Cars: Past, Present, Future

Tenfold Productivity Increase in Transport

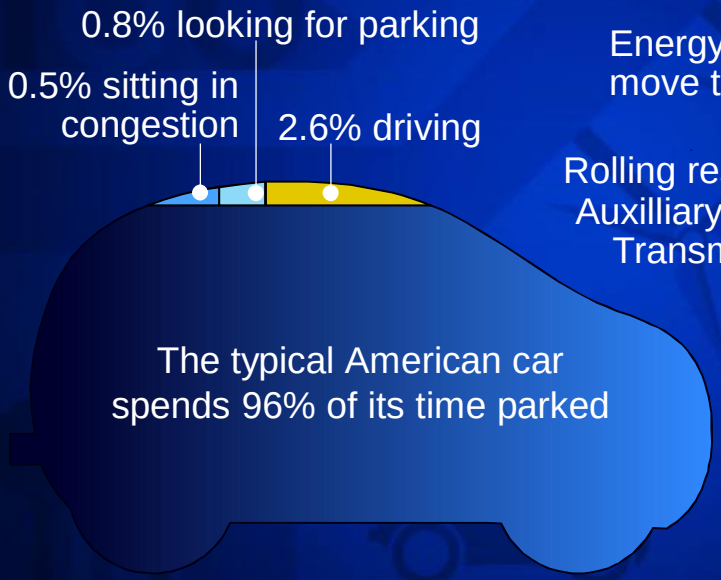
Driving Innovation in Connected Car

Dr. Stefan Heck
Stanford University

New York City 1870

Our transport system today is extremely inefficient

Productive use



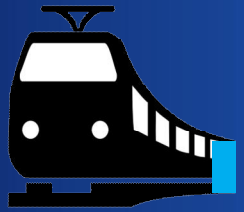
Energy flow through a combustion engine

Deaths per year from transport

More than 33,000 in US
$300B annually in cost

An American road reaches peak throughput only 5% of the time...

...and even then, it is only 10% covered with cars



US Transit - 5% of trips, 77% on-time vs 90%+ OECD, frequencies of 20-60 min in most cities
Starved infrastructure: 2.4% of GDP on transport infrastructure (vs. 5% Europe, 9% China, 5%+ US before 1960) and <25% on transit

Car ownership is expensive if car is utilized only ~3-6% of time

Cost of leased automobile ownership is ~$12,000 per annum – 17.5% of average household spending

$1,015 – 9%
Down payment - annualized

$1,258 - 11%
Fuel Costs[1]

$6,089 – 52%
Value Depreciation[2]

$783 – 6%
Parking[5]

Average new car price in the US is $30,445 and annual mileage driven ~10,700 miles[6]

$530 – 4%
Maintenance and repair[3]

$1,096 – 9%
Interest Payment[4]

$907 – 8%
Auto Insurance

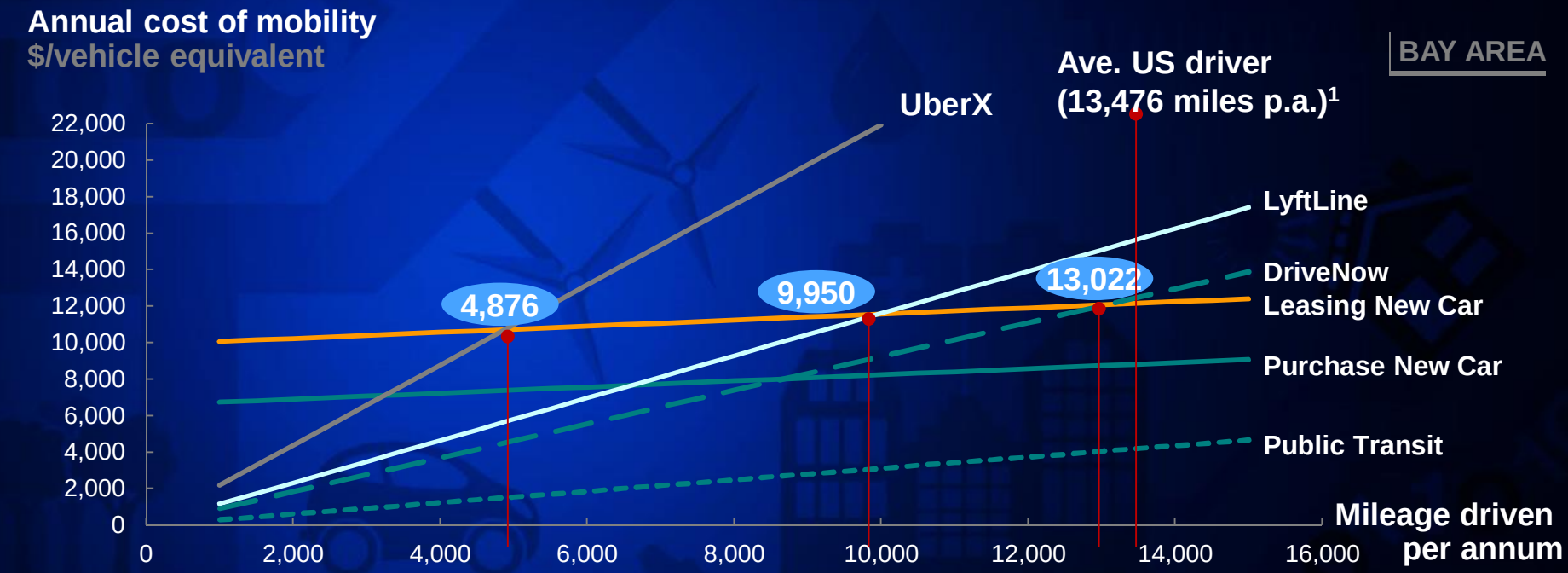
$46 – 1%
Registration

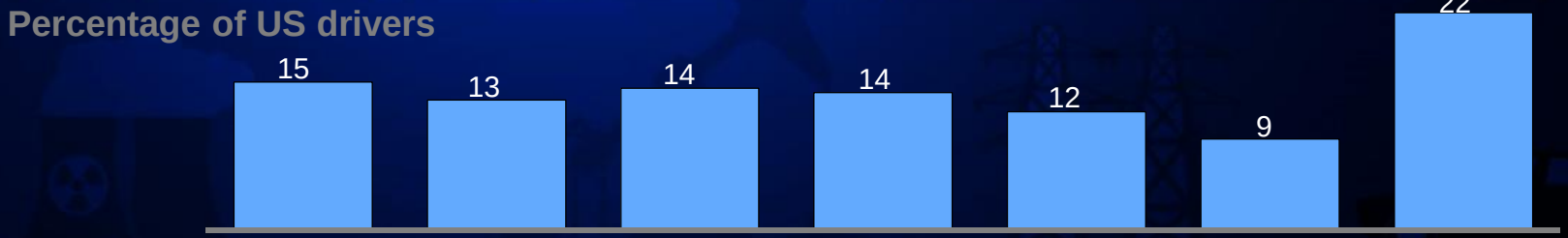
Ave. Utilization  3.2%  5%  5.9%

1 Nov 2014 US fuel price of $2.75/gallon and average car mpg of 23.3
2 Depreciation assumes 40% residual value after 36 months
3 Assumes maintenance and repair of $0.05 / mile travelled
4 10% downpayment and 4% annual interest rate
5 Assume average $1 / trip.
6 Vehicle Miles Travelled (not person miles travelled)

SOURCE: U.S National Household Travel Survey 2009; Cars.com; Team Analysis

Sharing is “in the money” for low mileage customers





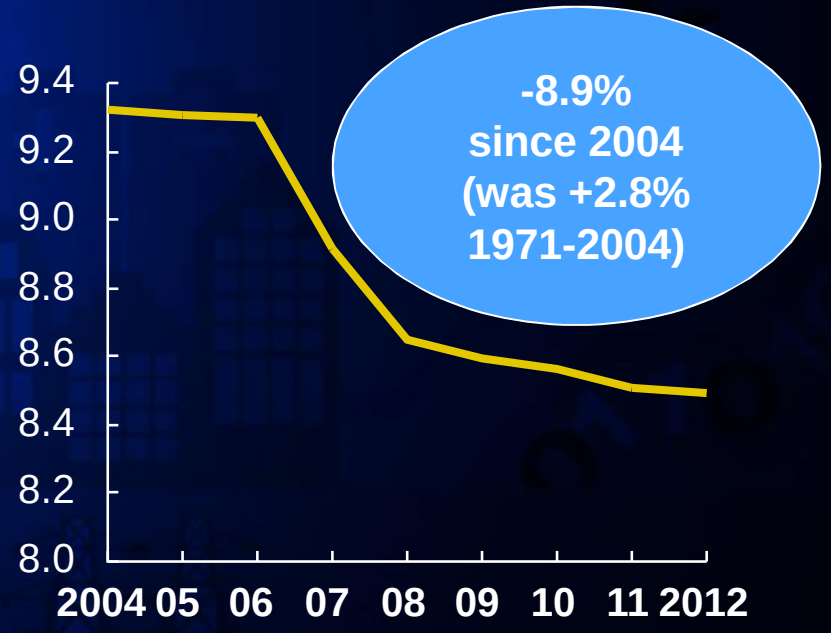
Major changes are afoot – especially in younger urban demographic

Households without a car

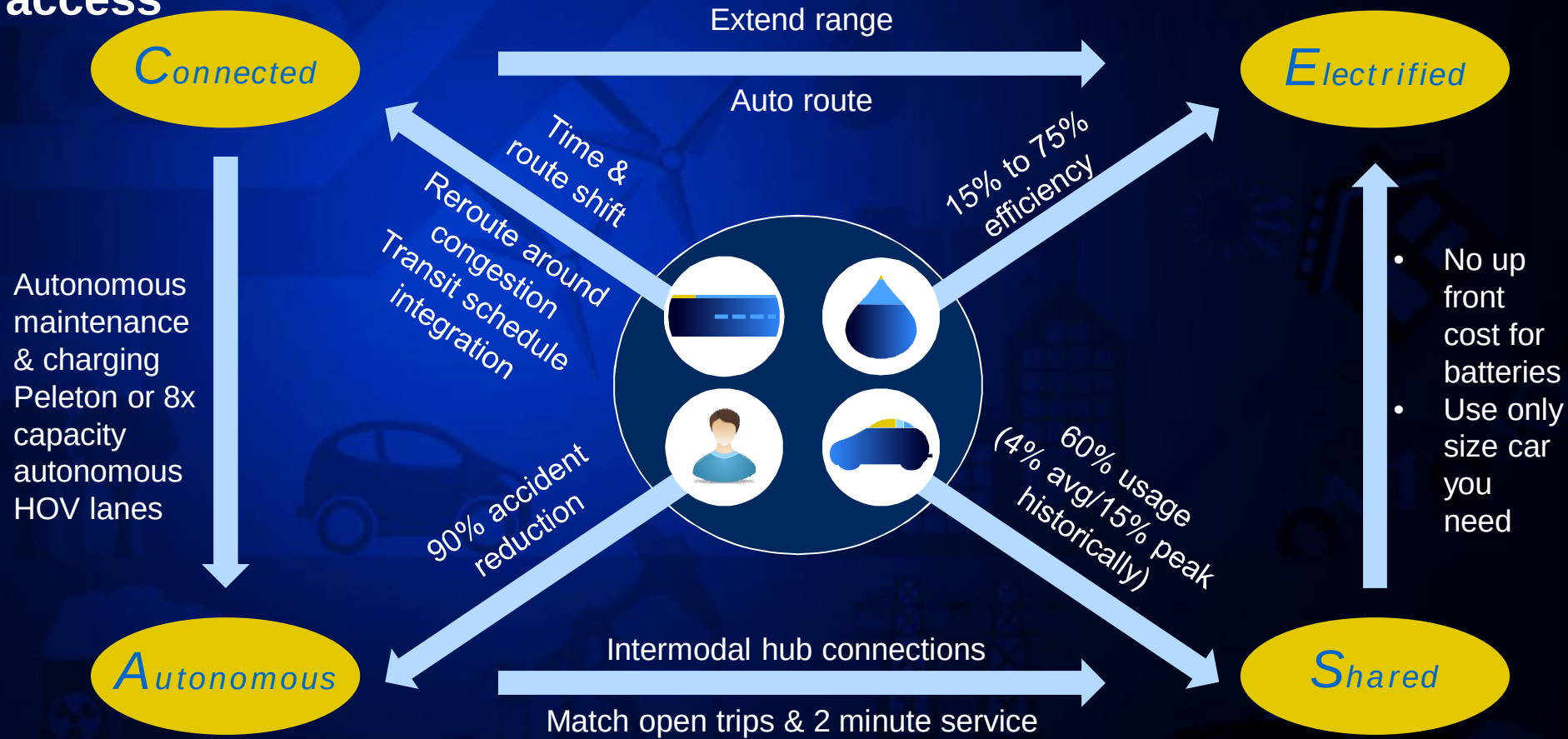
Cities	Population rank	2007	2012	Change
New York	1	54.1	56.5	+2.4
Washington DC	24	35.5	37.9	+2.4
Boston	21	36	36.9	+0.9
Philadelphia	5	32.4	32.6	+0.2
San Francisco	14	29.5	31.4	+1.9
Baltimore	26	29.3	31.2	+1.9
Chicago	3	25.6	27.9	+2.3
Detroit	18	21.2	26.2	+5.0
Milwaukee	30	18.4	19.9	+1.5
Seattle	22	15.3	16.6	+1.3
Portland	28	14.5	15.3	+0.8
Los Angeles	2	12.8	13.6	+0.8

SOURCE: US DOT, University of Michigan Transportation Research Institute, Bloomberg New Energy Finance

Annual vehicle-distance travelled (1,000 miles per person)



ACES: from 67-120 cents/mile today to 9 cents/mile and universal access



Thought starters

Urbanization: move to cities vs. real estate arbitrage with autonomous commute
Will VMT grow or shrink?

Who matters: driver vs. rider vs. fleet owner vs. fleet operator

Fleet: Number of cars on road vs sales – lifetime, miles/year, utilization

Winning model: First mover vs. premium experience vs. highest productivity

Innovation: upgrades/software, supply chain/fleet, customer interaction & convenience

Transit: Intermodal with suburban last mile vs. new “public” car fleet vs. autonomy kills transit

Value: Market share of vehicles vs. # of customers vs. mileage share