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Utilities as Tools for Shaping the City: Waste Management and Power Supply

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Introduction

Large, complex networks provide goods and services. Today, these networks fully cover the industrialized countries, even though they started out as local networks in cities. Utilities provide some of the goods and services that serve the basic needs of households and commerce. For example, electricity supply and drinking water are usually referred to as utility sectors. In terms of economic analysis, these functions used to be regarded as "natural monopolies" and therefore were run as public services. Besides these natural monopolies, some other services were for a very long time also provided by utilities. Public utilities were also found in housing, transport and communication sectors. The authorities that managed these huge infrastructures were often public bodies.

Nowadays, a wave of liberalization is washing over these public sectors. As a result of developing technologies and changing management visions, crucial services are not necessarily provided by public agencies. These developments also reflect changed visions on the purpose of utility functions and the way they can be used to manage the city and shape society. Nevertheless, these changes are still being extensively debated. In May 2002, for example, a referendum was held in Amsterdam on the issue of the independence of the Gemeente Vervoer Bedrijf (GVB). This public transportation company which operates the city's tram, bus and metro network is still a municipal agency and 66% voted against independence probably because most voters feared that this was one more step towards privatization.

The transformation of some utilities into private or hybrid sectors that in the past were considered public bodies, will be described here. We will focus on two sectors in which the municipal authorities have been dominant for about a century. The fact that local authorities have lost part of their influence in managing the public services is shaping some conditions for sustainable development within the city.

Economists used to distinguish certain sectors as natural monopolies, because of the large investments needed for the physical infrastructure (Foreman-Peck and Millward 1994: 11). These sectors were supposed to serve the general interests of the citizens and the economy, and were determined to be unprofitable for competing private companies. Generally, the investments were needed to build large, expensive networks, like railways or the electricity grid. Competing companies operating parallel networks would create inefficiency.

Although the economic theory considered these activities as natural monopolies – and therefore as activities that should be public – history shows that most of them started out as private initiatives. This applies, for example, to the US (Paul-Simon 1993), where many utilities remain private or semi-private. In most European countries, including the Netherlands, the utilities became publicly owned and managed companies. This first development from private to public illustrates the instrumental thinking regarding utility functions, as these were considered tools in shaping the city and pushing economic development.

From Private to Public Waste Management

The urbanization of the nineteenth century was partly the result of new possibilities for technical services, while simultaneously creating a good basis for the commercial provision of these services (Ausubel and Herman 1988). Many utility functions emerged in cities, long before they were extended to the rest of the country. A greater need for these utilities was recognized within the cities, although it is debatable whether this need was collective or rooted in private interests. According to De Swaan (1987), compulsory structures of utility functions are the result of a process of collectivization. He describes the collectivization of care-taking activities by the state as a civilizing process. Collective facilities, consisting of hardware (infrastructure) and software (organizations), were created for the provision of collective goods such as energy and water. His explanation for the collectivization of these goods is that they had qualities that were important for the wealthy (e.g., environmental hygiene). In the cities, pollution and malnutrition led to disease, which interfered with the availability of workers for the production process. It also resulted in epidemics that formed a direct threat not only to the working class but also to the wealthy. The concentration of poverty and the overcrowding in lower-class districts posed a threat in the form of a lack of hygiene and safety. For this reason in particular, sewerage, waste collecting, and drinking water became public tasks. It was public bodies, with the abilities to enforce cooperation and to charge levies for the services, that took charge of these collective arrangements, mostly as a result of the activities of well-organized pressure groups.

De Swaan's vision concerning the collectivization of utility functions may be challenged, however. Systems for waste removal had already existed in several cities for

centuries. The tasks of removing waste and selling manure and compost were leased in most municipalities to foundations for the poor, or occasionally to foundations set up to provide the unemployed with work. The systematic approach to waste removal from a general interest perspective started in the mid-nineteenth century. Amsterdam was among the very first cities to establish a waste management system. There were private initiatives in Amsterdam and these were mainly taken for reasons of hygiene, for example the waste removal concession of the medical doctor, Dr Sarphati (1847).

The increasing concentration of population created epidemics and problems of hygiene, and a social movement comprised mainly of doctors – called the ”hygienists” – emerged. In Amsterdam, this movement was linked to the crucial role of the water supply from the canals. The hygienists stressed the causal relationship between epidemics and general living conditions. Their movement was primarily idealistic – though based on professional knowledge – and they acted as a pressure group that tried to force the authorities to take measures by means of influencing public opinion (Van Zon 1986). At the time, waste consisted mainly of feces, which had economic value when mixed with other biologically degradable components. Existing private initiatives concentrated on this economic value. In Amsterdam, Sarphati had to compete with a company called Amsterdamse Landbouw- en Mestcompagnie (Amsterdam Agriculture and Manure Company). This private company had a license to dredge the canals, into which much of the waste and feces were dumped. Because the supply of water – including drinking water – came from the canals, the hygienists wanted to put a stop to this practice. They simultaneously stressed the importance of not dumping waste into the canals and of building a new infrastructure for drinking water supply. Eventually, Amsterdam became the first city in the Netherlands with water mains, which were built in 1854 with British capital and know-how. The water was collected in a drainage canal in the sand dunes near Haarlem and transported through a pipe to Amsterdam.

The quality of manure and compost produced from the waste was generally poor. Its economic value was not particularly high and the manure companies were not very reliable. The waste removal system started by Sarphati and his companions concentrated on removing feces in barrels. Solid waste removal concentrated on the waste lying in the streets. In the last decades of the century, municipalities discontinued the leasing agreements and licenses. Van Zon (1986) stresses that they were forced by the idealistic hygienist movement to make waste removal a public and municipal task. Again for hygienic reasons, municipal waste removal services started a system that was set up to prevent people from dumping waste on streets and in canals. The next step was a general system for solid waste removal, beyond the barrel system. Finally, the entire waste management function in Amsterdam (in 1880) as well as in other cities became a public service. The ideological view of hygienic conditions from a health perspective

soon broadened to a view in which waste removal was considered a natural public function as part of shaping a livable urban environment.

From Private Investors to Public Electricity Utilities

When and by whom the first electricity in the Netherlands was supplied is unclear, but it was not in Amsterdam. Some claim that it was the Nederlandse Electriciteits Maatschappij (NEM) that started electricity generation on 19 December 1883 in Rotterdam (De Goey 1991). Others say that it was an immigrant engineer with his company named "Systeem de Kothinsky" who obtained a license in 1884 from the City of Rotterdam to supply electricity from a boat with generators to a construction site in the Wine Harbor. In any case, other private companies soon followed, because generating electricity and supplying it concentrated on places where special local demand promised profits. A private company near Rotterdam built the first central power station in 1886. At the time, electricity was not seen as a public good by the authorities. On the contrary, municipalities – which feared possible competition as gas was the current source for lighting – openly frustrated several private initiatives to set up a public supply. The light system was based on the supply of gas, which was a very profitable activity for most municipalities, including Amsterdam. The local gas companies had been in the hands of the municipalities from the beginning of the nineteenth century. In some cities, private gas plants produced gas from coal and coke. In most cities, however, the authorities supplied gas to small businesses and households. They protected this profitable activity and did not hesitate to use their powers to defeat any competition (Kooy 1986).

The NEM was founded by nine investors. One of them was Adolf Krasnapolsky, who had already started to generate his own electricity for his restaurant on Warmoesstraat in the very center of Amsterdam. The company requested a permit in 1882 to establish a few lines to supply some nearby properties. However, the mayor and alderman refused to issue a permit, as they did with several other requests in the following years, so as to protect the supply of so-called city gas by the municipal gas company.

Generating techniques developed rapidly; in particular the emergence of alternating current techniques led to the development of larger grids. Soon the City of Amsterdam had to back down under pressure from private investors. The first permit to establish a small grid in Amsterdam (in a block between the Kalverstraat and Nieuwezijds Voorburgwal) was issued in 1888 to a company named NV Electra. The permits for block grids, however, were time limited, because the City had the idea that this type of service might become as profitable as supplying gas. Because of this temporary limitation, other private investors – including Krasnapolsky's NEM – refused to build a grid. Electra remained the only company and it soon

received a concession to supply electricity throughout the city. This led to the first alternating current power station in the Netherlands, which started generating electricity in 1892.

The factor that persuaded municipal authorities to generate their own electricity was the stimulating effect it might have on other sectors. In Rotterdam, the significance of power in the harbor triggered the actions of the municipal authorities. In Amsterdam, the possibility of replacing the horse-drawn public transport was the main reason for starting public electricity generation. The City decided to electrify all 50 km of rail tracks in 1900 and for that purpose a new central power station was built and managed by the City. The competition with Electra was considered undesirable. In 1913, the City of Amsterdam ended the concession, took over all the clients and Electra's grid, and established the Gemeente-Electriciteitswerken (Municipal Electricity works) , maintaining a local public monopoly on the electricity supply.

At the turn of the century, the number of individual consumers grew rapidly and municipalities began to realize that electricity could be a profitable activity (Van den Noord 1990). Municipalities that recognized the importance of electricity stimulated the development of small local networks and the linking of consumers to the grid. In the following decades the dependency on electricity increased rapidly and the number of local and regional networks grew. These local networks were public, and the former private companies were taken over by the local authorities. As with waste management, the entire chain of electricity supply functions was subject to a process of municipalization. As mentioned in an oblique remark, this had already happened with the local gas companies. This was in line with the development in other Western European countries, such as the UK (Foreman-Peck and Millward 1994). Unlike waste removal, however, it was not primarily the utility character of the energy services that was decisive in the municipalization process. Revenues were a crucial factor, as well as the new possibilities the utilities offered for stimulating economic activity and shaping the urban environment.

Municipal waste management within a national framework

Soon after the era of municipalization, a series of scale increases and interventions by national authorities took place. With waste disposal, the scale issue arose very quickly because the opportunities for manure and compost sales were decreasing. Ironically, the economic value of waste decreased partly because another service had been established for hygienic reasons. In 1872, sewers were introduced in a small part of Amsterdam. At first, this development was slow, as a system of pneumatically driven sewage system had been chosen. This system, as proposed by the engineer Liernur, was problematic, but sewerage became more important when a system of flushing linked to the drinking water system was introduced. The quality of the composition of waste as fertilizer decreased as the amount of solid waste increased and sewage systems were

built. Furthermore, demand for organic material decreased strongly at the end of the century when artificial fertilizer became readily available. Small, private enterprises disappeared and finally the only option for composting became the Vuilafvoer Maatschappij (VAM). The government founded this company for large-scale composting in 1929, as a sort of development aid for the poor province of Drenthe. The VAM has expanded over the years and is still nationally significant in the waste removal sector. Today it also processes other materials and it recently built a large incinerator for household waste.

The residual – a growing proportion of solid waste – was mainly landfilled. A large number of small landfills were created for that purpose. At the beginning of the twentieth century, Amsterdam needed a larger disposal site and decided to landfill the Naardermeer, a lake near the city. A new movement of mainly biologists protested fiercely and started a campaign to prevent the use of the Naardermeer for waste disposal. This typical "LULU"-conflict (locally unwanted land use) was one of the first cases in which general environmental values were defended by civilians against spatial developments proposed by authorities, something that became very common in the second half of the 20th century (Wolsink 1994). Eventually, the campaign in 1904 resulted in a new organization that bought the lake, which became the first natural reserve of the Vereniging tot Behoud van Natuurmonumenten (Union for the Conservation of Natural Monuments). The birth of this (still the largest) Dutch environmental organization for the first time showed that significance of waste was not limited to the hygienic aspect of the human environment. The public perception of local risks and wider environmental issues linked to waste facilities became textbook examples of rising environmental awareness and the conflict character of facility siting that desperate authorities nowadays often try to dispose of as "nimby-ism" (McAvoy 1999; Wolsink, 2004; Devilee 2002).

After World War II, the amount of solid waste started to grow very rapidly as a result of increasing consumption and the increased use of materials. The diversity of waste increased because of new materials, particularly synthetics. It caused a shift from primarily waste removal to waste management, including collection, processing, transport, and disposal. The emergence of new, significant functions within the waste chain created options for new private interests in waste management. Private enterprise started to deal with specific components of waste that could be recovered and sold at a profit. These companies could concentrate on only the profitable aspects of the waste stream and on functions that generated economically feasible revenues. Because of this "cherry picking," role of the municipalities was reduced to those functions that were considered unprofitable.

Semi-Public Energy Sector

In the 1920s, provincial utilities started to electrify rural areas. Simultaneously, there began a gradual shift towards national power planning and a partial integration with gas. In 1920, most of the 33 private and 167 local gas utilities were producing gas themselves. The local networks distributed more than 200 different qualities of gas, but this number decreased in the following decades. A few large industries (steel, mining) started to transport "distance gas," a secondary product, in some regions and there the local gas companies became distributors only (Tellegen et al. 1996). Later in the 1950s, municipalities throughout the northeastern parts of the country were supplied with natural gas, derived from various small fields, to distribute to consumers. The production of gas was in the hands of the Nederlandse Aardolie Maatschappij (NAM), a joint venture of Shell and Exxon. The exclusive right to drill in the northern and eastern parts of the Netherlands was granted in 1933 to the Bataafsche Petroleum Maatschappij (now Royal Dutch Shell). Nobody ever thought the commercial exploitation of natural gas would be important, but it later became the major consequence of this move. The Staatsgasbedrijf (State Gas Company) was founded to carry out the large-scale transport of natural gas from the numerous small fields.

In 1959, one of the world's largest natural gas fields was found in Groningen (a northern province). In 1963, the government abandoned all coal-based gas production and a national grid for natural gas was created. Production stayed with the NAM, but half of the profit went to the state. The other side of the deal was that the NAM got 50 percent of the Gasunie, a new company created for the transport and large-scale supply of gas. It established a full national monopoly by taking over the networks of the Staatsgasbedrijf and all the regional networks for "distance gas." The local companies had gradually lost their production function and the result was a separation of production and transport from distribution and supply. During these decades many gas utilities merged with local or regional power utilities, which in Amsterdam resulted in the Gemeente Energie Bedrijf (GEB).

The semi-public Gasunie held a legal monopoly on transport, as the gas produced by others was compulsorily delivered to it. Distributors remained the utilities, which were governed by provinces and municipalities. Compared to the electricity supply companies, most gas suppliers were rather small. Most utilities still owned power plants and these power-producing utilities cooperated in the Samenwerkende Electriciteits Producenten (SEP; Cooperating Electricity Producers) in managing the high-voltage electricity network. The national organization SEP did not generate power itself, as it could only coordinate production.

Strong Policy Connections

In the decades following World War II, there was a strong belief in the power of the policy that used utilities as its tools. Expanding waste utilities were supposed to handle the rapidly growing waste streams effectively, while energy supply was considered a key factor in economic growth. The Social Democrats in particularly believed this and tended towards state intervention. In the 1960s, Den Uyl, the former Amsterdam alderman, became minister of Economic Affairs. Den Uyl tried to enhance state intervention in energy production in his proposed Continental Shelf Mining Act. Locally – particularly in Amsterdam, a town dominated by social democratic administrators – waste and energy were also considered strong policy tools. Effective, cheap energy supplies and efficient waste removal were tools for creating favorable conditions for the establishment of new businesses.

The policy objectives shifted in the early 1970s. Environmental issues appeared on the agenda, and this changed the perspectives on waste and energy policy. Waste management became a top priority in the new policy domain of environmental issues, a trend that was accompanied by a scale increase in the waste planning system. Initially the Ministry of Health and Environment (1972) was in charge of waste, but since 1984 the Ministry of Housing, Spatial Planning and Environmental Management has been responsible for it. The objective changed from providing cheap and reliable waste removal to achieving environmentally sound disposal, and was accompanied by a critical view on the growth of waste streams.

Under the administration of Economic Affairs, energy policy remained a primarily economic policy domain. Here environmental issues were overshadowed by the energy crises. The first energy crisis influenced Dutch energy policy, because the country was boycotted by Arab oil states for several months in 1973. The electricity sector, which was almost doubling its output every ten years, suddenly had to reconsider its position within society. The 1974 Energy Policy Memorandum sketched three targets: more efficient energy use, more economic exploitation of resources, and the reduction of external dependence. The establishment of new, large-scale power plants became a matter of discussion. Although the Energy Policy Memorandum announced three new nuclear power plants, nuclear energy was no longer acceptable to the pubic. The use of oil had to be reduced because it had left the country too dependent on other countries, gas was considered a strategic reserve and coal was criticized mainly for its environmental impact. Hence, the establishment of new power plants came under pressure.

Since 1960, the demand had increased by over 7 percent, but after 1973 it dropped to less than 3 percent. This was not the result of efficiency, but because of the economic recession that followed the energy crisis. High energy prices had a strong social impact, which

became an issue in local policy in Amsterdam. Inefficient energy consumption created income problems as many residents saw their energy bill rise quickly, particularly in the nineteenth-century districts which had high unemployment rates and a high dependency on social security. Energy saving policies with insulation and improved installations for block heating became an important part of municipal housing activities. The GEB was an important tool and was involved in many urban renewal projects.

Policy Loses Control

Strong tension between national and local policy levels emerged. While the objectives within the energy and the waste sector deviated, scales of planning increased. At first this ran parallel to scale increases in technology that created economies of scale. Many small, uncontrolled and old-fashioned waste dumps were closed in favor of larger, more sophisticated landfills. Then a shift from landfill to incineration was established in the 1980s. Local and regional waste utilities were eager to create long-term access to waste disposal capacity, but the planning of that capacity was legally given to the provinces. Furthermore, the new, large waste facilities suffered from growing public opposition at the local level. There was a long struggle in Amsterdam over an incinerator that was finally built in the west industrial and harbor zone. Environmental policy had its first small successes in starting up some separate collection activities linked to waste processing instead of disposal.

Private investors tried to find profitable activities in separate collection and recycling. Most of these were local companies (e.g., Icova in Amsterdam) with mainly business customers. However, they also acquired contracts with municipalities for separate household waste collection. These systems did not include door-to-door removal, but mostly involved street containers to which citizens could bring waste components like glass or paper. Obviously these activities focused only on components that were profitable. However, the markets appeared very unstable and the reliability of these activities was generally low, while the private waste companies' commitment to the environment was often dubious. Mistrust was created by the many conflicts over permits for waste processing plants, a generally low commitment to the environmental conditions set in these permits, and various large waste disposal scandals. Nevertheless, waste management became more diverse and private enterprises were successful in cherry picking in the waste market.

In the power supply sector, the planning of large generating capacity also created struggles over the type and location of new plants. Strong differences emerged between the objectives of local and national energy policy, particularly among the proponents of strong public influence over the sector such as the Social Democrats. Nationally they were in favor of

national government planning in the energy sector and they supported organizational scale increases. However, the proposed concentration and national planning conflicted with the rejection of nuclear power, a top priority in their program (Wolsink 1985). This particularly large-scale technology, demanding strong state control, would be supported by the concentration and state intervention the Social Democrats favored. Local social democratic authorities, among those the City of in Amsterdam, recognized that contradiction and questioned the need for concentration and scale increases. They wanted to maintain control over their utilities. The discussion on concentration started by the government confirmed a trend of gas company mergers and mergers of gas and power utilities (CoCoNut 1980). In Amsterdam the relatively large GEB was able to survive. Furthermore, regional and local authorities wanted to secure the generating capacity of their own utilities. As the growth in demand dropped, a large surplus of generating capacity developed in the 1980s and building new generating capacity became more difficult for reasons of environmental impact. This is similar to the difficulties in decision making on other infrastructure facilities such as waste incinerators (Wolsink 1996). Amsterdam had its own conflict over the building of a new coal-fired power plant on the Hemweg in the west harbor zone.

The disintegration of policy objectives was reinforced by the developments in technology and the energy market. Large-scale power generation was at its peak in 1983, as the amount of electricity generated by private actors for their own use (supplying others was illegal) was at its lowest level (4 percent). From that moment, self-generating activities started to increase, because new small-scale techniques – in particular combined heat and power – were becoming cost effective. However, with the emergence of the new phenomenon of managing efficient demand, the feasibility of these systems was not only just a matter of effective generation.

Demand-Side Management

Originally, demand-side management (DSM) referred to activities engaged in by utilities to change the time of demand for electricity. This was primarily economically motivated, because balancing supply and demand was still part of supply-oriented management. Time-of-day tariffs were intended to increase power sales at night and weekends to improve the utilization of installed capacity. In Amsterdam, the City neglected this intention, as it forced the GEB in 1983 to discard time-of-day tariffs in favor of a slight overall price reduction for all households as part of its income policy. This intervention was contrary to the mainstream developments of the diversification of services and prices, and of reducing the need for building new power plants.

Later, environmental benefits became a goal and the scope of DSM was expanded either by associating environmental objectives with it or by including activities which might reduce electricity demand. Now, the activities of utilities can also include the environmentally motivated stimulation of consumer demand for electricity produced from renewables ("green" electricity). Similarly in the drinking water and waste sector there has been diversification of services and the scope of DSM activities is growing (Van Vliet 2002).

DSM should be considered all of the activities which have the following features: supply-demand balancing, intervening "beyond the meter," consumer auditing and advice, and all kinds of demand reduction, exceeding regulations and standards (Prindle 1991). Therefore, DSM measures are all of the activities performed by supply-side organizations (environmentally or economically motivated) directed at shaping consumer demand for utility services. Within the waste sector, activities directed at separated collection and public campaigning about how to limit the amount of waste are also DSM.

It is important to realize what services are actually provided to customers, as for an optimal environmental performance the definition of these services may need to be changed. For instance, in the electricity sector the service provided to customers can be seen as "supply of electricity." However, customers in fact need "energy services" such as motion, sound, vision, heat etc., rather than of electricity per se. Similarly, they need services helpful for managing their waste substances such as tools for separation, reuse, and discarding waste, rather than waste removal per se. Helpful tools in the shift to energy and waste services are "smart meters," which can do a lot more than simply count.

The environmental impact of waste management has become dependent on the quality of the services offered to the customers. Similarly, to improve the environmental performance of the electricity sector, the question is how to optimize energy services provided rather than a question of how to optimize electricity supply. The latter question was a rather simple one until the early 1980s. The emergence of new power generating technology that meant high diversification in scales, and the diversification in waste collection, processing, and disposal techniques required totally new systems of provision.

While private enterprise and competition already existed for particular waste services, the new electricity provision act of 1989 introduced some competition in the power sector. The act included an organizational separation of large-scale electricity production from electricity distribution, including small-scale generation (less than 25 MW).

Liberalization

The separation of the production of electricity from its distribution may be considered a first significant step towards liberalizing the electricity market. The Amsterdam GEB was split up into an electricity and gas distributor, and a power production company. The City of Amsterdam still held the shares of both and still tried to use them for its own policies. The system included a few incentives for competition among producers and between producers and distributors. The creation of new generating capacities was stimulated and new combined heat and power systems fueled by gas were developed. Many of these were larger than 25 MW and were built by joint ventures of the new distributors and private companies. This new capacity was more efficient both financially and environmentally, but resulted in a surplus capacity of large-scale generation. The costs of the capacity surplus were spread out over the entire sector, so that the captive consumers ended up paying the costs. The system that combined central planning with incentives for competition appeared unstable. Economic and political pressure grew, because in some countries a process of privatization had already started. The UK was the European trendsetter during the Thatcher era, mainly for ideological reasons. Soon other countries (e.g., Norway) followed suit, with more emphasis on liberalizing markets. As a result, the EU Electricity Directive required liberalization of the power sectors in all member states.

When liberalization is discussed, often the introduction of competition is what is meant. In fact, however, the liberalization process can involve many more organizational changes. Attention is focused particularly on certain organizational changes, which appeared to be crucial in the developments within the waste and electricity sectors of several industrialized nations. Some core elements in the waste sector appeared to be significant for the impact on waste reduction among households and these are all elements included in the privatization and liberalization discussion (De Jong and Wolsink 1997). The first is vertical separation, meaning the separation of functions (Table 1) in the chain of services. The second is horizontal separation of different parts of the waste market. The market for biodegradable waste could be separated, for example, or a separate market for packing waste could be created as has been done in Germany. The third element is the potential withdrawal of public bodies from market functions. This is a matter that has to be distinguished from public involvement in the fourth core element, the regulation and attribution of the responsibility for efficient management and waste reduction.

Similar distinctions can be made in the electricity sector. Slingerland (1999) concluded that liberalization involves the following organizational changes:

- A change in market structure, specifically the introduction of competition between the existing utilities and allowing parties other than the traditional utilities to enter the competitive market (third-party access).
- A change in the vertical structure of utility sectors. In its simplest form, this means an administrative unbundling of utility functions, which will become competitive, from those that will remain a "natural" monopoly. In its most drastic form, this can be a complete organizational unbundling, having all utility functions (Table 1) performed by different organizations.
- A change in ownership; in practice, often the privatization of formerly public utilities.

The changing context within which energy supply and waste companies have to operate after liberalization has large consequences for local governments. Their control over the energy and waste utilities has significantly changed. However, there is no full understanding of the impact of the changed contexts, and hence policy has become increasingly disconnected from an analysis of the regulatory and commercial pressures that occur in privatized and partially liberalized markets (Guy and Marvin 1996). The situation in Amsterdam is no exception.

Table 1. **Functions in the electricity and waste chains**

Electricity			***Waste***	
Function	*Infrastructure*		*Function*	*Infrastructure*
Generation	Power station		Disposal	Landfills, incinerators
Transmission	High-voltage network	Regu-lation	Processing	Recovery plants
Distribution	Low-voltage grid		Transport	Shipping
Supply	Connection, meters		Collection	Removal system & containers; meters
DSM of Consumption	Smart meter & tariff system		Source separation	Separation tools & tariff system

Functions in Utility Sectors

While utilities originally managed the entire chain of electricity supply and waste management, the different stages within these chains are now separate economic activities. Hence, the utility character of the services or the companies involved has become less obvious. The utility used to be the municipal energy company (GEB) that covered all functions from electricity generation to supply and metering, and the Gemeentelijke Dienst Afvalverwerking (GDA) that was responsible

for everything from removal to disposal. Since these functions may be carried out now by different organizations, it is better to speak of utility sectors.

Utility sectors should be regarded as systems of provision: collective, socio-material systems – including the set of institutional actors, their interrelations and the technological networks in use – which provide services to customers (Fine and Leopold 1993). "Functions" in utility sectors are defined as tasks that have to be performed to provide services to consumers. For instance, before energy services can be provided to consumers in the electricity sector, the following functions have to be carried out: supply of primary energy sources to electricity generators, generation of electricity, high-voltage transmission, low-voltage distribution, supply to consumers, and some effort to manage electricity demand. These functions can be performed by separate, unbundled organizations or by integrated organizations. The chain of five more or less comparable market functions in the electricity and waste sectors is presented in Table 1.

A crucial fact is that public as well as private enterprises may perform all distinguishable functions, because basically there are markets for all these functions. The only exception is the management of the grid. When organizationally separated from the other functions, transmission and distribution networks are the only parts that may still be considered a natural monopoly. The high-voltage network will remain state owned, as was decided in 2000. The local distribution grid, however, remains in the hands of the utility that keeps a territorial link this way, even though it is no longer a public company. It gives them a strong strategic position in the local supply market, as their competitors in local supply must use their grid.

Territorial links between companies supplying energy or waste services to customers are no longer self-evident. We see "splintering" networks now, whereas once they were clearly geographically determined (Guy et al. 1997). Hence, the connection between utilities and local policy is eroding. After the era of scale increases and the growing influence of national policy, liberalization is leaving local policy even further behind. Privatized utilities have started to concentrate on profitable activities (cherry picking). After full liberalization, utilities can no longer be considered tools for local policy-making (Marvin et al. 1999b). Nevertheless, the current situation is not the same for energy and waste, as can be illustrated by the developments in Amsterdam.

Policy in Amsterdam

The ongoing process of liberalization had large consequences for the Amsterdam GEB. In anticipation of the 1989 Electricity Act, a large number of mergers were carried out. The production function became organized on a large scale when the number of companies in the

country decreased from 15 in 1986 to four in 1989. The production branch of the GEB merged with its counterparts in North Holland and Utrecht. In 1999, this company (UNA) was sold to Reliant, an American power company with a not entirely undisputed reputation.

A little later, many mergers were carried out in the distribution and supply functions as well. In 1989, there were still more than 40 distributors. The Amsterdam GEB, separated from production, changed its name to EBA (Energie Bedrijf Amsterdam). However, a few years later, it could no longer survive on its own and merged with the provincial electricity company and some local gas distributors in the province of North Holland. A scale increase in energy supply also occurred in the rest of the country. The former provincial energy utilities of Gelderland and Friesland, for example, merged as Nuon, a company that became very active in taking over other activities in the Netherlands as well as abroad. It also merged with Energie Noord-West, the company that included the former EBA. Nuon is now one of the four main energy distributors in the Netherlands. The shares held by municipalities and provinces will be privatized, so eventually Amsterdam will lose its control over the energy supply in the city.

All these privatization steps were in line with new EU regulations, although there are ongoing discussions about the relation between privatization and liberalization in the Netherlands. Amsterdam can no longer use the energy supplier for its own policies. The city's attractiveness as regards setting up business is no longer supported by a publicly controlled energy infrastructure. The same applies to local social and environmental policy. In practice, this means that the City of Amsterdam has to negotiate with many partners about the energy infrastructure of new residential areas. In principal, it is not inevitable that Amsterdam will have to deal with Nuon. The idea is that the market for captive consumers like households will be free in 2004 as it is already for the small segment of so called green electricity. Nevertheless, since Nuon still owns the local infrastructure it has a strategic position. In most new residential areas such as the large VINEX locations (e.g., the new district of IJburg), the authorities still involve their "own" utility in the planning stages, although other companies might opt for the supply of energy in these areas. Actually, the individual household will only get to choose the supplier of energy. The decisions about the infrastructure (e.g. the local low-voltage grid and the local gas network) are addressed in the planning phase. Such decisions may result in a district heating network, or only an electricity grid minus a local gas network with consequences that will be felt by the individual customers.

Whereas policy and energy supply are almost completely disconnected, waste is a different story. Within the waste sector, organizational scale increases are still going on. The planning of waste management – and particularly of the processing and disposal infrastructure – is shifting from the regional towards the national level, while private waste companies operate on an international scale. Local and regional authorities play their part in national policy, because

their organizations are important members of the Waste Management Council. Although the legal obligations for planning have shifted to higher levels, the responsibility for the collection function and an environmentally sound disposal system remains at the local level. In many municipalities, private enterprise is contracted to carry out various services for municipalities; sometimes these are privatized municipal waste agencies. In City of Amsterdam, the public utility for waste collection, GDA, still exists, but private companies may be contracted for specific services.

There is a remarkable difference at the power sector at the level of generation when it is compared to disposal in the waste sector. Whereas fully privatized production companies own large power stations, large incinerators are mainly owned by public utilities. Investments in this infrastructure are enormous. Private waste companies consider the financial risks unacceptable because it would take too long to recover the cost. As a consequence, municipalities bear the long-term risks of these expensive facilities. Shareholders of incinerators are mainly large municipalities, and the GDA exploits its incinerator in the western harbor area of Amsterdam. Contracts between collectors of smaller municipalities and disposers, or between collectors and processors, are meant mainly to pass the risks of investments on to the contractors. So-called put-or-pay contracts are often used, in which a period is set during which a collector has to supply a certain amount of waste against a set price. A supply of less waste leads to extra costs, which is why such contracts conflict strongly with waste reduction. Hence, the captive consumers of the municipal waste collection systems carry the financial burden of expensive waste disposal. Private companies are not captive consumers and the waste companies they contract are able to negotiate with the disposers (Wolsink and De Jong 2001). Because the incinerators need to utilize their full capacity, the incineration rates on the short-term market are very low compared to the rates in long-term contracts.

Furthermore, local authorities are involved in DSM. The decisions regarding the about implementation of different source separation systems are taken by the municipalities. They have to implement national policy; for example, since 1994, the legal obligation to separately collect biodegradable waste. Some less coercive policy measures are part of covenants and of implementation agreements within the Waste Management Council, mainly concerning other waste components. In the Amsterdam, the decentralized boroughs take decisions about waste collection systems and DSM. As a consequence the waste removal and waste separation infrastructure varies from one part of the city to another. The trend is towards discarding traditional door-to-door collection and introducing new systems, such as large underground containers for districts with many apartments. Sometimes this offers more opportunities for waste separation, as apartments usually show low participation levels in waste separation, but at the same time it often means a decrease in overall waste services for financial reasons.

Further Diversification: Public or Profitable Perspective?

In the near future, the tendency to diversify services and to splinter networks will continue. There are new technologies that may be implemented and some of them, including options for small-scale energy generation, may even be on the scale of individual households. For example, photovoltaic electricity generation with PV equipment installed on rooftops. Nuon is involved in demonstration projects, and one of these is in the new residential district of Nieuw Sloten in Amsterdam. One of the issues there is why people that buy a new house would accept solar power installations on their rooftop that are owned and managed by an energy company (Van Mierlo and Sprengers 1995). Although these installations are managed by the energy supplier, this solar power technique can easily be applied on an individual scale or on the level of residential blocks. This would make customers less dependent on the supplier. Other promising techniques that may be applied on a small scale are heat pumps, fuel cells, and micro-power stations.

The application of these techniques will emphasize the significance of the fine-tuning between demand and supply from the grid. In the future, DSM will offer consumers the opportunity to be more efficient in their consumption and their individual production. It will reduce costs as well as the environmental impact. DSM when organized by the supplier, however, will be supply-oriented. The connection between power supply and information technology creates large opportunities for smart metering, a very helpful tool in DSM. All opportunities involve the increased diversification of services. It offers diverse and flexible services for the individual customer, and also opportunities for diversification between groups of customers. Hence, a smart meter is not a neutral device. Several social forces are shaping the meters, as they may support very different interests (Marvin et al. 1999a).

Smart meters include developments such as pre-paid smart cards that can also carry information about the consumer. These are particularly interesting for the suppliers in low-income districts, because they prevent payment problems, as demonstrated in the UK. Another example is the meter that can be read continuously from a distance, using cable, computer and even satellite technology. ENW Amsterdam held the first smart metering experiment in the residential sector in the Netherlands. Smart meters with remote monitoring and a display were installed in 250 households for a behavioral experiment. Substantial energy conservation was found in the groups where the remote monitor was used in combination with a differentiated tariff system. There was a net decrease in electricity consumption for all rates, but significant load shifts could not be established (Uitzinger et al. 1995). While load shifts are very interesting for

the supplier, decreased consumption may be environmentally sound but not particularly interesting for suppliers. Hence, the utility did not opt to carry out further experiments.

The smart meter carries a potential danger, as the developments in the UK show (Marvin et al. 1999a). It could provide consumers with useful information concerning their consumption pattern and could help them manage their total energy household. In the near future that may include individual production by PV, fuel cells, and heat pumps. As the meters are usually installed by the utilities, they obviously serve the purpose of managing the demand for a more profitable supply. An example of that perspective can be found in the development of the smart card. Prepayment devices using cards are usually more expensive for the consumer. However, they are usually used in low-income households, whereas smart meters offering interesting services to the consumer are found mainly in the wealthier parts of the cities. It is this kind of differentiation that is in the interest of the suppliers, but it should also alarm the authorities because of the possible social consequences.

Within the waste sector, smart metering is not as common. Nevertheless, there have been some developments here as well. Municipalities occasionally experiment with economic instruments. Basic micro-economic theory suggests that charges based on waste volume will contribute to waste reduction, and there are options for waste management systems that include such tariffs (Reschovsky and Stone 1994). In the Netherlands, waste reduction was achieved in most of the 16 experiments held in the second half of the 1990s (Zelle and Van der Zwaan 1997). The most effective and most sophisticated systems included sensors at the collection containers and meters on the waste lorries. The effects of differentiated rates are not always clear, however, and undesirable side effects such as illegal dumping or “waste tourism” (putting bags in containers of others, like in neighbor cities, employers etc.) might occur. There are suggestions that the motivation of citizens to separate waste and to reuse and recycle could be damaged by economic incentives (Thøgersen 1996). Experiments with varying waste collection tariffs in the Netherlands show that the reductions achieved are paired with side effects. The growing tendency of stopping door-to-door collection is another trend that may affect the motivation of the consumer to handle waste in a proper way, resulting in a less reliable and less environmentally sound collection system. When that happens in waste management, an effect similar to that in electricity supply can be seen.

The current development is one of splintering networks with local policy more and more disconnected from the utility services, and rapidly developing communication and control techniques applied by profit-seeking enterprises. The essence of this development is that utility sectors are becoming infrastructure networks that consist of vast collectives of social and technological actors (Graham and Marvin 2001). This is part of splintering urbanism and whether that will be a favorable development for the city from a social and environmental point of view

will depend on our ability to develop new policy scenarios that regulate the new utility sectors. From that perspective, the main trend does not favor social and environmental values. In most policy discourses, liberalization is usually called deregulation, although most studies on the development of the new markets indicate that for a properly working market, we certainly do not need less regulation but instead different kinds of regulation. An example is the proper definition of so called green electricity that must be strictly enforced by a regulator. At the time, there is a strong tendency among electricity suppliers to define power generated by waste incineration as "green" (Wolsink and De Jong 2001). Probably the liberalized and privatized systems of provision need more and stricter regulation of a kind that is not comprehensive in its aims and targets, but a regulating system that focuses on market conditions and on checks and balances.

In all of the countries that have taken steps that are supposed to be part of liberalization, new agencies are established, generally indicated as the "regulator." In the Netherlands, an agency of the Ministry of Economic Affairs has been transformed to the Dienst uitvoering en Toezicht Elektriciteitswet (DTE, Agency for the Execution and Supervision Power Bill). Officially DTE is the regulator, but the regulations it should be supervising and its own powers turn out to be very limited. It is still a very small organization compared to regulators of the power sector in other liberalized electricity markets, like OFFER (UK), PER (California), or NVE (Norway) that have several hundreds of employees whereas DTE has only a few dozen. Regulation regarding creating and sustaining reliability in the power supply system is almost nonexistent (Huygen 1999). Within the waste sector, there is no independent regulator for the market, as the basic idea is still that the involvement of authorities in parts of the market is enough to protect the public interest.

Liberalization is too often entangled with deregulation. Experiences with steps towards privatization in the transport sector have triggered a new political discussion on these issues. The referendum on the independence of the Amsterdam public transport agency is an example, but the discussion also includes the power sector. In the meantime, the emphasis on deregulation and privatization has removed a strong instrument from the city to maintain control over its development and this is probably largely irreversible.

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