

# Urban-Scale Mitigation of Transportation GHG Emissions: Opportunities and Challenges

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Globalization, Natural Resource Constraints  
and the different Scales of Sustainable Pathways

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CIREN, Nogent sur Marne

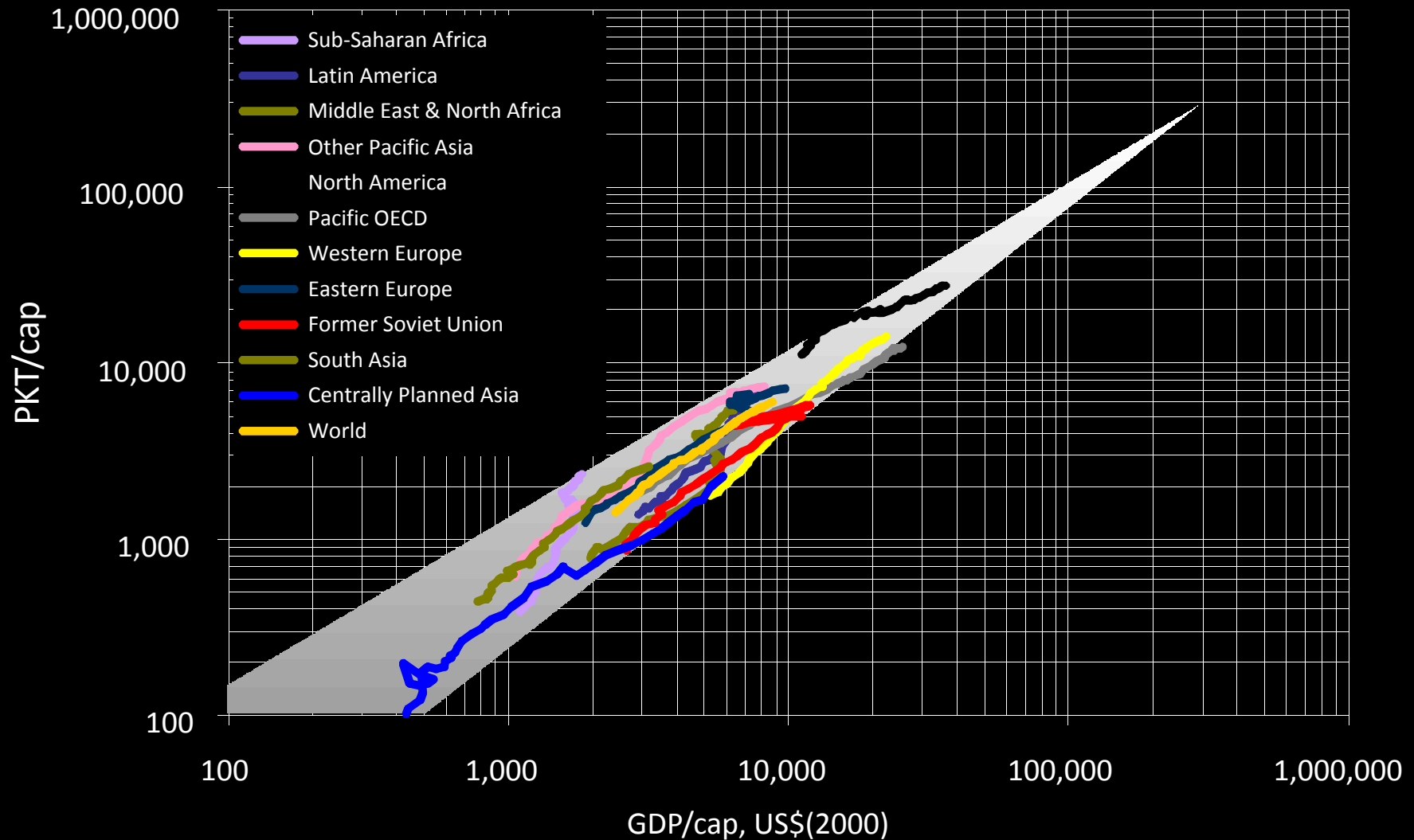


## Selected Sector Characteristics

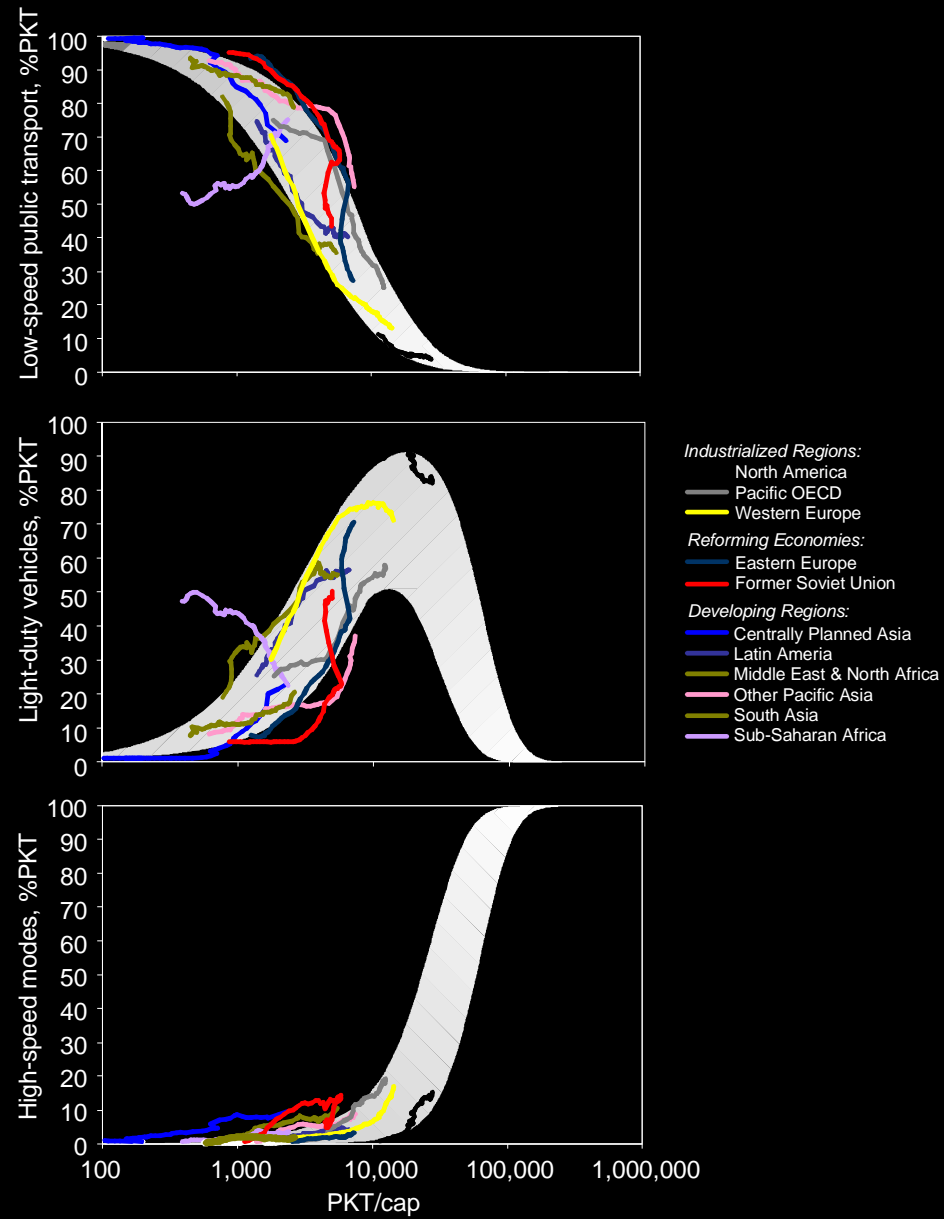
- Vast scale
- Rapid demand growth



# Growth in Global Mobility (1950-2005)



# Shift from Slow to Fast (1950-2005)

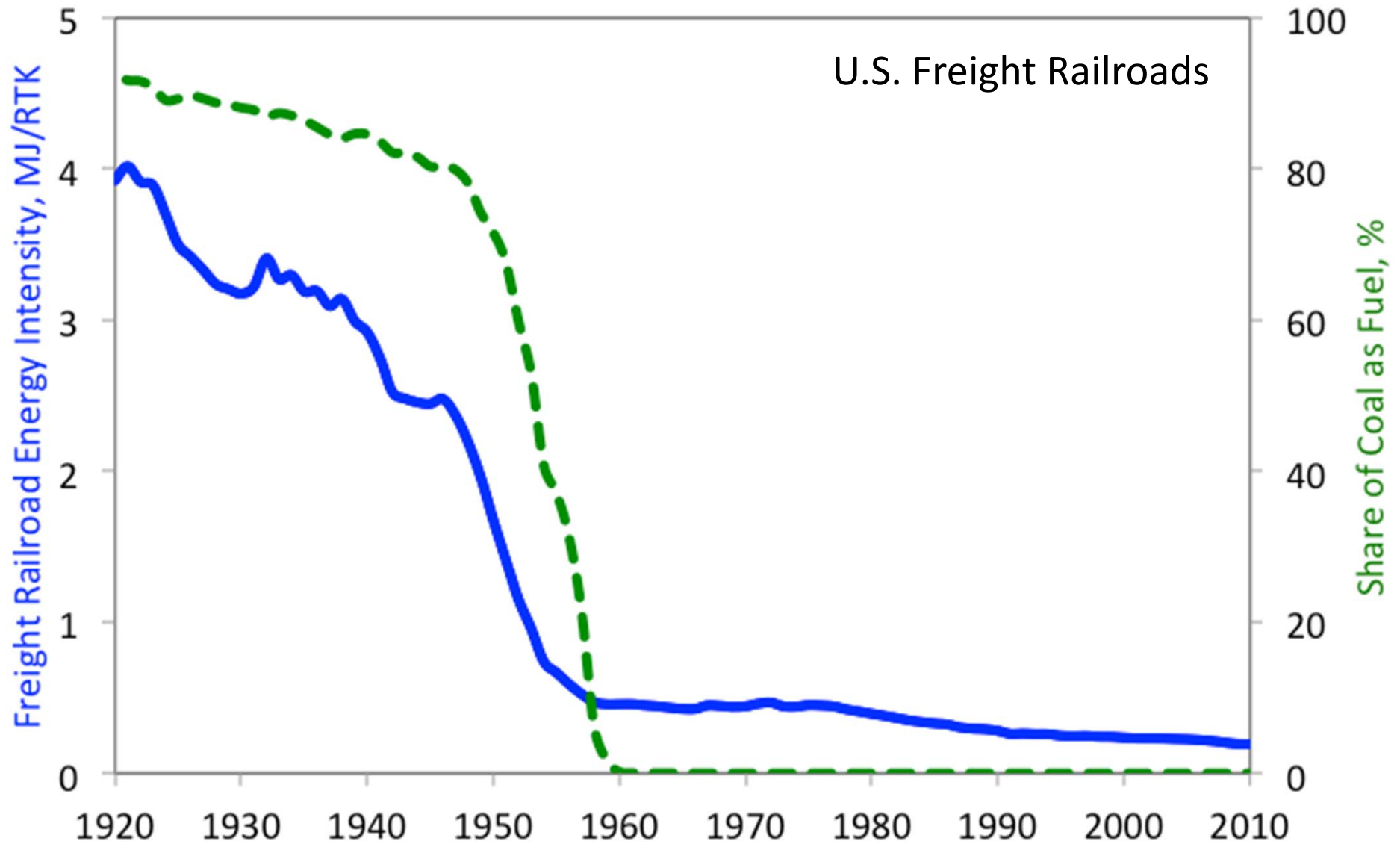


## Selected Sector Characteristics

- Vast scale
- Rapid demand growth
- Significant GHG mitigation expensive, but necessary for meeting climate targets in long run
- Capital intensive (=> typically incremental technological change => long time constants)



## Can We Engineer Our Way Out?

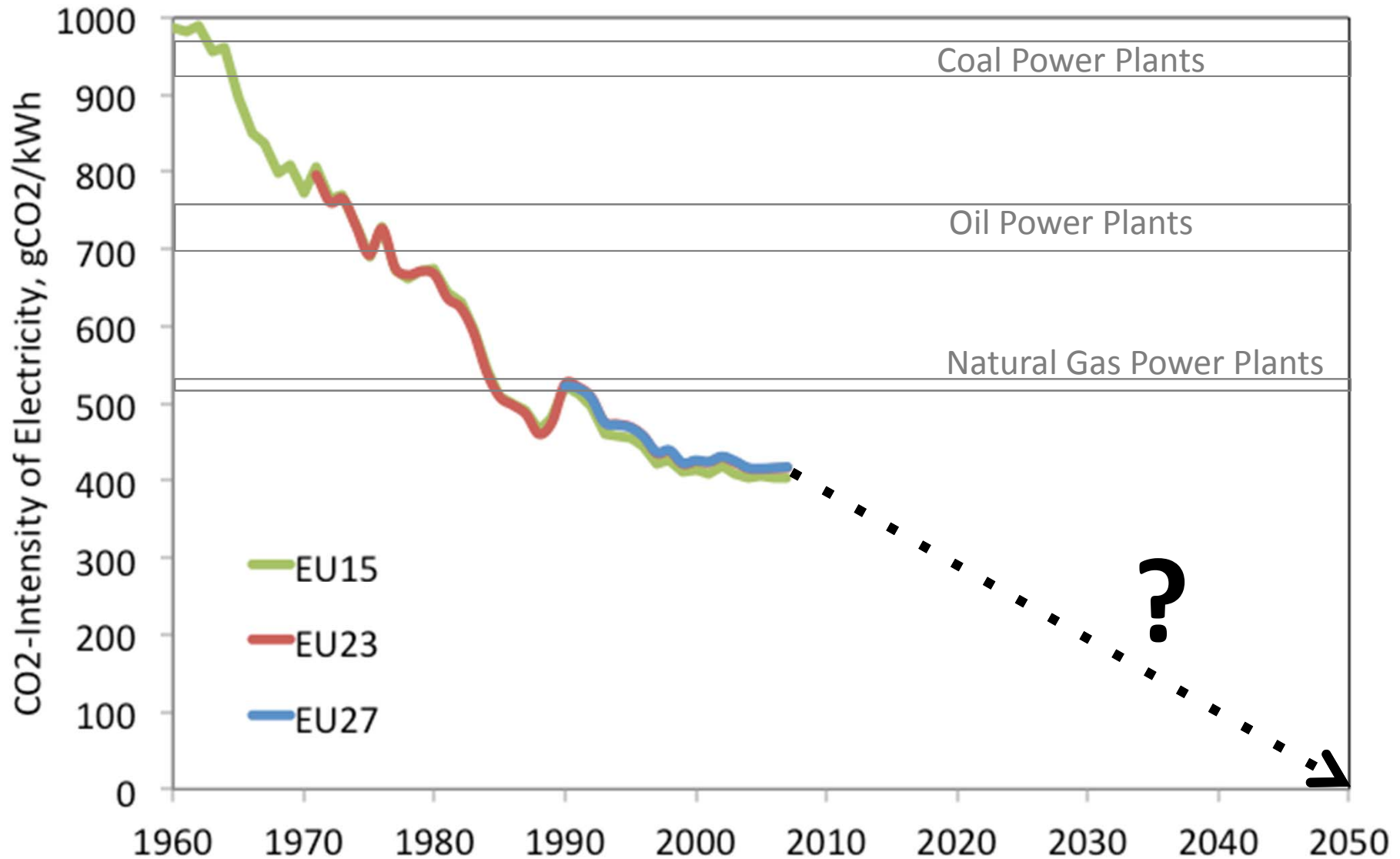


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# Sector Interdependencies: EU Electricity Generation



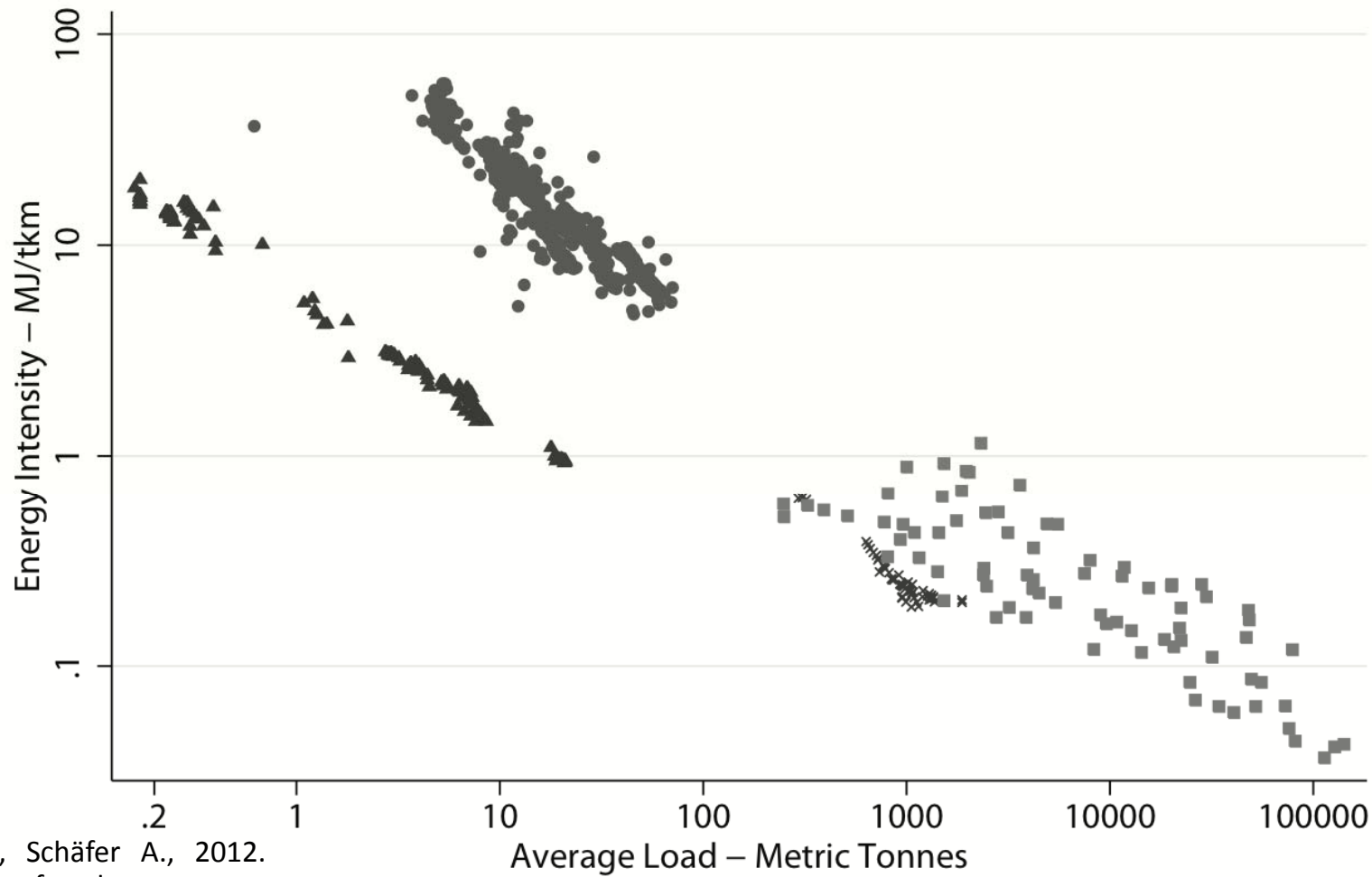


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- No silver bullet



# No Silver Bullet: Freight Transport Energy Intensity



Gucwa M., Schäfer A., 2012. The impact of scale on energy intensity in freight transportation, Transportation Research Part D, August 2013



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- Capital intensive (=> typically incremental technological change => long time constants)
- Sector interdependencies (e.g., electricity from low-carbon fuels)
- No silver bullet
- Climate policies leave demand largely unaffected



## Need For More Disruptive Technologies

- Fuels (synthetic fuels from cellulosic biomass, hydrogen???)
- Energy storage (high energy density batteries: Ld-Acid: 35 Wh/kg, Li-Ion: 150, Gasoline: 12,000)
- Hybrid-electric propulsion systems for aircraft, etc.
- These needs are most critical for intercity, long-distance transportation  
=> increased expectations from urban transportation

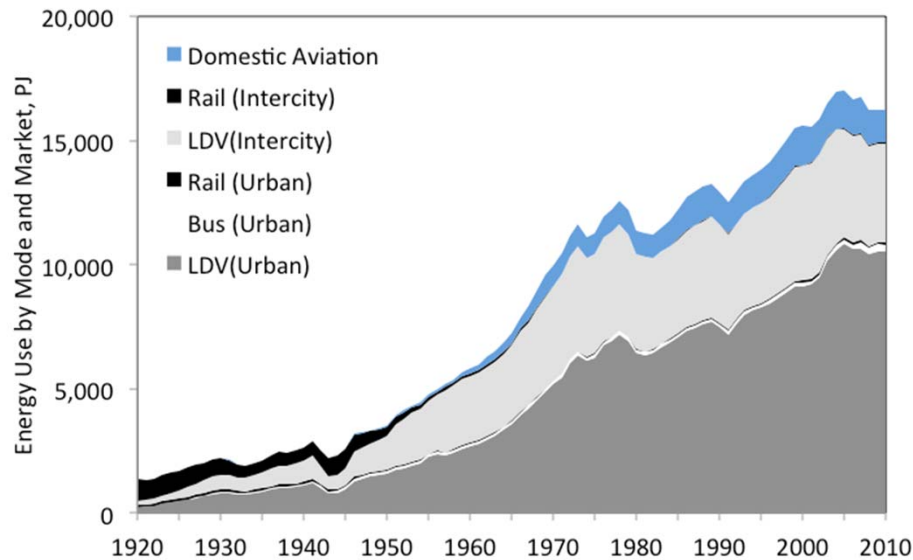


## Need For Induced Behavioural Change

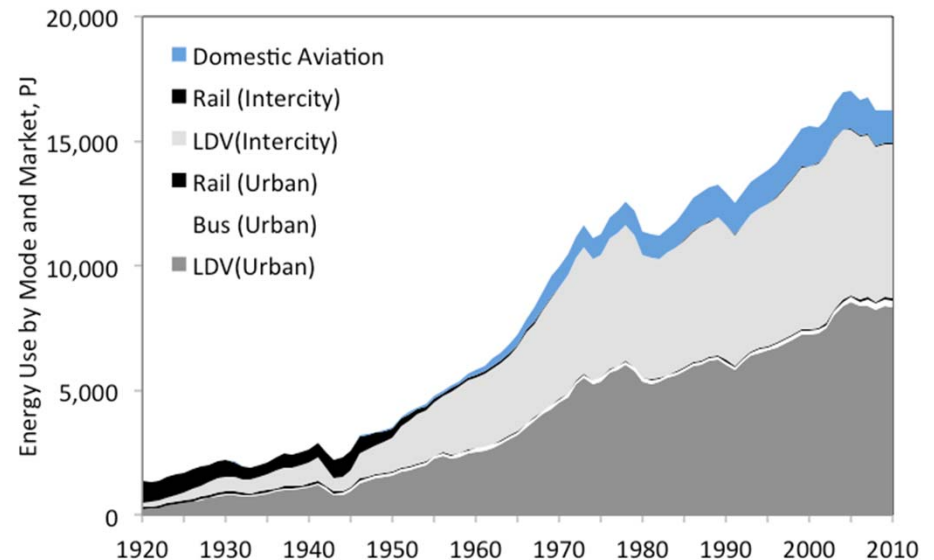
- Long technology time constants require behavioural change to meet targets
- Basic idea: rebalance consumer preferences in choice situation (vehicle type, mode, location, etc.)  
=> more opportunities in urban transportation



# U.S. Transportation Energy (1920 – 2010): Urban vs. Intercity



Urban LDV traffic: Urban  
Interstate + Other Urban Streets



Urban LDV traffic: Other Urban  
Streets

=> Urban traffic accounts for 50-67% of total domestic transportation energy use

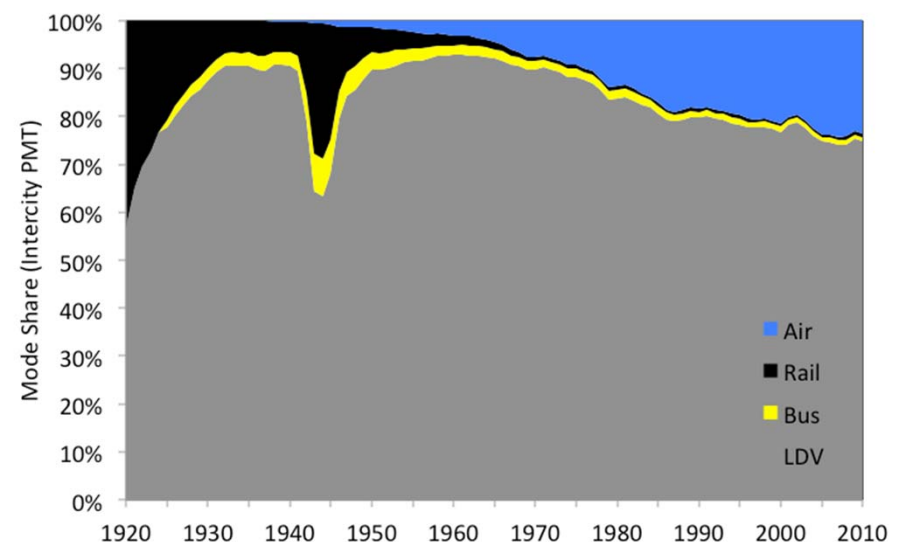
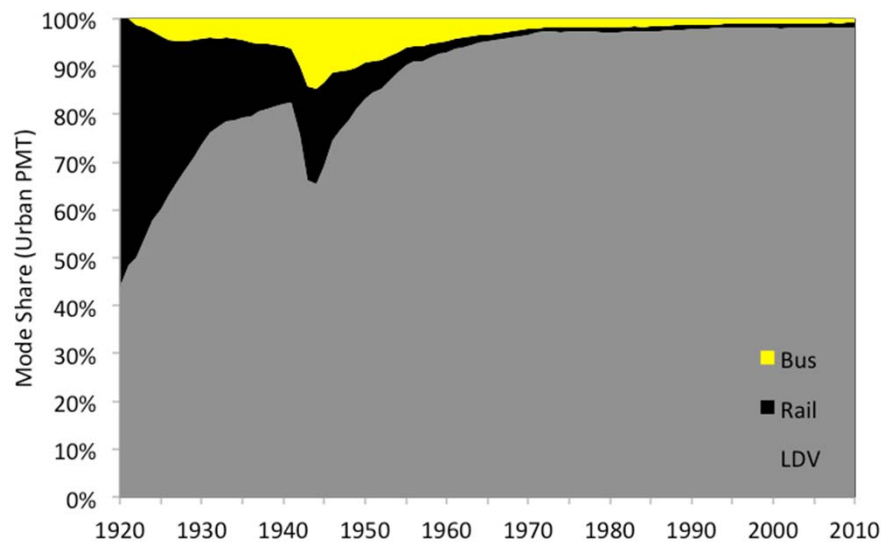
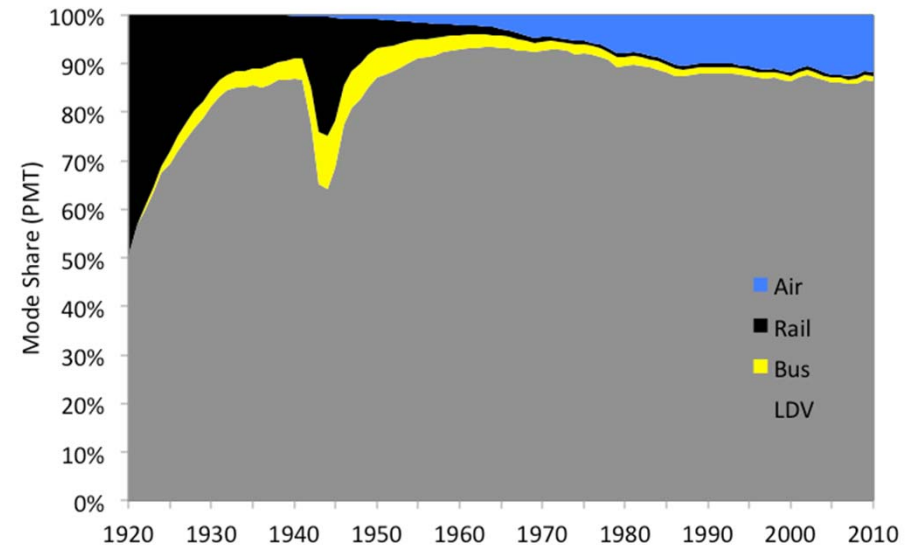
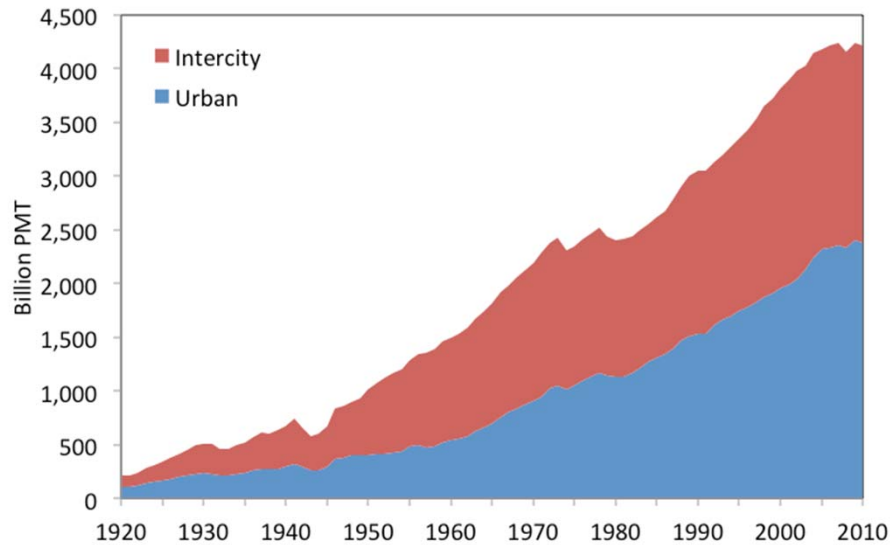


## Mitigation of Urban-Scale GHG Emissions (Reference = Intercity Transportation)

- Relaxation of binding technology constraints (EV range anxiety, commercial scale 2<sup>nd</sup> generation biofuels, etc.)
  - Larger number of alternative modes (especially non-motorized transportation and telecommuting)
  - Larger number of policy measures (e.g., use of land)
  - Potentially(!) simpler governance structures to introduce policies
- ⇒ More degrees of freedom (but some inter-dependencies remain)



# U.S. Passenger Travel (1920-2010)





# U.S. Transportation Energy (1920 – 2010): Passenger vs. Freight

