CHAPTER 6

Getting Away from Fossil-fueled Vehicles: Transportation and Mobility

If per capita automobile driving were the same in China as ours [in the U.S.] is today, China would consume the world’s total gasoline production.
— Ray Anderson, Mid-Course Correction

Introduction

Being able to get around easily and affordably to conduct the affairs of one’s life is a central need no matter where one lives — in a large city, in a small town, in the rural hinterlands. Those of us who are able to do so often take it for granted. Those who are not able to do so understand better its necessity.

In the United States, the car and the fossil fuels used to power it have become central to society — or seemingly so. It has also become apparent in recent years that fossil-fueled cars, trucks, and other vehicles are contributing hugely to the conditions that are causing global warming, climate change, and deteriorating air quality in many parts of the country and the globe. Transportation’s generation of carbon dioxide emissions is the fastest growing source of this greenhouse gas that accounts for 21 percent of the world’s total production. Central to the increasing concern with sprawl development in the United States is the automobile’s role in society that shapes people’s living and location choices, transportation policy, land use, business location decisions and operations, and, what is becoming increasingly apparent, foreign policy and national security.
Reducing dependence upon fossil fuels, as one of the four sustainability objectives, challenges us to understand, and then change, the complex network of factors that support the burning of fossil fuels by vehicles. One part of this network is patterns of land use and development that give people no other choice but to get in their cars and drive to work, food, and other people and places in their communities and beyond. Having no other means to move around, such as the ability to walk, bike, or take affordable, easy public transportation, reinforces the necessity to drive. When no other fuels are available to power those cars beside fossil fuels, fossil fuels will be used to power the cars. If people can only purchase cars that run on fossil fuels, these are the cars that people will drive.

Fortunately, increased understanding of this complex network fostering transport dependence upon fossil fuels plus efforts to lessen its grip are occurring even in the United States, where consumption of fossil fuels for driving and vehicle miles per person traveled per year is unparalleled in the world. Among these efforts, the eco-municipalities of Sweden are working to bring systematic change to the interconnections of transportation and mobility. This chapter presents two examples of systematic and innovative city approaches that encourage people to move around other than via private, fossil-fueled cars.

**Eskilstuna: Designing a transport system based on nature’s principles**

The City of Eskilstuna is changing its entire transportation approach to one based upon the eco-cyclic principles of nature. (The reader learned about Eskilstuna in Chapter 5.) The City is concurrently re-evaluating its approaches to traffic, land use, public transportation, emissions control, bicycle travel, noise abatement, business development, fueling, and municipal vehicles.

To accomplish this, Eskilstuna is using four eco-cyclic principles, similar to the Natural Step framework, as a policy guide. The city is developing approaches to the issues listed above to bring them into harmony with these principles. In using a principle-guided approach, Eskilstuna is working to assure that land use, business development policies, public transit, and municipal transportation policies all operate as a system whose parts will all work together toward reduction of fossil fuel use for mobility needs. The eco-cyclic principles guiding the city’s transportation program are that:

- Extraction of finite resources must be minimized
- Release of substances that are difficult to break down must cease
- The physical conditions for nature’s cycles must be preserved
• Extraction of renewable resources must not be greater than their ability to renew.

PICTURE OF EXISTING CONDITIONS

A first step in the program’s development was to obtain a clear picture of Eskilstuna’s current transportation and environmental situations, in particular, what city policies and actions were violating these eco-cyclic principles. The city learned that the total motor vehicle distance traveled within its boundaries was 3,800 miles per person per year. Total distance traveled in and out of the city center was 3,000 miles per person per year. Every day, there were 100,000 car, train, bicycle, bus, and walking trips to and from the city center. The city found that its stream of out-commuters was equivalent to the stream of in-commuters — about 10 percent in each case. One positive finding was that train travel in and out of the city had increased from 6 percent to over 25 percent between 1993 and 1998. Eskilstuna found that its carbon dioxide emissions from transportation sources were about equal to the national average in Sweden, but about 50 percent higher than that of a rival city also working to reduce emissions levels. One astonishing study finding estimated that vehicle traffic in Eskilstuna was wearing off about 15 tons of asphalt from roads on an average winter day and 100 tons of particles were wearing off the tires of privately owned cars. The city also learned that it dispensed 550 tons of road salt during the winter months of a given year.

SIX TARGET AREAS

Following its inventory of traffic and environmental conditions, Eskilstuna decided to concentrate on six areas of transportation policy. First, a community planning initiative is examining the relationship between land use and traffic generation. Other efforts are in the works to make the city more bicycle-friendly and to improve its public transportation. Other target areas include environmental adaptations for vehicles, improved traffic management, business and industry transport practices, and mobility management, that is, reducing needs for private vehicle trips in the first place.

The city then set specific goals, implementing actions, timetables, and indicators to measure progress within each of these six target areas. For example, mobility management actions include initiating carpools, running bike-to-work campaigns, and providing consultations to businesses about ways to make their transport practices more environmentally friendly. Another action was to improve the safety for children’s walk-to-school routes to reduce the necessity for parents to drive them to school.
Another city strategy is re-examining conventional public works policies for road improvements, since it became clear to the city that transportation "improvements" such as bypasses, road straightening, and road widening tilts people's trip choice toward driving and away from available public transit or bicycling. Eskilstuna can choose to invest resources into increasing the availability and desirability of public transit and other mobility alternatives to driving a privately owned car.

Eskilstuna's investigation revealed the importance of maintaining local stores and markets in residential neighborhoods to reduce trip generation. If householders are able to obtain food and convenience items by taking a short walk, they can reduce car trips by 200 to 1200 percent, studies found.

The city also found that car trips of less than three miles accounted for few of the total miles driven in the city; however, these short trips produced proportionately more emissions than longer trips. According to study findings, this was because catalytic converters that reduce car emissions operate less effectively when they are cold. This finding signaled to the city that its efforts to shift short trips from cars to bicycles would bring relatively high environmental gains in reduced emissions and improved air quality. Hence, the city has undertaken a systematic effort to encourage bicycling that includes expanding the present 60-mile network of bike trails, improving bicycle-riding safety, and designing traffic flows in the city center to give bicycles priority over vehicle traffic.

In efforts to improve public transportation, Eskilstuna is redesigning transit routes to increase their frequency and create more stops on those routes. Complementing these public transit improvements are corresponding restrictions on car traffic to help tilt trip decisions toward alternatives to driving a privately owned car. Eskilstuna is also working with neighboring municipalities to improve regional public transit opportunities, for example, creating additional train stops within the region and marketing efforts to increase regional transit ridership.

At the same time, Eskilstuna is working to adapt its municipal fleet of fossil-fueled buses, trucks, and cars to run on more environmentally friendly fuels such as ethanol or blended fuel mixtures. The city has begun to investigate biogas generation — gas created from organic waste — as a possible fuel source for city vehicles. Driver education courses will include eco-driving techniques that reduce fuel consumption, discussed in the next section.

To reduce truck trips, the city is helping private businesses find ways to increase truck load capacity, coordinate trips among different distributors, create more flexible pick-up and drop-off schedules, and arrange more con-
convenient storage and terminal locations. To avoid empty truck return trips after deliveries, the city is discussing with businesses the possibility for “green returns”; after delivering their goods, trucks then pick up and return materials for recycling. To cut down on municipal delivery trips, Eskilstuna is working to improve coordination in its own public purchasing. The city is also helping businesses explore ways to decrease employee trips, using its own municipal employee trip reduction incentive program as a model.

COORDINATING GROUP
To make sure this broad-based program is implemented, Eskilstuna has organized a coordinating group of both policy-makers and implementers. These include elected officials and representatives from municipal departments, such as building, traffic, public works, environmental, and planning. The transportation project is a long-term one, setting specific emissions reduction targets in five-year increments to 2025. By then, the city aims to reduce carbon dioxide emissions 75 percent below its level in 2001.

SYSTEMS APPROACH
Eskilstuna’s multilateral approach to changing its transportation system recognizes how trip choice is intertwined with availability of feasible, convenient, and affordable alternatives to driving a private, fossil-fueled vehicle. Eskilstuna is demonstrating how looking at transportation and mobility from a holistic systems perspective can create a more sustainable transportation policy.4

Luleå: working to reduce the dominance of the car

ABOUT LULEÅ
Luleå (Leuh'-leh-aw) is a city of 70,000 people in northern Sweden, just south of the Arctic Circle on the coast of the Baltic Sea. Among other features, Luleå is distinguished by a remarkable geographic condition. The city’s land is rising about one

Figure 6.1: Bikes, not cars, predominate in this central area of Luleå. Credit: Municipality of Luleå.
yard (one meter) every hundred years due to the reduced weight on the land after glacial melting. This phenomenon is increasing the city’s land area by about one-half a square mile per year. Fifty years ago, the city’s harbor was in the center of town. One hundred years ago, the harbor was even further up the river.

The car has slowly but surely been taking precedence over other transportation choices in Luleå despite its compact city center. To combat this trend, the city began a three-year project to persuade citizens to shift to buses, bikes, or walking, setting a goal to reduce car traffic by 10 percent. This translated into each city resident taking two fewer car journeys per week. The city’s team for this project includes the city planning department, public works department, and the municipal bus company. Rather than using advertising or leafleting to educate citizens, the team is using a personal approach, talking directly with citizens, workers, and car and bike users. City team members offer practical advice and training, mostly at workplaces — a good way to reach car drivers. The city believes in a “carrot approach,” providing incentives that encourage people to drive less and use alternative modes more often.

**Surveying the situation**

The city carried out a survey of car drivers, asking them to list the reasons they used their car. Forty-one percent said they used their cars for practical reasons, for example, picking up a child from a friend’s house or an after-school activity. About 10 percent said they used their cars because there was no bus route available between their starting point and their destination. And, 48 percent of respondents said they drive their cars for reasons of personal value, for example, simply because it “feels good.”

Luleå carefully studied car trip generation and alternative transportation use. During the fall of 2000, the city surveyed 60,000 residents, learning they make a total 100,000 trips per day. On average, each inhabitant made about 52 one-way trips on local buses per year. For short trips of less than three miles, 58 percent of surveyed citizens used cars, 25 percent used bikes, 9 percent walked, and 7 percent used the bus. There was not much difference between summer and winter travel patterns. In the winter, 10 percent of the travelers used bicycles, but otherwise the breakdown was the same as for summer travel. About 55 percent of respondents believed buses should have priority over cars, even though this would mean more inconvenience for car drivers. This was an interesting result, since the majority of the respondents drove cars themselves. The city also discovered that nearly one-half the
cars in Luleå are more than 20 years old. In general, Swedish cars are used for 15 to 20 years, according to the city’s transportation coordinator.

IMPROVING THE ALTERNATIVES

The city has a car-sharing system with several cars that municipal employees can book for taking work trips. It can be reserved at the main switchboard in city hall, so people don’t have to take their own car to work. At the same time, Luleå is working to improve its infrastructure network of car alternatives. As of 2001, the city had 220 miles (about 350 kilometers) of vehicular roads and 60 miles of biking and walking lanes, most of which were constructed 20 years earlier. The city is improving its public bus system, for example, by designing better information systems on bus schedules, giving buses priority at intersections, and improving and increasing bus stops. The city pays one-half the cost of the bus system; the rest is paid by rider bus fares. The city is developing plans for a bus exchange center featuring sheltered bus stops and waiting areas. The city considered developing a park-and-ride area, but decided this was not a good option for Luleå because of the city’s low, spread-out population density. The city also has been considering closing its main central city street to car traffic and is planning a public referendum on this issue.

WORKING WITH REALITY

In Luleå, 80 percent of all households own a car, and 80 percent of residents who drive are able to use a car on any day they wish. Every working day, around 70,000 cars carrying 80,000 to 90,000 people, averaging 1.3 persons per car, enter the city. Buses carry in another 9,000 people. About 9,000 bikers and pedestrians also enter the city center to work. Luleå accepts the reality that cars will keep coming into the city center. Realizing its transit vision is not as radical as those of other communities aiming for a car-free city center, Luleå’s goal is not to ban the car from the city, but rather to integrate other solutions to reduce the dominance of the car over other transportation choices. 5

Luleå and Övertorneå sponsor eco-driving

Luleå and Övertorneå are working to educate beginning and experienced drivers about driving techniques that can save gas, hence reducing fossil fuel use and emissions. According to a Luleå official, eco-driving techniques can save between 10 and 20 percent of the fuel energy that is consumed using conventional driving habits. One eco-driving technique involves shifting
quickly to a high gear after starting up the car, so that less energy is consumed in propelling the car. Slowing down when approaching a speed limit also saves gas. Eco-driving teachers explain how keeping the correct amount of air in the tires cuts down on fuel consumption. Other eco-driving techniques include reducing idling time, using the momentum of the car instead of gas on road inclines, driving at optimum speeds, and keeping unnecessary weight out of the vehicle. Planning vehicle trips ahead of time can avoid unnecessary diversions. As one program coordinator quips, eco-driving is how old men have always driven cars. In Luleå’s eco-driving education program, students drive a specified route without instruction, and the energy they consume is measured. Then, students re-drive the same route while energy consumption is measured. The cost of Luleå’s eco-driving program is about US$125 per person.

Överorneå runs its eco-driving program as part of the driving curriculum for all new drivers in high schools. The municipality pays for ten driving lessons that include eco-driving techniques, a program that costs the municipality US$18,000 a year. The town also is working with the trucking association and the local business sector that generates heavy traffic. According to a town official, truck eco-driving can reduce emissions by 20 to 30 percent. Överorneå has a three-day eco-driving educational course for business employees. The course cost per person is US$125. Town officials estimate that, through these two efforts, over 70 percent of the drivers in Överorneå have received eco-driving education and claim this is unparalleled among Swedish municipalities.6

Cutting down on gas-powered cars in Stockholm

Stockholm has joined eight other European cities to lease alternative-fueled cars for city workers. The cars have high-visibility stickers that make the case for using alternative fuels, since the city’s goal is to encourage drivers to switch to these cars. The first step was for the municipal government itself
to make the switch, providing a good example for others. These nine cities have made agreements with gas stations to provide alternative fuels such as electricity, ethanol, or biogas. One objective was to create a consumer market large enough to motivate car companies to produce alternatively fueled cars. For example, this initiative guaranteed the Ford Motor Company a market for 5,000 alternatively fueled cars, if they would produce these.

Also in Stockholm, many groups of 12 to 14 households own or rent a car together. Different groups have different organizational structures and mileage costs. In most cases, carpool members pay a monthly fee and mileage costs. Some cooperatives use a rental corporation that works in partnership with a gas company. The rental corporation offers different sizes of cars and vans and purchases the most environmentally friendly cars. The municipal government has also purchased such cars for carpool use among its department and agency employees. Only 20 percent of Stockholm households own cars, according to the city's sustainable development coordinator. There are very few places to keep a car, and public transportation is excellent, coupled with projects such as carpool cooperatives.7

Conversion of municipal fleets
As part of their efforts to reduce fossil fuel use, many municipalities have converted their public vehicle fleets from gasoline and diesel to alternative fuels such as ethanol, canola (rapeseed) oil, and other biofuels. The fleets include both buses within public transit systems and municipal cars, vans, and trucks that are used by employees in carrying out their duties. For example, the city of Umeå now has over 30 buses running on ethanol — more than two-thirds of its entire bus fleet. Umeå's goal is to have 100 percent of its fleet running on biofuel by 2003.

Stockholm has replaced 300 of its 2,000-vehicle fleet with alternatively fueled cars and plans to convert 700 more in the next two years. Since 1998, municipal departments needing new vehicles purchase only alternatively

Figure 6.3: Many bike lanes in Stockholm run along the edge of the sidewalk instead of the street.
fueled cars, trucks, or vans. Almost all the 250 inner-city buses in Stockholm now run on ethanol fuel instead of diesel. The city has begun to replace its fossil-fueled garbage trucks with ones that run on biogas — gas manufactured from organic waste from restaurants and commercial kitchens, as well as from sewage. The city has built a biogas production plant next to one of its sewage treatment plants that is producing the biogas equivalent of 180,000 gallons of gasoline. Using the gases generated from sewage and garbage reduces emissions from these sources and provides an alternative to fossil fuel use for vehicles — a win-win solution. Two more biogas plants that will produce several million gallons of biogas for the city are in the works.8

As of summer 2001, Överstomä's municipal fleet contained 12 ethanol-fueled cars, and the town planned to lease more for its elder home care staff. An ethanol gas station has opened in town. By the close of 2001, Överstomä reached its goal of converting all public buses and municipal vehicles from fossil fuels to alternative fuels. The town made ridership on public transport free, increasing ridership by 500 percent in the first six months following this decision.

North American examples

Municipal fleets

In North America, too, cities and towns are using more alternatively fueled buses and cars in municipal fleets. Almost 50 cities in 19 U.S. states were using electric buses as of 1996.9 Denver, San Francisco, and Monterey County have passed ordinances to reduce greenhouse gas emissions through increased use of alternatively fueled vehicles. Canadian cities also are investigating alternatives to fossil-fueled buses and cars. In Quebec City, an eco-bus project is testing various alternatively fueled vehicles for efficiency, performance, and emissions reduction.10

Car rides

To make it easier to get about in the city without the necessity of owning a car, Cambridge, Massachusetts, and neighboring Somerville provide free parking spots for a local car-sharing enterprise called ZipCar. For an initial membership fee, people can rent a car by the hour on short notice to run errands, attend meetings, or for other small trips. Cars are placed around the city in convenient places within a short walk of most neighborhoods. As another example, the New York State Power Authority has teamed up with
the Ford Motor Company to make electric cars available to commuters at eight metropolitan New York commuter rail stations.

Land use regulations

Cambridge is also including zoning regulations in a package of transportation approaches, to reduce car trips in the city. City zoning ordinances mandate that new non-residential development must include a plan to reduce traffic that must receive city approval before the development can proceed. Developers can propose steps such as mini-buses between public transportation and the building, encouragement of carpooling among employees, and free or subsidized public transportation passes. The city also encourages its own employees to use transport other than cars by providing subsidized transit passes, bicycles for work-related trips, and an education program about the importance of, and options for, alternative modes of travel. Other cities such as Toronto, Canada, have passed ordinances cutting down on truck or bus idling, a significant contributor to emissions and poor air quality. According to estimates, three percent of Ontario’s fuel is wasted through idling engines.\textsuperscript{11}

Public transit & transit-oriented development

In 1996, the city of Dallas, Texas, installed a 23-mile electric-powered rapid transit system connecting its outer fringes with the heart of its downtown. In the first two weeks following the rapid transit opening, its daily ridership exceeded all projections. By the end of the next fiscal year, total city public transit ridership had increased by 40 percent from the previous year and has since continued to climb steadily. Shortly after the opening of Dallas’s rapid transit, its downtown center experienced its largest burst of development and business growth in 20 years. Residential development, virtually unknown to the downtown, boomed. The city and its transit authority actively participate in encouraging mixed-use high-density development adjacent to transit stops — what has come to be known as transit-oriented development. Between the opening of the rapid transit in 1996 and the end of 2002, over 10,000 housing units had been built in the city’s downtown core, primarily in high-density clusters near transit stops. Dallas’s new rapid transit, coupled with the development of new living, working, shopping, and cultural opportunities in its downtown core, has made it possible for tens of thousands of Dallas commuters, citizens, and visitors to get into, around, and out of the city’s downtown without driving a car.\textsuperscript{12}