China Carbon Forum | 中国碳论坛

An independent platform to foster trust and cooperation among China's stakeholders for climate action

Mitigating transport emissions: European and Chinese perspectives

Executive Summary

On June 26th, 2017, China Carbon Forum, together with Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) and the Royal Norwegian Embassy in Beijing, co-organised an event, ***"Mitigating transport emissions: European and Chinese perspectives"***. The event was part of the China Low Carbon Leadership Network (LCLN), an event series jointly organized by CCF and GIZ since 2010.

The LCLN events aim to encourage communication among leading local and international experts in China's climate change sector. The event series are funded by the German International Climate Initiative on behalf of the German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB). This event also received funding from the Royal Norwegian Embassy, Beijing.

The event featured opening remarks from Mr. Vidar Helgesen, The Royal Norwegian Minister for Climate and Environment, and a presentation on 'Decarbonization of Transport in Germany' by Mr. Martin Schmied, Head of Department, Transport, Noise and Spatial Development, German Environment Agency. The two speakers were then joined by an expert panel, including Dr. Jiang Kejun, Director, Energy Research Institute (ERI) and Dr. Yin Zhifang from the China Urban Sustainable Transport Research Center, Ministry of Transport. The panel discussion was moderated by Mr. Robert Earley, COO, MotionEco.

Keynote speech

The event began with a keynote speech from Mr. Vidar Helgesen, The Norwegian Minister for Climate and Environment. In his speech, Mr. Helgesen made the point that the urgency of decarbonizing the transport sector in Norway is very pressing, given that the country is large and sparsely populated. Transport represents about a quarter of Norway's energy-related greenhouse gas emissions, so this is an important part of the country meeting its Paris Agreement commitments.

The transport sector also contributes to local air quality problems, and road traffic is also a major source of micro-plastic pollution. We therefore need new transport solutions, and to transform the transport sector, for a variety of reasons. However, these new modes also need to be affordable and convenient for users.

Norway has a strong history of hydropower, which fuelled Norway's industrialization. This means that the country's power and heating comes essentially from carbon-free sources, and allows Norway to explore electric solutions to decarbonisation across many sectors, especially transport.

The government has had in place supportive polices for electric vehicles (EVs) for about 15 years. However, at first, the electric vehicle market was limited, with very short kilometre spans. Nowadays, Tesla is the most fashionable car brand in Norway, while other less expensive vehicles are available with almost the same range. The combination of supportive policies and better cars has led Norway to lead the world in the number of EVs per capita. Even in absolute numbers, Norway was the fourth largest market for EVs in 2016. Norway has 1,000th of the world's population, but 6% of global EV sales. In the first quarter of 2017, one in three cars sold were either electric or hybrid vehicles. This puts the country at the forefront in terms of electrifying transportation.

Norway is also a leader in green shipping, where the country is moving to electrify the maritime sector. This includes the first fully-electric car ferry which is now operational, and many more are being commissioned. The world's first hybrid cruise liner is also being developed.

Government policy includes three main incentives: tax incentives, user benefits and environmental requirements. For cars, there is a very high registration tax in Norway and a high VAT. Electric vehicles are exempt from both. This means that you can buy a Tesla at about half the price of the

normal market price. This is now starting to create a fiscal impact, but the government has pledged to maintain this policy until at least 2020, though it may be prolonged beyond that.

Benefits for EVs include free parking, free ferry access and access to public transport lanes. The last of these is beginning to be changed given the growing impact on traffic in peak hours. These benefits also apply to fuel-cell vehicles, although they are at an earlier stage of development. Environmental requirements include public procurement which has played a particular role in developing electric ferries. When national or state-level governments set tenders with low emission requirements, this spurs innovation.

The private sector requires concrete measures and ambitious targets. Back in 2012, the parliament set a goal that the CO2 emissions from new cars should be less than 85 grams per kilometre by 2020. The country is on track to meet that goal in 2017. A White Paper in Spring 2017 set new targets for 2025 and 2030. By 2025, the government aims to achieve 100% of new cars and public buses will be zero-emissions. By 2030, they aim to achieve all new 'heavy vans', 75% of long-distance buses, and 50% of new lorries will be zero emission vehicles. By the same year, all urban distribution of goods will be emissions free.

These goals are ambitious, but achievable. Electric cars should be able to achieve this target under the current policy settings, while heavier vehicles are dependent on technology development. The government supports technological development directly, and is also currently discussing with industry the potential to use carbon tax revenue to fund development of lower emissions vehicles in the heavy-duty sector.

Technology development is also important for the development of autonomous vehicles. The OECD has estimate that if autonomous vehicles were applied to today's traffic, only a third of the current number of vehicles would be required, because the traffic pattern would be much smoother. The government has also established test area in a fjord for autonomous shipping, which could also reduce emissions. There is also some early discussion of electric airplanes, and of Norway being a pilot country for their use some time in the future given the number of short distance routes. Siemens has said that they expect that commercial electric airplanes will be on the market by 2030.

Norway has a small and open economy framed by circumstances largely beyond its own making. China is in a different situation, with a huge population and economy, and ambitious targets for domestic production and sales of electric vehicles. Therefore, Norway is very interested in following

the technology development and innovation that takes place in China, given that the technology that will be delivered from China and the development of prices that will result from adoption in China will greatly impact the achievement of Norway's climate goals. This demonstrates how interlinked all countries are in their climate change efforts.

Achieving climate goals also involves reshaping society, including the way that urban areas are designed. This includes the role of public transport, cycling, walking etc. Even with the adoption of EVs, we do not want to clog our cities with vehicles. Smart infrastructure investments in urban areas are being increasingly looked at in Norway, both to reduce greenhouse gas emissions and local air pollutants. Spatial planning can greatly improve local air quality. The government is also considering environmentally-differentiated road tolls, whereby an electronic device charges for road use according to emissions intensity of the vehicle.

In Norway's main cities, the government has set a goal that all growth in transport should be taken by public transport, cycling or walking. Oslo has largely achieved that in recent years. Today, I met with and was impressed by Mobike, who I invited to Oslo. This is an innovative solution that combines low emissions with digital solutions that are user-friendly and can help solve the 'last mile' problem between the home and public transport. China has an important role to play in these emerging areas of high-tech solutions which can help the world to meet the goals of the Paris Agreement.

Presentation

The keynote speech was followed by a presentation from 'Decarbonization of Transport in Germany' by Mr. Martin Schmied, Head of Department, Transport, Noise and Spatial Development, German Environment Agency (UBA).

Mr Schmied made the point that in order to achieve its emissions targets, the German Climate Action Plan 2050 requires a greenhouse gas-neutral transport system in the long-term. The government has a long-term goal to reduce GHG emissions by 80-95% by 2050 compared to 1990. Medium term goal is to reduce emissions by 55% by 2030. The plan also mentions that the government aims to get closer to the 95% goal than an 80% reduction, given the requirements of the Paris Agreement. This is relevant for the transport sector, and the plan has a target for the transport sector to achieve a 40-42% reduction in GHG emissions by 2030 compared to 1990, which is ambitious.

In order to reach the 95% target, the carbon budget for Germany in 2050 would be only about 60 million tons CO2e per year. For the 80% target, the budget would be about 250 million tons. The problem is that some emissions are unavoidable, which amounts to around 60 million tons, mostly from industry and agriculture. Therefore, in order to meet the 95% goal, the transport sector must go to zero emissions by 2050. This is a significant shift from the current trend, where transport emissions have remained relatively stable between 1990 and 2015.

Achieving this rapid decarbonisation requires on the one hand increased use of public transport, bicycles etc., but on the other hand it also requires an energy transition, alternative fuels and drive systems. By pursuing 'avoid, shift and improve' strategies, emissions can be reduced by 40-60%, while GHG mitigation above 60 % can be only reached with an energy transition in the transport sector. At the same time, an energy transition is expensive and energy-intensive, and efficiency measures will be important for reducing the overall cost of decarbonising transport.

Electric mobility is the key element of this transition. There are four pathways to carbon neutral transport: conventional passenger car + biofuels; conventional car + power to liquid/gas (PtL/PtG); Electric passenger cars (powered by zero-carbon power grid); Fuel cell passenger car + PtG hydrogen. The UBA excludes biomass, because cultivation presents high ecological risk, whereas residual biogas presents volume limitations.

Battery electric cars can travel 4-6 times as far per unit of energy than conventional cars using PtL or PtG. The PtL option, therefore, would require a significant level of electricity consumption, and leads the UBA to conclude that if possible, the strategy should be to use the electricity directly in the car, i.e. electric vehicles. However for long-distance, heavy duty vehicles and airplanes, however, PtL may provide a viable option to get us to a carbon-neutral transport sector.

According to the UBA's estimates, Germany will need 12 million EVs by 2030. In the context of 45 million cars totally at present, this is significant shift. Alternative strategies could include 6 million EVs (the government's existing target) and 4-5 million biogas cars, or 6 million EVs and 8-10% PtL. However, both of these alternatives have major problems, in terms of the limited renewable energy capacity that could be built by 2030 and the limited biofuel resource.

Sustainable transportation has many more requirements than just carbon emission reduction. Other important objectives include the reduction of local air pollutants, less noise, safety and efficient land use. Sometimes objectives conflict and they need to be seen in context.

Finally, transition to an electric mobility-based transport system requires not just the use of electric cars and buses, but also e-bikes, e-scooters and car sharing.

Record of Discussion

> *The following is an edited synthesis of the discussion that took place at the event among panellists (around 45 minutes) and open Q&A with participants (25 minutes). As per convention, individual's comments are not attributed.*

The panel suggested that it is useful for China to look at what Europe is doing and is planning to do, regarding its energy systems transition. Germany's target to reduce emissions by at least 80% by 2050, and for all new cars in Norway to be EVs by 2025, provide a useful benchmark for China's current policy-making process.

In order to meet the 2 degree target, China needs to peak its carbon emissions by around 2020, and reduce them by about 65% by 2050. China has conducted its own research regarding feasible pathways for the rollout of electric vehicles. Autonomous cars are also under consideration. In these scenarios, carbon emissions from the transport sector must be reduced by about half by mid-century. However, if the 1.5 degree target mentioned in the Paris Agreement is to be met, emissions would need to drop to near zero by 2050.

Beijing and Shanghai are both doing well in the uptake of EVs, and Beijing may already be the largest EV market worldwide. Shanghai claims to be the largest city in the world for "new-energy" vehicles, which includes hybrid cars. However, China sells about 23 million cars per year and needs some time to reach Norway's level of one third of car sales being EVs.

In 2015, a project was begun by the NDRC on low-carbon transport in small and medium-sized cities (population less than 1 million), of which there are over 2,000 in China. Although they account for over 90% of China's economy, limited resources are allocated to them. New technology is focused on larger cities, and urban planning in small and medium-sized cities is still focused on automobiles.

The government has launched many new policies encouraging 'new energy' vehicles since 2015, and small and medium-sized cities have been gradually following this lead. Another policy focuses on public buses in about 100 pilot cities. To qualify, at least 35% of a city's bus fleet must be 'new energy' vehicles.

The central government also encourages small and medium sized cities to reach of 85% of transport being 'green', i.e. non-motorized (bicycles and walking). For cities with population over 5 million, the percentage of 'green' transport must reach over 75%, while for cities 1-5 million it should be 80%.

Norway is investing heavily in railways, helping remote areas to reach decarbonisation targets. However, railways are inflexible, and some proportion of trips will still be carried out by cars. There is also resistance in rural areas to shifting away from conventional vehicles, though that may change for light-duty vehicles. Fuel cells may prove more promising than batteries for heavy-duty vehicles, and a project is currently being developed between Norwegian and Swedish companies in this area.

Germany has a challenge in transforming the passenger car sector, given that it has a large car manufacturing industry. The challenge, therefore, is not just how to introduce EVs, but also how to transform the industry without reducing its economic power. The government will release a roadmap within the next year detailing its plans in this regard. It is clear that changes must be made. For example, there are existing subsidies of about 3.5 million Euros per year for vehicles that are not sustainable, while 1 million Euros is provided for the introduction of EVs. The roadmap needs to deal with this and other major impediments to the required transformation.

The EU parliament has not traditionally been at the vanguard of environmental policy in Europe. But that is now changing. Volkswagen has shown interest in Norway's incentives, and hope to bring representatives of other governments to Norway to learn from their experience. The EU market is also quite fragmented, and in order to achieve their targets the EU needs to implement appropriate incentives and coordinate.

So far, the role of carbon pricing in this transition has been limited due to low prices in carbon markets. However, a long-term policy signal from government that carbon pricing will have a role to play, and that the sector must decarbonize is important.

China is also exploring other supportive policies, such as allowing EVs to use public transport lanes, creating gasoline car-free zones or gradually moving gas stations further outside the city centre. In Beijing, the quota for EVs this year is 60,000 and this may increase next year. Other strategies have been tried in Europe, for example charging drivers per kilometre based on their carbon emissions in Germany, and a strong tax incentive in Norway.

The panel identified that the transition of private car fleets to EVs should not be too difficult to achieve, given that the typical life-span of a vehicle is about 15 years, and for taxis about 6 years, meaning that they can change relatively quickly. The problem, rather, relates to larger vehicles and shipping, where life-spans can reach 25 years. Therefore, a proactive approach is required right now.

Recently, advisors to the Ministry of Transport have engaged with the bike-share company Ofo, to analyse the situation in twenty cities across China. The research tallied the riding distance travelled, compared it with distance travelled by cars, and found that in major cities such as Beijing, Shanghai, Guangzhou and Shenzhen, there has been significant uptake of cycling for the 'last mile' between home and public transport. In 2nd and 3rd tier cities on the other hand, users have been using share bikes to travel the entire distance from home to work. The report concluded that share bikes have had an impact on emissions reduction. In the first quarter of 2017, distance ridden across the 20 cities was 593 million kilometres, helping to reduce 130,956 tons of CO_2. According to the panel, anecdotal evidence from staff at PetroChina is that cities with share bike systems, oil sales have decreased. The Chinese government has been encouraging the rollout of shared bikes and the panel mentioned that the Minister of Transport has also suggested that restrictions on share bikes should be relieved.

The audience heard that next year, Norway will pilot zero-emission autonomous buses which can provide last-mile solutions, travelling from home to metro or train stations. These kinds of solutions, together with urban planning, are important for making the future transport system user-friendly.

The panel suggested that once autonomous cars hit the market, insurance companies will likely provide an economic incentive to shift away from conventional vehicles, given the inherently safer nature of autonomous cars. In addition, the younger generation is interested in using technology such as smartphones wherever they are, including while driving. This cultural shift provides an added impetus to driverless cars. The panel also expressed its expectation that autonomous cars will experience a steeply declining cost curve, given simplicity of operation and reduced costs from accidents.

Research in Germany has suggested that 150 cars per 1,000 inhabitants in larger cities should be enough. The national average today is 415, Berlin has 330 and Beijing has 240. Therefore, a big part of achieving carbon emission reductions can be achieved through reducing the level of traffic through car-sharing, much like shared bikes. This also provides large amounts of additional public

space which has been used for car parking. In order to achieve this, however, appropriate pricing signals are required.

The panel suggested that there is an opportunity in China, because much of the growth in demand may come from small and medium sized cities, where space is more abundant and infrastructure is not yet locked in. Distances travelled are also currently not as far as for larger cities, and they can therefore design their cities to take advantage of the new technologies. This process on a large scale will also help to drive down the cost of EV technologies.

In fact, the cost of buying and EV in Beijing is already quite cheap due to existing subsidies. After subsidies, EVs can be bought for around 50 thousand Yuan. Shunyi district has also announced that if you replace your gasoline car with an electric car, the local government will pay you 50 thousand Yuan. This means that a conventional car can be sold and an EV bought without cost.

The panel mentioned that public procurement measures introduced in May 2015 require new public buses should also be 'new energy' vehicles. The Minister of Transport has also recently said that the previous goal of 300,000 such buses by 2020 will need to be amended as the goal will likely be reached by this year already. Further supportive policies will also be introduced in coming years.

The panel discussed the importance of dealing with large volume of emissions from freight transport. China's Ministry of Transport has already implemented some measures to try and improve the efficiency of freight transport, by ensuring that trucks carry loads in two directions rather than travelling empty for part of the journey. Fuel standards for trucks have also been raised, and there is a policy encouraging the replacement of diesel vehicles with LNG. These policies are largely driven by air pollution concerns.

Fuel cell trucks for freight may be an option in the future. In Germany, there are also pilot projects (near Hamburg and Frankfurt), trialling electric trucks with overhead wires along motorways. The panel expressed the opinion, however, that mode shifting to railway and other alternatives will probably be more viable low-carbon options for China in the near future.

Fuel cell vehicles are also currently the most expensive option in terms of achieving carbon neutrality. And so, in Germany, using electricity directly in the car is prioritised. Where that is not possible, the potential for PtL and PtG will be explored, and fuel cells will be considered as the last option. However, fuel cell vehicles are still under consideration for the future. Toyota and Audi have

made breakthroughs in this area, bringing costs down. For example, Toyota now sells a fuel cell vehicle for about US$55,000.

When the Volkswagen CEO visited Oslo in 2016, he couldn't understand why a country dependent on oil revenue such as Norway, would implement such an ambitious incentive scheme that would undermine demand for oil. However, Norway has realised that oil and gas in the future will no longer be the engines of the economy that they were in the past. The national oil company, Statoil, is taking part in this transition and no longer sees itself as an oil and gas company, but rather as an energy company. They are investing in offshore wind in both Europe and North America, as well as solar energy. The company has pledged that by 2030, one third of their R&D work will be on renewable energy.

The panel also discussed the issue of biodiesel. In China, renewable diesel is made exclusively from kitchen waste, of which there is about 3 million tons available. This means that it is a very limited resource. However, the panel suggested that while the transport sector is transitioning to an electricity or hydrogen-based model, there is still the need for less carbon-intensive alternatives to fossil fuels. There will also still be, in the future, a need for fuels for agricultural vehicles. The market for biofuels, therefore, is small but important.

The panel also discussed the role of environmental education in enhancing the demand for carbon natural transport. In Norway, for example, there has long been a sufficient coalition of researchers, NGOs and politicians that bring attention to environmental issues. The multi-party political system also often leads to environment-focused parties influencing political debate and the formation of policy. The issues are also well represented in school curriculums. One panellist mentioned that when growing up, their parents taught them to eat all the food on their plate. Now their children are telling them to do the same thing. The former generation was influenced by the experience of war and poverty, while the new generation is influenced by food waste as a climate issue.

The panel discussed the situation of the Chinese EV market. Chinese EV manufacturers have a potential advantage in the European market given their lower costs. There could also be collaboration in the area of battery technology, given the work being done by both Norwegian and Chinese companies in this area. Cooperation would need to be primarily conducted within the private sector, as European governments take an arms-reach approach to governing enterprise. Government does provide incentives, however, and would welcome the participation of Chinese companies in the European market.

Finally, the panel identified that a common complaint in China is that urban planning is not done well. In particular, during the last two decades, planning for vehicle use has been the consistent priority. However, the recent boom in the use of shared bicycles presents a moment of hope that planning could shift back towards the days of China as a country of bike riders. The panel also mentioned that technology change will inevitably influence urban planning. Autonomous cars will be introduced, and it is possible that driving conventional cars will be banned in cities by 2035 or 2040. Whether autonomous cars also remove the demand for buses and bicycles is also an open question.

In Europe, urban planning is a key part of the approach to achieving carbon neutrality. Germany has a target to reduce land development per day to 30 hectares. This compares to 120 hectares ten years ago and 60 hectares today. This is supported by restrictions on developing on the outskirts of the city, instead incentivising redevelopment of inner-city areas. Broad city planning is focussed on developing functional, mixed cities that provide accessible public transport that can be reached by bicycle etc. In Norway, where expansion must take place outside of cities, it is focussed on hubs with public transportation that can bring people to the city centre. There is still much work to be done in this area, but policy is headed in this direction.