FROM VISIONS TO SMART ICT – LOCAL TRANSITIONS TO RENEWABLE TRANSPORTATION

Extended summary report from a project within the collaborative research program Renewable transportation fuels and systems (Förnybara drivmedel och system)

May 2017

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PREFACE

The project is financed and carried out within the f3 - Energimyndigheten (Swedish Energy Agency) collaborative research program "Förnybara drivmedel och system" (Renewable transportation fuels and systems).

f3 is a networking organization, which focuses on development of environmentally, economically and socially sustainable renewable fuels, and

- Provides a broad, scientifically based and trustworthy source of knowledge for industry, governments and public authorities,

- Carries through system oriented research related to the entire renewable fuels value chain,

- Acts as national platform stimulating interaction nationally and internationally.

f3 partners include Sweden's most active universities and research institutes within the field, as well as a broad range of industry companies with high relevance. f3 has no political agenda and does not conduct lobbying activities for specific fuels or systems, nor for the f3 partners' respective areas of interest.

The f3 centre is financed jointly by the centre partners, the Swedish Energy Agency and the region of Västra Götaland. f3 also receives funding from Vinnova (Sweden's innovation agency) as a Swedish advocacy platform towards Horizon 2020. Chalmers Industriteknik (CIT) functions as the host of the f3 organization (see www.f3centre.se).

This extended summary has been written by project manager Cecilia Sundberg based on the work of all project participants reported in the following deliverables:

- Emtairah, T., McCormick, K., Leire, C., Palm, A., (To be published) *Fossil fuel free municipalities in Sweden. Analysing modes of governing*. Report No 2017:05B, f3 The Swedish Knowledge Centre for Renewable Transportation Fuels, Sweden.

- Kramers, A., Bryntse, S., Sundberg, C. 2017. *ICT solutions to reduce fossil fuel from transport in a local and regional context*. (Manuscript under preparation for submission to a scientific journal)

This extended summary report should be cited as:

Sundberg, C et al. (2017) *From visions to smart ICT - local transitions to renewable transportation.* Report No 2017:05A, f3 The Swedish Knowledge Centre for Renewable Transportation Fuels, Sweden. Available at www.f3centre.se.

BACKGROUND

Local and regional authorities have an important role in the transition to fossil-free transport systems, but there is uncertainty regarding what choices to make in procurement as well as long-term planning. The project aims at analyzing how visions and strategies can be used to strengthen the understanding of the actions needed, what information is needed in different situations, how available ICT solutions support decision-making. The project was performed as two main subprojects, one focusing on visions and strategies and one focusing on ICT. There was also a minor subproject on life cycle assessment as decision support.

METHODS

The subproject on visions and strategies was based on qualitative analysis of data and information from primary and secondary sources. The data collection was conducted in 2015 and 2016. Sixteen Swedish municipalities with populations ranging from 27 000 to 900 000 were investigated. They are all members of the so-called *Klimatkommunerna* (Climate Municipalities), which is a network of Swedish municipalities with proactive climate work. Sixteen Master students from Lund University (supported by researchers) participated in the data collection and in interviewing persons in charge of environmental, climate and/or energy work at each of the municipalities using a standard interview protocol. The interviews were conducted in Swedish, and in most cases, they took place over the telephone. The researchers also consulted official documents; mainly policy reports, municipal plans and strategy documents, and online data retrieved from the official websites of the municipalities.

A framework developed by Bulkeley & Kern[1] that distinguishes four modes of governing was adopted. The modes are self-governing, governing through enabling, governing by provision and governing by authority. The analysis is structured in a way to uncover what is happening in these municipalities in terms of visions, goals, targets and strategies for leading the transformation toward fossil free municipalities.

For the subproject on ICT, information was collected through internet searches, literature studies, interviews and observations. The information sought for was of three types: (1) frameworks and classification systems of relevance for ICT for reducing fossil fuel use in transport (2) digital services that support change to more efficient modes of transport or optimize the use of existing infrastructure and (3) ICT systems for monitoring an developing fossil fuels free transport systems at local and regional authorities. For (2) the services have mainly been found by searching for information in internet, but also in already available overviews of new mobility and accessibility services. For (3), a regional case study was conducted at local and regional authorities in Mälardalen, Sweden. Interviews were held with seven respondents from three different local authorities and two regional authorities. Observations from sixteen larger seminars, workshops, lectures and network meetings related to emissions from transports complemented the interview material. The aim was to identify information systems used in the process of managing GHG emissions from transports within the organization, as well as understanding the current practices of GHG emission information management. A concluding project workshop was held with five participants, to summarize

[1] Bulkeley, H. & Kern, C. 2006. Local Government and the Governing of Climate Change in Germany and the UK. *Urban Studies*, 43(12), 2237-2259.

results. From the frameworks and classification systems found in literature, a method was developed for classification of the ICT systems and digital services under study. This method was then used in the description and analysis of these ICT systems and digital services. For the subproject on LCA, information was collected through a workshop and literature studies.

RESULTS

VISIONS AND STRATEGIES

The analyzed Swedish cities generally have explicit visions and goals toward fossil free scenarios by or before 2050. Sometimes these goals and visions are expressed as reducing greenhouse gas emissions and climate neutrality or a combination. These visions are anchored in various documents including political visions, but more often in the climate and/or energy plans. The levels of ambition and target years are not necessarily conditioned by the size or economic specialization of the municipalities. Goals and visions are often broken down to two sets of target years. Target years for the municipal organization and target years for the municipality as a whole.

In terms of translating these visions and goals into targets there are considerable variations in approach among the studied municipalities, reflecting - among other things - different stages of development work with climate planning and different human and economic resources available to municipal authorities to translate visions into actionable strategies and be able to follow up on these strategies. Key messages identified by the informants specific to target setting include: 1) the goals are long term and not easy to set measurable targets across all activities contributing to the vision; 2) targets are often non-binding, and difficult to measure the impacts or outcomes from all the activities municipalities promote; and 3) the importance of having political consensus across political cycles to maintain continuity of work on the visions as they are long term.

In terms of strategies, the most common approaches include a focus on municipal organization activities and procurement, infrastructure investments and planning, followed by strategies aimed at behavioral change. There is little experimentation to link citizen consumption patterns to the visions for the city.

The transport system clearly represents the most important and equally the most challenging sector to work with to achieve fossil free visions. Nearly all municipalities in the study are confident about achieving a fossil free energy mix in the power and heating sectors, but not necessarily in the transport fuels. Another key message echoed here is the link between strategies and outcomes. It is still a challenge for several municipalities to capture and see how the various and sometimes disparate measures in their strategies can lead to the achievement of political visions and goals.

Governing by example or self-governing is an apparent starting point for all municipal authorities in the transformation toward fossil free municipalities. The common portfolios of action areas include energy savings in municipal owned or managed buildings, energy supply and distribution system and travel means and behaviors within municipal departments and functions. But even under this mode of governing, not all municipalities are confident about their ability to achieve key targets. Reasons identified include lack of sufficient investments, ineffective coordination mechanism across functions and departments, and sometimes targets are non-binding (i.e. up to the functions to act on them).

Governing through enabling is equally important in the portfolio of municipal strategies, for two apparent reasons: mobilizing resources and encouraging behavior change. Particularly for the smaller municipalities, partnerships with business actors are seen important in order to make bigger investments. In a small number of municipalities, new types and forms of partnerships that go beyond just helping business actors improve their energy decisions, but also toward identifying and co-creating innovations and ideas for deployment in city context with the support of business actors.

Governing through provision in the transport sector is most strong in all municipalities in shift strategies, providing infrastructure for modal shifts to biking and walking. This is followed by efforts to improve the efficiency and reach of the public transport infrastructure. Given recent trends in the privatization of operators, the commercialization and tendering of transport services, it is not often clear who is making the investments and how these efficiency improvements are carried through. More interesting is the growing interest among municipalities in the provision of infrastructure for alternative fuels and/or charging stations for electric vehicles. In this context, Swedish municipalities are making radical changes in favor of cleaner transport modes and the promotion of alternative transport fuels alongside incremental approaches such as car speed enforcement, parking restrictions or route signing.

Finally, the common theme in governing through authority is the use of physical planning and permitting authorities. Very few municipalities are looking at or considering binding requirements on businesses with regard to energy use or fuel types. There is an apparent tension here with regard to balancing economic interest and environmental visions, particularly among municipalities with energy intense industries. On the one hand, some municipalities feel constrained by national regulations in taking putting requirements that are more demanding in the transport and building sectors to meet their visions.

ICT SOLUTIONS

Digital services for reduced fossil-fuel use in transportation

Digital services that can reduce transport demand, support a shift to more efficient transport modes, and optimise the use of existing infrastructure, were classified according to a 5-level transport hierarchy.

The first category contains all sorts of services that can lead to a demobilization (no transport needed). It is services like e-education, e-health and communication tools for remote work like tele- and videoconferencing tools and sharing of documents. It also consists of e-commerce services that leads to no transport for the recipient of freight and at the same time can lead to a more efficient logistics of the transported freight. Since these services are not directly related to personal transport, they were not categorised further.

The second category, transfer to efficient mode of transport means transfer to travel modes that are less space consuming, safer and less energy consuming, such as walking, bicycling and public transport. A prerequisite for walking and bicycling is that distance of the journey is not very long and that there are safe walking paths and bicycling paths.

Digital services for walking exist in different categories. They can support navigation and track routes. They can encourage walking in different ways by giving rewards (earn money for yourself or charity, health related earnings) or challenge participants in walking clubs.

Bicycling applications are divided into similar categories as the walking applications. They too can support navigation, track routes, encourage bicycling by challenging in different gamification applications. Moreover, there are applications for sharing of bikes, city-bikes and peer-to-peer sharing of bicycles. In the bike-category there are also supporting applications like "Fill that hole" and "Bike doctor" as well as weather-forecasts, which is essential for bicyclists.

The third category, digital services that can be used to optimize the use of the existing infrastructure, was divided into three different categories; "scheduled services", which are services that runs according to a time-schedule, "on-demand services", which are services that can be ordered on-demand and the last category "self-service" is categorized as a service where there is no driver included in the service, which means that you have to drive the vehicle yourself. A finally category is mobility as a service (MaaS), where several modes of transport are combined according to the needs of the customer.

Transport services that are operated by schedules include public transport, private shuttles and freight transport. On-demand services are taxi and taxi-alike transport services where a driver gets payment to drive one or more passengers to predetermined destinations. There are also on-demand services where several people share the ride, which lower the cost of the trip and save space in the road-infrastructure. In the category 'self-service', there are services available, which give access to a vehicle without driver. Car sharing exists in different forms and are at least dependent on 1) the character of the journey (either a return-trip where customers pick up and leave vehicles at the same location, or a point-to-point trip where customers pick-up vehicles at one place and leave it at another), 2) the business model that is used, and 3) the provider of the car. The identified business models for carpools in this study are business to consumer carpools, carpools within an organisation (ie: City of Stockholm own carpool for employees) and peer-to-peer car sharing where you share your own private car.

ICT systems to support reduced fossil fuel use at local and regional authorities

In order to fulfill their own climate targets, authority organizations need to monitor their own GHG emissions. Information systems play a vital role in this process enabling efficient data collection, aggregating data into statistics and transforming emission figures into meaningful information that can be presented to decision makers. Systems identified and categorized range from those that monitor vehicle fleets and their fuel use, to systems that monitor progress towards targets for energy and climate.

While monitoring systems are prerequisites for quality control regarding vehicle emission information, they merely show the present emission situation. To actually reduce emissions, actions need to be taken to change travel habits and offer fossil free alternatives. In general, municipalities struggle to decide what actions to take and how much that will cost. Specialized ICT for future scenarios is still rare, but a few have been used in Swedish municipalities.

One is a model, process and complementing software solutions, aiming to support organizations to reduce emissions from personal transport, developed at KTH Royal Institute of Technology, which has been used at about around 30 municipalities. One of its success factors is that it calculates costs

as well as emission reductions, and often identifies cost-saving emission reductions. Another success factor is the method to gather employees at key positions in workshops to ensure inclusiveness and broad support throughout the organization.

To plan for the implementation of fossil free energy systems in the future, there is software available to model future scenarios in a broader energy perspective. A number of scenarios based on different mixes of energy systems can be compared and used to simulate energy supply and use, and its climate impact, for the municipality in the coming decades.

Life cycle assessment

Two key areas were identified where improved information from life cycle assessments is important for well-informed decision-making. One area was electric cars, where comparisons with vehicles fueled by fossil fuels and biofuels need to include not only climate impacts of energy carriers, but also full resource use, including material resources used in vehicles. The other was biogas. The environmental impact in a life cycle perspective should not only consider the climate impact of biogas as a fuel, but also the full function of biogas systems including its role in waste management, and should also consider other environmental impacts such as nutrient cycling and local air quality.

CONCLUSIONS

The studied Swedish cities generally have explicit visions and goals toward fossil free scenarios by or before 2050. In terms of translating these visions and goals into targets and actionable strategies there are considerable variations in approach among the studied municipalities, reflecting – among other things – different stages of development work with climate planning and different human and economic resources available to municipal authorities. The transport system clearly represents the most important and equally the most challenging sector to work with to achieve fossil free visions. Nearly all municipalities in the study are confident about achieving a fossil free energy mix in the power and heating sectors, but not necessarily in the transport fuels. In terms of strategies, the most common approaches include a focus on municipal organization activities and procurement, infrastructure investments and planning, followed by strategies aimed at behavioral change.

ICT systems for monitoring the greenhouse gas emissions at local and regional authorities were identified, as well as ICT systems designed to support emission reductions.

Digital services that can reduce transport demand and that can support a shift to more efficient transport modes, and that optimise the use of existing infrastructure, were identified and categorised. Transfer to efficient mode of transport means transfer to travel modes that are less space consuming, safer and less energy consuming, such as walking, bicycling and public transport.

Knowledge gaps regarding life cycle environmental impacts of vehicles and fuels were identified; and includes information that reaches beyond the climate impact of fuel and electricity to include i.e. material resource use of vehicles and local environmental impacts of biogas systems.

KORT SAMMANFATTNING PÅ SVENSKA

Kommuner och regioner har en viktig roll i övergången till fossilfria transportsystem, men det råder osäkerhet kring vilka val man ska göra i t.ex. upphandling och långsiktig planering. Projektet syftade till att analysera hur visioner och strategier kan användas för att stärka förståelsen för vilka aktiviteter som behövs, vilken information som behövs i olika situationer och hur informationssystem och digitala tjänster kan stödja beslutsfattandet.

De undersökta svenska kommunerna hade överlag klara visioner och mål för att bli fossilfria före 2050. Det fanns stora variationer i kommunernas sätt att överföra dessa visioner till mätbara mål och strategier för genomförande, beroende på bland annat deras olika nivå av klimatplanering, tillgång på kompetens och ekonomiska resurser. Det är tydligt att transportsystemet är både den viktigaste och mest utmanade sektorn för att nå visioner om fossilfrihet. Nästan alla kommunerna var säkra på att nå fossilfrihet inom el och värme, men inte nödvändigtvis avseende bränslen för transporter. De vanligaste strategierna innefattar ett fokus på den egna organisationens verksamhet och upphandlingar, infrastrukturinvesteringar och –planering, samt strategier inriktade på beteendeförändringar.

IT-system för att följa upp växthusgasutsläpp hos kommuner och regioner identifierades, liksom system för att stödja arbetet att minska utsläppen. Digitala tjänster som antingen kan minska transportbehoven, stödja en övergång till mer effektiva transportsätt eller effektivisera användningen av befintlig transportinfrastruktur identifierades och kategoriserades.

Kunskapsbehov om miljöpåverkan från fordon och bränslen i ett livscykelperspektiv identifierades: information som innefattar annat än bara klimatpåverkan från drivmedel, såsom materialanvändning i fordon, och lokal miljöpåverkan från biogassystem.