

IMPACT OF ENVIRONMENTAL POLICY ON THE AUTOMOTIVE INDUSTRY: INITIAL RESULTS

Automotive Policy Research Centre

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SUMMARY

- Research Questions
 - Findings to Date
 - Next Steps in Research
 - Issues of Broader Application
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RESEARCH QUESTIONS

- Impact of Environmental Policy on the Automotive Industry
- Initial Assumptions
 - That Environmental Policies have been the largest single factor in Product and Technology development in the past 20 years
 - Theoretical Perspective: Varieties of Capitalism (VOC) perspective (Mikler 2009)

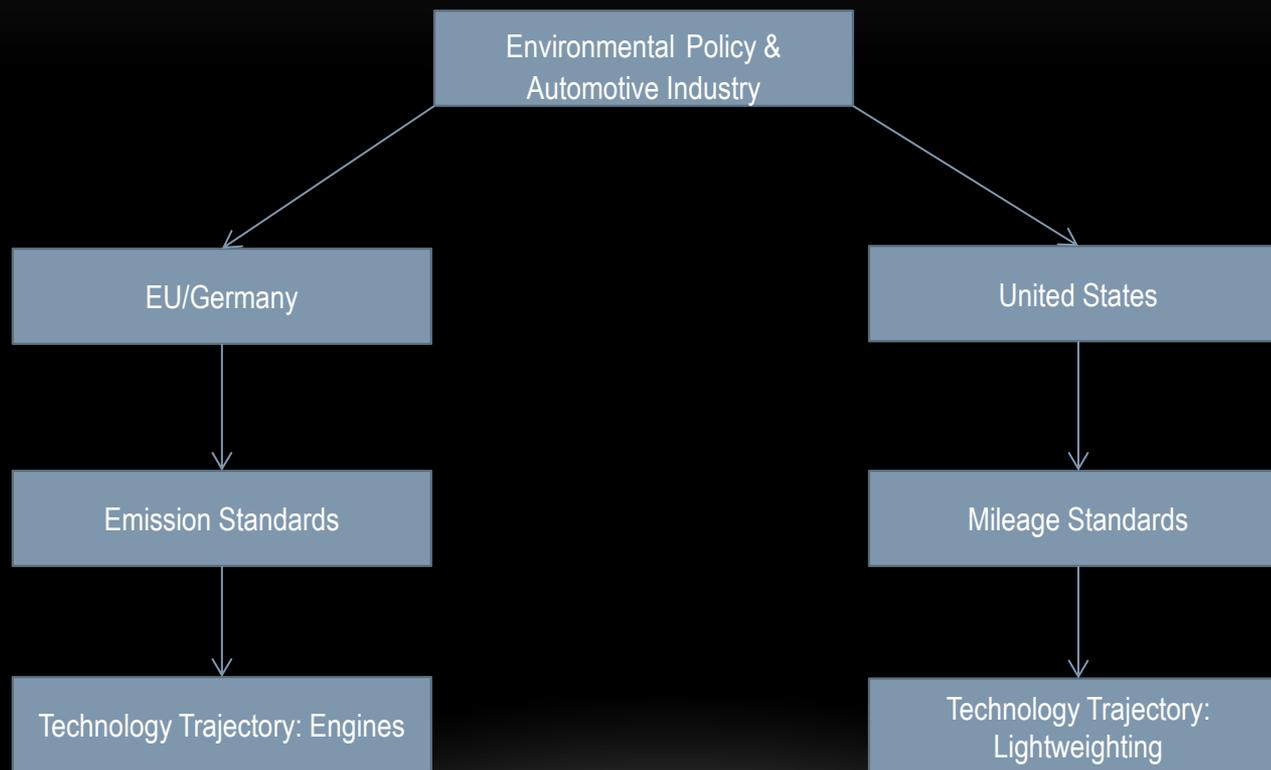
RESEARCH QUESTIONS

1. Is it accurate to say that environmental policy impacting the auto industry in the EU primarily emphasises emission standards while in the US it is mileage standards?
 2. Does the degree of difference affect decision makers?
 3. Do these policy differences result in different product development strategies regarding engine technologies and light-weighting?
 4. What are the relative environmental policy burdens falling upon original equipment manufacturers (OEMs) versus parts suppliers?
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FINDINGS TO DATE

- CAFE Standards 2017-25 are more than an incremental step
 - OEMs, Supply Chain
 - Materials Competition: Fe, Al, Mg, composites
- Standards:
 - USA: convergence of mileage and emissions policies
 - EU: emissions standards continue to dominate
- The differing regulatory approaches have significant impacts on auto firms decision-making and engender different technology trajectories

ENVIRONMENTAL REGULATORY REGIMES AND TECHNOLOGY TRAJECTORIES



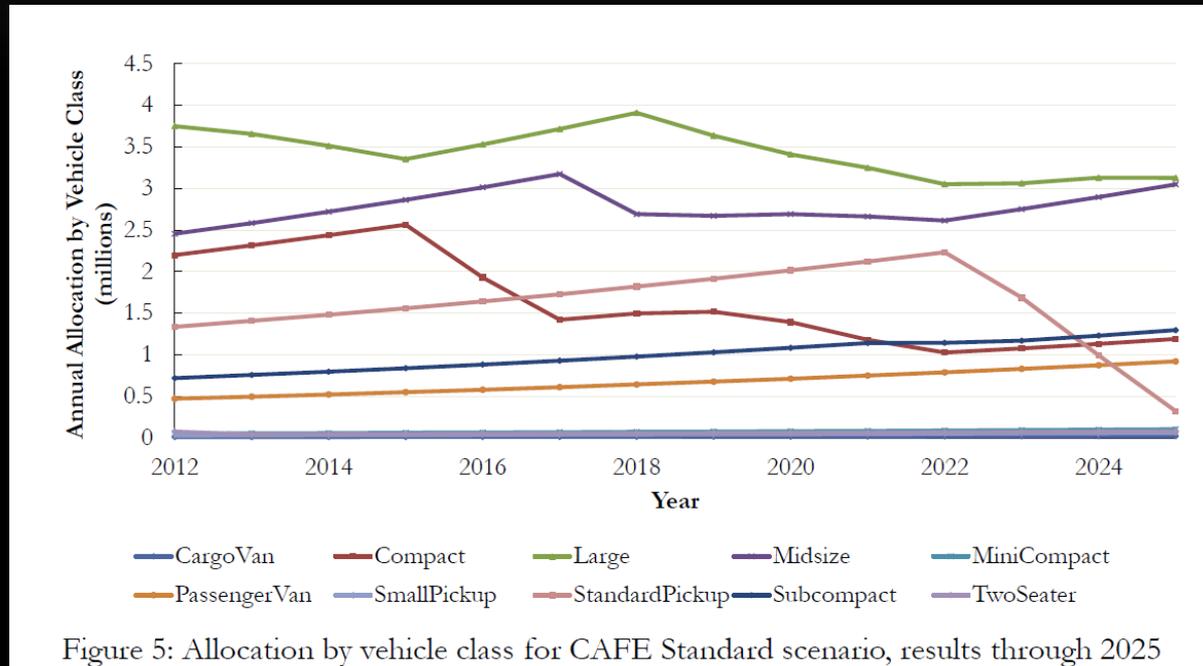
PARADOX OF POLICIES AND POLITICAL REGIMES

- USA: Most Liberal Market Economy has a relative absence of price signals but the most command and control regulatory regime.
- Germany: Has most the aggressive price signals but voluntary agreements with the industry conforming to existing technologies pathways.
- Japan: By North American standards has had relatively no formal regulations but has the best performing vehicles.

IMPACT OF NEW CAFE STANDARDS

- Represent a qualitative change in requirements for OEMs, material and parts suppliers
- The near term 2017-20 requirements will use available materials and technologies
- The later stages 2020-25 will require new materials and technologies
- Materials competition in the automobile will intensify
 - Materials composition within the car will be segmented
 - Advantage will still lie with Steel and Aluminum over Mg, carbon fibres, composites
 - Materials competitiveness turns on price, industrial capacities and life cycle impacts

CAFE SCENARIO 1: ALLOCATION BY VEHICLE CLASS



Source: Jenn, Azevedo, Michalek (2013)

CAFE SCENARIO 2: ALLOCATION BY VEHICLE TECHNOLOGY

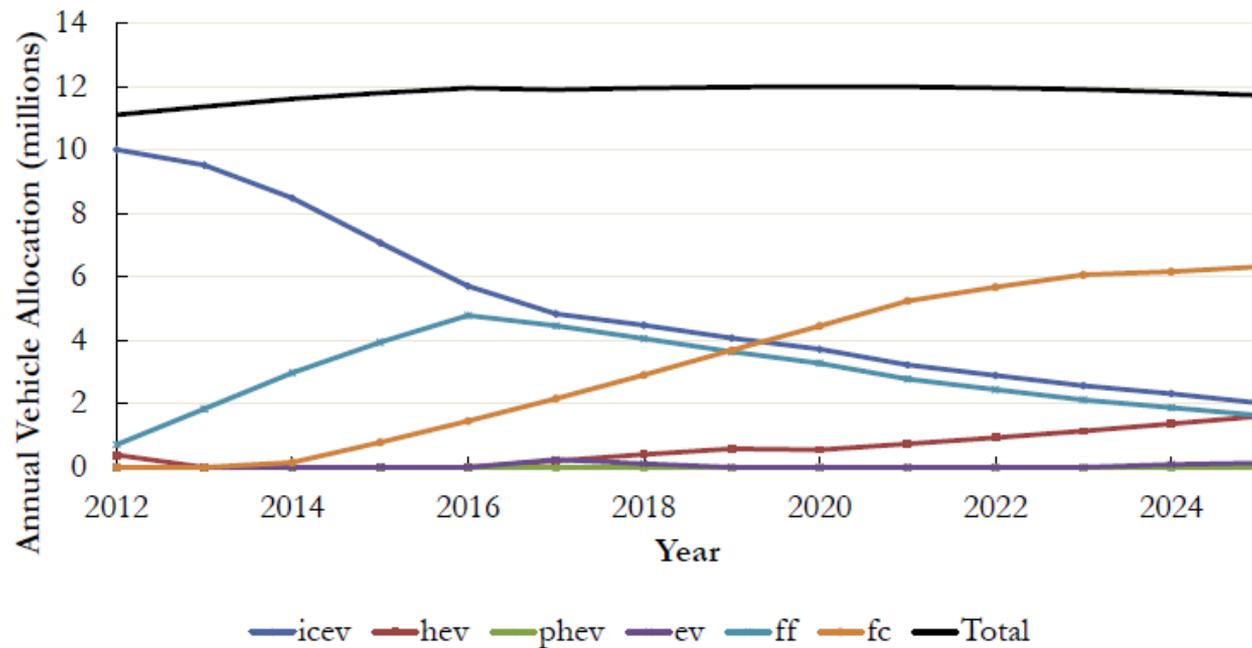
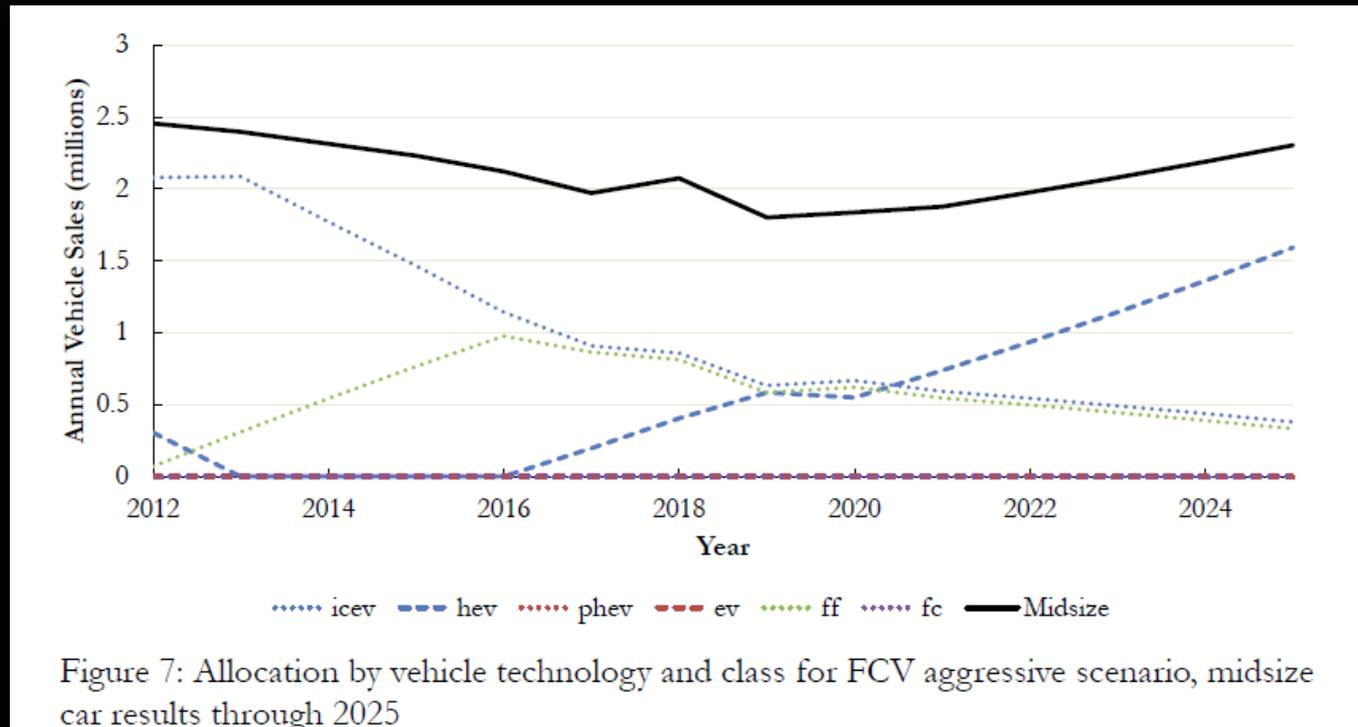


Figure 6: Allocation by vehicle technology for FCV aggressive scenario, results through 2025

Source: Jenn, Azevedo, Michalek (2013)

CAFE SCENARIO 3: BREAKDOWN BY VEHICLE CLASS & TECHNOLOGY



Source: Jenn, Azevedo, Michalek (2013)

RESULTS OF FIELD RESEARCH

IMPORTANCE OF NEW CAFE STANDARDS: OEMS

Yes, technology developments are driven by regulations. In Europe it drives diesel engine technologies because of the emphasis on emissions. In the US, it has led to new powertrain technology. Depending on the model strategy we would consider bringing diesel engines from Europe to the USA. It could also determine whether we rely on lightweighting or not. It is different again in Brazil and China.

OEM, Manager

ENVIRONMENTAL POLICY AND PLATFORMS

The strategy depends on the regulatory regime. In lightweighting, we can get to the 2017 standard through AHSS, UHSS. The 2025 standard may require aluminum, lighter interiors, etc. But we can't leap frog to the next standard. We offer all the available technologies BEV, EV, HEVs etc. We turn the platform strategies on and off. The platform is not dedicated.

The Platform is a rolling portfolio but we can build different vehicles and models with different mixes of powertrains and lightweighting under the skin.

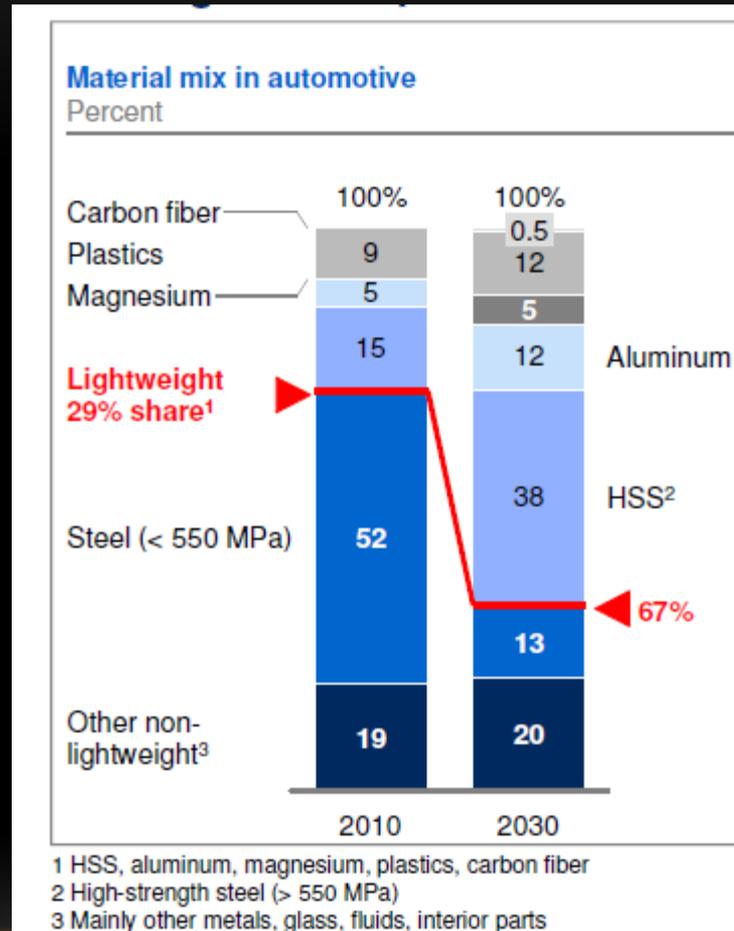
OEM, Technical Manager

ENVIRONMENTAL STANDARDS ENHANCE MATERIALS COMPETITION

In five years, the highest substitution rate will be from mild steels to ultra-high-strength steels, The second-largest shift will be from mid-level steels to aluminum, and the smallest shift will be from mid-level steels to magnesium. The steel industry has been extremely entrepreneurial and creative in finding new applications and new combinations of steel for use in vehicles. The outlook is still strong.

Materials Magazine, October 2011

MATERIALS COMPOSITION OF CAR 2030



ELECTRIFICATION VERSUS CONVENTIONAL TECHNOLOGIES

Our position on electrification is: It Depends! We build a car for everyone. All categories. BMW and Audi are luxury niches. We are aiming for 54.5 for all segments. What is the right mix of EV and ICE going to be? So internally we do Scenario Planning. We will always have Electrification. We can meet CAFE in one category. There may be more electric in larger cars. EV by itself will not be a solution. The issue will be how much electrification is needed. We apply the criteria across the Fleet under CAFE.

OEM, Technical Manager

REGULATION AND LIFE CYCLE COSTS

For aluminum, emissions during production has been a problem for twenty years, both aluminum and composites. With new technologies we can estimate the environmental impact. UHSS and aluminum decrease the life cycle costs. Some recycled Aluminum now 50% less and 85% for cast aluminum. AHSS and Aluminum are now on the same page.

Magnesium and carbon fiber on are another page. The jury is still out on them. They have high energy requirements.

OEM, Technical Manager

MATERIALS AND INDUSTRIAL INFRASTRUCTURE

Look at materials as a clear choice. What are the relative capacities in the world if one got the option. Break down the car: power train, chasis, body, closures. Start building the new infrastructure for each new material. What would the costs be? Look globally e.g. press hardenable steel and available infrastructure. Apply it at the production and processing ends.

I would do a scenario planning exercise. If we stopped doing what we are doing today. What are the global capacity and processing capabilities. What would be the cost to build that capacity today?

OEM, Technical Manager

NEXT STEPS IN RESEARCH

- The literature has a gap: Impact of Environmental Policy on OEMs vs Suppliers
- PACE Awards:
 - Awards for Innovation in Auto Supply Chain
 - Look at last ten years of award
 - Environmental, performance, safety, efficiency
- Research Question: How has environmental policy impacted innovation in the supply chain

ISSUES OF BROADER APPLICATION

INTEGRATION ISSUES

- Impact of Electricification
 - Segmentation/Regionalization of NA Auto Industry
 - OEMs, Supply Chains and Modularization
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MODULARIZATION IN AUTOMOTIVE

- Modularization and Regulatory Compliance and Accountability in Automotive
 - Volt battery catches fire, GM is responsible
 - Modularization in Auto vs Computers
 - Role of a Dominant Design: Wintel
 - Limits of Supply Chain: Magna and O.5 Supplier
 - Will Electrics be a Game Changer?
 - Introduction of an Open Architecture in Automotive
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