

# Fossil fuel dependency of urban transport systems

## How can transport authorities and operators navigate through multiple risks and threats at times of global crisis?

Sustainable mobility, Fuel dependency, Crisis management, Climate emergency, Risk management, Resilience

This article discusses the challenges and opportunities for sustainable mobility in times of overlapping crisis such as pandemics, volatile energy prices and climate risks. The sector needs to undergo a fundamental transformation not only to meet sustainable development and climate targets, but to maintain basic economic and social functions in the short- and long-run. A special emphasis is being laid on the increasing risks arising from global and regional oil and product markets.

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The accelerated pace of multiple crises is confronting transport systems with unprecedented impacts. The strong variations in fuel supply and demand because of the COVID-19 pandemic, and the volatile energy prices after Russia's attack on Ukraine showed a significant impact on the transport sector due to its reliance on the fossil fuels. In 2020, about 90% of the energy demand of the transport sector was covered with fossil fuels [1], representing 60% of global oil consumption according to the International Energy Agency (IEA) [2].

### Fossil fuel dependency of transport systems at times of global crises

The total consumption of fossil fuels, being the main energy source in the transport sec-

tor, has increased over the last decades. Especially in lower-middle income countries the demand has risen since the mid-1980s due to rising incomes and population (see Figure 1).

However, the COVID-19 pandemic and the reduction of mobility as a consequence of lockdowns has slowed down global oil demand in 2020. Due to the demand shock and oversupply, prices plummeted and shortly even went negative for the first time in history. In 2021, when containment measures were lifted and the recovery from the pandemic started, global oil demand rebounded with prices reaching seven-year highs. The production cuts by OPEC countries as a reaction to the pandemic led to diminishing oil inventories, which were aggravated at the beginning of 2022 after

Russia's invasion of Ukraine. Russia had been the largest exporter of fossil fuels, but due to its aggression the international community reacted with import sanctions and Moscow decided to cut the production.

As a consequence, global energy markets destabilised, with volatile prices and supply chains further strained. To ease the situation, in April 2022 IEA countries released emergency reserves. One year after the start of the invasion markets have temporarily calmed down and prices have reached pre-war levels. Nevertheless, in the coming years significant fossil fuel related shocks can be expected due to ongoing international conflicts, higher international economic interdependence, changing demand due to the shift to a low-carbon economy, and natural disasters resulting from the climate crisis.

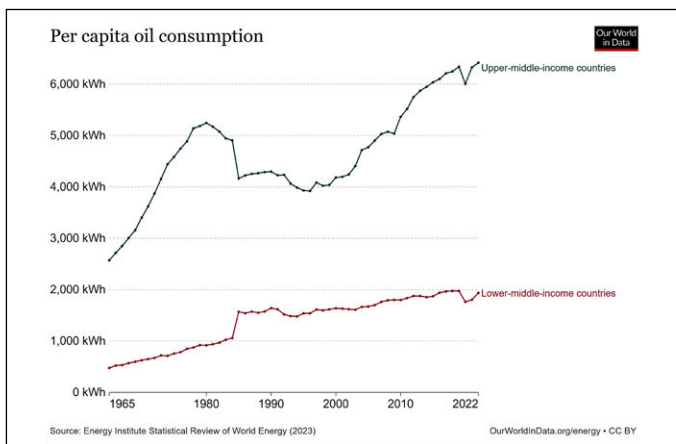


Figure 1: Oil consumption per capita, 1965 to 2022  
Source: Our World in Data [3]

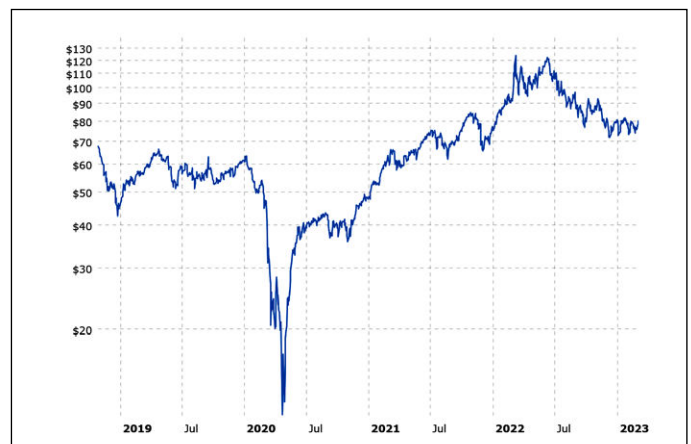


Figure 2: West Texas Intermediate Crude Oil Prices  
Source: Macrotrends [4]

In addition, the growth of population and income in emerging and developing countries is leading to a higher demand for mobility. Non-OECD countries are expected to increase their passenger-kilometres in urban travel 2.4 times by 2050, which will increase the related energy demand (see Figure 3). This development might further aggravate the exposure of these countries to fuel prices shocks if the dependency on fossil fuels is not reduced.

At the same time, the sector needs to undergo a fundamental transformation to cope with the climate crisis: decarbonising and phasing out fossil fuels, while investing in renewable energy sources and building resilience for climate risks. The transport sector is still responsible for more than a quarter of energy-related greenhouse gas emissions, being the fastest growing fuel combustion sector worldwide. More and more governments are perceiving the current multiple crisis as a way to accelerate the phase out of fossil fuels and shift towards a green future.

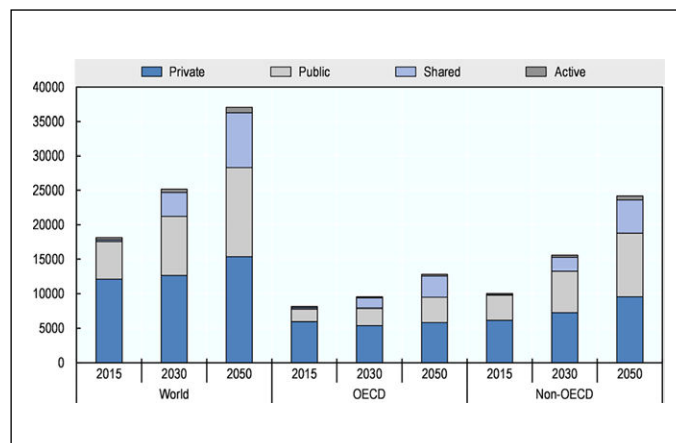
While a general shift away from investing in oil production facilities cannot (yet) be generally observed, the decarbonisation is generating dilemma for oil-producing countries. In the mid- and long-term, investors may struggle to invest in new oil production facilities, for example in the US, Europe or Japan. Aging infrastructure might not keep up with current demands and become less productive over time as more repairs will be necessary – thus increasing the probability for further supply shortcomings and prices shocks.

In the light of multiple crisis and an expected prolonged energy market volatility, urban transport systems need to increase their resilience. Therefore, reducing the dependency on fossil fuels, accelerating the electrification of transport systems as well as shifting towards sustainable modes of transport are paramount. More than that, crisis management and prevention strategies should be envisaged within the overall strategic transformation of the transport sector.

### Dealing with crises in (urban) transport systems

A fossil fuel crisis can be defined as a situation in which the availability or affordability of fossil fuel is severely disrupted, impeding the normal functioning of transport systems. To deal with the effects, a comprehensive approach for different stakeholders is needed, especially for oil and refined products-importing countries in the Global South. The approach should build on an integrated crisis management framework,

Figure 3: Expected urban travel in billion passenger-kilometres  
Source: OECD [5]



short term crisis response and long term prevention (see Figure 4):

- **Crisis management framework:** How to manage a crisis and prepare the necessary structures?
- **Short term crisis response:** What can be done in the event of a fuel related crisis?
- **Long term crisis prevention:** How can the impacts of a fuel crisis be mitigated, and the resilience of transport systems be strengthened?

### Crisis management framework

Crisis management aims to prevent or mitigate the damage a crisis can inflict on a transport system. Due to the uniqueness of crisis, organisational structures for coordination, communication systems and a scalable crisis management need to be set up to allow for flexible responses. Risks and vulnerabilities should be analysed, and procurement systems be checked for robustness. Crisis management builds on personal resources, information systems, communication, supply chain management, training and organisational structures as enablers to respond effectively to a crisis.

1. The first step for cities, transport operators and businesses is to *identify potential risks*, that in the event of local or global crisis impede the normal functioning of transport systems, such as fossil fuel supply disruptions or environmental disasters.
2. Next, scenarios should be identified and grouped. In a *vulnerability analysis* weaknesses of the transport system are identified, and the potential impact and likelihood of each scenario is assessed.
2. This output is then used to develop a *risk management plan* with staff structures, responsibilities and communication plans to address the identified vulnerabilities.
4. In subsequent steps, an *organisational structure with clear responsibilities* needs to be set up and a *crisis-resistant communication system* with dedicated protocols is

established to ensure effective communication between all stakeholders.

Crisis management frameworks may include *business continuity management* (BCM) with emergency plans and crisis training, resilience departments in municipalities and knowledge exchange between stakeholders.

### Short term crisis response

Crisis response actions have a short-term scope to alleviate crisis effects on economies and societies. The approach is rather general and can be applied to a number of circumstances, one of them being fossil-fuel-related crises. The possible measures can be clustered in supply side measures and demand side measures.

Typical supply side measures are subsidies such as fuel discounts or reduced public transport fares, price controls, fuel prioritisation for public transport and emergency services, and the release of emergency reserves to ensure that essential services and industries continue to function. Subsidies may temporarily soften the effect of the crisis but can have adverse impacts as they are increasing the demand despite of supply shortages. They can therefore have an impact on competition and trade by distorting market signals, which can lead to inefficiencies, price alterations, and lack of incentives. Subsidies also imply opportunity costs of public funds, which could be used alternatively for investments in resilience. Thus, subsidies for fossil fuels can inhibit the expansion of sustainable energy sources, as companies see no need to perform a fast transition.

Furthermore, governments can implement measures to reduce the demand for fossil fuel. The IEA presented a 10-point plan [6] to enable governments and citizens to significantly reduce short-term demand for fossil fuels. The plan suggests implementing nationwide lower speed limits,

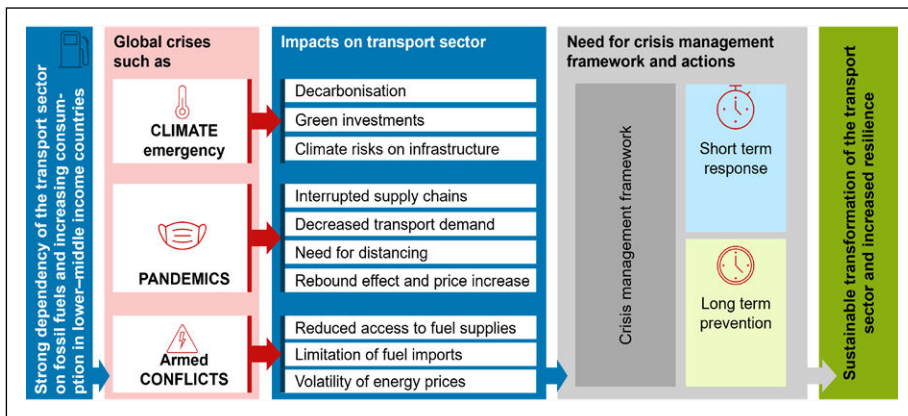


Figure 4: Crisis context and management framework

Own creation

home office requirements, car free days, pop-up bike lanes, alternated private car access to and incentives to shift to public transport, walking and cycling. With these measures, oil consumption in advanced economies could save a potential of 2.7 million barrels per day.

**Long term crisis prevention**

Crisis prevention actions aim at making the transport systems more sustainable and resilient to fossil fuel price shocks in the future. In contrast to the crisis response approach, this approach is strategic and long-term focussed.

Vienna stands out for its proactive approach to crisis management and resilience strategies. The city has implemented several concepts, such as the Smart City Framework, the Pedestrian Strategy Paper, and the Urban Development Plan 2025. The latter aims that by 2025, 80 % of the trips are covered by public transport, by bicycle or on foot. The share of motorised individual transport is to decrease from 28 to 20 %. The city focuses on the expansion of public transport and the fair distribution of road space. Vienna has established a Crisis Management and Security Group and prepared a disaster management plan. All blue light and relief organisations are organised in the so called “Wiener K-Kreis” [7]. Specific crisis prevention actions are pricing schemes, e-bus deployment, strategic energy reserves and the creation of redundant capacities.

**Guidance to reduce fossil fuel dependency of urban transport systems and managing related crises**

Global crisis such as climate emergency, pandemics and military aggression, as well as the ongoing global transformation are leading to higher volatility of fossil-fuel prices and a higher likeliness of temporary

fuel supply disruptions. The impacts are putting passenger mobility, delivery of essential goods and production inputs, and basic urban services in danger.

Developing and emerging economies that rely on imported fossil fuels are especially vulnerable to sudden changes in oil supply and price. Limited financial resources and social security mechanisms make it harder to compensate for increased transport costs and absorb price increases for basic goods. The resulting fuel shortages or higher prices can have serious consequences for businesses and the population, such as reduced access to education and job opportunities, as transport service may have to be suspended or become unaffordable.

To ensure resilience in the event of multiple crises, all relevant actors need to understand the impact of local and global risks on urban transport systems and prepare accordingly. Governments, municipalities, businesses, and transport operators worldwide are seeking guidance to reduce the dependency of their transport systems on fossil fuels, manage the related crises and embark on the transition towards sustainability.

The best way of preparing for crisis is acting early on and reduce the immediate source of risks of fossil fuel dependency, pursuing a transformation towards sustainable urban mobility and logistics. Furthermore, crisis preparation and prevention are cheaper than the potential consequences of not being able to respond properly. Long-term strategic policies are needed, resources should be shifted towards more efficient and environmentally friendly options and energy sources, and supply chains should be diversified.

On behalf of the Federal Ministry of Economic Cooperation and Development (BMZ), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), and civity

Management Consultants, conducted a study that identifies strategies for addressing fuel crises and building resilient transport systems. The publication, planned for Q1/2024, seeks to enhance the capacity of international development stakeholders to advise decision-makers and professionals in developing and emerging economies. GIZ supports the phase-out of fossil-fuel subsidies through its International Fuel Price Project since 1999 [8].

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