City of Münster, Germany

Advancing sustainable development: the role of public transport

ICLEI Local Governments for Sustainability

Münster's approach to urban mobility has been widely regarded as a success story: from improving cycling network to enhancing public transportation services, the city has continued to balance the mobility needs of people with a sustainable environment. In 2016, the city launched its third Urban Transportation Plan, prioritizing measures to enable connectivity, accessibility of its transportation system.

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Importance of the issue

Transport is one of the major sources of carbon emissions in cities. Overall, the transport sector produces around 23 percent of global energy-related carbon dioxide (CO_2) emissions. The figure is projected to increase by 50 per cent by 2035 and almost double by 2050 under a business-as-usual scenario (Dulac 2013; IPCC 2014). Approximately 80 percent of the emissions come from road vehicles. Dependency on the motorized vehicles is significantly associated by the availability of public transportation and other ecomobile modes of transport.

Münster in context

Münster, one of the largest cities in Germany, has approximately 310,000 inhabitants in the Federal State of Nordrhein-Westfalen (NRW). Münster assume important functions for a region including culture, trade, education and research. It has many universities with international reputation, serving approximately 60,000 students.

Like its neighboring cities in the Netherlands, Münster is the Cycling Capital of Germany. It has a long history of cycling and has a cycling modal share of 39% - highest of any German cities. Münster also won the German Sustainability Award 2019 (Deutschen Nachhaltigkeitspreis für Städte und Gemeinden 2019), following decades of transport planning practices and commitment to sustainable mobility.

Yet, like in many cities in the world, Münster and its transportation system face major challenges. Increasing urbanization and economic growth expected in the upcoming years are likely to further increase the pressure on existing public transport system and road networks. In total, the trip and route volumes of Münster residents has increased to roughly 1,064 million routes and trips daily in the past 25 years. This corresponds to an increment of about 130,000 routes and trips daily (The Münster Application for the European Green Capital Award 2009). This led the city to prioritize a strategy for long-term, sustainable growth.

Transport sector as a focal point in Münster's commitment to climate protection

Local governments are crucial in mitigating climate change. As a member of ICLEI's Cities for Climate Protection Campaign, the city of Münster has a long tradition of institutionalizing climate protection. Since the early 1990s, Münster has taken steps

Facts & Figures

Population (2016)

310,039

Land area

302.9 km^2

Modal split (2013)

Walking: 22%
Bicycling: 39%
Public transportation: 10%
Personal automobile: 29%

EcoMobility
An ICLEI Initiative

Münster has been a member of ICLEI since 1995 and was among the first cities to join the EcoMobility Alliance.

to protect the climate by introducing innovative residential area planning and sustainable transportation concept. In 2008 the city launched the Climate Protection Concept 2020, aiming for a 40% reduction of its 1990 CO_2 emission levels by the year 2020.

Recoginising the critical role of transport in the decarbonization process, in 2016 Münster developed the "Master Plan 100% Climate Protection" and aims to reduce CO_2 emissions by 95% by 2050. Its climate protection plans serve as an overall strategy for sustainable urban development, climate protection and adaptation to climate change. In terms of mobility, the city is determined to make mobility options more efficient, accessible, socially inclusive and environmentally-friendly by improving walking and cycling conditions, and enhancing public transportation services. In addition, the city also recognizes the strategic importance of electric mobility and plans to promote it further.

The Third Urban Transportation Plan

Public transport is the core of a transport system in any city. Ideally, public transport should be incorporated with other means of transport, providing an integrated urban mobility system. Cycling network is particularly integrated and complemented with Münster's good local and regional transport services.

It is currently implementing its third Urban Transportation Plan (called "Nahverkehrsplan", NVP), launched in 2016. By emphasizing accessibility and connectivity as the underlying objective of mobility and its transportation system, the NVP implies a great recognition of transport characteristics such as transport infrastructure, services and travel speed in addition to environmental and social characteristics such as gender equality, livability and sustainability.

Some of the key interventions include:

- Reduce the level of fine particulate matter and NO_2 emissions in the vicinity of residential buildings in the urban area through the air quality plan;
- Provide equitable access to public transport by ensuring the participation of people with reduced mobility;
- Consider gender issues as public transport is more often used by women than by men; and
- Promote electrification of city buses.

Description of activities

Münster focuses on creating a people-centered transport system, with efforts to improve accessibility, connectivity and inclusivity, to make public transport reliable.

Make public transport accessible

Local public transport (öffentlicher Personennahverkehr, ÖPNV) in Münster consists of the city bus and regional bus systems. In the city, the transportation company Stadwerke Münster is the main provider of public transport service, serving 120,000 passengers on a daily basis. City buses run at approximately 20-minute intervals and less than 10 minutes on main roads during peak hours. With a network of 18 bus routes, they serve all the districts in the city. Currently around 90% of Münster residents live near a public transport stop (within 300 meters of their home). Looking at regional buses, 7 express bus lines and 9 regional bus routes cover the transport links with the surrounding areas. Complementing ÖPNV is the railway system (Schienenpersonennahverkehr, SPNV), with 8 regional train lines. What also noteworthy is the newly planned regional railway (Westfälische Landes-Eisenbahn, WLE) line connecting Münster and its neighbouring city Sendenhorst, expecting to provide high-quality transport for 10,000 passengers per day.

In order to enhance the overall user experience of mobility options and encourage commuters to use public transport, the city has taken measures to improve the speed and reliability of buses: set up priority lines for buses with shorter waiting time at traffic junctions; increase passenger comfort through its waiting hall program; provide real-time traffic information through smartphone App; implement bike & ride, park & ride facilities and so on.

Münster has been working to integrate various mobility options. The key initiative is the introduction of "PlusCard" in 2001, a transportation card which can be used for buses, trains, car sharing, car parking as well as taxis in and around the city. It is affordable. Instead of 3,00 Euro, 45,000 PlusCard holders get discounted rate of 2,10 Euro for a 90-minute bus ride in the city. With the aim of increasing the viability for passengers to opt for the mobility option tailored to their needs, the city initiated the "Leezenbox" ("Leeze" means bicycle in Münster dialect) project [*Image 1*]. For PlusCard users, they can park their bikes in the bike parking spaces near several major bus and train stations. Consequently it encourages the use of public transport and cycling.

Image 1: Leezenbox near the train station. Cyclists can park their bikes for free with their "PlusCard" Source: Stadwerke Münster

Make it socially inclusive

It is widely known and acknowledged that there are differences in mobility patters between men and women (SUTP 2018). The increased awareness started a momentum of change in the transport policy, planning and operation in Münster. The city adopted the "gender mainstreaming" strategy by making women's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of its transport policies and related programs. Given that women use buses more than rail services and they are more likely to use door-to- door services such as taxis (shared and individual) and ride-hailing services than men (ITF 2017), Münster's pubic transport network has been designed to ensure short walking distances and good connections for women to places like childcare facilities, hospitals and workplaces. Complementing to the bus journeys, ladies' night taxi have also been provided for female passengers.

The 3rd NVP also looks into an urban mobility model that is efficient and convenient for people with reduced mobility. To date, Münster's improvements of public transport infrastructure include: 527 bus stops are designed with 16cm curb height and bus kneeling systems in common use, 415 stops with tactile paving and 367 stops are equipped with easier access facilities. Any new construction or rebuilding of the stations will take into account the needs of passengers with reduced mobility and disabilities.

Public participation

Public sector plays a critical role in leading transportation projects and making the transformation to environmentally- friendly mode of transport. However, governments cannot achieve this single-handedly. In Münster, many efforts have gone into involving residents and local communities to ensure that the interventions and proposal align with their needs at an early stage. The mobility service center - "mobilé" was set up to inform

passengers about best travel options, road and rail traffic, and traffic education. The mobility services also include ÖPNV tariffs, mobility service packages and through this, greater awareness of the ecomobile transport choices is created.

Prior to project implementation, the city organizes information sessions and holds public consultations. For instance, around 350 citizens were invited by the city in May 2018 to voice out their expectations of the upcoming WLE (Westfälischen Landeseisenbahn) project and are provided with comprehensive information on the opportunities and costs of the project. Feedback was gathered and discussions were documented [*Image 2*].

Image 2: Keep citizens in the loop: information session was organized by the city to provide residents with comprehensive information on the WLE project Source: City of Münster

Electrify public transport vehicles

Globally electrification of the transport sector is gaining traction – total number of electric buses is estimated to more than triple, from 386,000 in 2017 to around 1.2 million in 2025, accounting for 47% of the global city bus fleet (BNEF 2018). In Europe, approximately 2,500 buses are electric at the moment. Germany is the one of the leading countries in adopting electric buses (e-buses) in Europe and having policies in place to explicatively stimulate the use of renewable electricity in EVs by providing financial and fiscal incentives (Germany Federal Ministry of Transport, Building and Urban Development, 2018).

Against this backdrop, Münster's deployment of electric buses is as much a result of policy consideration as environmental concerns. It corresponds to the guidelines to the city's climate protection and sustainable urban mobility program by fulfilling the initiative for modal transportation with low environmental impact. According to its Climate Protection Plan 2050 and 3rd NVP, Münster aims to electrify motorized vehicles with renewable electricity sources.

In partnership with UITP (International Association of Public Transport), the city launched the Zero Emission Urban Bus System (ZeEUS) project. The project was funded by the European Commission and it started in September 2015, ended in April 2017. Under the demonstration project, 5 VDL Citea e-buses were procured and were operational between September 2015 and April 2017 [*Image 3*]. With a battery capacity of 62.5 kilowatt hour (kWh), the buses run on route 14, serving the city center and Münster's central railway station, as well as the zoo and suburban areas. With a fleet of 80, the e-buses provided transport for an estimated number of 5,000 passengers. The charging infrastructure is essential to ensure the reliability of e-buses. Supported by a team comprising of university researchers, consultants and bus companies, three charging stations were set up at the terminal bus

stops and at the bus depot. Mainly powered by renewable energy, the charging infrastructure was improved from slow-charging side-coupling to fast- charging system over the course of the project. In addition, the city has invested resources and put effort into awareness raising campaigns and provision of on-site training to the e-bus drivers.

Image 3: The electric bus in Münster. Under the ZeEUS project (2015-2017), Münster procured 5 electric buses Source: Stadtwerke Münster

As an integral part of Münster's actions to meet its sustainable development targets, e-buses demonstrated the feasibility of transitioning away from fossil fuels and moving towards low emission economy. Between November 2016 and August 2017, five e-buses running in pure electric mode travelled 118,012km during the operation. Because of the project, 44,844 litres diesel fuel (assuming 38l/100 km) were saved and 49,047kg CO_2 emissions (ISO 16258 factor for Diesel and GaBi factor for EU electricity grid mix (2014)), in additional to the environmental benefits provided by reduced noise generation and emission of air pollutants.

However, there remains a fair amount of obstacles hampering the shift: e-buses remain more expensive than those fueled by diesel or compressed natural gas (CNG). According to BNEF calculations, a typical e-bus with 250 kWh battery operating around 166km per day with slow charging once per day at the depot has a total cost of ownership (TCO) of €0.81/km. Sensitive to driving distances and charging costs, the TCO goes up and would not be competitive of diesel or CNG buses (BNEF 2018). For a city size like Münster where the daily distance travelled by a bus is less than 160km/day, transport planners have to make a finely balanced choice about whether deploying cheaper e-buses with smaller batteries (110-350 kWh); and take into account some form of on-route or intra-day charging in order to achieve the travel distances.

With the completion of the demonstration project, Münster has procured five additional electric buses and will use the same charging infrastructure under the ZeEUS project. The buses feature larger batteries and can run 120 kilometers without recharging. Driven by the increasing adoption of hybrid and electric bus technologies and the benefits of the initiative, the city hopes they can promote its uptake elsewhere therefore further reducing CO_2 emissions and improve air quality.

Results

Creating a sustainable city

Münster's long-lasting ambition to reduce emissions shows success: between 1990 and 2005, the CO_2 emission per

capital (t CO_2/capital) dropped from 8.10 to 6.32; the CO_2 emission per capital from transport (t CO_2/capital) was reduced from 2.15 to 1.99.

Admittedly, its effort in enhancing public transport services and promoting sustainable modes of transport is a worthy cause in the quest to tackle climate change. The number of buses equipped with EEV (Enhanced Environmentally- friendly Vehicles) increased to 88 buses in 2014. Between 2005 and 2014, the use of hybrid-, lightweight- and electric- bus fleet contributed to the reduction of NO emissions by 70%. With the increasing population and urbanization, Münster's transport policy ensures a good level of mobility and accessibility with the aim of creating a compact city with short trips. Between 1990 and 2013, the modal share of environmentally-friendly means of transport increased from 61% to 71%. The use of public transport has also increased: from 6.6% in 1990 to 10% in 2013. Due to the enhanced services, overall satisfaction rate of the passengers also increased: from 2,57 (grading according to German academic grading system, a 1 to 5 scale is used with 1 being the best grade) in 2005 to 2,30 in 2015, significantly higher than the average satisfaction rate of 2,88 nationwide.

Awards, recognition and knowledge sharing

Known as the “Cycling Capital”, Münster has been awarded the German National Cyclists’ Association (ADFC) in 2018 for the seventh time since 1991. In addition, it was awarded the title of “Most livable city worldwide” in 2004 and was shortlisted “European Green Capital Award” in 2009. It holds other titles “Climate Capital of Germany” and “Most child-friendly city”. As the first cities to join the EcoMobility Alliance, Münster hosted the second EcoMobility Alliance Workshop in 2013 and helped pioneer the project of knowledge sharing among peer Alliance Cities, while sharing experience in promoting ecomobile modes of transport.

Challenges and lessons learnt

The improvement of the public transportation network, whether in terms of physical expansion, technological improvements, or better quality of transport services, has been a major intervention of the city of Münster. Nonetheless, the growth of the ridership is slow. The city hopes to increase the modal split of public transport to 15%. In order to achieve this, the city will take a needs-based approach in developing a viable system that satisfies the passengers. Transparent tariffs, integrated mobility options and mobility marketing campaigns (e.g. “Münster fährt ab”) are identified by the city to motivate people to choose sustainable modes of transportation [*Image 4*].

Image 4: The mobility campaign "Münster fährt ab" examplifies sustainable means of transport in Münster: walking, cycling, public transport and shared mobility Source: City of Münster.

Building on its existing urban mobility strategies, Münster explores the future of urban mobility through solutions such as electrification of its public bus fleet, providing opportunities to reduce the CO_2 footprint of transport and improving inclusive access. However, this has been accompanied by questions about whether this approach is as effective as promised. Many argue that the production of EVs transfer pollution from roads to power plants

Key Contacts

City of Münster
Heinrich Bruns
Amt für Grünflächen, Umwelt und Nachhaltigkeit
Albersloher Weg 33
48155 Münster
www.muenster.de

ICLEI World Secretariat
EcoMobility Team
Kaiser-Friedrich-Str. 7
53113 Bonn, Germany
Tel. +49-228 / 97 62 99-00
Email: ecomobility@iclei.org
www.ecomobility.org
www.iclei.org

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Author
Yiqian Zhang
ICLEI World Secretariat

Contributors
Beatrice Ch'ng; Tsu-Jui Cheng; Pourya Salehi
ICLEI World Secretariat

Heinrich Bruns
City of Münster

and consumes a fair amount of energy. Thus policy and planning needs to account for these changes to avoid locking in carbon-intensive development pathways, for instance, building expensive infrastructure which will soon become obsolete.

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