Average miles/year/person : 13,000 miles
- Average ownership of cars: 11.4 yrs (2012)
- Ave passengers/car: 1.55, average daily travel time: 22-25 min.

4. Measures of vehicle efficiency and use

- VMT – vehicle miles travelled
  - MPG – tells us vehicle efficiency (1 MPG = 0.4 km/l)
- BTU per passenger mile tells us efficiency in moving **people** (what we want!)
  - 1 kWh per p-km = 5459.68 BTU per p-mi

– kWh per 100 p-km = 54.59 BTU per 100 p-mi

Transport mode	Ave passengers per vehicle	BTU per passenger-mile	kWh per passenger-km	kWh per 100 passenger-km
Rail (Intercity Amtrak)	20.9	2,435	0.45	45
Motorcycles	1.16	2,460	0.45	45
Rail (Transit Light & Heavy)	24.5	2,516	0.46	46
Rail (Commuter)	32.7	2,812	0.52	52
Air	99.3	2,826	0.52	52
Cars	1.55	3,538	0.65	65
Personal Trucks	1.84	3,663	0.67	67
Buses (Transit)	9.2	4,242	0.78	78
Taxi	1.55	15,645	2.87	287

Source: Transportation Energy Data Book, Edition 33, 2014 (stats from 2012)

5. Calculating cost and emissions –A new Nissan Leaf (all electric) to new Honda Civic

Assume you drive 11,400 miles/year, you drive each car for 12 years, your access to a loan is 7% interest, and the average price of gasoline over this time period is 3.50 $/gallon (anyone's guess!!).

- A 2014 Honda Civic has an MSRP of $19,000 and gets a combined (cty/hwy) mileage of 33 mpg.
- A 2014 Nissan Leaf has an MSRP of $29,000, a range of 73 mi per charge, and an efficiency of 29 kWh/100 mi. Assume electricity costs 0.12 $/kWh. Assume you are getting your electricity from PNM, 0.66 kg CO2/kWh.

<u>Honda Civic</u>

Annualized capital cost:

Annual fuel cost:

Annual total cost:

Annual CO2 emissions:

<u>Leaf</u>

Annualized capital cost:

Annual "fuel" cost:

Annual total cost:

Annual CO2 emissions: