An HSR Program for the USA

- 2050 is Closer Than You Think -

High Speed Rail: Mobilizing a New Generation

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The St. Regis Hotel

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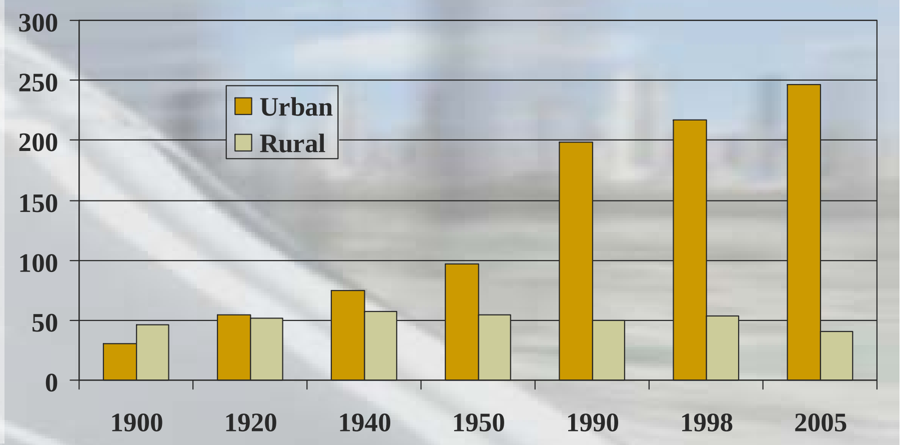
How Can HSR Compete in the US?

- US conditions: ubiquitous and high quality highways; very high auto ownership
- Dense air network
- Most travel is local – within urban areas and under 50 miles in length (14B trips vs. 2.6B over 50 mi. in 2001 national survey)
- Freight transported by both truck and rail; increased rail use urged for environmental and energy reasons, but many key rail lines are getting congested.

The Transport Challenge in the US

- Demographic trends --- potential for HSR
  - Increasing urbanization
  - Wealth increasing
  - Demand for mobility is increasing, but limited by access and capacity

Urbanization in the US
(population in millions)



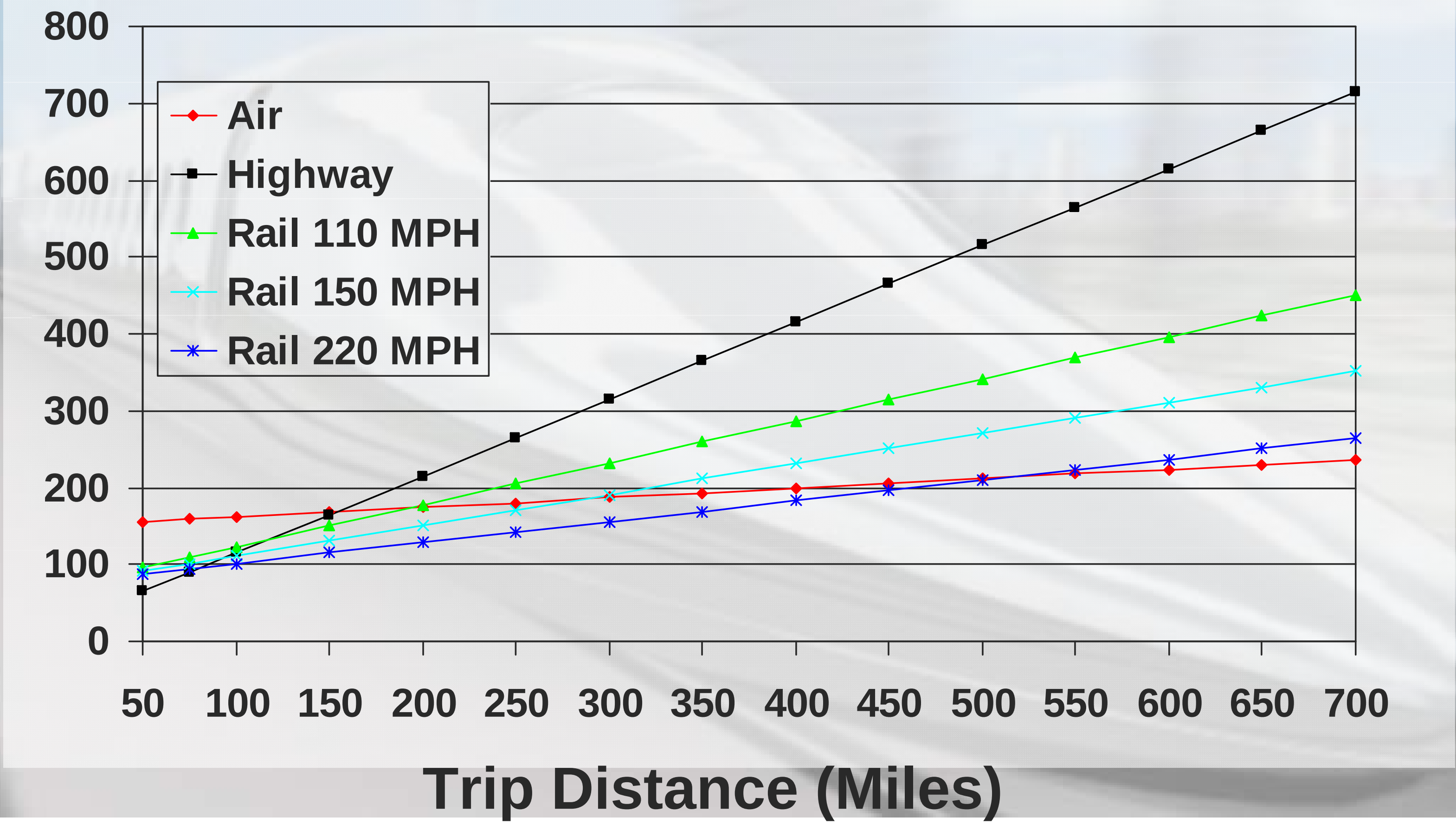
- Current modal trends can not continue
  - Highway congestion still increasing
  - Airport congestion serious, and airlines focusing on long haul

HSR Offers an Opportunity

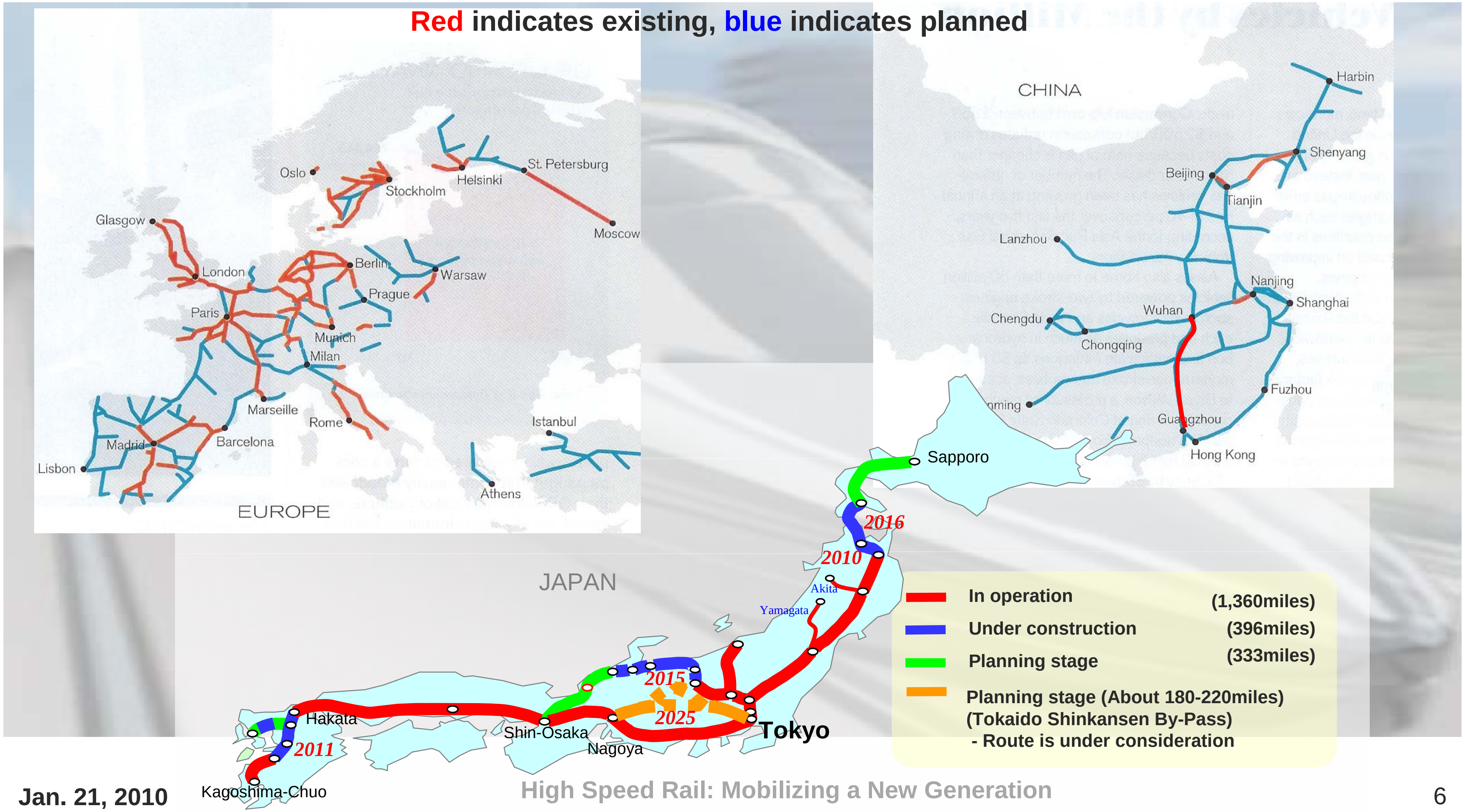
- Conventional rail has a limit but HSR can play a role.
- Critical passenger market: 100 - 600 miles
  - Where most congestion exists.
  - Below 100 Miles autos will usually dominate
  - Above 600 Miles, air will dominate, but air will not serve short haul markets with congested airports

The Role of Speed:

Total Trip Time in Minutes



The HSR System around the World



Visioning American HSR in 2050

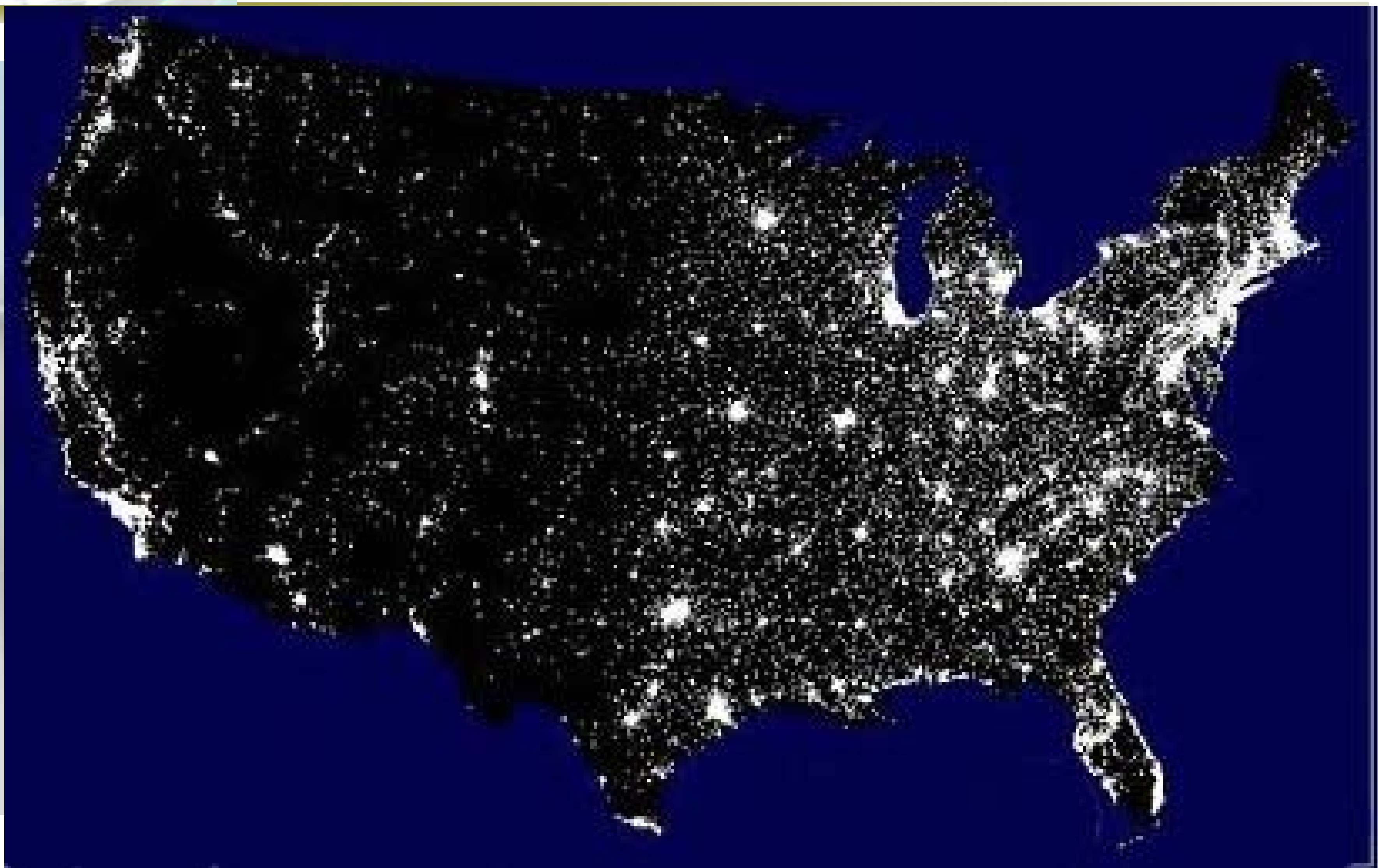
A Vision, not a Plan: evaluate all the reasonable options

Facts behind the Visions:

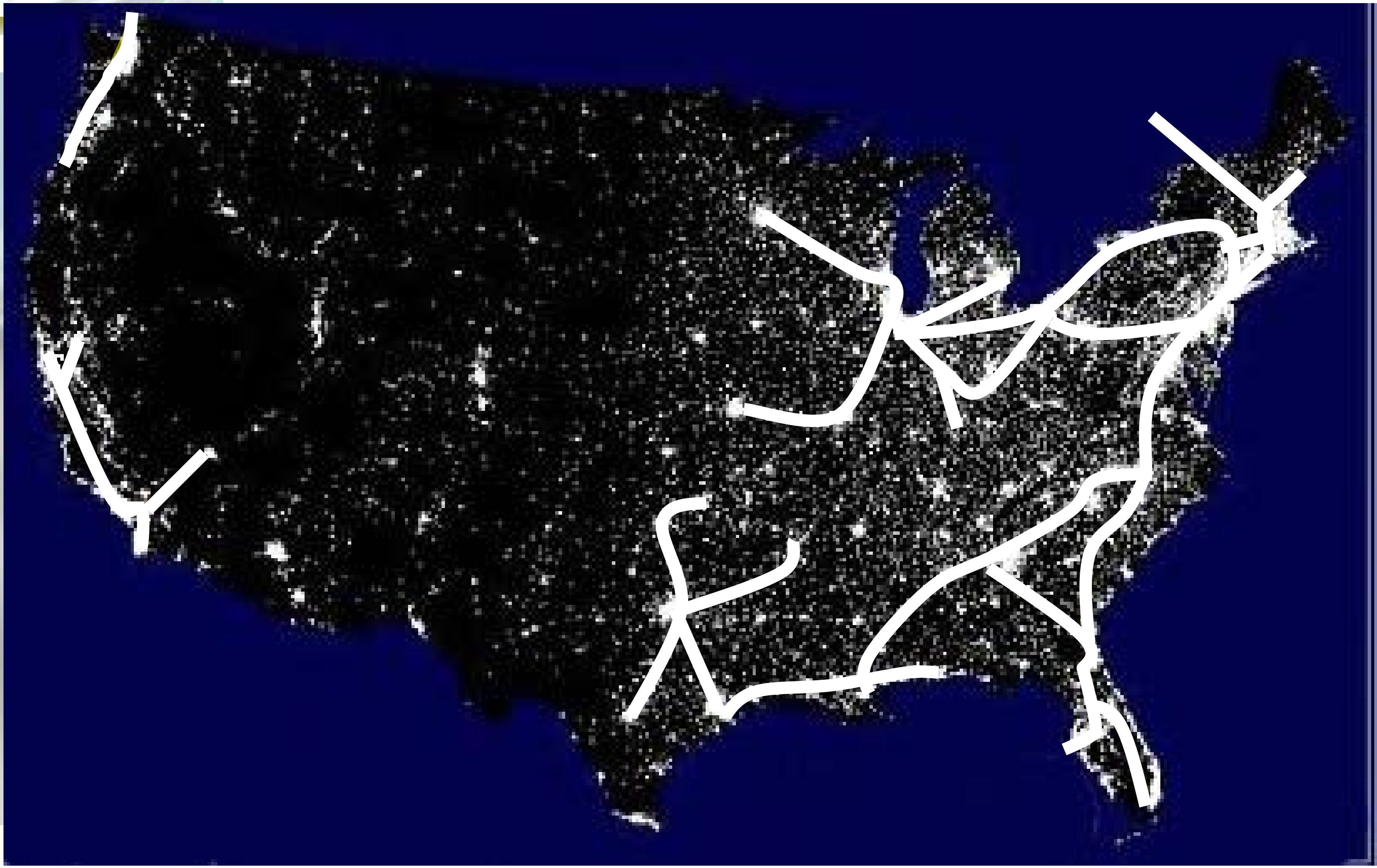
- The Obama Proposal (10 “Designated Corridors”)
- The FRA Commercial Feasibility Study of 1997
- The CA HSR Business Plan
- SNCF studies of four corridors in 2009
- Past corridor studies by independent groups
- The FRA 1981 High Speed Rail study (more conventional)
- Studies and experience outside the US

The Ten FRA Designated Corridors and the NEC

The USA in Lights



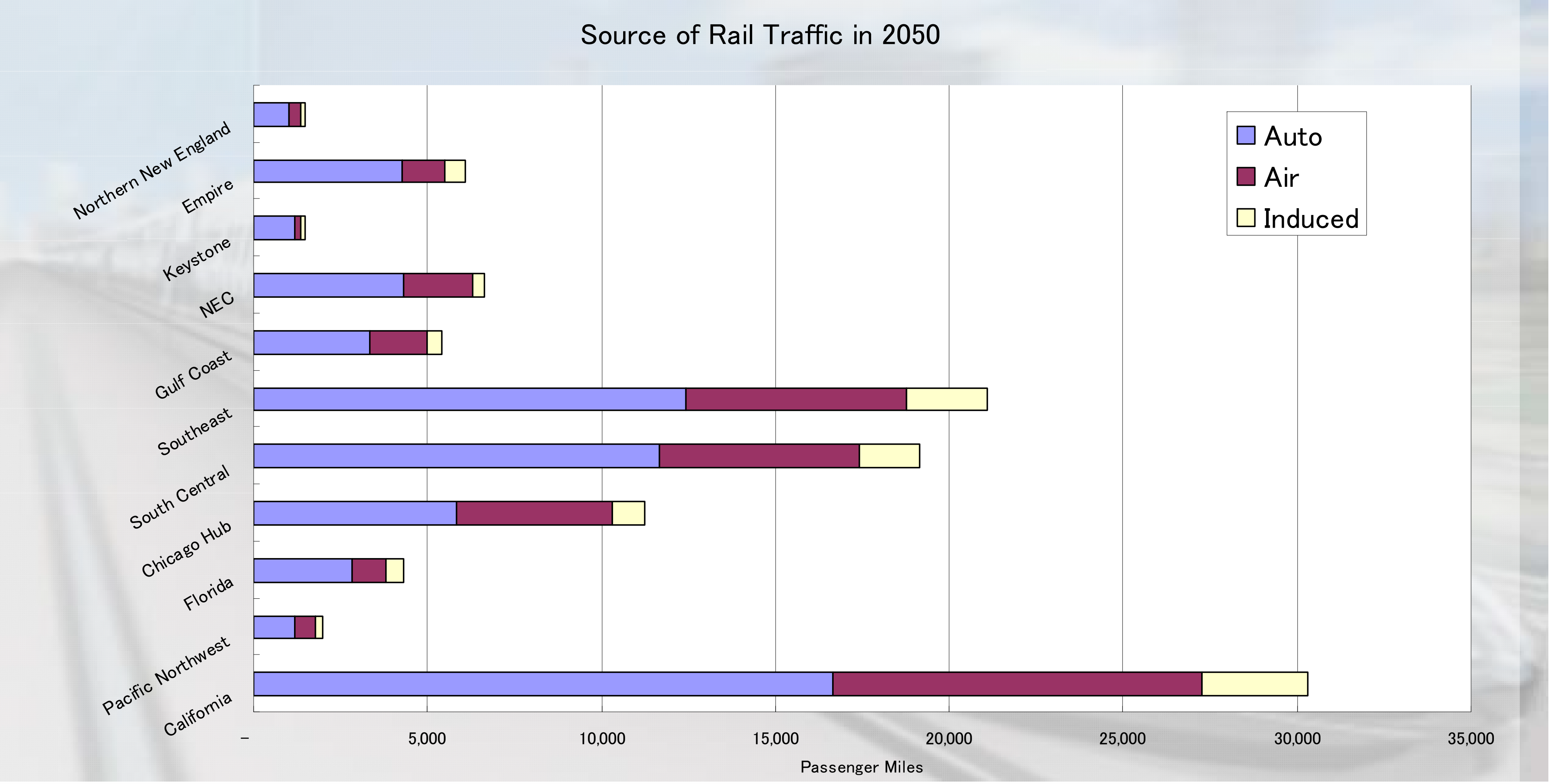
HSR Corridors



Eleven Corridors Analyzed

	Corridor	Service Provided
1	California (with LA/LV)	Sacramento, San Francisco, San Jose, Central Valley, Palmdale, Los Angeles, LA/Anaheim, Riverside, San Diego, and LA to Las Vegas
2	Pacific Northwest	Vancouver (BC), Seattle/Tacoma, Olympia, Portland (OR), Salem, Eugene
3	Florida (included Jacksonville to Orlando link)	St Petersburg, Tampa, Lakeland, Orlando, West Palm Beach and Miami. Jacksonville to Orlando added.
4	Chicago Hub	Minneapolis, Madison, Milwaukee, Chicago, Springfield, St Louis, Kansas City, Indianapolis, Louisville, Kalamazoo, Ann Arbor, Detroit, Toledo, Cleveland, Cincinnati and Columbus
5	South Central	Tulsa, Oklahoma City, Dallas/Ft Worth, Austin, San Antonio, Little Rock, Texarkana, Houston
6	Southeast	Washington, DC, Richmond, Norfolk/Virginia Beach, Raleigh/Durham, Greensboro, Charlotte, Greenville, Atlanta and Columbia, Savannah, Macon, Jacksonville
7	Gulf Coast	Atlanta, Birmingham, Meridian, New Orleans, Mobile, Biloxi and Houston
8	NEC	Washington, DC, Baltimore, Wilmington, Philadelphia, Newark, New York City, Stamford, New Haven, New London, Providence and Boston
9	Keystone (includes Pittsburgh to Cleveland link)	Pittsburgh, Harrisburg, Philadelphia, Cleveland
10	Empire (includes Buffalo to Cleveland link)	Buffalo, Rochester, Syracuse, Utica, Albany/Poughkeepsie and New York City, Cleveland
11	Northern New England	Albany, Springfield/Hartford, Boston, Portland (ME) and Montreal

Rail Passengers in 2050
– where does the traffic come from?-



Summary Program
- Thompson Projections -

Corridor	HSR Line Miles	2050 Corridor Population (million)	2050 Corridor Trips (millions)	Total CO2 savings (metric tonnes)		Low Infrastructure Cost (2009$ Millions)	High Infrastructure Cost (2009$ Millions)
				Low	High		
California	1,088	54.1	101.0	1,292,113	3,878,697	35,904	63,104
Pacific Northwest	467	14.5	12.3	76,070	245,354	7,005	9,340
Florida	478	31.6	28.9	135,212	509,228	7,170	26,768
Chicago Hub	2,137	39.1	66.0	544,612	1,502,751	49,151	74,795
South Central	1,202	33.0	63.9	759,691	2,416,287	14,424	52,888
Southeast	1,659	33.2	84.4	795,858	2,604,359	29,862	49,770
Gulf Coast	1,024	22.0	21.6	219,380	688,417	18,432	30,720
NEC	457	54.5	35.0	289,370	874,338	11,425	26,049
Keystone	486	16.6	9.9	34,030	166,381	11,178	17,010
Empire	630	28.1	22.6	188,070	722,979	12,600	17,010
Northern New England	665	15.3	9.9	54,681	185,283	13,300	17,955
TOTAL	10,293	277.0	455.5	4,389,087	13,794,074	210,451	385,409

- Have 10,293 Miles of lines
- Serve 35 States with 379 million people: 88% of the US total population
- Serve 85 urban areas with 277 million people: 65% of the US total population

High Speed Rail and CO2 In the US

Schipper-Kosinski-Deakin Scenario Approach

- Scenario Approach – National Broad-Brush Aggregate Projections
  - Project present US travel patterns by mode, purpose, distance interval
  - Focus on car (LDV) and air travel in likely HSR range 100-600 mi (160-1000 km)
  - Provided ranges because of large uncertainties in 2050 travel patterns and emissions
- Estimating CO2 Emissions Reductions from Mode Shift to HSR
  - HSR could reduce car pass-miles in 100-600 mile range by 2 to12 %
  - HSR could reduce air pass-miles in 100-600 mile range by 15-50%
  - Range of CO2 emissions from electricity, LDV, and air travel from previous work
- Key Findings for CO2 Savings
  - HSR will reduce CO2 emissions from passenger transport in the US, cutting emissions from both cars and planes.
  - Savings dependent on amount of mode shift, electricity source and efficiency, and unit emissions from auto and air travel.

*Results Give Informative **Range** of Travel, CO2 Impacts*

US Medium and Long Distance Travel (>50 Mi. One Way)

http://www.bts.gov/programs/national_household_travel_survey/long_distance.html

- Annual Amounts – How Much is HSR-able?
  - Total US: over 1.3 trillion person-miles of long distance travel a year
  - About 2.6 billion long distance trips
  - 90% by personal vehicles, 7% air, 2% bus, 1% rail
- Who Makes Long Distance Trips – Who is HSR-Able?
  - Men make 57 percent of long distance trips
  - 57 percent have total household income of $50,000 or more
  - Almost two-thirds of long distance trips made by travelers 25 -64
- Trip Purpose - Which are HSR-Able?
  - 56% for vacations, sightseeing , visiting friends or relatives, outdoor recreation
  - 16% business trips
  - 15% commuting to work

9.5% of Air Pass-mi, 22.3% of Car Pass-mi 100-600 mi Range

Only 0.2% of Air, but 8.8% of Car Pass-mi in 50-100 mi Range

How We Estimated Future US Travel Patterns

Schipper-Kosinski-Deakin (SKD) UC Team

- Data on Travel Passenger-mi in 100-600 Mile Range from
  - 2001 National Household Travel Survey (NHTS)
  - T-100 Data (FAA) on all air tickets 2001
  - Estimate of urban, non-urban local and intercity travel by mode
- Projections of US Travel in Passenger-Miles – Other Studies
  - US Energy Information Administration (EIA) light duty vehicles vkt to 2030
  - FAA passenger-miles flown to 2025, EIA used to project to 2030
  - Projected US Travel to 2050 for “Low Carbon 2050” Study– lower p-miles than EIA
- Scenarios of US HSR Travel Passenger-mile
  - Started with SKD projections of US Travel to 2050 from “Low Carbon 2050” Study
  - Projected shares of air, LDV travel from 2001 to 2050 proportional to total travel
  - Used air and LDV pass-miles by distance/ trip type to estimate potential switch to HSR

Simple First Draft Approach: UC Carbon 2050 Scenarios

Share of HSR Travel in Key Interval Constant at Present Value

Findings and Assumptions for Mode Shift

Based on Travel in 100-600 mi "HSR interval"

- 22.3% of 2001 Total LDV pass-mi was in (100-600 mi) interval
  - Separate driving into business trips/commute trips and other trips
  - Assumed solo drivers most likely to switch (avg assumed 1.15 people/car)
  - Multi-passenger non-business trips continue in cars because of cost considerations
- 7% of 2001 Total Air Pass-mi was under 600 mi
  - EU experience of HSR getting air travelers (Nash): Up to 75% of flyers switch to HSR
  - "High" shows "what if" 100% work related and 25% of other air travel switched to HSR
  - Assume load factors similar to national averages (~77% in 2005)
- Other Mode Shifts (Induced travel not treated here)
  - Shifts from existing small rail travel ignored for now – will count later
  - Intercity bus travel also ignored – mostly low cost, emissions small
  - Long commutes shifting to HSR will be included at later stage

Focus on LDV and Air Modes:

These Dominate Travel and Emissions

Assumptions for CO2 Intensities of Modes Many Uncertainties Must Be Acknowledged

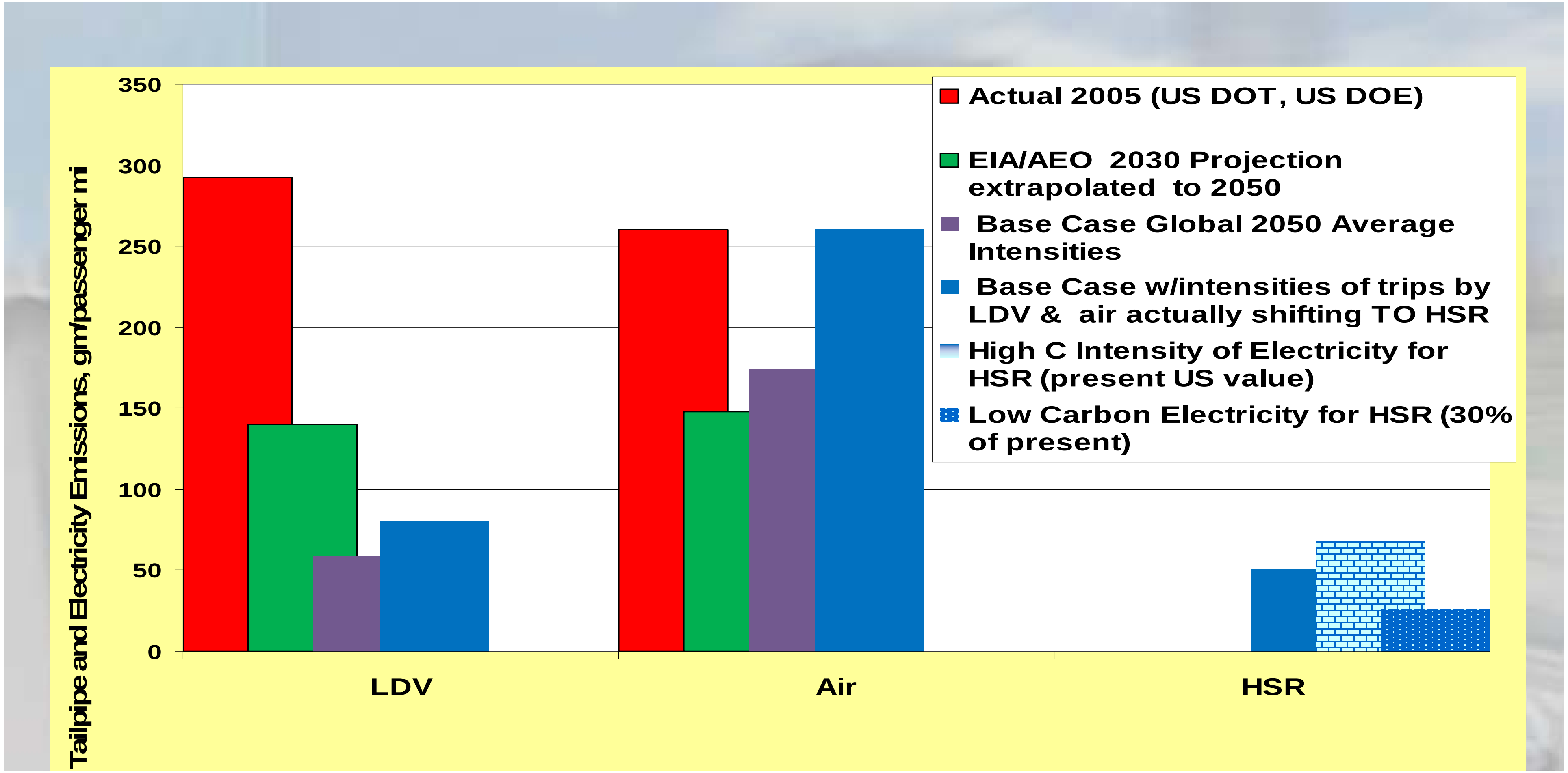
- Energy Intensity of HSR (kwh/seat mi) and (kwh/pass-mi) - range
  - Electricity/seat km from literature , data from Japan Rail Central gathered by Thompson
  - Ultimate electricity intensity will depend on train size, technology, running conditions
  - Electricity/pass-km from assumption of 60% load factor
- Electricity for HSR to CO2 – Generation Efficiency, Carbon Content
  - US nat'l average C02 from electricity as delivered to train 2005 US EIA (684 gm/kwh)
  - Used IEA projected improvement in carbon/electricity ratio (30%) to 2050
  - Projection assumes less coal in generation & improved generation and transmission efficiency
- CO2 Intensities of Other Modes in 2050
  - LDV, air travel CO2 intensity projections from "Low Carbon 2050" study for JITI/ITPS
  - Assumed LDV average CO2 intensity (62 gm/veh-mile) 30% of today – possible?
  - Assumed air travel CO2 intensity 40% below present and 10% below EIA 2030

Projected CO2 Intensities of Modes to 2050 Highly Uncertain

Key Factors are whether LDV and Electricity Power Production in US "Decarbonize"

CO2 Emissions per Passenger Mile: Actual and Projected

Note HSR Intensity range below most projected air or light duty vehicle values



Air and Auto intensities in HSR case reflect those of the travelers switching to HSR, because
LDV vehicle occupancy of switcher is presumed lower than avg; short-haul air fuel intensity is 50% higher .
EIA intensities given to 2030, projected to 2050 at same rates of change

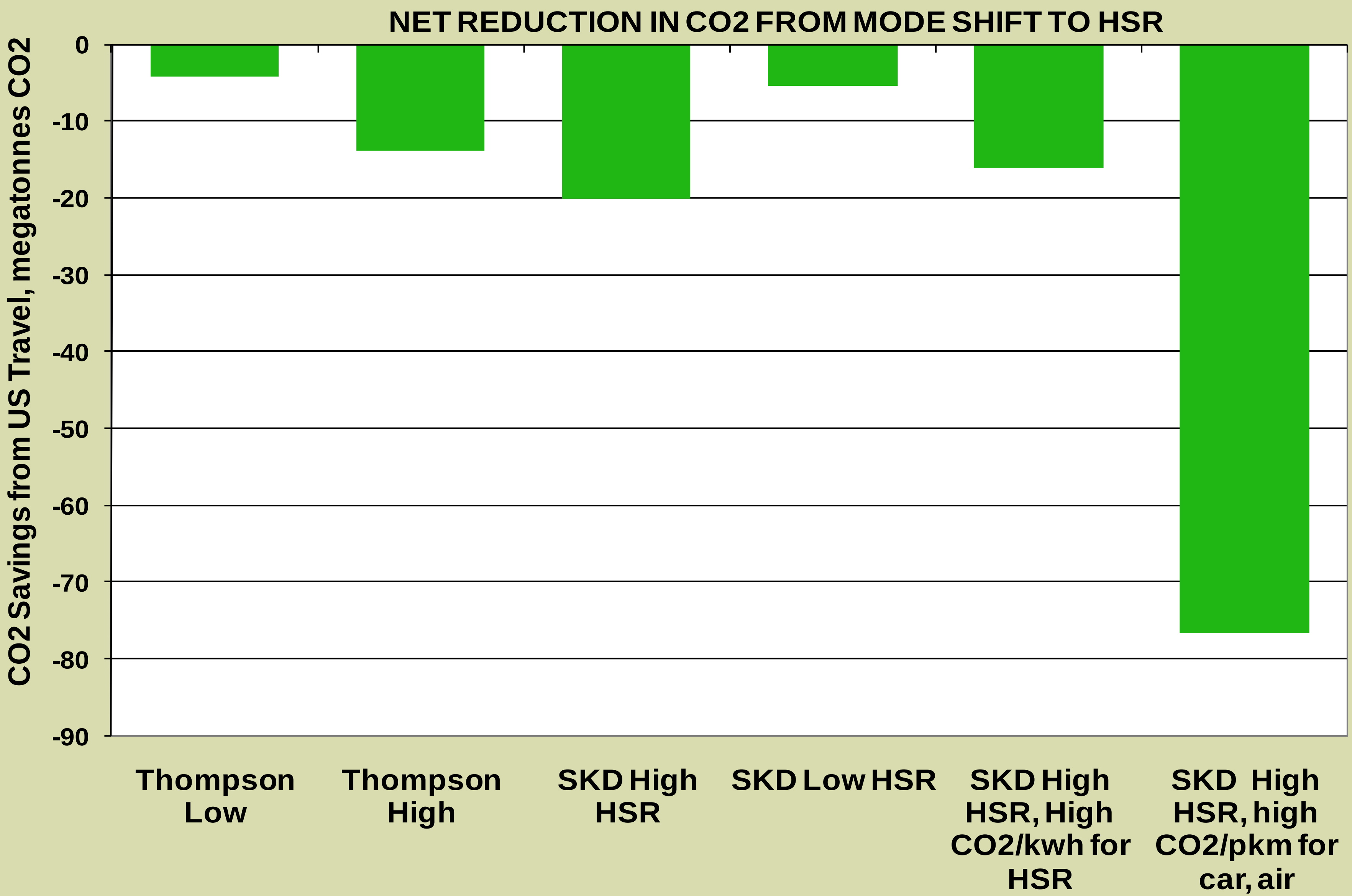
Mode Shift to HSR and Fuel/CO2 Balance Summary from SKD " Broad Brush" Scenarios

- Savings of CO2 in Corridors– High and Low Estimates
  - Cut corridor emissions by 6 to 22.3%
  - Cut national emissions from travel by 1-3.5%
  - Results small because share of pass-miles in HSR range small, but local reductions and co-benefits (lower pollution, congestion) could be large
- Important Assumptions for Savings – CO2 Intensities of Modes
  - 60% HSR load factors- Higher means greater savings
  - Assumed 30% decline in CO2/kwh from present value
  - CO2/pass-mi for car was very low: higher value in 2050 means greater savings
- Uncertainties in this Estimate Affecting CO2 Savings
  - Key factor for CO2 is level of mode shift, which is very dependent on many factors
  - More total travel (pass-miles) in BAU could increase HSR and CO2 savings
  - Future work could examine life cycle emissions, key corridors in detail, policies

CO2 Savings Will Be Important Cobenefit of Good HSR
Justification for HSR will Rest Mostly on Issues Related to Overall Service and Advantages

Range of Projected CO2 Savings

Corridor and “Broad Brush” Aggregate Travel Approach Results Compared



What will make HSR attractive – or not?

- Time and costs need to be “reasonably competitive” - door to door, not just in vehicle
- That means keeping operating speeds high and yet also having fairly easy access times (tradeoffs with number of stations and speed, but also could have local and express versions)
- Lower hassle factor and higher utility for time in travel could offset higher costs than car and somewhat slower speeds than air (within reason)

Policies that can affect attractiveness of HSR as a LD travel choice

- Urban development policies – e.g., the number of people living and working within walking distance of rail station, the ease of access by various modes
- Transport policies - e.g., access services provided, multimodality of stations, subsidies for HSR and other modes, congestion pricing, etc.

Opening Up HSR Markets

- Reform subsidies and investment policies so that they better align with policy intent (sustainable development)
  - Shift some trips now in car and air to rail
  - Capture a higher percentage of new trips as population and economy grows
  - Anticipate induced travel especially for discretionary trips

Emerging Market: TOD Dwellers and Workers?

- Transit oriented development could be part of the HSR development strategy (already is in CA)
- Increase both origins and destinations within easy access of HSR station
- Markets can be long distance business travel, long distance personal travel, and longer commutes
- HSR will reduce travel times so it could change location choices for residents and businesses

“Induced” Trips

- With better access to cities and to recreational areas, entirely new trips that would not otherwise be made may be induced – especially for discretionary trip purposes such as social and recreational travel.
- At the margin, also would tend to expand labor shed and work opportunities
- Planning for new recreational travel: policies for carrying bikes, sports equipment; first and last mile transport services

HSR is Manageable
- Japan's Experience -

- Private Sector Can Operate.
  - Operation and maintenance by private companies using their income only.
  - No subsidy and pay the lease fee of the infrastructure.
- Competitive Fare Setting Possible.
  - Passengers' Fare between Tokyo – Osaka (320 miles)

    HSR (Tokaido Shinkansen) JPY 14,050 ($150)

    Air JPY 10,100 - 22,600 ($110 - 240)
  - Market Share : HSR 80% vs. Air 20%

HSR in the US… YES!

- HSR is a well proven option elsewhere, logical option for the US in future – can work in high density corridors.
- Issue: getting the right mix of modes with proper planning.
- Tomorrow always arrives: need to start planning NOW.

THANK YOU VERY MUCH FOR YOUR ATTENTION!