Energy Usage in Transit :

A Comparison to other modes of Transportation

Prepared for the WILMAPCO
Technical Advisory Committee
January 15th 2009

Agenda

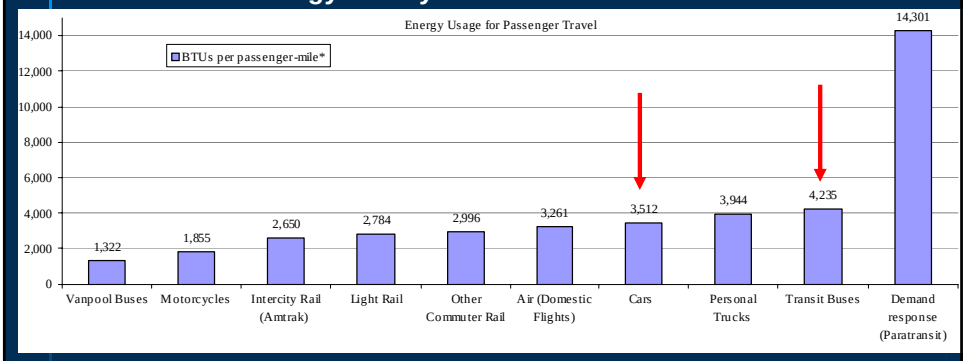
- How energy is measured?
- What was shown at the 10/22 Our Town Event?
- Historic Trends
- Energy consumption by fuel types
- Application to local conditions

Measuring Energy

- BTU (British Thermal Unit) is defined as the amount of heat required to raise the temperature of one pound of liquid water by one degree from 60° to 61°Fahrenheit at a constant pressure.
- BTU is used to describe the heat value (energy content) of fuels
- Will see term throughout presentation

10/22 Our Town Event

Energy Use by Travel Mode 2006:

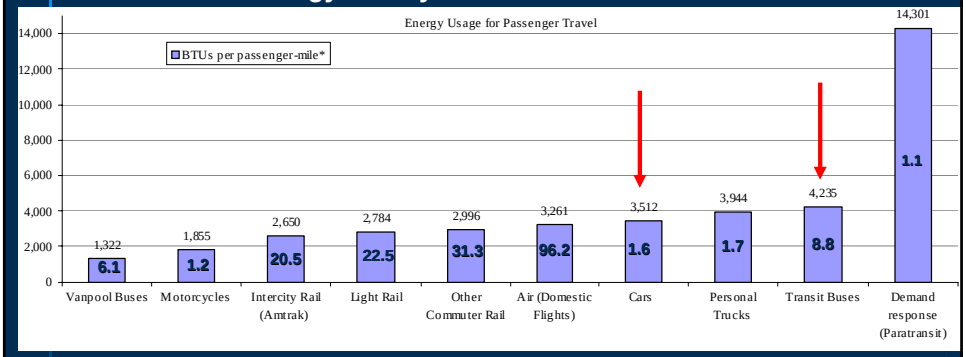


- These values are averages
- Data shown is an average for the entire U.S.
- Use varies widely with the number of riders per vehicle.

Source: National Transportation Data Book, 2006

10/22 Our Town Event

Energy Use by Travel Mode 2006:



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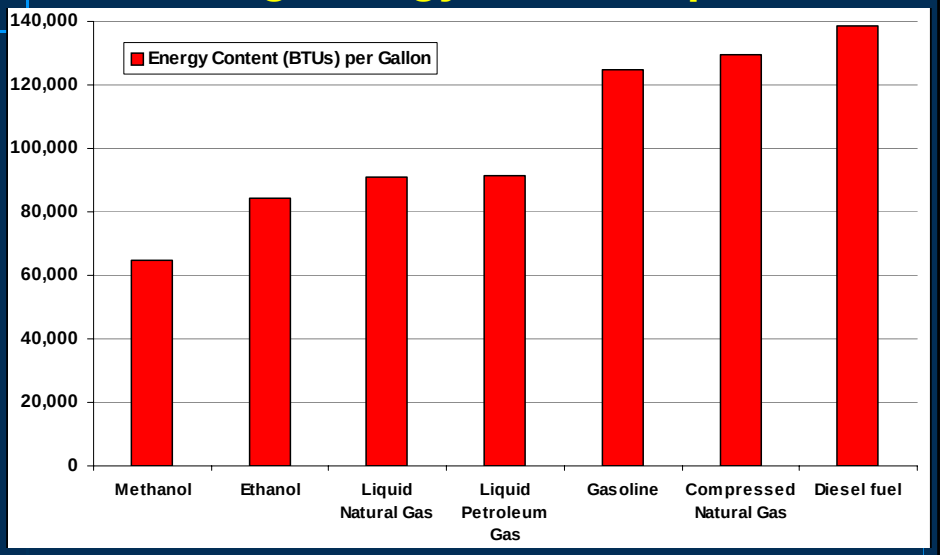
Measuring Energy- Transit Fuels

How it is measured:

- Fuels are measured in the total energy available (BTUs) per gallon

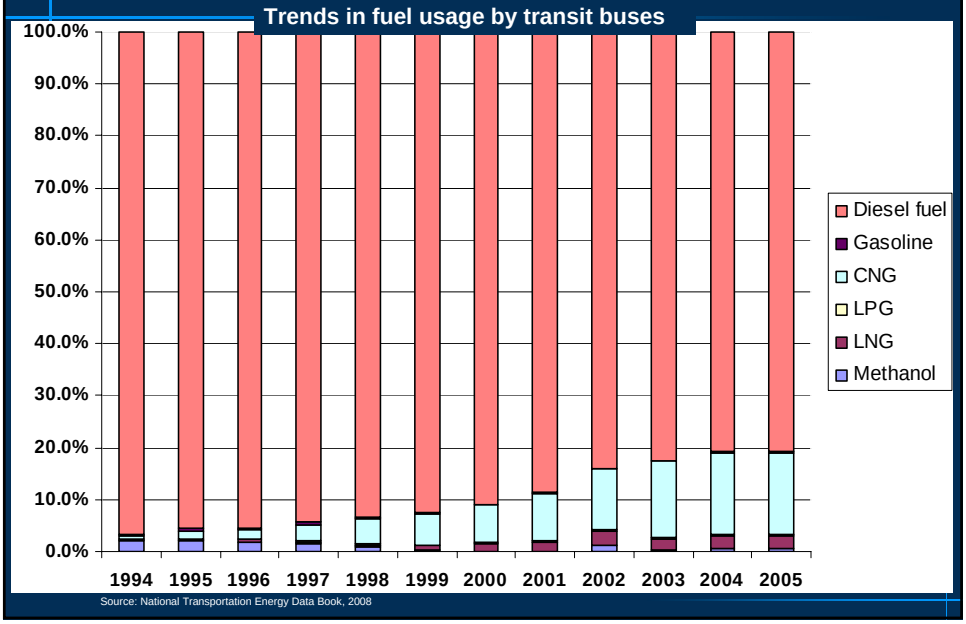
Measuring Energy- Fuel Properties



Source: National Transportation Energy Data Book, 2008

- Diesel gives the most energy per gallon
- Methanol has 46% the total energy per gallon than diesel

Measuring Energy- Transit Fuels



Source: National Transportation Energy Data Book, 2008

Measuring Energy- Transit Fuels

- In short, non-diesel fuels less efficient, but more air quality friendly fuels to power motor vehicles, including buses
- More reliable and renewable
- Less reliant on imports for transportation energy

* Conventional Diesel used in comparison. New Advanced Diesel is comparable to PM emissions of both CNG and ethanol. Source: http://www.cleanairnet.org

Measuring Energy- Transit Fuels

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All other fuels are better for air quality, especially particulate matter (PM) and nitrogen oxides (NOx)

Diesel emission comparisons:
to CNG:
- 67-90% fewer PM emissions
- 25-86% fewer NOx emissions

Diesel emission comparisons:
to Ethanol:
- 20-30% fewer PM emissions
- 20-30% fewer NOx emissions

* Conventional Diesel used in comparison. New Advanced Diesel is comparable to PM emissions of both CNG and ethanol. Source: http://www.cleanairnet.org

Application to Local Usage

- How does our local bus fleet compare?
- Currently too complex to determine exact energy usage for current DART fleet
  - Multiple bus types and ages (Diesel, hybrid)
  - Multiple bus types used on a single route

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- Currently too complex to determine exact energy usage for current DART fleet
  - Multiple bus types and ages (Diesel, hybrid)
  - Multiple bus types used on a single route
- However, we can use national data for rough analysis
- National averages derived from APTA

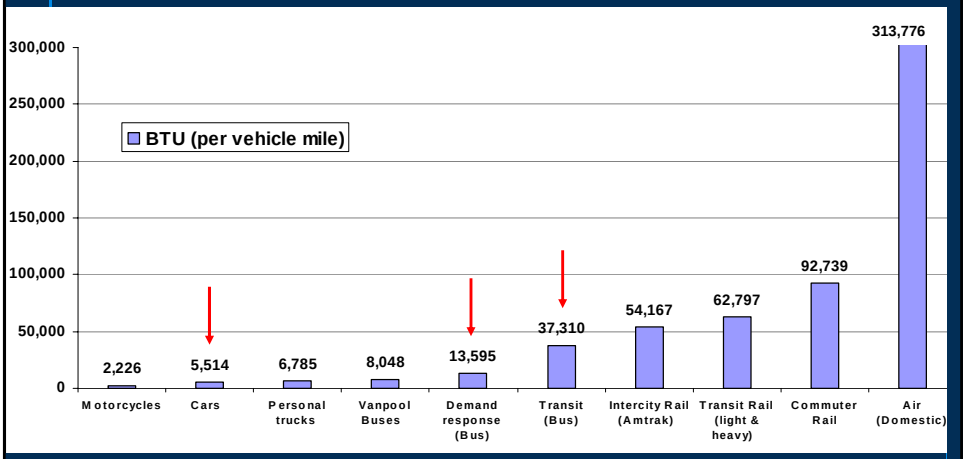
Application to Local Usage

Measurement method:

- Use known energy usage (BTUs) per vehicle mile from national data
- Apply average ridership by mode or route
- Compare the total energy used to move each passenger a single mile (BTU/passenger mile)

Application to Local Usage

- Energy needed to move vehicles one mile



Application to Local Usage

- BTU per vehicle mile applied to local transit usage

- Use of 2007 Ridecheck Data
  - Collected in spring of 2007
  - Calculated number of riders on bus before/after each stop
  - Multiple days collected
  - Ability to develop avg. ridership per route

Application to Local Usage

- Figure represents the AVERAGE number of riders along entire route
- Applied to all fixed routes

Route Name	Load Factor (persons/ vehicle) from Ride Check
Route 2 Concord Pike	14.50
Route 6 Kirkwood Hwy.	14.10
Route 42 Glasgow Express	13.60
Route 5 Maryland Ave.	13.01
Route 22 Wilton Blvd./ US 13	12.94
Route 41 US 40 Express	12.41
Route 1 Philadelphia Pike	12.40
Route 30 Limestone Rd.	12.30
Route 15 New Castle Ave.	12.22
Route 35 Concord Pike	11.80
Route 25 Llangollen / US 13	10.50
Route 4 Lancaster Ave.	10.43
Route 33 Christiana Mall / Newark	10.10
Route 40 US 40 Corridor	10.10
Route 24 Gov. Printz Blvd.	8.73
Route 36 Milltown Rd.	8.30
Route 17 Holloway Terrace	8.23
Route 39 Chestnut Hill Rd. Express	8.12
Route 9 Boxwood Rd./Broom St.	7.85
Route 12 Baynard Blvd.	7.52
Route 19 Pike Creek	7.38
Route 34 Christiana Mall/Marrows Rd.	7.26
Route 3 26th St./Lea Blvd.	7.04
Route 28 A.I. Institute	6.93
Route 21 Foulk Rd.	6.58
Route 55 Old Baltimore Pike	6.49

Passenger Travel Type	BTU (per vehicle mile)*	Load Factor (persons/ vehicle)**	BTU per passenger mile
Van Pool	8,048	6.1	1,319
Motorcycle	2,226	1.2	1,855
Route 2 Concord Pike	37,310	14.5	2,573
Route 6 Kirkwood Hwy.	37,310	14.1	2,646
AMTRAK (Nat'l avg.)	54,167	20.5	2,650
Route 42 Glasgow Express	37,310	13.6	2,743
Light/Heavy Rail (Nat'l avg.)	62,797	22.5	2,784
Route 5 Maryland Ave.	37,310	13.0	2,868
Route 22 Wilton Blvd./ US 13	37,310	12.9	2,883
Route 41 US 40 Express	37,310	12.4	3,006
Route 1 Philadelphia Pike	37,310	12.4	3,009
Route 30 Limestone Rd.	37,310	12.3	3,033
Route 15 New Castle Ave.	37,310	12.2	3,053
Route 35 Concord Pike	37,310	11.8	3,162
Air Travel	313,776	96.2	3,262
Average Car (Nat'l Avg of 1.57)	5,514	1.6	3,512
Route 25 Llangollen / US 13	37,310	10.5	3,553
Route 4 Lancaster Ave.	37,310	10.4	3,577
Route 33 Christiana Mall / Newark	37,310	10.1	3,694
Route 40 US 40 Corridor	37,310	10.1	3,694
Bus NCC Fixed Route Transit (2007)	**37,310**	**10.1**	**4,095**
Bus Transit (Nat'l avg.)	37,310	8.8	4,235
Route 24 Gov. Printz Blvd.	37,310	8.7	4,274
Route 36 Milltown Rd.	37,310	8.3	4,495
Route 17 Holloway Terrace	37,310	8.2	4,533
Route 39 Chestnut Hill Rd. Express	37,310	8.1	4,595
DE Avg. car occupancy to work (1.2 per car)#	5,514	1.2	4,595
Route 64 US 40 Feeder	13,595	2.9	4,640
Route 9 Boxwood Rd./Broom St.	37,310	7.9	4,753
Route 12 Baynard Blvd.	37,310	7.5	4,961
Route 19 Pike Creek	37,310	7.4	5,056
Route 34 Christiana Mall/Marrows Rd.	37,310	7.3	5,139
Route 3 26th St./Lea Blvd.	37,310	7.0	5,300
Route 28 A.I. Institute	37,310	6.9	5,384
Single Occupant Car	5,514	1.0	5,514

- **Several Routes exceed national avg.**
- **Many routes more efficient than DE auto trips to work**
- **NCC avg. 15% higher than Nat'l avg.**
- **25 routes better than SOV car trips**

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Conclusion

- Data is "best available"
- WILMAPCO policy for increased transit services
- First time comparing energy usage
- Trade off between AQ and fuel usage
- Apply actual DART fleet data when available

Questions?