

Preparing State Transportation Agencies for an Uncertain Energy Future

Summary of Findings



Transportation fuels and vehicle technologies are rapidly evolving. At a minimum, future petroleum-fueled vehicles will achieve much higher fuel economy. It is also possible that natural gas, biofuels, electricity, or hydrogen could increasingly displace petroleum in the coming decades. Such shifts will pose challenges for state departments of transportation. The goal of the study summarized here is to help state departments of transportation (DOTs) plan more effectively for an uncertain energy future. Steps in the analysis included:



1. Plausible transportation-energy futures and potential challenges for state DOTs.

Through extensive research and expert interviews, the team identified a range of plausible futures for the 2050 timeframe encompassing fuels and vehicle technologies, travel demand, and possible shifts in relevant federal policies. Interviews conducted with senior DOT staff considered how the plausible futures could impact state DOTs, as well as the types of strategies that states might consider in response. Seven potential challenges were identified:



- > **Declining fuel-tax revenue** if conventional vehicles achieve much higher fuel economy or if alternative fuels achieve significant market share.
- > **Higher highway construction and maintenance costs** if the price of oil rises significantly.
- > **Worsening traffic congestion** if there is significant growth in total vehicle miles of travel.
- > **More crashes and fatalities** if there is significant growth in total vehicle miles of travel.
- > **Greater difficulty meeting air quality standards** if total travel increases and if less polluting fuels and vehicle technologies fail to emerge.
- > **More pressure to mitigate greenhouse gases** if greater public consensus emerges and if petroleum remains the dominant transportation energy source.
- > **More demand for alternative travel modes** if driving becomes much more expensive or if urban traffic congestion becomes much worse.

2. Identifying and assessing potential strategies.

After identifying potential impacts, the next step was to develop a set of candidate strategies—such as DOT efficiency measures, congestion pricing, or carbon taxes—that states could pursue to mitigate specific challenges or to promote a more desirable energy future. The team carefully assessed each strategy in terms of:

Effectiveness in mitigating specific impacts or supporting certain energy goals	Performance on broader economic, environmental, public health, and equity goals	Barriers relating to cost, acceptance, technical risk, legislation, and institutional structure	Lead time required to implement strategies and achieve desired results
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Based on their assessed strengths and limitations, and also considering the manner in which some strategies can complement one another, the research team rated, or prioritized, strategies for mitigating each of the potential challenges associated with plausible transportation-energy futures. For each mitigation objective, we rated strategies as most promising, optional (still beneficial, but posing less clear-cut tradeoffs between benefits and barriers), and fallback (least desirable in terms of common policy goals but generally preferable to taking no action at all).

3. Addressing uncertainty with robust decisionmaking.

There are effective strategies for addressing all of the potential impacts that could arise with different plausible transportation-energy futures. The main challenge is uncertainty—some impacts occur in certain futures but not others. To address this uncertainty, we employed the principles of robust decisionmaking (RDM), a method for long-term policy analysis that enables the development of “robust” plans that should perform at least reasonably well however the future unfolds, with little chance of regret.

One of the ways in which RDM supports robust plans is by preserving greater flexibility for future planners wherever possible. Specifically, RDM distinguishes between actions that merit near-term attention and actions that can be safely deferred until more information about how the future is unfolding becomes available. In parallel, RDM analysis helps to clarify the degree of risk associated with certain actions:

Lower Risk	Higher Risk
<p>Near-term robust strategies If a strategy appears useful, or at least benign, for all plausible futures, then it can be pursued in the near term with little chance of regret.</p>	<p>Near-term hedging strategies Relying on signposts might not be feasible for strategies with very long lead times—land use reforms, for example, take decades to unfold. States can pursue such strategies in the near term as a hedge against certain futures, but this entails a greater degree of risk that the strategies will not end up being helpful or needed.</p>
<p>Safely deferred strategies If a strategy is intended to mitigate a challenge that occurs in some futures but not others, and if there are signpost indicators (such as the price of oil, total vehicle miles of travel, or total crash fatalities) that can be monitored to provide advance warning of when the strategy will be needed, then the strategy can be safely deferred with little chance of regret.</p>	<p>Near-term shaping strategies States might also pursue near-term strategies aimed at promoting (shaping) a more sustainable energy future. The main risk here is that the actions of a single state may do little to influence global energy and climate outcomes.</p>

4. Integrated framework for robust long-term plans.

The table below summarizes the results of the analysis, offering a comprehensive framework for robust long term plans that includes near-term robust strategies, safely deferred strategies, and potential hedging and shaping strategies entailing greater risk. For each objective, the table also lists strategies rated as most promising, optional with higher impact potential, and optional with lower impact potential (strategies listed in the table are defined at greater length in the main report).

Objective	Most Promising Strategies	Optional High-Impact Strategies	Optional Low-Impact Strategies
Near-Term Strategies to Address Highly Probable Impacts			
Stabilize or increase DOT revenue / decrease DOT costs	Fuel taxes Tolling or MBUF Registration fees Beneficiary fees DOT efficiency Land use	Carbon pricing Congestion pricing	Private capital Agency energy use
Deferred Adaptive Strategies and Near-Term Hedging Strategies to Address Uncertain Impacts			
Mitigate traffic congestion	Congestion pricing Goods movement TDM Public transportation	ITS	TSM&O
Improve traffic safety	Traffic safety ITS Goods movement TSM&O		
Improve air quality / reduce greenhouse gas emissions	Vehicle feebates Carbon pricing Goods movement TDM Land use	Fuel mandates and programs Public transportation	Fuel production and distribution Agency energy use
Improve non-automotive travel options	Public transportation TDM Land use Traffic safety	Congestion pricing ITS	TSM&O
Shaping Strategies to Influence Future Transportation-Energy Outcomes			
Promote more sustainable energy future	Vehicle feebates Fuel taxes Land use	Carbon pricing Fuel mandates and programs Public transportation	Fuel production and distribution Agency energy use
Key			
ITS - intelligent transportation systems		TSM&O - transportation system management and operations	
MBUF - mileage-based user fees		Green type denotes higher-risk hedging and shaping strategies.	
TDM - transportation demand management			

Customizing strategic plans for state context.

The analysis framework is intended to provide general guidance on effective long-range planning that should be applicable across states, but individual states can tailor plans in various ways to meet their own contextual needs. Options include selecting a preferred mix of strategies to address any given goal, omitting strategies that would not fit well within the context of a state, choosing whether or not to defer strategies to mitigate uncertain impacts (states with already severe traffic congestion, for example, may not wish to wait to see if it becomes even worse in the future), selecting signpost indicators that can be monitored in future years to determine whether and when to implement deferred strategies, choosing whether to pursue hedging or shaping strategies, and modifying the mix of policies included as part of a given strategy.

Customization Options

Selecting a preferred mix of strategies

Omitting strategies that would not fit well within the context of a state

Deferring or proceeding with strategies to mitigate uncertain impacts

Selecting signpost indicators to monitor for deferred strategies

Choosing whether to pursue hedging or shaping strategies

Modifying the mix of policies included as part of a given strategy

While there are highly effective strategies for mitigating all of the potential impacts identified in this study, many fall beyond the existing authority of most state DOTs and thus are likely to require enabling state or even federal legislation. In developing their long-range plans, state DOTs may therefore wish to identify backup strategies that could be pursued, if helpful, without the need for legislation.

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