

ThinkTank Tuesday: Wine, Water, and Policy Whimsy

Driving Change – Autonomous Vehicles’ Big Impact

National Economic Education Delegation

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National Economic Education Delegation

- **Vision**

- One day, the public discussion of policy issues will be grounded in an accurate perception of the underlying economic principles and data.

- **Mission**

- NEED unites the skills and knowledge of a vast network of professional economists to promote understanding of the economics of policy issues in the United States.

- **NEED Presentations**

- Are **nonpartisan** and intended to reflect the consensus of the economics profession.



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Who Are We?

- **Honorary Board: 44 members**

- 2 Fed Chairs: Janet Yellen, Ben Bernanke
- 6 Chairs Council of Economic Advisers
 - Furman (D), Rosen (R), Bernanke (R), Yellen (D), Tyson (D), Goolsbee (D)
- 3 Nobel Prize Winners
 - Akerlof, Smith, Maskin

- **Delegates: 365 members**

- At all levels of academia and some in government service
- All have a Ph.D. in economics
- Crowdsource slide decks
- Give presentations

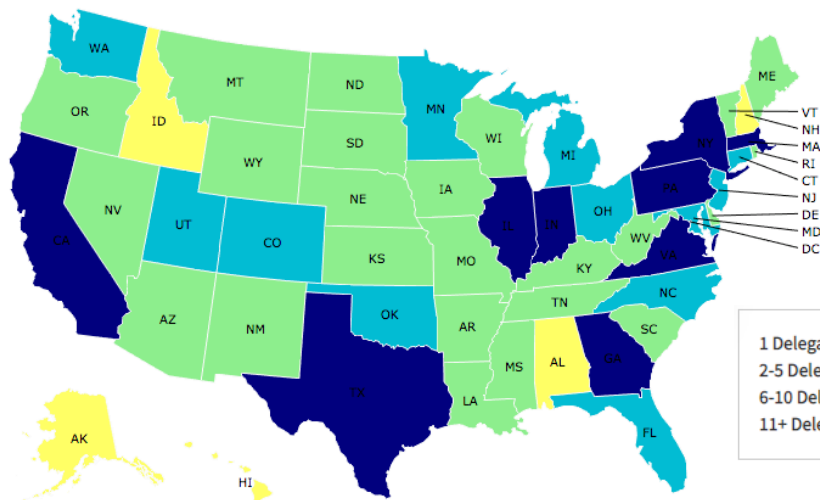
- **Global Partners: 42 Ph.D. Economists**

- Aid in slide deck development



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Where Are We?

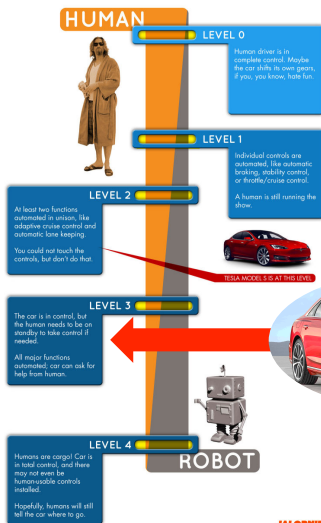


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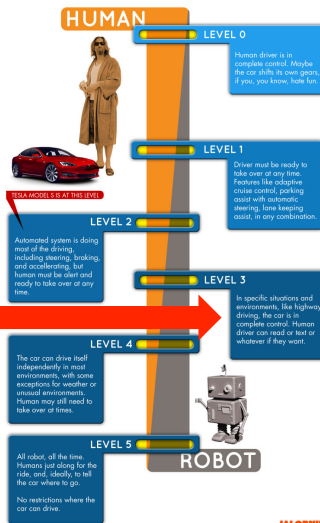
Outline

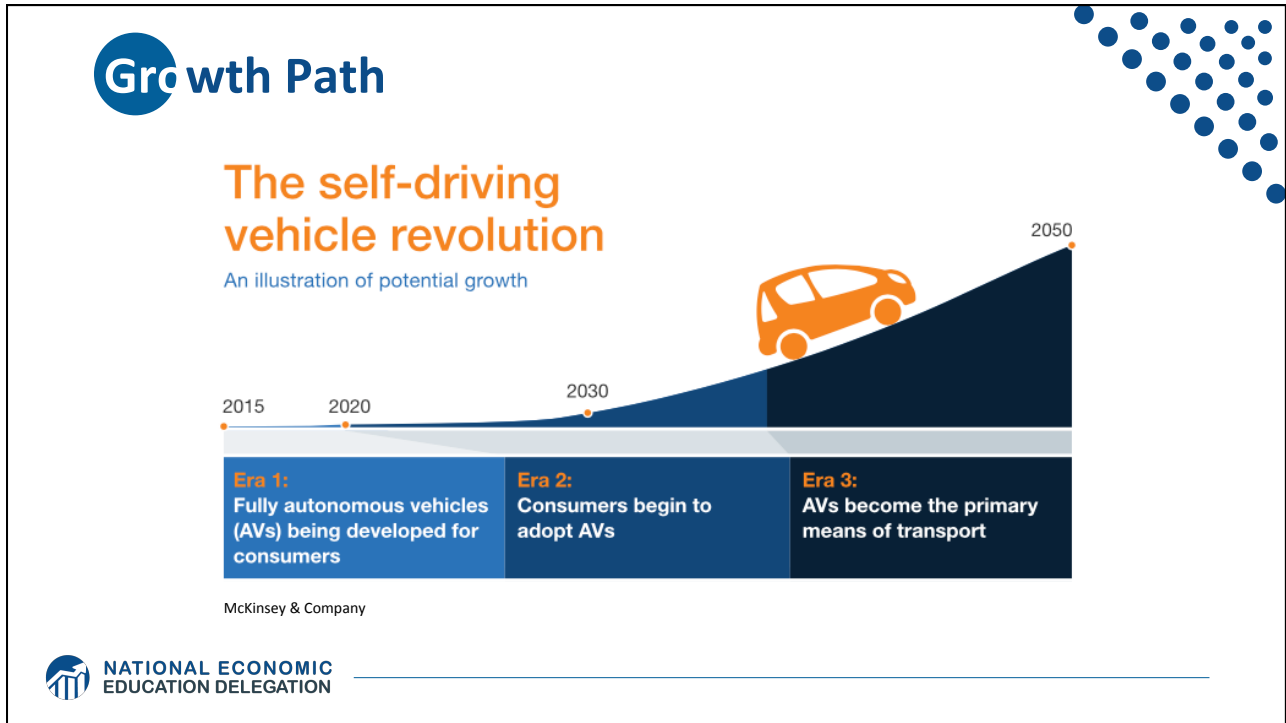
- Where does the AV path lead?
- Transition
- Policy/Planning Issues
- Major Economic/Development Changes
- Environmental Implications

NHTSA AUTONOMY LEVELS



SAE AUTONOMY LEVELS





WHEN?

What do the headlines say?

NVIDIA.

NVIDIA to introduce level-4 enabling system by 2018

TOYOTA

First autonomous Toyota to be available in 2020

Audi

Audi to introduce a self-driving car by 2020

Volkswagen

Volkswagen expects first self driving cars on the market by 2019

TESLA MOTORS

Elon Musk now expects first fully autonomous Tesla by 2019, approved by 2021

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WHEN?

What is possible?

- Potentially 95% by 2035
- Last 5% is going to be very difficult to achieve
- Is this possible?
 - Horses to cars: 10 years – early 1900s
 - But adoption of EVs is so slow
 - Adoption of AVs will be rapid



What will the future look like?

But, Will it be:



Hell

- **Primarily individual private car ownership**
 - Much as today
- **Combustion engines**
- **Why Hell?**
 - Dramatically increased VMT and pollution
 - Potentially increased congestion
 - Parking



Heaven



- **Vehicle ownership will be very limited**
 - Private ownership for those with specialized vehicle needs.
 - Fleet ownership will serve everybody else.
- **Engines: electric**
- **Insurance: product liability**
- **Not clear when we will get there, but this is the likely model.**
 - 2030 for widespread adoption in many regions.



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Why is this Heaven?

- **Not only autonomous, but:**
 - Shared
 - Connected
 - Green
- **Far fewer cars in existence**
 - Better resource utilization
- **VMT could go up or down, but more productive than in Hell.**
 - Fewer zero passenger miles driven.
- **Minimal need for parking**



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Transition

- **Short term: Tesla model of highway autonomy**
 - Level 2, adaptive cruise control
- **Medium term:**
 - short period of personal vehicle ownership with level 3 capability
 - introduction of independent private fleets – Uber, Lyft, Google, nuTonomy, etc., with level 4/5 capability
- **Long term:**
 - Personal vehicle ownership is largely a thing of the past



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Economics Drives Transition: Private

- **ADOPTION DIVIDEND for private individuals**
 - Eliminate car ownership
 - Ave annual cost of owning a car: \$9,576
 - Cost per mile will fall: \$0.59 to \$0.19
 - Repurpose your garage
 - \$50,000 from transition to bedroom
- **Time recovery**
 - 50% of Bay Area workforce has a commute in excess of 30 minutes
- **It will become too annoying to drive around all of those autonomous vehicles!**



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Economics Drives Transition: Public

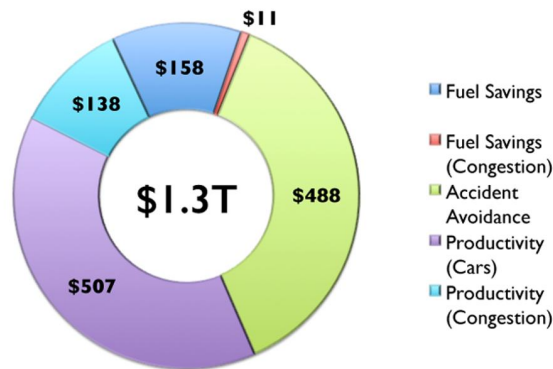
- **Economic and social costs associated with human drivers are enormous:**

- Estimated at \$0.8 to \$1.3 TRillion each year
- Accidents drive 25% of congestion
- 40,000 deaths from car accidents
- 2 million injuries
- 90+% of accidents caused by human error



Potential Savings

Potential US Savings (\$B)



Encourage Change

- **Mobility and equity considerations**
 - Elderly/disabled/impoverished
- **Safety:** only way to reduce traffic fatalities is by coordinated effort
- **Productivity:** reduced congestion
- **Environment:** speed transition to electric vehicles

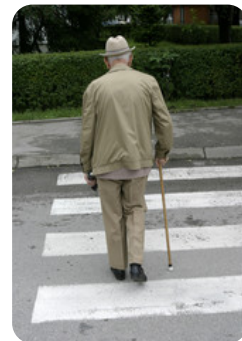
These are all societal benefits that come about too slowly if the private market is left to itself.



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Mobility and Equity

- **Mobility**
 - Handicapped
 - Elderly
 - Lower income
- **Equity**
 - Public Transportation often does not work well for low income workers/residential workers
 - Does not go from residential to residential, but from residential to commercial



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Safety and Productivity



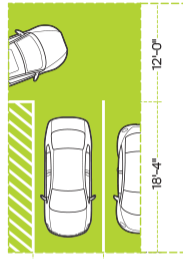
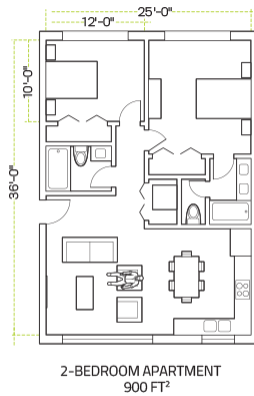
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Environment

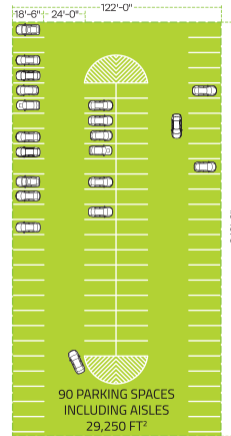
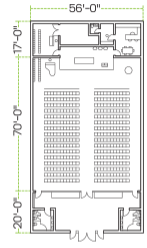


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Environment



size for 2 parking spaces: 650 FT²



Mother Jones



Environment



Incentives Through Policy and Planning

- **Allow vehicles equipped with ACC into HOV lanes**
 - Eventual conversion of HOV lanes to ACC/AV lanes
- **Allow ACC equipped vehicles to travel faster in HOV lanes**
- **Subsidize ACC upgrades**
 - Arguably more concrete benefits than electric vehicles
- **Sticks: higher costs of vehicle ownership**
 - Registration fees, VMT taxes, etc.



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What Changes Will This Bring?

- | | |
|------------------------------|--------------------------------|
| • Disposable Income | • Public Transportation |
| • Employment | • Infrastructure |
| • Government Finances | • Housing |
| • Transportation | • Parking |

Potentially dramatic improvements in infrastructure planning and maintenance - Data sharing and integration



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Disposable Income



- Costs \$9,576 to own a car
- Will cost \$3,000 to use TaaS
- Net increase in disposable income of > \$6,000
- Spread across all households: > \$1 trillion in new spending in the economy
- Major boost to economic activity
 - CREATING JOBS!

Summary of Change

- Massive employment upheaval
- Local government finances will look very different
- Housing will be easier to build and more plentiful
- Parking conversions will be commonplace
- Demand for transportation infrastructure will likely decline
 - Transportation infrastructure technology will be a booming business
- Demand for public transportation may well decline

Environmental Implications Depends: Heaven or Hell

- **Improved resource utilization**
- **More efficient travel**
 - Right sized vehicles
 - Optimized routes
 - Reduced congestion
 - No searching for parking
- **Increased VMT**
- **Cleaner technologies**
 - Electric
 - Lighter vehicles
- **Energy use of onboard electronics**
 - Weight and functional

Bottom line: push governments at all levels to embrace and to implement policies deterring private vehicle ownership and zero passenger miles



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Overall Summary

- **There is an enormous upside to autonomous vehicles**
 - Many private benefits.
 - Also positive externalities – public benefits.
- **There is also a potential downside: Hell**
- **The role of government?**
 - Promote the development of autonomous vehicles.
 - Reap the public benefits.
 - Ensure heaven and not hell.
- **When they arrive....nobody knows!**



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Thank you!

Any Questions?

www.NEEDelegation.org

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