



POLICY BRIEF **MANAGING GLOBAL TRANSPORT ENERGY USE AND EMISSIONS THROUGH TECHNOLOGY, POLICY, AND COLLABORATIVE INITIATIVES**



Task Force 2
CLIMATE CHANGE AND ENVIRONMENT

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موجز السياسة إدارة استخدام الطاقة والانبعثات المصاحبة في قطاع النقل من خلال التقنيات والسياسات والمبادرات التعاونية

فريق العمل الثاني
تغير المناخ والبيئة



المؤلفون

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ABSTRACT

Transportation is a significant contributor to global energy consumption, greenhouse gas (GHG) emissions, human health impacts, and environmental degradation. The Group of Twenty (G20) nations have collectively and individually sought to address and improve transportation sustainability through novel policy-making, technologies, and social interventions. However, these efforts have yet to overcome rising emissions and their impacts. If global GHG reduction goals are to be met and sustained, the G20 must provide and disseminate a framework to more rapidly advance the transportation system towards a state of sustainability and economic benefit. Such a framework must encompass the development and deployment of paradigm-changing technologies, processes, and systems, as well as extensive public-private engagement, novel financing mechanisms, and transformative systems that affect change in the movement of people and goods around the globe. This policy brief recommends a set of proposals to enable these transformations, including strategies for technology infusion and market-making, a partnership among G20 countries to develop domestic policies that improve the adoption of electrified vehicles, and the adoption of systems-level sustainability metrics and objectives to enable efficient shifting of transportation modes. Each of the recommendations can be undertaken by all the members of the G20 to improve transportation sustainability towards the goals of the T20 Task Force on Climate Change and Environment.

يسهم قطاع النقل إسهامًا كبيرًا على مستوى العالم في استهلاك الطاقة وانبعاثات الغازات الدفيئة وتأثيرات الصحة البشرية والتغير البيئي. وقد سعت دول مجموعة العشرين بشكل جماعي وفردى إلى معالجة استدامة النقل وتحسينها عبر صياغة جديدة للسياسات والتقنيات والتدخلات الاجتماعية وغيرها، ولكن هذه الجهود لم تتغلب بعد على تزايد الانبعاثات وتأثيراتها. وإذا أُريد لأهداف تقليل الغازات الدفيئة على مستوى العالم أن تتحقق ويُحافظ على استدامتها؛ فلا بد أن تقدم مجموعة العشرين إطار عمل وتروج له من أجل تحويل منظومة النقل بشكل أسرع لتصبح مستدامة ومفيدة اقتصاديًا. ويجب أن يشمل إطار العمل هذا على تطوير تقنيات تغيير مثالية ونشرها، وكذلك عمليات وأنظمة ومشاركة مكثفة من القطاعين العام والخاص، وآليات تمويل حديثة، ونظم تحويلية تجعل التغيير يسري على حركة الناس والبضائع حول العالم. يوصي ملخص السياسة هذا بمجموعة مقترحات من أجل تمكين تحول نظام النقل، بما في ذلك استراتيجيات ضخ التقنيات وإيجاد الأسواق، والشراكة بين دول مجموعة العشرين من أجل تطوير سياسات محلية تحسّن من تبنّي المركبات الكهربائية، وتبني مقاييس الاستدامة وأهدافها على مستوى الأنظمة من أجل تمكين تحول فَعَال لأنماط النقل. ويمكن أن يشارك جميع أعضاء مجموعة العشرين في تنفيذ هذه التوصيات من أجل تحسين استدامة النقل تطلّعًا إلى تحقيق أهداف فريق عمل مجموعة الفكر (T20) بشأن التغير المناخي والبيئة.



CHALLENGE

Transportation in the age of COVID-19

Around the world, the COVID-19 pandemic has upended commerce, mobility, and social norms in unprecedented ways (ITF 2020a). The travel and transportation industries, which are directly linked, have been particularly impacted as the daily transactional and social interactions among people have ceased or have been severely restricted. Even with the potential for a vaccine, the ways in which society approaches transportation and mobility are likely to be altered for years to come and perhaps, permanently changed in ways that are not yet fully recognized or appreciated. It is clear that some behavioral initiatives and policies previously established to mitigate the emissions impact of transportation, particularly in population-dense urban areas, may need to be reimagined with the potential for viral transmission in mind. For example, public and mass transit systems (buses, airplanes, light rail, rental cars, taxis, and other ride-sharing services, etc.) will need to be redesigned to accommodate social distancing, urban respacing, improved routing and more frequent service, and better air flow filtering within confined compartments (ITF 2020b). Otherwise, individuals who have chosen mass transit options for transportation to and from work, school, and social/commercial engagements may feel compelled to return to individualized transportation modes, which are perceived to be safer but translate to more single-occupancy cars on the road, vehicle miles traveled, petroleum-based fuel consumption, and an attendant loss of already-realized greenhouse gas (GHG) emissions improvements.

Times of challenge always present profound opportunities, and the advent of COVID-19 is no different, particularly regarding transportation and other energy end uses (Papandreou 2020). The pandemic presents the world with an outstanding opportunity to proactively address climate change and to simultaneously stimulate economic development through the development and deployment of clean transportation technologies. The images of clean air in urban areas around the globe that have been seen in the media during the height of the pandemic are evidence that GHG emissions can be reduced quickly, when human activity associated with mobility and transportation are restricted.

Apart from eliminating mobility altogether, the next best idea is to invest (politically, socially, and economically) in zero-carbon transportation technologies, which today largely means full electrification of all transportation sectors to the extent possible. Indeed, freight transportation and the related logistics industry are difficult to fully electrify. Therefore, a multi-pronged approach is needed in that sector. Meanwhile, proven zero- and very-low-carbon technology already exist for the emissions-intense light-duty personal vehicle sector; therefore, a rapid transition to full electrification is a realizable goal. However, vehicles are only part of the story; scaled up manufacturing is required. Better access to and from electrical grids is also essential, along with more rapid and advanced charging systems, longer-life batteries, a denser network of charging stations, designation of electric vehicle (EV)-only routes, enhanced connectivity, and related systems and technology. The opportunity for improvement exists, admittedly with its own challenges (ITF 2020a), but the recovery from the COVID-19 pandemic is the perfect time to align economic redevelopment and climate change to create a cleaner and better planet in a shorter time frame than was previously imagined (Engel et al. 2020).

Significant challenges

Transportation is a critical component of the global economy, but the current state of transportation modalities, systems, infrastructure, and fuels pose significant sustainability issues. Petroleum supply, energy security, environmental limitations, human health impacts, infrastructure growth and maintenance, and human welfare considerations all provide pressure to improve the environmental, economic, and social sustainability of the global transportation sector. Various initiatives have been proposed to improve fuel economy, reduce the impact per unit of energy in fuels, limit kilometers traveled, and improve passenger/cargo efficiency, but their collective impact has yet to overcome the expanding transportation demands of a global population that is rapidly expanding in terms of numbers and economic activity (Sims et al. 2014). Real and permanent reductions in the energy and emissions impacts of transportation will require the adoption and proliferation of advanced technologies, progressive policies, and global collaborations across the transportation spectrum. Such interventions, which encompass the applications of light-duty vehicles (LDVs), heavy-duty vehicles (HDVs), off-road vehicles, rail, aviation, and water-going vessels, seek to provide transportation systems that can reliably and efficiently operate on clean, sustainable energy. These new systems, which have already been demonstrated in various locations and applications across the globe, now require a broad deployment of policies to refashion transportation systems and infrastructure, including electricity

grids, fueling/charging stations, fuel generation/distribution/storage facilities, mobility networks, and more (Pigato et al. 2020). The challenge at hand is how best to affect a more rapid transition to a clean and sustainable global transportation sector and to do so in a way that is socially equitable, scalable, and sustainable across different economies.

The economies of the Group of Twenty (G20) collectively account for two-thirds of the world's population, more than 80% of global energy demand, and over 90% of new LDV and HDV sales (Miller, Du, and Kodjak 2017). Based on the most recent research, including our own work and expertise, we have identified three proposals as key to expediting the mitigation of transportation-related GHGs. We believe these elements and tasks can be most successfully addressed through international economic cooperation as enabled by the G20.



PROPOSAL

Proposal I

Align automotive transportation technology infusions, investment strategies, and collaboration initiatives towards targeted transportation applications and early markets

Rationale

The literature on transportation sustainability recognizes that the benefits associated with emissions reduction technologies, including zero-emissions vehicles (ZEVs), come at an incremental cost relative to business as usual (Al-Alawi and Bradley 2013). For clean vehicle technologies to be broadly adopted, supporting systems and infrastructure of high cost and low technology-readiness level must be moved towards the market. Whether this infrastructure comes in the form of the development and deployment of fueling stations, charging infrastructure, the redesign and construction of mobility and travel corridors, or deployment of connected mobility networks, these systems are often costlier than the vehicle technologies themselves (Nelder and Rogers 2019).

To avoid incurring these costs of transition all at once and to mitigate the risk of transportation system transformation, various government organizations (Fisher et al. 2017; CARB 2019) and thinktanks (CalStart 2020) have developed a strategy of investing in targeted, first-success applications and geographic or application-based first-mover markets. Concentrating vehicles and their supporting systems into regions or into particular applications can foster advanced, clean technologies in a developing marketplace and can provide transformative examples for the next wave of cities, states, or regions looking to advance their clean vehicle economies. From the governmental perspective, this strategy focuses resources into a targeted area or areas to enable benchmarking, policy-making, standards-setting, and effective use of financial resources before moving into larger markets or other applications. From a commercial perspective, it allows for companies to de-risk new technologies and systems and enables the growth of economies of scale for key technologies and systems. These early-adoption or first markets can establish market conditions that will grow to make rapid, large-scale vehicle deployment more affordable and manageable for fleets and customers.

For example, forklifts and industrial lift trucks have served as important first commercial applications for a variety of ZEV technologies including batteries, fast-charge technologies, and fuel cells. As the zero-emissions forklift market has grown, stakeholders have developed technologies, systems, business cases, and education that can be applied to nascent applications and markets. In this case, the applications currently undergoing transition to these technologies and systems include aviation ground-support equipment, medium-duty vehicles, and truck refrigeration units.

Implementation strategy

We propose that the G20 countries each identify and fund four targeted transportation applications or early markets where they will align technology infusions, investment strategies, and collaboration initiatives to develop beachhead markets for advanced technology vehicles as appropriate to local conditions. These efforts would be limited in geographic scope and application, and governments, industry, and research organizations should cooperate to perform these tasks. The G20 would dedicate financial resources for this purpose and would enable G20 nations to apply for matching funds. Best practices and lessons learned would be communicated to the 2020 T20 Task Force on Climate Change and the Environment.

This proposal is motivated by global research into the challenges and successes of advanced technology implementation for transportation system transformation. In studying key market areas where technology can be successful and then serve as a launchpad for additional market segment deployments, each policy-maker must account for:

- The ability of the technology or its core components to transfer to other applications or scale to other weight classes in an application. For example, in early market ZEV transportation applications, such as fuel cell forklifts or transit buses, the technology associated with charging infrastructure immediately enabled follow-on applications in short-haul trucking that could reuse infrastructure, personnel, safety infrastructure, and more.
- The ability of early market applications and their successors to expand on a common supply chain that can provide similar components for powertrains and systems, reducing cost over time. Early LDVs have built up the battery supply chain, reducing costs for follow-on applications in off-road applications.
- The ability of policy-makers, manufacturers, and customers within each nation to coordinate to achieve collective goals. By targeting applications that can be easy first successes, industries can then use these markets as living laboratories to deploy and improve their vehicles, supply chains, and business practices. Coordination and trust among all stakeholders are required for building a collective capability to achieve market expansion and large-scale technology adoption.

Proposal II

Adopt collective goals and commitments among the G20 to implement best-practice domestic policies with the objective of increasing the deployment of ZEVs to a minimum of 30% of LDVs and HDVs sold in each G20 nation by 2030

Rationale

In constructing policies to improve the environmental and economic performance of the transportation sector, policy-makers must construct synergistic and complementary policies that seek to achieve collective goals. Complementary emissions and fuel economy regulations are an example. Many of the G20 nations have already adopted best-in-class emissions reduction strategies for the LDV and HDV sectors by adopting standards largely equivalent to US Tier 3 and Euro 6 (VI) standards (Miller et al. 2017). Similarly, fuel efficiency policies such as the US CAFE and the EU 2019/631 have reduced LDV CO₂ emissions of new vehicles by about 50% in 20 years. Further progress in meeting climate goals by improving the CO₂ emissions of both LDV and HDV fleets will require the development and implementation of policies that explicitly replace legacy petroleum-fueled vehicles with ZEVs (Al-Alawi and Bradley 2014).

In contrast, in many regions of the G20 nations, policy that seeks to increase the adoption of zero-emissions LDVs and HDVs is dominated by provincial, state-level, and EU member state-level policy. For example, Norway, the Netherlands, France, Denmark, the United Kingdom, and China all have substantial tax exemptions for EV purchases, and various US states, Canadian provinces, and even municipalities, offer EV purchase rebates (Sheldon and Dua 2019).

This proposal asserts that coordination among the G20 nations to adopt and implement complementary and equivalent policies would improve the effectiveness of both the policy-making and the vehicle manufacturers' responsiveness. The benefits of partnership among the G20 nations to achieve this coordination comes with the scale and rate of growth of the LDV and HDV sectors in the G20. At present there are more than 1 billion vehicles on the road in G20 nations, with the potential to reach approximately double this number before 2050 (Miller et al. 2017). If those vehicles were ZEVs, then the economic and environmental impacts could be very large, as complementary improvements in the GHG intensity of electricity and fuel production accrue (IRENA 2017).

Implementation strategy

We propose that the G20 countries each commit to implementing domestic vehicle supply policies that will ensure the deployment of ZEVs at a minimum rate of 30% of LDVs and HDVs sold in 2030.

When multiple policies from multiple G20 nations target an industry, such as the automotive industry, the potential exists for generating mixed, even contradictory, messages to policy targets. Through this proposed coordination, policy-makers' combined goals could be achieved through a unified set of policies with the ultimate goal of cost-effective GHG reduction (Siddiki et al. 2018). Although there are a number of jurisdictions that are committed to higher rates of EV deployment than proposed in this brief, generating a long-term and unified set of objectives and mandates for ZEV adoption will send clear signals to policy targets and enable the global transformation scales that are prerequisites for climate stabilization.

Therefore, we recommend that the G20 establish a forum and framework to critically review and disseminate existing subsidies, manufacturer requirements, and mandates for ZEVs, as well as policies for accelerating the retirement of conventional vehicle fleets. Model policy dissemination, partnerships, and coordination could be performed through a variety of forums, including international working groups, to share best practices and progress in meeting the commitments, such as those promoted by the International Partnership on Energy Efficiency Cooperation (IEA 2019) and the IEA Electric Vehicle Initiative (IEA 2020).

Proposal III

Adopt transport system-level environmental impact objectives for commercial transportation, as measured by environmental impacts of individual commercial transportation modes and commercial mode shares, to be implemented in key multilateral trade agreements by 2030

Rationale

The modal share for freight transport has large variations due to each country's demography, geography, infrastructure, and economic factors. However, the share of freight transport energy demand in many countries is skewed towards auto-mobility (Tavasszy and van Meijeren 2011). The commercial transportation sector must be recognized as a major contributor in order to address the challenges of transport sustainability. For example, a Boeing 737 that flies seven hours per day for 350 days on average each year uses approximately the same amount of fuel as 325 heavy diesel trucks each traveling 52,000 km per year. In China, the world's second-largest oil consumer, one of these trucks consumes about 25 times as much fuel on an annual basis as a passenger car (Collins 2016). At the same time, it is particularly difficult to transition this sector to low- or zero-emitting options. Heavy-duty road vehicles, aviation, and maritime vessels are not as amenable to battery electrification, and much of the effort to improve the GHG emissions of the sector have concentrated on changing the modal share towards low emissions options (e.g., electrified rail). An optimized modal share with maximum share of lower lifecycle energy consumption can reduce overall transport energy intensity as well as carbon emissions (IEA 2019b). Increasing modal share of less energy intensive modes of transport (e.g., railways and waterways) must be a short-term goal of transport planning for a carbon-constrained globe (Nelldal and Anderson 2012).

Implementation strategy

The G20 should commit to the goal of reducing the GHG emissions' intensity of trade by 30% through improvements in freight efficiency and increases in the modal share of lower GHG emissions in commercial transportation modes. The G20 countries would commit to reducing the lifecycle environmental footprint of commercial transportation, as measured by the environmental impact of individual commercial transportation modes and commercial modal shares, to be implemented in key multilateral trade agreements.

- The high level of coordination required between fragmented and specialized participants in the logistics industry at the country level is one of the causes for a relatively high proportion of logistics expenditure in GDP. The G20 is an ideal forum to recognize that changing modal shares in commercial transportation can bring localized costs and benefits to individual nations and therefore should be the focus of international cooperation.
- The G20 would develop and share roadmaps focused on integrated and multi-modal transport planning, including best practices on energy efficiency and vehicle emissions standards for commercial transport vehicles/vessels.
- The G20 would perform these partnership and coordination activities through a variety of forums. Building on the sustainable development goals in multilateral agreements such as the EU-Mercosur Trade Agreement and the United States-Mexico-Canada Agreement may be especially relevant. Moving international freight away from truck and aircraft modes and towards maritime and rail modes has the potential to reduce GHG emissions globally by 30%.
- The G20 would develop a common data- and knowledge-sharing platform to promote standards and best practices adopted across G20 countries.

Collaborative innovation of policy mechanisms and initiatives across G20 countries for the implementation of low emission technology vehicles is needed, especially for the commercial transport sector. The necessity of highlighting the economic benefits of a modal shift that are scalable and sustainable is critical, for reasons beyond environmental benefits.

A smart, clean transportation system

The road to a cleaner transportation system passes through the Internet. Rapidly evolving connectivity, combined with data, analytics, artificial intelligence, and machine learning, are disrupting the ways in which citizens, businesses, and governments view mobility and transportation, both personally and commercially. From ride-hailing and ride-sharing apps to optimization of fleet portfolios, transit schedules, capacity planning, and traffic management to WiFi-enhanced battery charging and vehicle-to-system communications, the Internet of Things is revolutionizing the ways in which people and products move around the globe (Cuddy et al. 2014). This transition to a smart, more fully integrated transportation system is directly tracking the move to a cleaner one, with the two concepts seemingly progressing in lockstep fashion. All sectors of the transportation system are being impacted, particularly in the LDV

and HDV sectors where electrification and autonomous operations are making steady progress. Countries around the world recognize the advantages of Internet- and analytics-enabled technologies in the drive to reduce transportation-related GHG emissions. In fact, the European Commission (2020) lists the development of a “smart, green, and integrated transport” system as one of its grand challenges. Achieving these mutual objectives will require a systems approach, a 360-degree re-imagining of conventional transportation paradigms, and close collaboration and communication among all involved stakeholders (Hautala et al. 2014).

Key Recommendations

This policy brief seeks to comprehensively address transportation sustainability. These recommendations address strategies for technology adoption, policy development, and mode-shifting to achieve a transportation energy transformation. Among the many ideas that could be advanced, we contend that the following three concepts have the greatest potential for impact and success in the near- to mid-term.

We recommend that each G20 nation:

- Select, designate, and fund four targeted transportation applications, technology infusions, investment strategies, or collaborative initiatives for the purposes of establishing beachhead markets for advanced technology vehicles appropriate to local conditions.
- Adopt collective goals to implement best-practice domestic policies that will increase the deployment of ZEVs to a minimum of 30% of LDVs and HDVs sold in each G20 nation by 2030.
- Adopt transport system-level modal shift objectives for commercial transportation as measured by lifecycle sustainability metrics by 2030.

Summary

Researchers at leading think tanks and major research universities across the globe are studying and innovating the policies, technologies and systems that will facilitate the transformation to sustainable transportation. With the leadership of the G20, the proposals outlined in this policy brief have the potential to address three key aspects of this global challenge. Together, we can advance the commercial/government activities around technology and policy infusions. We can enable best practices and cohesive policies across the G20 to incentivize the next generation of zero-emissions on-road vehicles. Further, we can measure, set objectives, and track the progress of mode-shifting for international commercial transport. These strategies, combined together, have the potential to demonstrably reduce the GHG emissions burden of the 27% of global GHGs that are emitted by the transportation sector (National Academies of Sciences, Engineering, and Medicine 2018).

Disclaimer

This policy brief was developed and written by the authors and has undergone a peer review process. The views and opinions expressed in this policy brief are those of the authors and do not necessarily reflect the official policy or position of the authors' organizations or the T20 Secretariat.



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