‘Burning for the Future’?

A qualitative inquiry into the paradox of incineration as a waste management solution for “green” Denmark

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Abstract:
Paradoxically, despite its reputation as a "green" leader, Denmark has the highest levels of waste and incineration per capita, as well as low levels of household recycling. Incineration ranks low on EU and Danish waste strategies, due to its negative environmental impact. While much social science research on waste management focuses on behavioral change at the individual level, this study explores how urban Danish household recycling habits and waste management, with an inclination towards incineration, are shaped by social, political and historical structures. Using a reflexive hybrid constructivist-structuralism epistemology, inspired by Bourdieu's *Logic of Practice*, Schnaiberg's *Treadmill of Production* and Hannigan's *Claims-making Process*, the research project utilized an inductive qualitative approach. A three-pronged research design included: an exploration of the current household recycling practices using research diaries and secondary data, a historical inquiry into notable shifts in waste management related to incineration since 1850, and a case study of ARC/Amagerforbrænding, a Danish incineration facility. The study found that, due to a complex interweaving of the investigated structures, incineration was favored over recycling within the institution of waste management, with the exception of times when risk has felt sufficiently "real" by Danish citizens. This occurred through the political claims-making process, where the public collectively misrecognized that the economic benefits of incineration is the driving mechanism and underlying factor behind waste management decisions in Denmark, rather than ambitions to meet environmental goals.

ACRONYMS

AF - Amagerforbrænding

ARC - Amager Resource Center

BIG - Bjarke Ingels Group

CO_2 - Carbon Dioxide

DK - Denmark

DKK - Danish Krone

DSB - Danish Railway Company

EPA - Danish Environmental Protection Agency

EU - European Union

GDP - Gross Domestic Product

HCI - Hydrogen Chloride

KMEK - Copenhagen Environment and Energy Office

LAB - National Society for the Combating of Unemployment

MSW - Municipal Solid Waste

MSWI - Municipal Solid Waste Incinerated

PVC - Polyvinyl Chloride

R98 - Renholdningsselskabet af 1898

SF - Socialistisk Folkeparti

SO_2 - Sulfur Dioxide

TEC - Copenhagen Technology and Environment Committee

WTE - Waste to Energy

WWII - Second World War

WQ – Working Question

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1. Introduction

1.1. Chapter Introduction

This chapter will begin with outlining and delimiting the problem area in **1.2.**. Then, in **1.3.**, the problem definition will be presented, followed by three working questions in **1.4.**.

1.2. Problem Area

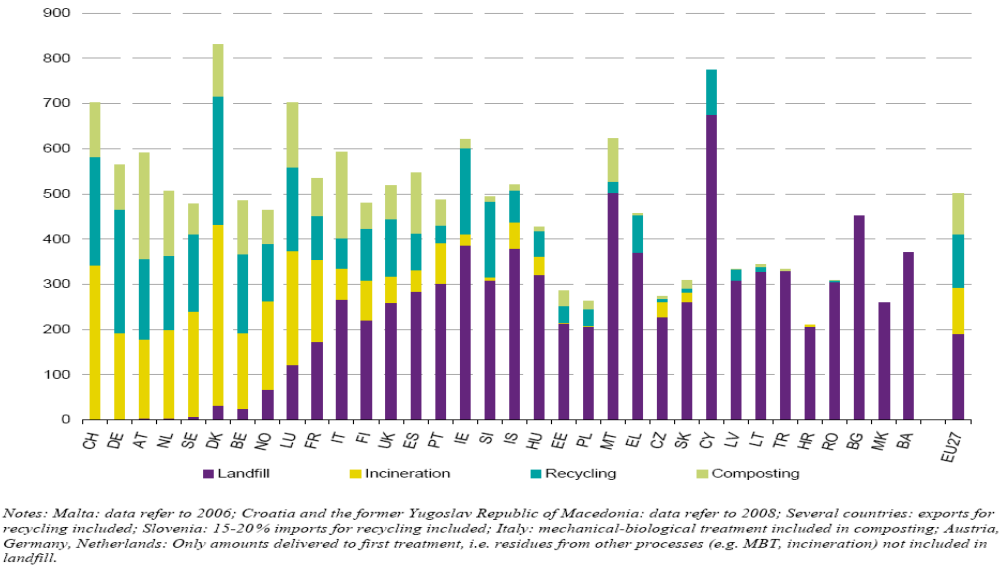
According to the Stern Review, an overwhelming wealth of scientific evidence shows that climate change is a serious global threat, demanding immediate and international global response (Stern, 2007: vi). Additionally, the cost of investing in climate change reduction now far outweighs the long-term cost of not taking action (*ibid.*). Ambitious and deliberate policy choices must be made to tackle this problem, including the removal of '*barriers to energy efficiency, and to inform, educate and persuade individuals about what they can do to respond to climate change'* (*ibid.*: viii). One particular area where improvements can be made in regards to resource efficiency and emission reduction, is within waste management.

In a global report by the World Bank (2012), it has been observed that municipal solid waste is growing faster than the process of urbanization. A decade ago, 2.9 billion urban residents generated 0.64 kg of solid waste per person per day, and presently, 3 billion urban residents are generating 1.2 kg per person per day, in a total of 1.3 billion tons per year. The rapid increase of urbanization and the even more rapid growth of total municipal solid waste are the main challenges within the field of waste management, where improper practices can lead to a negative impact on health, climate change, air pollution and ozone depletion (*ibid.*: x-xi).

Consequently, the European Union (EU) is tackling the waste issue by aiming to transform the region into a 'recycling society' (European Parliament, 2008: L 312/6). The European Parliament regulates waste management for member states based on the underpinning principle of *'moving up the waste hierarchy'* as outlined in the EU directive on waste management (*ibid.*: L 312/10). Under the *Waste Hierarchy* five modes of waste treatment are prioritized based on environmental impact. Working down from the top optimum level, the ranks are: (1) waste prevention, (2) preparation for reuse, (3) recycling, (4) other recovery, and lastly (5) disposal (*ibid.*).

More specifically, the *Waste Hierarchy* emphasis is on reducing the use of landfills (rank no. 5) and incinerators (rank no. 4 or 5 depending on level of energy recovery) (*ibid.*). Disposal practices encourage the further depletion of earth's limited raw resources by burying or burning what could be recycled (European Commission, 2010: 2). Additionally, landfills and incineration are potential health hazards. Water sources, agriculture, and the air are at risk of contamination by toxins such as methane, leachate, dioxins, acid gas and heavy metals (*ibid.*: 7-8). Furthermore, the use of incineration poses a threat to climate change and global warming through the release of greenhouse gases in the flue gases (*ibid.*: 2).

Within the EU, Denmark stands out as a problematic case, in that it has both the highest percentage of incinerated waste (54%) (Kjær, 2013a: 4) and amount of waste generated per capita as of 2009 (831 kg/capita as shown in *Fig. 1*) (Blumenthal, 2011: 2). Moreover, Danish household waste is increasing at an alarming rate. Based on market trends private consumption and household waste grow congruently and by 2020 domestic waste is expected to increase by 35% (European Environment Agency, 2011, Miljøministeriet, 2011a :17). While landfilling has practically been eliminated in Denmark since 1997 (Veltze, 1999: 78) incineration use and capacity is increasing (Miljøministeriet, 2009: 19) with no clear target in the national waste strategy 2010-2012 (Miljøministeriet, 2010: 27-28) for limiting the practice.



Notes: Malta: data refer to 2006; Croatia and the former Yugoslav Republic of Macedonia: data refer to 2008; Several countries: exports for recycling included; Slovenia: 15-20% imports for recycling included; Italy: mechanical-biological treatment included in composting; Austria, Germany, Netherlands: Only amounts delivered to first treatment, i.e. residues from other processes (e.g. MBT, incineration) not included in landfill.

Fig. 1 Treatment of municipal waste in EU countries per capita in 2009 (Blumenthal, 2011: 6)

This is quite paradoxical, considering Denmark's reputation in EU politics as a "green leader" member state with innovative domestic policies and strategies regarding wind energy, transportation, waste water treatment, the 1982 'ban on cans' and CO_2 taxation, to name a few (Liefferink and Andersen, 2005: 51). While Denmark is considered by academia to be one of the 'motors' of EU environmental policy-making (*ibid.*: 49) it begs the question of why there is apparent tolerance towards incineration. This motivates further investigation into the incineration practice in Danish waste management.

Another anomaly in regards to Denmark's "green" reputation, is that the national Danish household recycling level is negligible at only 12%; this is far below EU target levels of 50% (European Parliament, 2008: L 312/13). Surprisingly Danish policy makers seem content with this. According to the Danish Environmental Protection Agency (EPA), the national waste reduction and recycling targets for 2012 were reached in 2011 when 69% of national waste was recycled, superseding the national target of 65% (European Environment Agency, 2011). However, a closer look shows this is because manufacturing sectors are accounting for the progress: between 2000-2006 industry and treatment plants reduced waste by 34% and 45% respectively, coal energy waste is reducing significantly each year and recycling rates are high in construction (95%), and coal energy (87%) (DCE – Nationalt Center For Miljø og Energi, 2011). Conversely, households are the second largest waste sector (25% of national waste) but their recycling rate is steadily the lowest of all the sectors – just 12% is recycled and the remaining 88% is incinerated (Miljøministeriet, 2011a:17). This further demarcates the research area to explore why there is low household recycling in Denmark. Within Denmark, 87% of the population lives in urban areas (World Bank, 2011: 166). Due to this indication, Danish urban households are the main focus of this research. Furthermore, Copenhagen and the greater Copenhagen area has been chosen as a primary research field, due to its status as Denmark's capital and the presence of relevant cases that will be elaborated upon in this project.

Perusing the academic literature on household recycling practices in Denmark and other developed countries it was found that many quantitative studies were conducted on the household level to analyze attitudes towards waste minimization and recycling (Tonglet *et al*., 2003), behavioral traits (Barr & Gilg, 2005), norms and motivational factors (Biswas et al., 2000; Mannetti. *et al.*, 2004), situational factors (Vencatasawmy *et al.*, 2000; Klöckner &

Oppedal, 2011), and environmental values (Larsen *et al*., 2012) of individuals in order to predict socio-psychological determinants or indicators of recycling practices. Additionally, other studies focused on economic mechanisms to enforce the acceptance of systems for waste separation and collection at the household level (Aadland & Caplan, 2006). Similarly, cultural analysis looked at how educational and informational programs had an impact on changing norms of household recycling (Carlsen, 2001; Cox et al., 2010). Collectively, the bulk of the literature reviewed was focused on analyzing how recycling practices were determined at the household level by the individual.

Theoretically, this research project departs from that notion by raising the need for a different form of inquiry into the broader social and political-economic landscape that has led to this current state of affairs in the Danish context. With his *Logic of Practice* theory (Bourdieu, 1990), Sociologist Pierre Bourdieu proposed a framework for analyzing the production and reproduction of practices and institutions, such as household recycling habits and incineration, within the dynamic interplay of agency and structure, objectivity and subjectivity, in '*accordance with the schemes generated by history*' (*ibid.*: 54). Furthermore, environmental sociologists such as Allan Schnaiberg (1980) highlight the struggles between government, industry and citizens over environmental issues, where citizens are caught between the other more powerful institutions and the paradox of private consumerism and environmentalism. Institutional power plays in regards to issues of environment can be mapped out as part of a claims-making process, as proposed by John Hannigan, (2006) where the perception of environmental problems is a process of negotiation and legitimization.

Therefore, in order to investigate the problem at hand, this research project will apply the aforementioned theoretical framework to analyze the legitimization of current urban Danish household recycling practices and incineration as a dominant waste solution. This will be accomplished by looking at both the micro and macro levels: the current practice of household recycling, the historical processes which have led to the common-sense status quo of waste management, and taking Amagerforbrænding/ARC's new incineration facility as a case study to explore the economical and political institutions which compete to govern said practices. Thus raising the following problem definition.

1.3. Problem Definition

How and to what extent are urban Danish household recycling practices and the management of household waste, with its focus on incineration, shaped by social, political and historical structures?

1.4. Working Questions

WQ1: What is the current urban household recycling practice and collective disposition towards recycling as a waste management solution in Denmark?

WQ2: How have notable political, economic and social historical shifts in Danish society since the 19th century shaped the current household recycling practices and the practice of incineration as a disposal choice for waste management?

WQ3: How does the development process of Amagerforbrænding/ARC's new incineration facility in Copenhagen render influences of political and economic interests on household recycling practices and waste management?

2. Methodology

2.1. Chapter Introduction

In this chapter, the research project's methodological framework will be accounted for. First, in **2.2.**, the project's constructionist ontology and Bourdieu-inspired reflexive hybrid constructivist-structuralism epistemology, with additional environmental considerations, will be explained. Then, in **2.3.**, the theory and concepts will be described and accounted for in terms of brief operationalization, including habitus (**2.3.1.**), structures (**2.3.2.**), practices (**2.3.3.**), misrecognition (**2.3.4.**), Hannigan's concept of the claims-making process (**2.3.5.**) and Schnaibergs's model of the treadmill of production (**2.3.6.**). Then, in **2.4.**, the project's emergent research design will be explained, including an account of the methods (**2.4.1.**), data collection and literature review process (**2.4.2.**), the analytic strategy (**2.4.3.**) and finally an evaluation of the research design.

2.2. Epistemological and Ontological Considerations

Reality, in terms of this research project, is seen as experienced individually through interpretations, thoughts, actions and sense-making of the world (Berger and Luckmann, 1966: 19). In this sense, reality is not "out there" as tangible objective matter, rather it is perceived and experienced subjectively, and becomes a product of social consensus rather than hard objective fact. Hence, reality is socially constructed. Therefore, the human essence of being is *'socio-culturally variable'*, imprinted upon the individual from the social orders in which they inhabit and themselves reproduce and mold (*ibid.:* 46). Subjective perceptions of this sense of reality become perceived as objective through social consensus, as they become habitualized, institutionalized and legitimized over time. The sense of what is experienced as "real" is thus contingent, conditionally based on a complex interweaving of historical events which in time become taken for granted as a common-sense, objective reality. For Berger and Luckmann, these seemingly objective structures '*must and do claim authority over the individual'* (*ibid.*: 59), as the individual's knowledge of the social world is constructed based upon knowledge, practices and customs imparted from particularly powerful and legitimate institutions such as government, religion, and education, constraining courses of action to conform to the institutional order. That is not to imply that institutions are deterministic -- rather, if these institutions do not maintain legitimacy, they will lose power and influence, giving way to new constructions, practices, and so on.

Given that this research project is dealing with issues related to the environment, the social constructionist approach utilized does not deny the natural existence of environmental problems when stating they are socially constructed. Rather the notion implies that the magnitude, impact and rank ordering of these environmental problems is defined in a social process that ebbs and flows with the institutional and political nature of agenda setting (Hannigan 2006: 31).

In conjunction with this constructionist ontology, it becomes epistemologically relevant to analyze how social constructions come to be perceived as common-sense i.e. assuming that '*reality is socially constructed* [...] *the sociology of knowledge must analyze the processes in which this occurs'* (Berger and Luckmann, 1966: 1). Beyond this, it is of interest for this project to analyze how institutional constructions govern, shape and constrain the practices of individuals. This will be accomplished by employing a reflexive hybrid constructivist-structuralism approach inspired by Pierre Bourdieu's *Logic of Practice* (1990), supported by environmentally concerned concepts put forth by environmental sociologists such as Allan Schnaiberg's (1980) 'treadmill of production' and the 'claims-making process' as adapted by John Hannigan (2006).

Bourdieu himself dwelled between structuralism and constructivism, where structures are neither completely deterministic, nor agents completely free. In this grey area, there is a dynamic interplay of objective subjectivity and dynamic structuring structures which are generated in a fluctuation of structure and agency (Grenfell & Hodkinson, 1998: 30, 31). Allan Schnaiberg's (1980) neo-Marxist model of conflict can be used both as an explanatory theory of the state and economic system, and as a radical normative theory for environmental protection. However, this project will only employ the use of the model to situate the inequities of power distribution between state, industry and citizens as claim-makers over environmental issues.

Bourdieu's theory (1990) is useful in this research project, as within this dynamic interplay between structure and agency, structures contain agents, agents compete to define structures, and are themselves shaped by structures. Within the field of waste management, Bourdieu gives the framework to look at not only how structures shape household practices, but how agents such as government, industry, and individuals struggle amongst each other to gain agency over these structures.

This motivates a three-pronged line of inquiry directed at (1) the subjectivity and practice of waste management for individual agents in Copenhagen (2) the historical contingency leading to the common-sense understanding of Danish waste management, and (3) the competition between agents in the field of waste management to define institutional structures which produce and reproduce said practices and subjectivities.

2.3 Theory and Concepts

2.3.1. Habitus

Habitus can be described as an internal system of dispositions, which are being acquired by one's own past experience of practice, thus constituted by practices and '*oriented towards practical function*' (Bourdieu, 1990: 52). The notion of habitus is concerned with everyday practices of individuals during their life and with the '*collective history inscribed in objective conditions*', which tend to '*reproduce itself and the status quo is perpetuated*' (Jenkins, 1992:74, 80-81). The interplay between the habitus and the objectified conditions is a crucial point in this social inquiry, thus '*habitus enables the institution to attain full realization through the capacity of incorporation*' (Bourdieu, 1990: 57). Furthermore, '*the habitus, a product of history, produces individual and collective practices - more history - in accordance with the schemes generated by history*' (*ibid.*: 54). This research project pinpoints the historical and current Danish household's waste management practices, and the historical shifts and current status of institutionalized waste management practices in Denmark, in order to clarify the relation between the daily private practice of waste management in Danish households to the daily public and objectified practice of waste management in Denmark, with an emphasis on incineration.

2.3.2. Structures

Here, a distinction between internal and external structures is made. Institutionalized structures (external), which are legitimized by the individual and collective habitus, and thus inscribed in everyday practices (Bourdieu, 1990: 53-55), are the external objectified conditions, which are internalized by one's subjectivity and maintain its practices (Jenkins, 1992: 79-80). The internal structures are structured dispositions embodied in the habitus, which tend to produce practice in present time according to the past experience of the same practice (Bourdieu, 1990: 55). The internal and external structures maintain each other's

reproduction by potentially influencing each other's practices and past experiences (Bourdieu, 1990: 59 *cited in* Jenkins, 1992: 80-81). Within this definition, structures are not deterministic, but influential and socially constructed. By viewing and examining the historical and current power relations between economic and political conditions of waste management in Denmark and the structural dispositions of Danish household's habitus, this research project discusses and concludes on the shaping forces of recycling habits in Denmark and Copenhagen, in particular.

2.3.3. Practices

Practices are located and tied with time and space. They are not happening randomly and not '*wholly consciously*', but they are following a practical sense or logic (Jenkins, 1992: 69-70). Practices are produced by habitus, which tend to reproduce its internal structure by generating similar practices according to its past experiences (or history of practice) (Bourdieu, 1990: 53-55). Furthermore, practices can be generated by collective habitus or external structures (perceived as objective), and they become internalized by the individual habitus, influencing the internal structure, thus internalizing the external (*ibid.*: 57,58). Moreover, *'practices always have double truths, which are difficult to hold together'*, this duality should be noted throughout the analysis of a practice (Bourdieu, 1998: 95). Waste management is a perfect example for that ambiguity, it is a complex practice where the subjective truth is that waste is a material without value for one, but in the objective reality it is a good with economic value, which has market price and is being traded. The practice of waste management includes other sub-practices such as recycling, reusing, incineration, landfill or any other way to dispose waste. The focus of the research project is on the relations between public and private management of waste disposal, and the inquiry is concerned with the power relations these practices are producing in contemporary Denmark.

2.3.4. Misrecognition

A process caused and generated by the legitimization process of structures, which are perceived as objective, but they are actually socially constructed outcomes of power relations between public, private and civil society. Hence, misrecognition is *'the process whereby power relations are perceived not for what they objectively are but in a form which renders them legitimate in the eyes of the beholder'* (Bourdieu and Passeron, *cited in* Jenkins, 1992: 104). Moreover, *'collective misrecognition is inscribed in objective structures'*, sustained by

social dispositions or beliefs, and caused by mystified agents, who produce collective deception by mystifying other agents (Bourdieu, 1998: 95). Misrecognition is achieved by the systematic reproduction of practices by the individual or collective habitus (dispositions), which potentially legitimize the objective structures to maintain the overall practice (Jenkins, 1992: 104).

2.3.5. Claims-making Process

Environmental problems are *'products of the dynamic social processes of definition, negotiation and legitimation'* (Hannigan, 2006: 31) otherwise conceptualized as the 'claims-making process'. When using the concept as an analytical tool, emphasis is not on proving the validity of a claim, but rather on the process of how that claim came to be warranted within society. The concept has an analytical focus on *'perceptions and power'* (*ibid.*: 32) and it is particularly useful for mapping the instrumental influence on collective dispositions towards a risky or contested practice. It will be used to situate environmental issues of Danish waste management, particularly the practice of incineration, within the value-laden socio political field.

It will be operationalized throughout the project by asking who makes claims on environmental issues to do with waste management in Denmark and Copenhagen in particular, and who opposes them in order to analyze the fluctuating power of claims-makers to shape the *'definition of the situation'* (Hannigan, 2006: 63) and the current habitus. It will contribute to the analysis of legitimization by highlighting when a discourse has become hegemonic to the point of stifling public debate by demonstrating how industry and state actors convince public opinion that environmental concerns have been eradicated even when this may not be the case (*ibid.*).

2.3.6. Treadmill of Production

The concept depicts the dynamics of production – the generation and distribution of social surplus, from a neo-Weberian/neo-Marxist perspective, but the analytical focus is on how this 'treadmill of production' leads to environmental problems or scarcity. Society is organized in three groups, state, capital, and labor and all work in alliance to maintain optimal economic growth. This growth is dependent on expanding capital intensive production (e.g. manufacturing industries) to produce sufficient social surplus for society; meaning that corporate investors must gain a profit, labor must be provided with adequate wages so they

can purchase the commodities, and tax revenues must be sufficient for the state (Schnaiberg, 228-229). This is the essence of the logic behind the self regulating model of the 'treadmill of production'. However, the cost of providing this social surplus is that the ever expanding treadmill of production simultaneously exploits the ecosystem because the industrial production depends on extracting dwindling natural resources and inevitably pollutes the environment at the same time.

Here Schnaiberg departs from the neo-Marxist concepts, by explaining that this results in tension between economies and the ecosystem when mediating the impacts of production: the 'addition' of pollutants (e.g. chemicals, toxins, waste, slag,) and the 'withdrawal' of raw materials (e.g. oil, feedstock for energy supply) (Schnaiberg, 1980: 23). Government (the state) has a contradictory yet powerful role as both a regulator of these impacts or environmental values (negative externalities) and as a promoter of economic development (*ibid.*: 244-246). In short, externalities are situations where there are external effects (e.g. pollution) which are not reflected in the cost of production or price of a good (Aage, 2012: 285). The economic resources and technical expertise of industry leaders (capital) gives them a monopoly on claims-making regarding the environmental impacts, often managing to ignore them if it would cause a decrease in production (Schnaiberg, 1980: 141, 246). The 'worker-consumer-citizen' (labor) has the least influence on claims-making due to lack of capital and power, and is also constrained by the dualistic tension of private consumption needs over environmental preservation (*ibid.*: 214-216). Most often the economic interests of the state and capital run the 'treadmill of production' paying only nominal attention to the environment through 'greener' technological advances (*ibid.*: 427-428). This concept will be used to explain why waste management is failing to do the job of 'saving the environment' and the lack of agency on the individual level regarding the use of incineration and household recycling.

2.4. Research Design

Based on a preliminary problem definition focused on exploring the relation between external structures and household recycling habits, and an initial interest in applying a Bourdieusian framework, it was decided that a combined macro/micro level approach was needed to explore broader influences on the household waste management practice. Throughout the development of the research project, new problems, actors, and areas of interest came forth, resulting in an emergent methodology which adapted as the project progressed. The intent of

the research design, and structuring of the project report, is therefore to follow and give an account of the researchers' own progression of inquiry, as the methods and data brought forward discoveries throughout the research process.

Beginning with the micro level of the community and households the research sought an understanding of how the waste management practice is carried out and which societal structures shape the recycling practice (WQ1). From this it emerged that national macro level factors were strongly dictating and shaping the practice. In order to explore the details on how and to what extent this was the case the research turned to a macro level approach where the political and economic institutional structures were explored (WQ2). The research traced historical notable shifts where waste policies, environmental policies and industrial interests appeared to have influence on the recycling practice. Additionally, reactions and shifts in recycling practices on the micro Copenhagen household and community level were qualitatively compared to analyze how or to what extent the macro level discourses and strategies over waste management in these notable shifts changed public opinion, collective dispositions and household agency. This clarified who the agents of power in the field of waste management were, when they had influence, and where or to what extent in order to answer on the problem definition.

Furthermore, based on the emergence of incineration as a particularly influential factor within waste management in Denmark through the historical/macro portion of the research, the researchers aimed to conduct fieldwork by visiting an incineration facility in Copenhagen. Amager Resource Center (ARC), formerly known as Amagerforbrænding, emerged as a convenient possibility, and after booking a tour with ARC, the researchers began to investigate the facility, in order to gain background knowledge. Within this research, ARC emerged as a significant case study, as the development process of its new incineration facility had been subject to extensive political controversy, and worldwide media attention. This lead the researchers to take on the development of this new incineration facility as a case study, as it provided an arena to explore the struggles between institutions and agents to claim influence over household recycling practices and waste management (WQ3). The case study was comprised of two parts. First, the political-administrative decision-making process was traced out, in order to bring forward how actors within waste management struggle over influence in the handling of waste, and shape household recycling practices. Second, the

research group conducted fieldwork at ARC, in order to triangulate data and further explore the case.

The following table visualizes the research design.

Working Question ⇨	**Method ⇨**	**Data ⇨**	**Aim ⇨**	**Concepts ⇨**
WQ1: What is the current urban household recycling practice and collective disposition towards recycling as a waste management solution in Denmark?	a. Research diaries b. Document content analysis	Subjective recycling experiences EU/DK waste hierarchy & waste strategies - Danish waste statistics - Nørrebro case study	Map the current habitus (dimensions) and actors that influence the practice including: internal and external dispositions on the household level	Habitus (and dispositions), practice, structures, misrecognition
WQ2: How have notable political, economic and social historical shifts in Danish society since the 19th century shaped the current household recycling practices and the practice of incineration as a disposal choice for waste management?	a. Document content analysis	Journal articles, reports, books, newspaper articles, EU and DK legislation	Map out (in historical chronological order) external dispositions more clearly (hidden games not seen in the first chapter). Map out the structures	Collective dispositions (within the habitus), claims-making process, treadmill of production, misrecognition
WQ3: How does the development process of Amagerforbrænding/ARC's new incineration facility in Copenhagen render influences of political and economic interests on household recycling practices and waste management?	a. Document content analysis b. Observation and unstructured interview at ARC	- Meeting protocols from Copenhagen municipality website - Industry and policy documents - Media archives Observation, presentation and interview with ARC	Use ARC as case study to further clarify how competing structures and agents lay claim on waste management and household recycling practices	Structures, claims-making process, treadmill of production, misrecognition

2.4.1. Methods

The methodological approach of this research inquiry is inspired by Bourdieu's reflexive epistemology, which '*informs and is informed by practice, on the one hand, and* [...] *choices of method and experience of research, on the other*' (Jenkins, 1992: 61). The focus of the research is to identify power relations in the investigated habitus and practice of waste management in Denmark, and explain how these are maintained. Different type of methods were used throughout the research, guided by the research questions and the theoretical framework.

The point of departure of the research is subjective inquiry, carried out by the researchers in four research diaries, where the focus is collation of emotions, challenges and experiences of their current households recycling habits. Additionally, document content analysis of EU and Denmark's current waste management strategy is outlined, one case study (Bjørn, 2008) of a private initiative (Nørrebro Waste Model) was viewed critically, focused upon the challenges, experiences and power relations within the area of private waste management company located in Copenhagen, in order to define the actors and map the structures within the research field of waste management in Europe and specifically in urban Denmark. Furthermore, the current statistics and empirical data on Danish household waste management practices was viewed and interpreted qualitatively.

The constructivist epistemology and the theoretical framework of the research emphasize the role of historical shifts, experiences, and challenges in shaping current social practices and phenomena. By viewing articles, books, and studies dealing with historical shifts in waste management practices in urban Europe, and more specifically in Copenhagen, Denmark, the external political and economic structures were mapped. Internal and external collective dispositions, social factors and processes such as, labor market changes, urbanization and consumerism, political shifts, were explored to the demarcation of power within the research field of waste management in Denmark.

A case study of ARC was carried out by the researchers in order to exemplify the power relations and struggles between the external political and economic structures to the Danish urban households recycling habits. Important events and agents were traced by viewing meeting protocols and documents from Copenhagen municipality and ARC, followed up by

looking on Danish media articles, outlining a time axis of important events, policy changes, and the actual development of ARC.

To further explore the case, and triangulate data found in the document review, the researchers visited ARC for a guided tour and presentation on Monday, 29th of April. The presentation was recorded for the purpose of analysis of this primary data, and a form of questions was made preliminarily, followed up by investigative questions on the presentations topics, such as, future planning, the decision making-process, labor conditions, economic interests and the relations with other companies in the area of waste management in Denmark. In the actual guided tour, observation notes were collected, and photos were taken.

2.4.2. Data Collection and Literature Review

The primary data collection included four research diaries, which were written by the four researchers during a period of week in the start of the inquiry. Every researcher conducted their own diary about their private household waste management practices, within the intention of recycling all their waste. Challenges, thoughts, reflections and interpretations were documented, and triangulated between the four diaries in order to reject bias. Additionally, field data, i.e. observation and an unstructured interview, was gathered from the trip to ARC.

In the preliminary phase of the research project, a thorough review of relevant research was done to map the field of study, as outlined in the problem area. This process gave a guideline on major empirical and theoretical bases related to the problem at hand, including key methods, and possible gaps or biases in the field, giving insight into finding an angle on how to provide new, relevant knowledge (Kamler & Thomson in Somekh & Lewin, 2011: 16). Quality literature was selected from peer-reviewed journals, based on a criteria of relevance (specifically to Denmark), and on number of citations, where possible. New empirical research was prioritized, but also older, highly-regarded theoretical literature was chosen to provide a varied perspective on the field.

Databases used to gather literature included: JSTOR, ISI Web of Knowledge, SCOPUS, SUMMON using keywords such as “waste management Denmark” “incineration”

"incineration overcapacity" "recycling Denmark" "household recycling" "recycling behavior" "waste disposal".

Secondary data for analysis came from documents such as EU regional and Danish policies, directives, ministerial documents, government meeting protocols, newspaper clippings, online news media, environmental sector reports, industry publications. The sources were: Københavns Kommune, Eurostat, Euro-Lex, Danish Ministry of Environment, Danish Energy Agency, Dong Energy, International Solid Waste Association, European Environment Agency, Dansk Affaldsforening, GAIA institute, DCE – Nationalt Center For Miljø og Energi (Aarhus Universitit).

For the ARC case study specifically, the Copenhagen Municipality website was used extensively to obtain relevant documents, as well as the Amagerforbrænding/ARC website and articles pertaining to the case from the Danish media such as Ingeniøren, Information and Politiken. All documents from the municipality's website pertaining to Amagerforbrænding/ARC from 2007 and onwards were investigated, categorized and analyzed, in order to make a timeline of events. Almost all data gathered for this case study was in Danish, so the researchers had to translate relevant quotes into English, which could potentially reduce reliability.

2.4.3. Analytic Strategy

Considering the qualitative and inductive approach of this research project, the analytic strategy for the content analysis was ethnographic, meaning that '*culture and context were important interpretive aspects*' (Grbich, 2013: 189) as opposed to a more quantitative enumerative approach. The nature of the data collection process and analysis was iterative thus depending on preliminary data analysis to detect emerging themes, working questions and directions for new data sources. The techniques used throughout the ethnographic content analysis was to manually search for significant thematic categories but to keep the data largely intact maintaining the narrative format of the data. Data was considered significant if it showed patterns, context, and explanatory meaning of the behaviors relating to the waste management practice (*ibid.*: 195). Data was then coalesced into timelines to highlight the shifts in power structures and changing practice of waste management.

Using Bourdieu's methodology gave the project design a skeleton structure where the practice, habitus, and actors within the field of waste management were explored. This gave initial direction where multiple sources (see data collection **2.4.2**) were qualitatively assessed to build a thick description of the current waste management situation including key historical events, actors, and dimensions of action. From this data it became clearer who the pivotal players were in deciding the waste management practices, what struggles in agency took place, and how the relations were linked to broader society and politics and which environmental issues were sources of contention within the practice. From this preliminary data analysis the research focus became clearer and theoretical concepts from environmental sociology and political economy were included in the theoretical framework. The emerging paradox of incineration vs. recycling then came into focus as a problem area where the power to alter the practice in favor of recycling was largely removed from citizens. This then became the focus of the final data analysis: to qualitatively find and theoretically explain how this came about.

2.4.4. Evaluation of Research Design

To account for reliability, validity, and analytic generalizability: firstly, the research project was conducted as a team where collaboration and discussion facilitated the cross checking of data to ensure that it was a valid indicator of the concepts. The researchers used the following stages: Documents were collected by individual researchers using preliminary analysis where face validity was employed (Bryman, 2008: 152). Significant portions were summarized and posted on a group forum (i.e. Google Drive) this way all group members could comment, change, and add to the preliminary analysis to ensure 'inter-observer consistency' (*ibid.*: 150). All findings were assessed in a weekly group discussion and compared to the theoretical framework and thematic categories further ensuring internal reliability and also enhancing the internal validity (*ibid.*: 376). Secondly, data was triangulated through different sources to check that the findings were verified as reliable and that they could be said to be an indicator of the phenomena, structural processes or historical changes. As a result the conclusions made in this project could be generalizable in the following way: structural shifts (political, economic and societal) in regards to to the practices of incineration and recycling that were explored on a national level could be considered as generalizable findings to the national level. Whereas, the findings within the ARC case study brought to light political power plays and information which is specific to the incineration institution in Copenhagen, although,

their claims-making process could be used as an example of how the incineration practice in the country maintains legitimacy.

One of the limitations of the project is that due to restrictions on time, possibilities were limited for triangulating the data with expert interviews from civil organizations or political /industrial agents mentioned in the ARC case study. Using the ethnographic approach, which is iterative, meant that much of the focus demarcation of the research field, namely the politics of the incineration paradox, came to light towards the middle of the research stage. This left insufficient time for arranging an interview with some of the key players or gatekeepers of information to corroborate findings and shed greater light on specific power plays in this case study.

3. Danish Urban Household Recycling Practices and Waste Strategy

3.1. Chapter Introduction

The aim of this chapter is to answer the first working question *What is the current urban household recycling practice and collective disposition towards recycling as a waste management solution in Denmark?* by using a mix of data from research diaries, government waste strategies and secondary data. This chapter will look at both subjective/objective, micro/macro levels to triangulate findings on the current household recycling practice and collective dispositions.

First, in **3.2.**, the current recycling practice will be outlined as found firsthand by the research diaries. Then, in **3.3.**, the recycling practice of a local community initiative, the Nørrebro waste model, will be outlined to see how this relates to the subjective findings in the research diaries. Next, in **3.4.**, quantitative statistics and qualitative secondary data will triangulate the initial research diary findings on systems of recycling. Additionally, it will explore Danish citizen's collective disposition regarding recycling and incineration. Then, in **3.5.**, Data from the current Danish Waste Strategy (2010) will outline the institutional practices of handling the household waste, from which it is revealed that incineration is the dominant means of disposal. Finally, in **3.6**., a preliminary conclusion will summarize the findings from the chapter and link them to the next chapter and subsequent working question.

3.2. Research Diaries

Initially, to exemplify the current recycling practices in Copenhagen, Denmark, the researchers recorded research diaries regarding their recycling practice in their urban household in the greater Copenhagen area in Denmark (See Appendix A for relevant excerpts). Four research diaries were conducted, every diary was managed by one researcher and her/his household. In short, each researcher carried out self reflections upon their household's recycling practices for a weeklong period. The form of the diary included a two column table, one for the main types of waste, namely, paper, cardboard, plastic, metal, organic, bulky, and hazardous, and the other for inscribing challenges, experiences, thoughts, problems and wonderments regarding the type of waste recycled. Inter-researcher triangulation was utilized in order to be maintained from bias, and to emphasize the main challenges of recycling habits and practices of urban households in Copenhagen and their relations to external conditions, such as municipal waste management, dwelling place etc.

One issue reoccurs in three out of four diaries. Only one of the households had the possibility to dispose all types of waste in its building's backyard. The other three had only containers or spaces for paper, cardboard, and bulky waste types. In these cases, other solutions (e.g. a visit to a recycling station) were necessary to dispose plastic, organic, glass, hazardous and metal waste. The accessibility to a recycling station was noted in different ways, only one researcher was comfortable with disposing waste in the recycling station, '*not a big inconvenience as it is on my daily route to the shops*' (Diary nr.1).

In another reflection, regarding the accessibility to the recycling station, one of the researchers noted,

> *'I don't have any container* [for Organic disposal] *in my backyard, and the recycle station seem so far away for me on my bicycle and a bucket full of food leftovers from cooking and eating. I throw the container to the general garbage, and felt very bad about it'*. (Diary nr. 4)

It is clear, that a challenge occurred when the recycling station was not located in the backyard, new considerations were made, time constraint and conditions were rearranged, while the 'easy' choice of disposal to a general container was more readily available and faced on a daily basis.

Following up on the research diary, the researchers conducted a visit to Bispeengen Recycling Station in Frederiksberg, in order to investigate the possibility of improved household waste disposal. Although there were over 30 fractions for sorting waste, it was not possible to deposit organic household waste for compost. When asked, a worker informed the researchers that this was due to municipal regulations, as deposited organic waste could lead to rats and other health hazards. Additionally, the only available fraction for plastic was "hard" plastic, meaning that it was not possible to sort e.g. plastic film, plastic bags, and diverse types of packaging. There was no choice but to deposit these forms of waste into the general waste bin, leading to their incineration.

Dwelling on the lack of options, the habit to dispose all types of waste in one trash bin was considered:

> *'every time that I am washing dishes, I have some leftovers of food in the sink, these go straight to the general garbage container under the sink, this is almost an instinct for me, but today I was wondering what should I do to prevent it. So first, clean out my plates to the organic container and from there to a compost bin. But there is no compost bin at my yard.'* (Diary nr.4).

Here, the need in changing the habits of disposal is reflected as a struggle of the individual to overcome internal dispositions and change his recycling practice, by disposing organic waste to a separate container. In the previous thought, the external structure is being reflected, opposing to the change of habits, and maintaining the past practice of disposal to a general container.

Also, some confusion regarding the type of waste was noted,

> *'If I will follow my supermarket list,* [...] *there aren't products which contain only one kind of waste, and some of them are a combination of three or even more types of waste* [...] *one can wonder on which type of waste is the package material, and there is no clear explanation of it on the package itself, unless it is an environmental friendly package'* (Diary nr.4).

Here, the confusion relates to the fact that there is almost no information on the proper disposal practices of products. The responsibility traced to the product's producers, which are not obligated to write any additional information regarding the proper disposal of packaging material or a clarification of other additional material to the purchase. In another example, one researcher noted (Diary nr. 2), *'the first day in the experiment, I am exhausted of thinking about where everything goes. I think it is a big hassle, and the fact that I only have a container for paper in my courtyard, makes it even more difficult'*, emphasizing how challenging the transformation of practices is, and especially when the external structures of municipal waste management are not collaborating fully with the change in the individuals recycling dispositions.

The collaboration between individual's recycling dispositions and pro-recycling external conditions to waste disposal simplified recycling practices and generated uncomplicated outcomes, as noted, *'Went down with cans into the metal bin. No problem there'* (Diary nr. 3). If there is a simple solution, in this case metal container in the backyard of building

apartment, for waste disposal, managed by external structure, positive outcomes are noted. When these external conditions for recycling waste were undermined, the recycling practices were weakened. As described in one of the diaries, after four days of dysfunctional compost machine in the building's backyard, '*the machine is just broken*', the organic waste is disposed to the general container in the backyard, '*into the normal waste. Honestly, what else am I gonna do?'* (Diary nr. 3), thus determined recycling practices, and maintained standard municipal energy recovery practices instead.

Obviously, during one week of attempting recycling practices, the researchers were struggling to find solutions to increase their household's recycling rates. Frequently, new considerations were made and some despair was noted regarding the external conditions being present. Although different types of waste were being separated to different containers at the private household level, the lack of appointed recycling containers in the surroundings prevented the completion of the recycling practice, as described in one diary, '*It is pretty easy to separate the plastic from the rest of the garbage but I don't have where to dispose it, except the general bin which go to incineration station'* (Diary nr. 4). Apparently, the external conditions of municipal waste management in Copenhagen are not fully committed to recycling household waste, such as plastic, organic, or metal, but seemed to solve the waste problem by recovering it to energy throughout an incineration process. This lead the research project to question why certain waste fractions such as plastics which seem valuable to recycling schemes are not included in a national or municipal sorting scheme. This was explored further in the next chapter and answered on by showing the combustible value of plastics to the incineration practice (see section **4.4.** for details).

In summary, the research diaries helped to exemplify household recycling practices in Copenhagen and emphasize the main challenges derived from the relations between the individual's recycling dispositions and the external conditions for recycling waste management. The current household recycling practices in Copenhagen are lacking facilities, which are appointed to recycle, such as specified containers for all the different waste types in buildings courtyard. Furthermore, the descriptions emphasize the challenges in changing the internal dispositions of the individual to recycle, which are maintained by past practices and permanent external conditions, and show the necessity of collaboration between private and public actors in managing recycling practices.

Continuing from this last point, the need for public and private collaboration in order to improve recycling practices, the next section will explore a mini case study where that collaboration took place. The discussion will look at how this practice relates to the household recycling experiences previously outlined by the research diaries.

3.3. The Nørrebro Waste Model

The project of the Nørrebro waste model was originally started as a private initiative by urban residents from the area, who contacted Copenhagen Environment and Energy Office (KMEK), and together they planned a project proposal for "Øko-by" (eco city), which is a project by Nørrebro District (Nørrebro Bydel), that tries to make Nørrebro a greener part of the city. The Nørrebro waste model was planned by KMEK, R98 [1], Copenhagen Municipal Environmental Inspection (Københavns Kommune Miljøkontrol) and Nørrebro District. Additionally, a management group with representatives from the different departments was made to maintain and supervise the project (KMEK, 2002: 9). In 2001, 25% of the courtyards in Nørrebro had implemented the Nørrebro waste model (*ibid.*: 17). Furthermore, in courtyards with the Nørrebro waste model 35% of the total amount of waste was being recycled, whereas only 21% of the waste is recycled in the rest of Copenhagen and Frederiksberg (KMEK, 2001: 5).

The purpose of the Nørrebro waste model was to reduce the amount of waste that was being incinerated. The plan was to give residents more categories in which to sort their waste, compared to the rest of Copenhagen and Frederiksberg (KMEK, 2002: 5). Like in the rest of Copenhagen, paper, cardboard, glass and residual waste can be sorted. However, with the Nørrebro waste model it is also possible to sort organic waste for compost, metal, PVC [2] and hazardous waste, among others, in the residents courtyard. In total, it would be possible to sort the waste in up to 30 fractions within 4 categories (KMEK, 2001: 9, 16). It is notable, however, that there is no fraction for "soft" plastic, e.g. plastic bags, plastic foil, packaging plastic, etc. This was one of the projects future goals (KMEK, 2002: 8), but does not seem to have been implemented at present time (see Appendix B for poster displaying current sorting guidelines and possibilities).

[1] Renholdningsselskabet af 1898, a municipal waste collection company

[2] The incineration of Polyvinyl chloride based material is associated with high toxicity for the environment, such as dioxin pollution (Gotlib *et al.*, 2000: 209)

There are different factors and actors that are important for the project to run, one of these factors is the information for the residents. KMEK made different information material, in the format of flyers, video, CD's and signs to explain how to recycle the waste in the different fractions (KMEK, 2002: 39-40). The role of the courtyard keeper is important as well, as he is in charge of the general running of the courtyard, distributing material to residents, and contacting R98 about pick-ups and manage the compost heap (KMEK, 2001: 11).

After 2001, when the trial period ended, R98 took over the general administration of the project from KMEK. This meant some of the guidance and information stopped, more specifically, the network for the courtyard keepers and the management group were disbanded (Bjørn, 2008: 33). The Nørrebro waste model was meant to be implemented in further 12 courtyards, after 2001, but it never happened. This could be because R98 took over the general management, and did not offer the same guidance when implementing the model in new courtyards, as KMEK (*ibid.*: 40). This exemplifies how administrational changes are an external condition with potential for changing the practice at the individual level.

In a 2008 study, three different courtyards, which have implemented the Nørrebro waste model, are investigated. In all three cases there have been made some changes to the model, since it was implemented, to better suit the residents. For instance, it is not possible to recycle PVC, either because of confusion about differentiating between PVC and other plastic waste, or because R98 could not dispose of the PVC and therefore did not want to pick it up (Bjørn, 2008: 49, 69, 71). Compost is only running well in one of the three cases, where they had invested in a better and more expensive compost disposal system, that basically runs itself (*ibid.*: 69). One case has completely abandoned the compost solution, and in another case it is still possible to recycle organic waste but at a lower capacity (*ibid.*: 50). Some residents who live close to the compost container do not use it, because it is in bad shape and it looks like it is not maintained (*ibid.*: 56). This shows the importance of the role of the courtyard keeper. If residents do not feel that the courtyard and the recycling system are maintained, they feel reluctant to recycle.

Generally, in all three cases, the recycling runs worse than when first implemented, one of the cases started out with two courtyard keeper, which was funded by the "green job pool" which KMEK had applied for them, but because of changes in 2001, they had to lay off one of the

courtyard keepers, as they could not afford both (Bjørn, 2008: 49-51), which resulted in bigger workload for the one courtyard keeper, and less time to maintain the recycling station.

It seems that there is a direct correlation between residents use of the recycling model, and how engaged the different actors, within the courtyard, are in the project. The times when the recycling ran well, were also when the courtyard keeper was engaged in the recycling program, and helped build it up in the beginning (Bjørn, 2008: 49, 69). Communication seems to be an important factor for the running of the model, both communication between the courtyard keeper and the residents. As previously mentioned, the courtyard keepers' role is very important as he is in charge of the general running of the courtyard's recycling station and distribution of information material to the residents (*ibid.*: 42). That is why the less engaged the courtyard keeper is, the less information residents get, and the less they recycle. Even though the recycling practice is within a private residence, the waste model still depends on some structural factors to be working, one is the role of the courtyard keeper, another is the working relationship to R98. In all three cases, dissatisfaction about R98 is expressed, they forget pickups and '*are difficult to dance with*', as one person describes it (*ibid.*: 63). All three cases experience having to call R98 repeatedly about different problems, but mostly lack of pick ups (*ibid.*: 64). One case even took it so far, that R98 no longer picks up their glass fraction, because there were disagreements about how it should be collected (*ibid.*: 72).

It seems that residents are willing to sort and recycle their waste, but they often show signs of confusion about where to put the different waste categories, and that is because of lack of information. One courtyard keeper expresses annoyance with residents' lack of proper recycling practises, but at the same time he does not distribute information material to the residents, because he says that they do not read it anyway (Bjørn, 2008: 61). Again this shows the importance of the courtyard keeper's engagement to making the project run, and the residents rely on him for information about recycling practices.

In conclusion, there are different factors that are in play when recycling practices have to be improved. It is an oversimplification to say that all it takes is for residents wanting to recycle, because as these cases show, even with the willingness of the residents, the recycling program is not running optimally. First of all, the role of the courtyard keeper, or someone else who is in charge of the general administration of the recycling lot, had to be engaged and striving for improvement. Additionally, it is important that s/he has a good relationship with the residents,

and can guide and help them recycle, thus easing the recycling practice and help to solve problems regarding the waste model. Also it is important to distribute information to new, as well as 'old' residents, to keep reminding them how to properly recycle their waste. Furthermore, it is important that the recycled waste gets picked up, otherwise it will just pile up, and might end up in the residual waste container. Lack of pickups, is something all three cases had problems with, which is an external condition, which is out of the hands of the residents, and all they can do is call the company in the hopes that they will show up, and pick up the waste. For the waste model to work there seems to be a need for extra resources, one person cannot manage a courtyard alone, that is simply too big a workload for one person.

In light of these findings it appears that even this notable private initiative is not sufficient in itself to improve the levels of recycling. The inadequate objective structural organization and external conditions also affected the collective dispositions, leading to reluctance and ultimately poor recycling practices. Continuing from this last point, the next section will explore what the collective Danish disposition is in regards to the recycling practice, but on a macro level. This will be explored in the next section to find out if it is only when structures were poor (i.e. municipal recycling schemes) that citizens are disinclined to recycle or could there be other collective dispositions to waste management that influence the household recycling practice.

3.4. Statistics on Collective Disposition and Practice in Regards to Household Recycling and Incineration

A survey from 1997 called *Residents' behavior and attitude towards waste* (Borgernes adfærd og holdning på affaldsområdet), carried out by Ministry of the Environment (Miljøstyrelsen), investigates Danish residents' behavior and attitudes towards waste management. The survey was sent out to 1,341 'single-family residences' i.e. villas and houses, and 680 apartments, and it is considered representative of the Danish national population. Because the survey is over 15 years old, other more recent national statistics from the Ministry of the Environment, from 2011 will be used to support the survey's data. The survey from 2011 will be the primary data source with the statistics on the practice, whereas the 1997 survey will be used as an indication of the collective disposition. Furthermore, it was deemed relevant because theoretically the habitus of a practice is a product of the past, and the more time a collective disposition is in uncontested existence it lends to further legitimization of the institution it supports (Bourdieu, 1990: 52-54), in this case the national system of recycling.

Today, about 12% of total household waste is recycled and 88% is incinerated, the majority of that latter portion being organic waste with a fair amount of plastic mixed in (Miljøministeriet 2011a: 17). Of the 12% that is recycled the following data will breakdown which waste fractions are recycled and which are not.

Glass and paper are the two fractions that are recycled the most in Denmark, the two fractions are also the ones which Danes have been able to recycle for the longest period of time. 88% of all glass waste is recycled, and 78.6% of all paper waste is recycled (Miljøministeriet, 2011b: 10). The majority of household waste gets picked up at the residency (Miljøministeriet, 2011a: 36). In the survey from 1997, the respondents answer that they get their paper picked up at their residency, whereas the majority of glass recycling happens by supermarkets, parking lots, or squares where containers are placed. However, it should be mentioned, that a big percentage of the respondents who live in apartments, have glass recycling in their courtyard. Common for all glass recycling seems to be that the distance to a place where glass recycling can happen is short. Which makes it very convenient and easy for the respondents to recycle their glass, and often it happens on the way to something else, not a trip on its own (Miljøstyrelsen, 1997: 11). This was also confirmed in the research diaries. A big percentage of metal packaging, from households and industry, is recycled, it amounts to 76.9%, but this percentage also includes bottom ash, which is a byproduct from incineration. (Miljøministeriet, 2011b: 10). Interestingly, plastic is the one material that has not seen improvement in recycling since 1996 – it remains steady at below 20% recycle rate and the majority is from household waste (European Environmental Agency, 2011).

In the survey from 1997, about 30% of the respondents answered that they seperate their organic waste for compost (Miljøstyrelsen, 1997: 7). The majority of the percentage are single-family residences, which makes perfect sense, because it can be difficult to have a compost heap in an apartment complex. The majority of respondents would prefer to sort their organic waste for compost, if given the opportunity (*ibid.*: 48, 72), which shows willingness among respondents to recycle their waste.

Along with plastic and organic, hazardous waste is one of the fractions that is the least recycled, only 24% is recycled, 20% incinerated and 52% disposed, though it should be mentioned that these numbers include industrial waste (Miljøministereiet, 2011a: 29). In the

study from 1997, hazardous waste is one of the categories where there is a big difference within single-family residences and apartment complexes, and that is why they will be looked at separately. In single-family residences the majority of the respondents recycle their hazardous waste, and drive it to the recycling lot, generally they are satisfied with this waste disposal. In the responses from the apartments complex there is no uniformity showing one way of disposing hazardous waste (Miljøstyrelsen, 1997: 83), this indicates confusion about how to properly dispose of the waste. Also there is a fairly big portion that answer that they dispose of the waste in other ways, which often indicates that they throw it in residual waste, or in the case of liquids pour it down the drain (*ibid*.: 14).

Throughout the survey from 1997, which the statistics from 2011 also confirm, it seems that recycling practices are at its highest when it is the most convenient for the respondents. For instance when the distance is short, or containers are located by supermarkets, which makes it possible to recycle on the daily route. Information about how, what and where to recycle seems to be an important factor as well. For instance, paper and glass is easy to recycle, because it is easy to know what is paper and what is glass, where as hazardous waste has many sub categories, which makes it more difficult to figure out where it can be recycled.

The respondents show willingness to recycle, and sort their waste, but often the structures of the recycling practices are missing, which make it more difficult for respondents to recycle. Also the majority agrees that it should be possible to recycle all sorts of packaging, like shampoo bottles (Miljøstyrelsen, 1997: 69, 89). As it is now, there is nowhere to recycle plastic, which neither of the surveys ask about. Overall, this data from 1997 and 2011 points to a collective disposition that is inclined to recycling, when adequate structures are in place to facilitate recycling opportunities for households.

This was corroborated in a 2010 study on recycling practices in the city of Aarhus by Larsen *et al*. where it was found that the highest rates of household recycling were achievable when multiple waste fractions were collected separately at the source (i.e. households or apartment complexes) by municipalities, instead of relying on citizens to bring the sorted waste to recycling stations (Larsen *et al*., 2010: 753). The study examined five potential structural changes to the Aarhus 2005 recycling scheme, which was formerly the same as national schemes outlined above in the 1997 and 2011 data. The research also studied economic tradeoffs to determine how changing recycling rates would affect incineration as the waste

disposal practice, and it concluded that the overarching demand on the energy market was a significant factor in the cost-benefit analysis conducted by municipalities, giving incineration the legitimate edge as a preferable economic choice for household waste disposal (*ibid*.: 749, 753).

This brings the discussion back around to the qualitative links between low household recycling rates and incineration. It can be argued that if there are economic factors involved, it can have a greater effect on the environmental choices made by municipalities, for instance, choosing incineration over setting up more accessible and effective recycling schemes for individuals. This issue of economic interests will be taken up in greater analysis in the next two chapters as it has emerged as a significant qualitative explanation of why incineration is so dominant today. However, this incineration finding, also led the research project to question what the collective disposition was towards incineration in relation to recycling to explore how they conflated to influence household recycling practices.

In a paper highlighting three conducted interviews with experts [3] in the field of waste management in Denmark, the Danish society is portrayed as having high environmental awareness regarding waste management (Hill *et al*., 2002: 3.2). This has been exemplified by the utilization of waste disposal for energy recovery, demonstrations regarding waste disposal opportunities, and realization of waste as environmental problem (*ibid.*). Despite the high environmental awareness for the waste problem, low rates of household recycling are evident. For example, in 2000, households recycling rates were estimated to be 29%, much below the target of 49% (*ibid.*: 3.5). Although more recent data puts that rate at even less, only 12% (Miljøministeriet 2011a: 17). The poor rates were attributed to the lack in municipal collection schemes for organic waste, and inter-municipalities companies, which are distanced from the local communities and civil society initiatives (Hill *et al*., 2002: 3.5) As a solution, the interviewees emphasized the requirement for some market exploitation, for example, plastic recycling and reusing, and the importance in quality of waste collection, where proper separation methods are needed (*ibid.*).

Furthermore, the present infrastructure for district heating from Waste to Energy (WTE)

[3] Lone Lykke Nielsen, Head of Section in the Household Waste Division of the Danish Environmental Protection Agency. Henrik Wejdling, Dakofa, The Danish Waste Management Association - a cross-sectoral forum for discussion of waste issues with members from the waste management industry and local and national government. Jacob Hartman, Greenpeace Denmark

plants seems to be maintained as the primary solution for waste management, as according to Lone Lykke Nielson, head of section in the household waste division of the Danish Environmental Protection Agency, *'incineration is seen as an environmentally sound solution because of recovery of heat and power at all incineration plants in Denmark'* (Hill *et al*.: 3.6). Here, a misrecognition can be viewed, as incineration is seen as a 'green act', where waste becomes a resource for energy, thus recycled. However, incineration is contested as causing different environmental problems, such as, air pollution, hazardous incineration waste and damaging gas emissions. While some argue that dangerous emissions are limited through technology, other studies argue that incineration emissions are still present but technically canceled out through energy production by the savings made to saving fossil fuels (i.e. crude oil) from burning waste as feedstock (Larsen *et al*., 2010: 745). Furthermore, reports have shown that the current method of calculating CO_2 emissions is inaccurate, and emissions are actually greater than assumed (Rørbæk, 2011). Also Danish incinerators on average overstep their boundaries for allowed toxin emissions once a day in total (Bredsdorff, 2012a), further muddying the already unclear waters surrounding environmental risks associated with incineration.

Regarding air pollution in the incineration practice, this highlights the contention that surrounds calculating risk and social benefits within the realm of political and scientific experts. It highlights the complex interweave of societal needs for energy that is increasing, and nearly always at a cost of the preservation of environment. This further problematizes that the decisions of waste disposal are not made in an isolated arena (i.e. waste management institutions), but rather in a field of interlinking yet competing economic, environmental, and societal interests as will be analyzed in more depth in the following two chapters using the theoretical treadmill of production model. These interweaving structures can be argued as influencing the collective disposition as touched on in the data above, but how this is brought about will also be analyzed in more depth in the following two chapters by using the combined theoretical framework.

Before turning to that analysis, the last section of this chapter will outline the Danish waste strategy to triangulate the findings on the practices of household recycling and the predominance of incineration as a waste disposal choice.

3.5. Danish Waste Strategy

Danish waste management is organized in a decentralized way in that the Danish Environmental Agency, under the national waste strategy, sets out general objectives and guidelines for waste disposal. However, responsibility and final decision-making is on the municipal level when it comes to waste collection plans and waste disposal choices, often involving the outsourcing to private companies (Miljøministeriet, 2009: 9). The politics of this system will be elaborated on in the forthcoming chapters but, an important point to note here is that there is flexibility regarding the application of the national waste strategy objectives.

In the Danish waste strategy from 2010, there is a focus on waste as a resource. The objective for many years, has been to decrease the amount of waste that is incinerated, and to increase the amount of waste that is recycled and reused (Miljøministeriet, 2010: 7). The Danish waste strategy refers to the EU waste hierarchy (*ibid.*: 7) as outlined in the problem area, which is used as an indicator of where Denmark is in terms of waste management, and where they need to improve. As it is now, Denmark is in the second to last category in the waste hierarchy, which is because the majority of Denmark's waste is incinerated, and the heat created from incineration is used for electricity and heating in households, so even though the waste is disposed, it creates heat and electricity.

In the strategy much emphasis is put on reducing the amount of resources going to waste, and therefore one of the objectives for 2020 is to increase the amount of waste that is recycled and reused. By 2020 the government has a goal that 50% of glass, paper, plastic and metal, from household waste, should be recycled (Miljøministeriet, 2010: 41). The waste strategy seems somewhat unambitious, because as previously mentioned paper and glass are the two fractions, in Denmark, that are recycled the most, and within the metal fraction, slag (i.e. bottom ash) and electronic devices are calculated, and a calculation from 2005 shows that Denmark is close to reaching that goal of 50% (*ibid.*: 41). Interestingly, glass and paper were some of the first obligatory waste fractions setup for recycling on a national level in 1986 (Larsen, 1990b: 2) and this was because glass is non incinerable (*ibid.*:7), and paper had a low combustion value (*ibid.*). This further problematizes the history of recycling schemes which appear to have aided the incineration practice. Because, taking the environmental viewpoint for recycling, these two waste fractions are actually the least harmful for the environment when compared to disposed organic or plastic waste fractions (*ibid.*).

In the Danish waste strategy it is emphasized that waste management is a collective responsibility, and that all groups/actors in society should do theirs to improve recycling and reuse of waste (Miljøministeriet, 2010: 10). It is important that all pull their weight to reach the goals, companies as well as individuals, and it is important that the government and municipalities provide the needed means to go through the plans for increasing the amount of recycled waste (*ibid*.). The amount of waste should be decreased on the production level, as in less packaging, and on the individual level as buy less, and to purchase environmentally friendly products, repair products and reuse products through exchange and sale (*ibid.*: 13). On the municipal level, they are to provide individuals with the means to recycle and reuse products, and on the national level provide economic support and guidance, and help individuals pick the environmentally friendly products through different tools (*ibid.*: 14). The strategy seems to be quite undefined, as no real initiatives are proposed in the strategy, and only vague guidelines are given.

It seems that the general understanding is that Denmark is fairly competent at recycling and reusing their waste, and it is said in the strategy from 2009, that Denmark is recycling a big part of their waste, and they want to keep the low disposal rate and the high recycling rate (Miljøministeriet, 2010: 5). There are no new initiatives for recycling and reuse (except for batteries), because it seems that the capacity of the incineration plants is about equal to the amount of waste, and therefore no new initiatives are taken (*ibid.*: 21).

Incineration is the primary waste disposal in Denmark and it does not seem like there is a move away from incineration. In the plan there is a focus on the recycling of resources, but again without clear plans on how to implement this (Miljøministeriet, 2009: 7). The Danish government is still positive about incineration, and other ways of waste disposal are not being discussed, when looking through the waste strategy plan for 2009-2012. It is the responsibility of the municipalities to make sure that the incineration capacity is enough to handle the amount of waste (*ibid.*: 9). Because of recent increase in the amount of waste, the capacity of the incineration facilities has to keep up with the amount of waste being produced. The capacity should not be too small, as that means that waste has to be stored for shorter or longer periods of time, before it can get burned, which means different environmental harms. On the other hand the capacity should not be too big, as this means that recycled fractions like paper and cardboard could be under prioritized and burned instead. Also, financially is it expensive to have overcapacity that is not being used (*ibid.*: 11).

The use of incinerators for residual waste, is also the only waste disposal operation which has a cost due to a tax on incineration (527 DKK per ton) (Larsen *et al.,* 2010: 749). Recycled materials such as paper, glass, steel and aluminum are income generating for the private waste handler (341-1233 DKK per ton); the exception is plastic for which there is no recycling market in Denmark (*ibid.).*

The waste strategy plan from Copenhagen municipality for 2013-2018, appears to be more ambitious than the waste strategy from the Danish government. Much more emphasis is put on recycling of waste, and the reuse of resources. For instance, three new recycling lots are going to be built before 2018, and more bulky waste facilities will be available in residents' courtyards. By 2018, all of Copenhagen should have access to recycling facilities, and 45% of all household waste should be sorted for recycling (Københavns Kommune, 2013: 10-11).

However, this project questions the usefulness of these schemes if the aim is to truly make a significant leap into high household recycling rates. If these facilities are more 'bring-to' stations instead of 'pick-up' systems then it would seem to be a poor structural choice based on the findings above. Moreover, it still appears there is no planned strategy for recycling household organic and plastic waste. In addition, these facilities will need to be accompanied by some clear instructions and awareness campaigns for the citizens as it is not enough to only distribute new facilities, but citizens must be aware of how, what and where to recycle.

3.6. Preliminary Conclusion

In summary, the research diaries outlined the main challenges in urban households recycling waste management. The power relations between recycling dispositions of the urban resident and the external conditions of municipal waste management are reflected, and some issues are highlighted, such as, accessibility to designated bins for recycling of plastic, metal, and organic waste. Despite the intent to recycle and sort the main types of waste, external conditions maintained mixing waste disposal, where all types of waste are disposed to a general waste bin and incinerated. In the diaries, the researchers describe challenges and considerations regarding recycling waste practices. However, the current habit of disposing all types of waste to one general container seems to be difficult to change for urban households, especially, when accessible recycling facilities could not be found or confusion was noted regarding the waste type.

The Nørrebro waste model exemplified a case, where recycling facilities exist and some degree of collaboration between urban households and private initiative are taken. Here, more waste is being recycled, although some challenges occurred regarding the power relation between disposal disposition and the external conditions for recycling. Guidance and information for the residents were needed in order to maintain the urban households recycling practice, further highlighting the requirement for collaboration between urban households and recycling facilities and methods.

The data from the statistics and waste strategies confirmed the objective structures that were highlighted in the above, that the citizens are willing to recycle their waste, but structural conditions hinder the recycling practice. Household collective ambitions for waste recycling are high. However, their waste recycling practices and initiatives are low, and if action has to be taken, private initiatives have to step in. As shown throughout this chapter, due to lack of 'higher' structural recycling conditions, recycling practices will be a challenge. As previously mentioned, the only fractions that are properly being recycled are paper, cardboard and glass, which are the fractions where government initiatives were taken to improve the recycled amount. What can be found through this chapter is, that recycling practices can be changed and improved when it is made convenient to do so, but there is a need for an overall structural change.

From this chapter incineration also emerged as a practice that seems to interlink with the structural decisions made in the waste strategies regarding household recycling or rather the lack thereof. As mentioned throughout the chapter there appears to be a complex interweave of social, economic and political interests which overlap in the playing field of waste management and influence the specific decisions made in when to recycle and what to recycle. Furthermore, it was found that the collective dispositions towards incineration was favorable and showed acceptance of the practice as a form of recycling with benefits to society. This then led the research project to inquire further into these somewhat conflictual collective dispositions of favoring recycling and incineration, by questioning in chapter four how the habitus was shaped historically and which social, political and economic structures influenced the micro and macro practices of waste management, namely those of household recycling and incineration of household waste.

4. Historical Outline of Shifts in Waste Management

4.1. Chapter Introduction

The aim of this chapter is to answer the second research question *How have notable political, economic and social historical shifts in Danish society since the 19th century shaped the current household recycling practices and the practice of incineration as a disposal choice for waste management?* by building on the previous chapter's findings and analyzing additional secondary data in an ethnographic content analysis. This chapter will discuss some of the notable historical shifts in Danish waste management, not only it's internal organization, governance, and environmental values, but also external societal and economic conditions which may have shaped the current recycling practice of household waste. This chapter outlines five stages which this project considers to be pivotal moments of structural change. Notable, not only because they exemplify a historical rise and decline of recycling, but also because empirically they show how incineration emerged as the dominant and legitimized waste disposal practice in Denmark. This chapter will also explore the practice by looking at how and the extent to which Danish citizens had agency in the waste management practice at these stages, and it will discuss how citizen's collective disposition changed in regards to incineration as a waste disposal means.

These five stages are outlined in the following sections: **(4.2)** Stage one: Waste as a health problem and the institutionalization of waste management (1850-1940); **(4.3)** Stage two: Waste is recycled and provides jobs (1940 -1945); **(4.4)** Stage three: Waste Increases and Recycling Declines (1950's -1960's); **(4.5)** Stage four: Waste becomes a political and environmental problem (1970's -1990's); **(4.6)** Stage five: Incinerated Waste is a Resource (2000-present day), and finally in **(4.7)** a preliminary conclusion will answer the second working question.

4.2. Waste as a Health Problem and the Institutionalization of Waste Management (1850-1940)

The first stage begins during the last half of the 19th century. At the time, Copenhagen experienced an urban growth boom where resident numbers increased by a factor of 5, so that by 1901 Copenhagen residents represented 19% of the national population (Andersen & Engelstoft, 2004: 56). This urbanization was largely due to increased industrial job opportunities, as Copenhagen offered more than half of all manufacturing jobs in the country

(Andersen, *et al.* 2011: 601). A byproduct of this urbanization was a sharp rise in the volume of household waste and the need to institutionalize the handling of waste disposal. In the late 1850's household waste posed a health threat as waste was left in the streets causing Cholera outbreaks (Kleis and Dalager, 2004: 28). In response, municipalities organized the collection and landfilling of waste locally. By 1903 the densely populated municipality of Frederiksberg lacked suitable landfill sites to handle the rising volume of waste (*ibid.*: 6).

This waste disposal crisis heralded the start of the waste incineration practice in Denmark. In 1903 Babcock & Wilcox Vølund built the first incineration plant as a solution for the increased volume of waste (Kleis and Dalager, 2004: 6). The economic advantage was the co-production of steam combustion which was used for heating at the local hospital in Frederiksberg (*ibid.*: 7). The disadvantages were mostly concerned with the noxious pollution released from the process of burning material.

By the 1930's urbanization had also increased the township population in other Danish provinces due to improvements in the transportation systems (i.e. railways and shipping lines) and agricultural technologies (Andersen *et al.,* 2011: 602). Both created access and opportunities for labor from small rural communities. Once again, waste disposal was a challenge and burgeoning landfill sites were claimed to be posing a health problem in Aarhus, and Gentofte also ran out of adequate landfill space (Kleis and Dalager, 2004: 14). The solution -- two more incineration plants were founded in these cities by Vølund Co., where efficient machinery was developed to tap into producing electricity for the local housing districts (*ibid.*). In 1931, the incineration plant in Gentofte was inaugurated with the Prime Minister Thorvald Stauning in attendance (*ibid. :9*). By the time the Aarhus plant was built in 1934, it warranted the attention of King Christian X who along with the Mayor of Aarhus, H.P. Christensen visited the plant before the lavish inauguration which was covered by the national press (*ibid.:* 15-16). Denmark's cutting-edge incineration development was attracting international attention, by which Vølund Co. had established themselves as the leading supplier in the incineration industry serving Denmark, Sweden, Germany and the UK (*ibid.*).

However, not all residents were enthusiastic about the developing incineration plants and the first process of political claims-making regarding incineration appears to have arisen in 1926 spurred by the state-owned Danish railway company's (DSB) land-use interest near Aarhus. At the time DSB wanted to purchase the existing Aarhus landfill site and surrounding farms

which were earmarked as future landfill sites by the municipalities (Kleis and Dalager, 2004: 15-16). DSB petitioned for the removal of the site and campaigned to highlight the "El Dorado" of millions of rats at Aarhus landfill (*ibid.*). As a result, incineration was deemed a health and sanitation choice by Mayor H.P. Christensen who was already an advocate in the political debate on incineration. Using 'strong-arm tactics' he was able to overrule any concerns by 'professional grumblers', as he called them, who opposed smells, gases, or pollutants caused by incineration and by 1934 the Aarhus Incineration plant was opened (*ibid.*).

4.3. Waste is Recycled and Provides Jobs (1940 - 1945)

At the second stage, an interesting shift in waste management occurred. Here, during WWII, waste became a reusable good in both the industrial and household dimensions resulting in a national-level recycling program born out of scarcity. The German occupation restricted imports used for fire heating plants such as H.C. Ørsted Værket in Copenhagen which only maintained a five month reserve (Kleis and Dalager, 2004: 16). Shortages in fuel forced inventiveness in finding alternative feedstocks from industrial waste and other raw materials further merging the two industries of energy and waste. Old fly ash from the incinerators was dug up and reburned at the heating plants as it contained small but usable levels of coal; industrial waste of oil, tar, wood shavings, sawdust, or rubber were also used as feedstock (*ibid.*).

Simultaneously, in 1940 household waste was 'salvaged' and sorted professionally for the first time in a private initiative organized by the National Society for the Combating of Unemployment (L.A.B.) (Kleis and Dalager, 2004: 16.). It created hundreds of new jobs nationwide to combat the rising unemployment. The former 'street scavenger' was replaced by a professional L.A.B employee in a highly organized and effective scheme where their slogan was *'Waste is not a waste when the refuse salvagers get it'* (*ibid.*). As a result recycling and reuse rates of household waste were very high during the war leaving practically nothing behind for the incineration plants (*ibid.*). For instance household and restaurant organic waste was used to sustain pig farms. In addition, other national rationing and recycling schemes were started such as the one where Danes were encouraged to deposit or resell any old rubber products to the 'Rubber Committee of the Danish Industries.' This data shows how it is actually possible to radically alter the collective practices towards recycling, as long as the dangers of not doing so are felt as "real".

It could be analyzed that this period marked the start of new collective disposition that regarded waste as a resource. The scarcity of the war, as an external condition, had changed the habitus of waste management by increasing the recycling practices through a change in collective recycling dispositions, to the point that nearly all Danes were directly involved in reuse or recycling schemes of some kind. As a result waste became valued as a commodity by both the individuals and industrial sector. Consequently, during these years incineration dwindled as the predominant institutional waste management practice.

On another note, due to a lack of financial resources post WWII there was a pause in the expansion of incineration plants for over 25 years (1934-1960). But this was not to last.

4.4. Waste Increases and Recycling Declines (1950's-1960's)

The third stage is marked by a dramatic increase in waste production post WWII, as a result of the rapid increase in levels of economic activity (Gandy, 1994: 1) and a change in consumption patterns. The rapid increase in municipal solid waste in western economies, such as Denmark, is attributed to some socio-economic factors, i.e. rising variety levels of material goods, cheaper consumer products, 'built in' obsolescence in products, increasing usage in packaging, changing patterns of taste and consumption, and high demand for convenience products (Crowther J, 1974, Harwell M, 1958, Packard V, 1960, *cited in* Gandy, 1994: 1).

Denmark's economic growth restarted in the 1950's. Denmark's manufacturing industry peaked at an all time high of 30% of GDP (Christiansen, 1996: 68) and this rapid economic growth continued through the 1960's with the start of high government spending through welfare services (Andersen & Engelstoft, 2004: 56), and the emergence of the consumer industry in Copenhagen (*ibid.*:57). With more equal job opportunities and higher incomes (*ibid.*) private consumption rose sharply and in 1967 Danish household expenditure [4] peaked at an all time high when it represented 59.56% of GDP (World Bank Statistics *cited in* IndexMundi).

[4] GDP measured by the *expenditure approach* calculates the value of expenditures on final goods and services by residents and institutions in a national economy during a given period. It is calculates private household consumption (C), plus investment by firms (I), plus government spending (G), plus net exports (EX-IM), equals GDP

Danish consumption trends changed in the late 1950's when new plastic and disposable consumer products entered the market. The Danish plastics industry began to create new disposable packaging products and plastic bags entered the market for the first time (Kleis and Dalager, 2004: 20). Women entering the labor market required new disposable market goods to streamline family life and work balance, such as diapers, baby bottles, milk cartons, and juice packets (*ibid.*). Danes become convenience consumers and quickly developed new norms of 'buy-and-throw' instead of repairing old items (*ibid.*) due to time-value prioritizations in the everyday life. It can be analyzed that these new external conditions, the shift towards more women on the labor market and spending less time at home as housewives, further legitimized the production of new comfort products and expanded the total volume of household waste. This exemplifies how citizens are complicit in running the treadmill of production by maintaining a demand for consumer goods which require the withdrawing of scarce natural resources, such as oil in the case of plastic or disposable goods manufacturing, and have manifold negative externalities or 'inputs' on the environment, such as pollution from chemical processes in the production or increased volumes of waste.

More importantly, the resultant problems arising from this magnitude of waste 'inputs' was largely unacknowledged at the time by all parties (i.e. the general population, the state and economic industries). This increased 'input' of waste pollution to the ecosystem was not recycled, as by the end of the 1960's the L.A.B. recycling scheme ended as unemployment was less of a problem in light of the economic boom (Kleis and Dalager, 2004: 20). This is an example of how up until this time, the justification or basis for household recycling programs was less associated with a collective disposition towards environmental preservation values, and rather a product of jobs creation or a response to tangible resource scarcity felt by the community (see section **4.3**).

Consequently, when the L.A.B program ended household recycling rates dropped. Meanwhile, absolute levels of waste increased as a culmination of the aforementioned socio-economic factors. Once again, the solution was to turn towards incineration to handle the disposal of municipal solid waste in the growing urban areas. By 1963 the rapid expansion of 'dormitory' urban housing complexes also created nationwide demand for new heating plants (Kleis and Dalager, 2004: 22). Moreover, the oil crisis in 1973-74 caused the Danish industry leaders and government to seek more reliable sources for energy production (*ibid.*: 31). Both cases led to municipal waste being recognized as an industry solution, causing more resource

investment into WTE development. Here the power relations between external structures and citizen's dispositions collaborated towards a mutual interest in the field of waste management: citizens received reliable and accessible heating and electricity which enhanced the legitimization of the waste incineration industrial process.

As a result, during the 1960s-1970s municipal waste collection schemes attracted private companies to the market and waste started to be valued as a resource for energy recovery. This lead to a change in the political context and definitions of recycling (Gandy, 1994: 5). Specifically in the greater Copenhagen area, two large capacity inter-municipality WTE plants were established. Namely, Amagerforbrænding and Vestforbrænding, in association with two sanitary landfills for disposal of bottom ash and other leftovers of the incineration process (Larsen and Børrild, 1991: 242). Many other small WTEs were opened by *Bruun & Sørensen A/S (B&S)* a viable competitor to Vølund Co. (Kleis and Dalager, 2004: 22). It is interesting to note that by 2002 this company was bought out by Babcock & Wilcox Vølund ApS, and throughout the five stages Vølund emerges as a major market player in the incineration industry. Other WTE industry developers at the time were *Helsingør Jernskibs- og Maskinbyggeri, A/S E. Rasmussen* and *Staalmontage.* In 1965, Rambøll & Hannemann (R&H) emerge as industry leaders (consulting) in incineration/waste plant processes with the construction of Vestforbrænding (*ibid.*). This fierce competition to "get a slice" of the new WTE market, meant that by 1984 there were 48 incineration plants treating municipal solid waste in Denmark and three on the Faroe Islands and in Greenland (*ibid.*), firmly establishing incineration as the dominant waste disposal practice.

Another important waste management shift was that in 1964 the responsibility for the collection of household waste in Copenhagen was also re-contracted out to a private company, Renholdningsselskabet af 1898 (R98) (Larsen and Børrild, 1991: 243). While the municipality maintained its inspection rights on the process of waste collection, the collection scheme was essentially turned over to private decision makers. This further alienated citizens from the decision-making process and removed opportunity for public agency regarding the waste management collection schemes. Instead, decisions were made in accordance to profit maximization of firms. At the same time this reinforced the lack of civic responsibility for waste collection decisions which were removed from the realm of public debate.

Furthermore, this period strengthened the disposition of industrial leaders to regard waste as a

valuable resource for energy generation even though this period was marked by low thermal efficiency (heat recapture rate of steam); in most plants efficiency was under 60% (Kleis and Dalager, 2004: 24). Interestingly, by 1967 the calorific value of municipal solid waste (MSW) had tripled through the introduction of new synthetic and plastic waste fractions (*ibid.*: 21). Calorific value measures the amount of heat produced per unit of fuel or waste during combustion. Higher caloric values means more heat or energy is extracted and resold. In 1967 the process of pyrolysis (the thermal decomposition of carbonaceous materials in the absence of oxygen) was introduced to further increase the calorific value of waste (*ibid.*). Current median calorific values are 14.8 MJ/kg for MSW or 32 MJ/kg non-recycled plastics when separated (Themelis *et al*, 2011: 6). To give an example, through pyrolysis 1 ton of non-recycled plastics converts into three barrels of crude oil (*ibid.*: 23).

This technical data further exemplifies the treadmill of production theory by showing that incineration of waste has been an environmental degradation dilemma, with room for political debate over negative environmental impacts and industrial use of scarce natural resources (Schnaiberg, 1980: 424). When plastic waste fractions are incinerated instead of recycled it has a short-term economic benefit to the energy industry by producing more resell able heat and electricity. However, the negative cost of this energy production exchange is that in the long run it perpetuates the 'withdrawals' of exploiting new raw materials such as fossil fuels for new plastic products. Moreover, waste incineration was not a win-win situation for the environment: in this waste to energy exchange there are also 'inputs' of toxins or pollutants to the environment. Empirically, this will be shown in the next stage where increasing volumes of waste kept challenging the WTE plants and the sanitary landfills and new pollution problems arose, more specifically dioxin pollution and leaching began to attract political attention.

4.5. Waste Becomes a Political and Environmental Problem (1970's-1990's)

The fourth stage can be marked as beginning in 1971, when under the Social Democrat's government, the Ministry of the Environment was established (formerly known as the Ministry of Pollution Control). In 1972, the newly instituted Pollution Board produced a pamphlet on air pollution from waste incineration flue gas. It recommended restricted levels of dust and acid gases (HCl and SO_2) to reduce the emissions of toxins. However, it was not well received by the industry and the response from the published periodical of the Society Danish Engineers called it an '*emission of hot air*'; according to Kleis and Dalager, the

industrial attitude was '*How can you regulate on the basis of a pamphlet?!*' (Kleis and Dalager, 2004: 29).

The first environmental legislation on incineration (Environmental Protection Act, 1974) attempted to further regulate the industry in two key areas. It established sanitary disposal procedures of bottom ash and established an approval scheme for *Heavily Polluting Enterprises* (Kleis and Dalager, 2004: 30). However, both areas appear to have been contested by the industry and had apparent loopholes for continued practices of environmental degradation.

Firstly, this was because the policy was based on a "balancing principle" whereby environmental concerns should be '*balanced against the costs and economic consequences of the measures in question*' (Christiansen, 1996: 32). Any decisions made by public authorities could be taken up at the newly instituted Environmental Appeals Board which had a corporatist trait, and as was often the case, economic interests were negotiated at the cost of environmental protection (*ibid*.). Secondly, strong interest groups [5] were involved in the formation of that first policy and one of their main arguments was that decentralization of power was crucial to the proper regulation of industrial activities (ibid.: 33). This was supported by the Liberals (*Venstre*) and the Radical Liberals (*Det Radikale Venstre*) who were also cautious about giving the Environmental Minister too much discretionary control (Christiansen, 1996: 34). In the end, decentralization won out and the final environmental governance on the national level presented mere guidelines, not hard and fast rules. Thirdly, the inspection teams were inadequately equipped for their task (*ibid.*). When coupled with policy loopholes, quality checks on old plants were lenient. Only 50% of the *Heavily Polluting Enterprises* had obtained the approval permits over a 17 year period (*ibid.*). Even those who had been denied a permit had received exemptions to operate for up to eight years until they could upgrade (Kleis and Dalager, 2004: 30).

The result was that the deregulated inspection and control system was very vulnerable to economic pressures, especially in the late 1980's when the structure was faced with the choice of maintaining high environmental standards or combating the rising unemployment through continued industrial production (Christiansen, 1996: 35). Again, this is supported by the

[5] Danish Federation of Industries (Dansk Industri), the Agricultural Council (Landbrugsrådet), the National Association of Local Authorities (Kommunernes Landforening) and the National Association of Counties (Amtsrådsforeningen)

treadmill of production model which explains that in a showdown, societal needs such as employment, will take precedence over preservation needs of the environment (Schnaiberg, 1980: 244-246).

Consequently, environmental problems persisted within the new institutional structure of waste management through till the late 1990's. Oil and chemical waste was delivered straight to the sanitary landfills without being collected in the proper receiving stations beforehand; this meant hazardous waste disposal was not following the obligatory protocol and large quantities were illegally transported to landfill sites (Larsen and Børrild, 1991: 244). Toxic leachate was discovered in some of the landfills sites in Copenhagen area, for example in 1986 in a Vestforbrænding landfill site (Ganløse) posing a health risk to the local groundwater supply. At the time there were no landfill sites that guaranteed separation between groundwater and toxic leachate (*ibid.*). Air pollution was another problem. An outcome of incinerating PVC was that large quantities of hydrochloric emissions contributed to forest death and acidification (decrease in PH) (*ibid.*: 245).

The first dioxin survey was done at the Varde incineration plant in 1980 and the dangers of the emissions in flue gas were noted. However, it took 23 years for legislation to officially regulate a dioxin limit (Kleis and Dalager, 2004: 32). There had been previous attempts to limit the rate of dioxin emission in 1986, 1989 and 1994 but they '*failed to materialize*' (*ibid.*). In 1986 it was suggested by the Danish Environmental Protection Agency that one step to solving the rate of emission was to require existing incineration plants to upgrade to auxiliary burners [6]. After a tryout in the VEGA incineration plant, on the outskirts of Copenhagen, this was deemed operationally problematic and an expensive investment so the case was dropped (*ibid:* 33).

Then, in 1989 when an EU directive mandated the auxiliary burner upgrade, the Danish Environmental Protection Agency (EPA) skirted the issue by finding a *'"shrewd" wording requiring that only green-field plants should install auxiliary burners'* (Kleis and Dalager, 2004: 33). Once more in 1994 the incineration upgrade issue was addressed by the EU commission, but as two industry actors explained it *'...thanks to determined lobbying, also by*

[6] According to the EU incineration directive (2000) in order to minimize the escape of toxins in flue gas, waste must be brought to a combustion temperature of 850-1100 degrees Celsius within 2 seconds (European Parliament, 2000: L 332/97). Auxiliary burners are supplemental burners which assist in the rapid ignition of the combustion chamber and stabilize the temperature when waste is of a low calorific quality.

Danish organisations, the final version of the directive – and hence the Danish order – contains an exemption clause' (ibid.). It wasn't until 11 March 2003 under Order no. 162 of the EU Directive 2000/76/EC that Denmark finally had to enforce dioxin limits and the requirements led to the eventual closure of several incineration plants decreasing the total number of 48 to 33 *(ibid.).*

This last portion of data can be theoretically discussed as a case of political contention within the claims-making process at various domestic (EPA and incineration plants) and international levels (EU). The Danish government initially had grounds for reducing dioxin emissions through the 1980 Varde report. However, their definition of the situation and nominal attempts at environmental protection was apparently contested by the industry as seen in the 'failed attempts' to regulate the practice. Furthermore, it appears that the Danish EPA backpedaled on their warranted environmental solution (auxiliary burners) when it boiled down to economic costs which the industry was reluctant to incur. Finally, the EPA even contested the EU regulation twice, aligning instead with the domestic industrial will. This problematizes the dualistic role of the state in regulating the treadmill of production: the state, in this case the EPA, faced the conflicting role of mediating between environmental protection whilst simultaneously ensuring optimal conditions for continuance of maximum economic growth. This case followed the treadmill of production model in that the domestic economic interests once again took precedence over environmental protection, but only until such a point as it became politically impossible to outmaneuver the stronger political power, in this case the EU. This is not to say that Danish environmental governance was stagnant during this period. Rather, tightening control in favor of environmental values was incremental as it took time for the industrial dispositions to regard the environment as a significant issue.

In contrast, Danish citizens' concern over the environment was peaking at an all time high in the 1980's and was influential in placing the environment on the parliamentary agenda (Christiansen, 1996: 34). Citizens enjoyed a greater degree of agency through membership to politically connected organizations such as Greenpeace and the Nature Conservancy Association (Danmarks Naturfredningsforening), both of whom channeled media attention towards their claims-making bids and raised the citizens' collective knowledge regarding environmentally risky practices (*ibid.*). In 1989 Danish membership to Greenpeace was it's highest ever at 45,000 members (*ibid.*:60) and in the mid 1980's the Nature Conservancy

Association had more than 250.000 members (*ibid.*:59). This environmental peak is highlighted by looking at a 1987 a survey which showed that 51% of voters '*totally disagreed that economic growth should be pursued even at the expense of the environment*' (Togeby 1995, *cited in Christiansen*, 1996: 39).

However, in the 1990's that same poll showed that only 31 percent of voters still felt the same way (Togeby 1995, *cited in* Christiansen, 1996: 39), and at the same time membership to Greenpeace and the Nature Conservancy Association dwindled to less than half of the 'golden days' (Christiansen, 1996: 59-60). What could have changed citizens' collective participation in environmental politics in this way? Does this mean that Danes were less concerned about the environment and how incineration was affecting their lives in the following years?

Before jumping to that erroneous conclusion it is interesting to note empirically that from 1982-1994 all Danish Political parties, both the left and right wings, responded to the "greening" movement of the electorate by including environmental priorities in their party issues although to varying degrees (Christiansen, 1996: 39). This period of the mid 1980's to mid 1990's was also marked by several new legislative directives on waste management and incineration (i.e. CO_2 tax, and incineration tax) (Kleis and Dalager, 2004: 38), new subdivisions for waste operations, new (but short lived) state led pilot programs in organic recycling and composting (Larsen, 1986, Larsen, 1990a, & Larsen 1992), the initiation of the privately run 'pant-system' to collect, recycle and refund consumers on deposits made for bottles and aluminum cans (Dansk Retursystem A/S), and the obligatory recycling of household glass and paper waste in 1986 (Larsen, 1990b: 2).

Theoretically, in light of these structural political shifts it can be discussed that perhaps the Danish collective disposition was changed at this point to regard the state as looking out for the collective environmental interest of the electorate in regards to waste disposal. Through hegemonic environmental concern by all political parties, and an effective system for committee representation of environmental issues for legislation proposals (Christiansen, 1996: 40-41), the citizens' concern were placated thus negating the need for action.

Furthermore, it can also be discussed that this time period (1982-1994) marked the institutionalization of environmental politics where scientific experts and consultant agencies began to move into the realm of political decision-making, and the details of the claims-

making process to do with waste management's *best practice* became much more technical. The effect of this institutional shift on the collective disposition could be discussed in line with Bourdieu's theory of power, in that this lack of technical understanding amongst the public, both government and citizens, diminishes their political astuteness so they are unable to recognize or determine when a claim about incineration or it's environmental risk is being shaped to serve a particular economic or political interest. The result is a further shrouding of the playing field of waste treatment within environmental politics from public participation. This can be seen empirically in the 1990's when Danish citizens protested the incineration practice: one study found that citizens' opposition was subdued when *"the environmental authorities were able to persuade people that incineration plants were able to limit dioxin emissions"* (Hill *et al*, 2002: 36). This was a culmination of stricter emissions requirements through the years which according to the study meant that by 2002 '*...the public has now accepted incineration as "people know we use the energy from incineration"*' (*ibid.*). At this point it can be noted that through this process of acceptance, the incineration practice became legitimized by the public.

However, previous to any possible consensus on incineration, in 1993 legislation essentially established incineration as the official waste disposal practice when under the political 'biomass agreement' it stated that, *'...the application of waste for combined heat and power production must continue to take precedence over other kinds of fuel'* (Kleis and Dalager, 2004: 41). This was further reinforced with the 1997 ban on landfilling any incinerable waste (*ibid.*). Denmark was one of the first countries to abandon the use of landfills, and use incinerators instead (Copenhagen Cleantech Cluster, 2012 : 9).

4.6. Waste is a Resource (2000 - present day)

In this fifth and final stage, waste is no longer viewed as a useless by-product from production but as a valuable resource (Copenhagen Cleantech Cluster, 2012: 4). Not only in the most logical sense, where household consumption waste is a potential resource for reuse and recycling, as is emphasized in the the latest Danish waste strategy 2009-2012 that waste be a used as a resource with renewed focus of moving up the waste hierarchy as previously outlined in chapter three (see section **3.5.**). The Danish waste management institutions also established household waste as a sound resource for energy production. This political claims-making decision has strategically opened the door to two other 'waste is a resource' markets: firstly, through the questionable recycling of waste incinerated bottom ash, and secondly,

through the the exporting of incineration expertise. Both of these markets will be discussed in the following section to highlight how their economic market opportunities are external conditions that reinforce the legitimized practice of incineration as Denmark's disposal of choice.

The expertise of the waste management sector (private and public) in Denmark has been increasing rapidly in the last several years, despite the financial crisis, and a majority of the companies have had an increase in activity and employment (Copenhagen Cleantech Cluster, 2012: 6-7). This is not a sudden change as throughout the five stages certain Danish waste supplier companies were leading the research and development of incineration on an international level, namely the company Babcock & Wilcox Vølund AS. In 1999, the Danish exports of environmental products and consulting services in waste management amounted to DKK 427m. (Danish Environmental Protection Agency and Danish Ministry of Environment and Energy, 2001: 12). Of that amount, incineration products and consulting accounted for 69% the exports (*ibid.*) and foreign demand has been growing annually. By 2008, incineration exports were estimated at DKK 4 billion (Kjær *et al*., 2011). Commenting on Denmark's presence in the international incineration market the EPA said, *'the strong foothold in incineration plants is firmly rooted in Denmark's deliberate choice to incinerate and exploit the energy obtainable in waste suitable for such incineration'* (Danish Environmental Protection Agency and Danish Ministry of Environment and Energy, 2001: 20). This data shows that new cutting edge incineration plants such as Amager Bakke, which will be discussed in the next chapter, is an important means of product advertisement through which Denmark gains valuable international contracts. Citizens are probably unaware of the value this 'incineration advertisement' brings to the national GDP but the following chapter will discuss how the interested parties maintain political support for continued incineration practice through claims-making.

Returning to the questionable 'waste is a resource' discussion: today incineration is touted as an environmentally sound choice by the industry and is apparently supported by the public. This has further legitimized the practice as a recycling effort and energy producer. However, this paper finds that certain elements of the practice still leave room for collective misrecognition regarding the level of political lobbying and scientific discretion in the 'waste as a resource' claims-making process. One empirical example is in the case of bottom-ash.

For every ton of waste incinerated approximately 200-280 kg of bottom ash (remaining residue) is produced and must be used or disposed of in some manner . Bottom ash can vary in quality and toxicity depending on post-incineration treatment procedures and the original content of the waste, but will typically contain high levels of chloride and heavy metals. Until 1973, most bottom ash was landfilled within Denmark but with the establishment of the Environmental Ministry it became apparent that toxins were posing a threat to groundwater supplies through leaching (Kleis and Dalager, 2004: 29). As a result the 1974 legislation restricted the landfilling of bottom ash to allow only hazardous bottom ash to be dumped in specially designated 'sanitary landfills' (*ibid.*). It also imposed a tax on waste incineration per ton (*ibid.* 38).

The legislation did not reduce the amount of annual bottom ash produced. It did however create a new market for the utilization and sale of bottom ash as a good within construction in particular as a sub-base substance in cement mixtures for road works (Crillesen & Skaarup, 2006: 9). Bottom ash was a marketable substitution product as Denmark has diminishing natural supplies of gravel (*ibid.*). Within a short time, 98% of bottom ash was reused in some such capacity (i.e. parking lots, embankments, roads, industrial building bases) and the high percentages of reutilization remains today (*ibid.*).

However, the bottom ash market remained unregulated and continued to pose an environmental threat until the Bottom Ash Order of 1983 finally stipulated conditional uses and three environmental quality levels for the testing of toxicity (Kleis and Dalager, 2004: 28). Nevertheless, most of the bottom ash was not meeting the highest quality criteria and thereby restricted to particular uses for low grade product. These regulations were revised in 2001 in an effort to improve the bottom ash market and the result was that quality testing *'...is assessed on the basis of its environmental impact (leaching) and less on the physical or chemical characteristics of the material'* (Crillesen & Skaarup, 2006: 29). Since 2001, it became the responsibility of the incineration plant to test and analyze the quality levels of bottom ash before further marketization and utilization (*ibid.*). New technical processes were implemented to upgrade the product by changing the chemical composites and removing trace metals (*ibid.:* 35).

Despite such measures and a loosening of the quality criteria, most large incineration plants in Denmark *'...found that even with chemical treatment it was not possible to meet the very low*

leaching criteria set by the Ministry of Environment, although it came close' (ibid.). In 2006 it was evident that this was impacting the market of bottom ash utilization as a good. The resultant need for environmental claims-making by industrial players regarding the risk is voiced in a joint report by I/S Vestforbrænding incineration plant and the slag bottom ash treatment plant AFATEK A/S,

> *'...it seems impossible to meet the acceptance criteria* [...] *Will it be publicly acceptable to maintain more lenient utilization criteria* […] *It is an unanswered question, but maybe with arguments based on specific, scientific calculations of the maximum allowable impact on the environment, calculated for each specific contemplated land use (type of construction work), it will be possible to persuade authorities and public opinion...* (Crillesen & Skaarup, 2006: 31-32)

A paradox is that on the one hand Denmark is positively noted as a forerunner of recycling and reutilization of bottom ash and an innovative industry leader (together with the Netherlands) within in the EU bottom ash market. However, environmentally these solutions may be shortsighted by overlooking the fact that *'sooner or later the constructions will be demolished and pollutants will be set free'* (Crillesen & Skaarup, 2006: 32*)*. This continued threat to Danish groundwater supplies led the Danish waste strategy (2005-2008) to attempt a decrease in the rate of utilization to 85% (*ibid.*:41).

However, while the market demand for the product in Denmark remains higher than the current supply, companies with a vested commercial interest are angling for further growth in the use of bottom ash. Notwithstanding, the industrial players are facing barriers when citizens get involved and are aware of this specific recycling paradox as the same report points out:

> *'In several regions MSWI* [Municipal Solid Waste Incineration] *bottom ash is unwanted because of its potential environmental impact. These regions refuse to approve applications of MSWI bottom ash, practically laying a ban on the utilization of bottom ash. Not being aware of the scientific and legislative facts however, the local authorities tend to have an emotional approach to the subject, influenced by public opinion. The* [market] *trend is in larger projects with the authorities (especially the Danish Road Directorate) as an active player'* (Crillesen & Skaarup, 2006: 46).

In this case, incineration as a practice appears to have it's limits as a longterm solution especially when bottom ash is a 'dormant expense.' Private property values decrease when bottom ash is in the foundation, removal is restricted (relocation of environmental toxins) and expensive. Public property may also face expenses in future demand for removal (Crillesen & Skaarup, 2006: 41).

Theoretically, the whole last section on bottom ash as a 'resource' can be discussed to show that the treadmill of production continues, and capitalism (i.e. firms and industry) is quick to adapt to new political stipulations which try to regulate environmental risk. In response, incineration is being done under the banner of recycling. However, most of the public is likely unfamiliar with the contested 'risk' claims and decisions regarding the definition of the situation.

Theoretically, there is an 'environmental consciousness', capable of effecting state intervention or social action, to alter this process (Schnaiberg, 1980: 362). This environmental consciousness or collective disposition, which is socially constructed (*ibid.* :364) takes time to form. It may be a result of either a catastrophic event where a claimed "risk" materializes. Or it may be a cummulative effect over several generations of claims-making on environmental issues, as was empirically shown in the fourth stage during the 1970's when the Danish public became aware of the risks related to incineration.

In practice however, Schnaiberg (1980: 422), points out that often when there has been longstanding debate in regards to environmental risk or if the scientific measurement of risk is too technical for the average citizen to keep up with, it confuses the public and often it leads to apathy regarding the issue. When this happens, the risk debate is once again left in the realm of the 'experts' and the connected political state representatives. Apathy does not appear to be the case in the data found so far regarding 'waste as a resource' in Denmark, but technical confusion regarding the risk of incineration and it's residue of bottom ash does appear to be the case. Moreover, this use of 'bottom ash recycling' has not appeared to be common knowledge, so there appears to be collective misrecognition of political power plays within this subfield of waste management where economically interested parties are negotiating and claims-making in an effort to maximizes profits from waste. This issue of misrecognition regarding 'waste as a resource' and for whom will be taken up again for more detailed analysis in the following chapter using the ARC case study.

4.7. Preliminary Conclusion

In summary, in the first stage, increased volumes of waste resulted from the external shift towards urbanization. At this time (1850-1940) waste was regarded as a health problem and incineration emerged through claims making as the leading disposal choice due to limited land use. In the second stage, WWII lead to scarcity and when the collective disposition regarded the threat as "real" it increased recycling causing incineration to nearly stop for five years. In the third stage, the 1950's heralded an economic boom. This lead to shifts in labor and increased production, causing a disaster for waste accumulation, a decline in recycling and facilitating incineration to skyrocket again. Through plastics household waste gains calorific value, causing industrial enterprises to jump at the chance to exploit the energy value of household waste through WTE plants, leading to incineration as the dominant waste disposal means for households. In the fourth stage, environmental problems of air, ground and water pollution arise from the unregulated and weakly governed waste management sector. The political response from civil society and government effect change in the collective disposition by placing environmental protection as a firm priority. However, the waste practices, namely incineration, take considerable time to adjust to the tightening controls. This period marks the start of political debate over waste practices of incineration between citizens, domestic industries, the state and regional governance.

Ultimately, as the last and fifth stage shows, incineration continues in Denmark as the legitimate 'waste to resource' practice for household waste and by this time the collective disposition has accepted the technical claims regarding reduced 'risk' within the practice. The state and energy industry is proud of the 'waste to energy' recycling, even promoting it as an international poster child model and garnering profitable incineration export contracts as a result. However, this chapter questioned whether the 'claims' in incineration recycling were perhaps economically biased and clouded with misrecognition regarding the details of continued environmental risk as seen in the case of bottom ash. This issue of misrecognition of 'risk' will receive further analysis in the following chapter where this project will utilize a case study of ARC's WTE plant, in order to explore how they have established themselves as the legitimate waste disposal system through their claims-making, and how the public is an audience for those claims.

Throughout the five stages it became apparent that the treadmill of production model was an adequate theoretical explanation for why environmentally sound practices, (i.e. recycling

plastic waste fractions, or restricting the permits of *Highly Polluting Enterprises*, or installing auxiliary burners) are historically ignored. Empirically, the theory was substantiated in regards to the governance dilemma that the Danish state arbitrates within the power field of waste risk claims-making. The winner was often the high capital intensive production which boosts domestic economic growth. The loser was often recycling schemes which are low capital intensive and possibly without lower economic returns.

Citizen participation in the politics of this negotiation and 'claims-making process' were discussed as fluctuating throughout the stages, and the extent to which agency was effective in changing the practice was not considered to be qualitatively significant in determining the future of incineration as a waste disposal practice. Especially, considering that the collection and disposal schemes are operating in the private domain. The claims-making process was further discussed to highlight how the construction of risk was successfully swayed by institutional agents (L.A.B., incineration and energy plants, the state) to suit their definition of the situation: during war times the scarcity of natural resources required the claims-makers to encourage recycling. At all other stages the treadmill of production was run as normal and the claims-makers swayed the collective disposition to accept incineration as as a risk free, recyclable practice. This was largely done by paying nominal attention to the environment through 'greener' technological advances.

In short and to answer the second working question, these empirical findings and theoretical discussions outlined the emergence of economic, political and societal structures since the last century which this project argues as influential in giving legitimacy to the dominance of incineration as a waste management practice, which in turn have shaped the household recycling practices and perpetuated the current collective disposition that 'waste is a resource' through incineration. Furthermore, it began to emerge throughout the chapter that the Danish public is misrecognizing the political power plays that maintain these structures. However, most of these findings were on a broad and macro level, where it was not possible to deeply analyze how these structural processes are perpetuated. This leads into the next chapter which will zoom in on a micro level case study to explore this issue further.

5. Amagerforbrænding/ARC Case Study

5.1. Chapter Introduction

The aim of this chapter is to answer the research question *How does the development process of Amagerforbrænding/ARC's new incineration facility in Copenhagen render influences of political and economic interests on household recycling practices and waste management?* by unfolding the political decision-making process involved with the new incineration facility, in order to give an account of the actors, struggles, and the power relations that ultimately shape the management of household waste in Copenhagen, as motivated in the findings from the previous chapters. Also, fieldwork in the form of a visit to Amagerforbrænding/ARC was undertaken to further illuminate the case. First, in **5.2.** Amagerforbrænding will be presented briefly, including information about its inception, administration and function. Then, in **5.3.**, the main actors and conflict involved will be introduced. In **5.4.**, changes in the Danish political landscape will be discussed, as well as further struggles between the main actors in the case study. Then, in **5.5.**, the agreement and negotiation process between Amagerforbrænding and Copenhagen municipality concerning the new incineration facility will be outlined and evaluated. In **5.6.**, further controversies in the negotiation process will be brought forth, as well as an overall analysis of the political process thus far, before embarking on the fieldwork at Amagerforbrænding/ARC in **5.7.**. Finally, in **5.8**, a brief preliminary conclusion will be presented, leading into the overall conclusion in the next chapter.

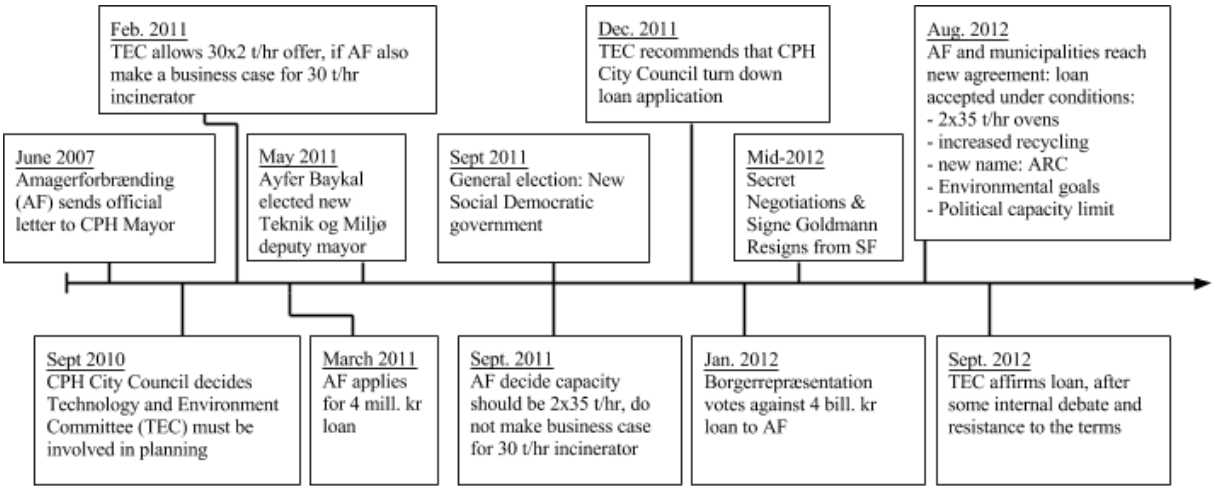
5.2. About Amagerforbrænding

Amagerforbrænding, a WTE plant located in Amager founded in 1970, was created as a response to the scarcity of space for landfill disposal in the greater area of Copenhagen (Larsen & Børrild, 1991: 242). The generated energy from the plant was and is used for district heating in Copenhagen, and later on, also for producing electricity (*ibid.*: 242). The facility is owned and managed by five municipalities, and approximately 70% of the waste being incinerated in Amagerforbrænding is household waste from these municipalities, namely, Hvidovre, Tårnby, Dragør, Frederiksberg and the majority of Copenhagen (*ibid.*: 242). Additionally, a new sanitary landfill site was established in Uggeløse, there bottom ash and non-combustible waste were disposed until it had been filled up in 1988, further showing the requirement for landfill site for residues from incineration (*ibid.*: 243, 245). In 1986, the new regulations from the Ministry for the Environment caused an upgrade in the plant, a new facility was installed by the Vølund company in Amagerforbrænding, a flue gas cleansing

system, where the gas emissions are filtered in lime water (*ibid.*: 246-247, Kleis & Dalager, 2004: 27). In Amagerforbrænding, there are currently four incineration ovens, with a total capacity of 48 tons per hour (*ibid.*: 49).

The choice of Amagerforbrænding as a case study for this research, is derived from a few facts. Amagerforbrænding has the second biggest incineration capacity in Denmark, in terms of total waste incinerated. The waste is arriving mostly from urban households, and the energy recovered is connected directly to the heating system of Copenhagen, the biggest city in Denmark. The plant has a seniority of 42 years in the field of waste management in Denmark, and during these years, some main actors such as Copenhagen city council and Vølund Co. were involved in the development of the facility. Furthermore, Amagerforbrænding is undergoing transformation, since the facility is considered old, and it requires public investment, in order to improve its performance. This case constitutes an opportunity to follow the decision-making process of the development of the plant, and trace the influences of political and economic interests in waste management practices in the greater area of Copenhagen.

5.3. A New Incinerator for Amagerforbrænding



Amagerforbrænding's new incineration facility Financing Timeline Overview - From 2007 - 2012

As Denmark's oldest incineration facility, plans for rebuilding Amagerforbrænding began in 2007 (Teknik og Miljøudvalget, 2007). In September 2010, the Copenhagen city council decided that any new incineration capacity should be presented to Copenhagen's Technology and Environment Committee (TEC) [7] already in the planning phase, and in coordination with Vestforbrænding, to avoid overcapacity (Teknik- og Miljøudvalget, 2011a). Then, in February 2011, the Technology and Environment Committee affirmed that Amagerforbrænding could tender an offer for a new capacity with two ovens burning 30 ton of waste per hour (totalling 480,000 ton/year), but only if they also presented an alternative business case for a much smaller facility, having only one oven running at 30 ton/hour (240,000 ton/year) (*ibid.*). Despite these requests, Amagerforbrænding did not come with a business case for the 30 ton/hour facility, and rather decided that the new capacity should be two ovens burning 35 ton/hour (560,000 ton/year), exceeding the TEC's original proposal by 17% (Teknik- og Miljøudvalget, 2011b). Amagerforbrænding had found this larger facility to be more attractive, as it was estimated to provide 150 million kroner more in profits (*ibid.*). A 30 ton/hour facility, according to Amagerforbrænding director Ulla Röttger, would be '*practically impossible*' (Borking, 2011).

Capacity size	Waste incinerated ton / year	CO_2 Emissions ton / year
30 t / hr	240,000	100,000
2 x 30 t / hr	480,000	140,000
2 x 35 t / hr	560,000	200,000

(Comparison of proposed incineration capacities, waste incinerated and CO_2 emissions in tons per year. Adapted from Teknik- og Miljøudvalget, 2011c)

At the time, the Technology and Environment Committee had several arguments for limiting the capacity at a maximum two 30 ton/hour ovens. Primarily, they projected that there would not be a need for increased incinerator capacity in the next 5-8 years. This was due to an expectation of new treatment methods for organic household waste and better sorting of plastics, that the liberalization of waste would lead to uncertain levels of import and export, and a possible fusioning with Vestforbrænding could lead to more efficient capacity use (Teknik- og miljøudvalget, 2011a). Nevertheless, as of February 2011, the plan was that the

[7] Teknik- og Miljøudvalget, in Danish

loan for Amagerforbrænding's new facility would be granted by Copenhagen municipality in the fall of 2011, as well as a final decision regarding the capacity by Amagerforbrændingens board by the end of 2011 (*ibid.*). Amagerforbrænding officially applied for a 3.95 billion DKK loan in March 2011 to finance a 70 ton/hour capacity incinerator (Amagerforbrændingen, 2011a).

Already at this point, early in the initial phases of the development process of the new incineration facility, clear lines of opposition are drawn up in the claims-making process between the main actors in this case study, namely Copenhagen's TEC and the board of directors at Amagerforbrænding. While the TEC seems to err on the side of caution, with a desire to evaluate alternative waste treatment options and possible future complications, Amagerforbrænding appears to have a clear vision of waste treatment, as they themselves expressed it earlier in the chapter: building big in order to maximize profits. This conflict would only continue to escalate further.

5.4. The Struggle over Capacity and CO_2

Before Amagerforbrænding's loan came up for evaluation, a housing scandal caused the Technology and Environment Committee Deputy Mayor Bo Asmus Kjeldgaard to resign his position (Astrup, 2011). This allowed young Socialistisk Folkeparti (SF) spokesperson Ayfer Baykal to take over the position as of May 2011 (Københavns Kommune, 2011a). Notably, another important political development in 2011 was the election of a new Red-Green governmental block (i.e. Socialdemokraterne, SF, Enhedslisten and Det Radikale Venstre) in Denmark, changing from a Liberal to a Social Democrat led government.

Additionally, at a 2011 budget meeting, Copenhagen developed the goal of becoming CO_2 neutral by 2025 -- what came to be known as KBH2025 -- following on an initial environmental framework from 2009 (Teknik og Miljøudvalget, 2012a, Københavns Kommune, 2011b). Lowering emissions created by incineration was one of the challenges that the municipality would have to overcome to meet this goal, as incinerator related emissions totalled 140,000 tons in 2010; increasing capacity to 560.000 ton/year as proposed by Amagerforbrænding would lead to 200,000 tons of CO_2 emissions per year (Teknik- og Miljøudvalget, 2011c). Notably, CO_2 emissions can be lowered, if not removed completely, if plastics are sorted prior to incineration, as plastics are oil-based products. However, sorting plastic out completely could have a negative effect on profitability, as these products make up

40-50% of the fuel-value of waste. Cutting down its presence would necessitate supplementation with other materials, increasing costs (*ibid.*). It can be speculated that these changes in household recycling habits could have an unforeseen impact on the business model of Amagerforbrænding's new facility.

Copenhagen's 2025 plan for CO_2 neutrality, and the change in Danish political structure, would soon cast a shadow of doubt on the future of the loan for Amagerforbrænding's new facility. In December 2011, the TEC and Deputy Mayor urged the city council to turn down the loan request (Teknik- og Miljøudvalget, 2011d). The reasoning behind this decision was manifold. Primarily, they put forth that the new Red-Green government block wanted to ensure waste management with a focus on climate and the environment, in accordance to Copenhagen municipality's 2025 plan. Future waste management, they stated, would need to be fit in with these environmental goals at the municipal and national levels, and simultaneously be economically viable, requiring alternative and sustainable initiatives. They feared that expanding incineration capacity would lock Copenhagen into this form of waste management for the next 30-40 years, compromising their plans and limiting the adoption of new, innovative recycling techniques. The TEC also expressed uncertainty as to whether or not the new government would create changes to the national politics of waste, as they had a focus on both green technological adaptation, as well as waste prevention and more recycling. Another waste-related change in policy they believed could have impact involved the liberalization of waste -- the previous government's "Competitiveness Package," and the calculations Amagerforbrænding's capacity cost-benefit analysis had been based on, involved supranational market competition of waste. Changes to any of these policies were believed to have a large impact on the viability of a large incineration facility.

Fearing that Copenhagen municipality would turn down the loan guarantee upon the basis of the TEC's recommendation, a consortium of union representatives from Amagerforbrænding wrote an open letter to Mayor Frank Jensen, urging him and his colleagues to '*think about workplace conditions and green energy'* when voting (Amagerforbrænding, 2012). Here the union representatives underlined the outdated working environment of the current facility, and that a new facility would '*make Copenhagen a growth forum for green energy* [...] *that other capital cities will be jealous of. All else equal, it will create growth, jobs and respect'* (*ibid.*).

Despite these efforts and the support of the other four municipalities, and in a shock to

Amagerforbrænding, Copenhagen's City Council officially denied the loan in the end of January 2012, on the grounds that they wanted a marked reduction of incineration and a focus on recycling (Bredsdorff & Wittrup, 2012a). This led to a heated debate in the media between Deputy Mayor Ayfer Baykal and Amagerforbrænding's Chairman of the Board/Copenhagen city council member Mogens Lønborg, as they battled to define the situation in the claims-making process. Lønborg lashed out at Baykal, putting pressure on her for being "flighty" and "vague," and argued that postponing a new facility would cause 100,000 tons of unnecessary CO_2 emissions per year, as well as cost countless jobs (Lønborg, 2012). Furthermore, Amagerforbrænding's board of directors also threatened to shut down operations if the loan was not granted (Borking, 2012, Wittrup, 2012a). In response, Baykal criticized Lønborg and Amagerforbrænding for not presenting business cases for any other alternatives to incineration, and pointed out her concern that increased capacity would bind Copenhagen to incineration for 40 years, and possibly lead to waste imports to pay off the hefty 4 billion DKK investment (Baykal, 2012).

Clearly, when viewing these developments through the theoretical framework, the political struggle over the claims-making process of Amagerforbrænding's new incineration facility begins to intensify at this point, with the Technology and Environment Committee having the upperhand, as they were able to convince the city council to follow their claims. Amagerforbrænding, backed into a corner by Copenhagen's city council under the advisement of the TEC, used the media to attempt to delegitimize Deputy Mayor Baykal through personal attacks in order to tilt the scales in the claims-making process to their advantage. Furthermore, this case begins to resemble a textbook example of the treadmill of production, as industry -- Amagerforbrænding, to be precise -- gains support of the union organizations in the name of creating and maximizing growth, jobs and so forth. This occurs in the name of promoting and branding Denmark as an engine for "green energy" with the construction of a large incineration facility, thus defining the new facility as environmentally friendly in the claims-making process. This push for legitimization occurs despite the fact that the Technology and Environment Committee provides justification for at least evaluating other options besides the large capacity incinerator, resulting in the City Council turning down the loan grant. However, as the treadmill of production gained traction in 2012, the claims-making process would soon be influenced by other powerful actors on the behalf of Amagerforbrænding.

5.5. A Change in Course - Rebuilding the ARC

In the fall of 2012, following a series of secret meetings between Copenhagen municipality and Amagerforbrænding that took place throughout mid-2012, the loan guarantee from Copenhagen was finally granted for a new waste facility. Although the negotiations were hidden from public record, making it difficult to investigate for this research project, certain media sources have had access to pertinent documentation, thus necessitating the use of media coverage to gain insight into what took place at these meetings. What is described as a '*massive pressure from many interest groups'* (Nielsen, 2012) paved the way for this change in course, but who these interest groups are was not specified in the media. One of the key factors was that Amagerforbrændingen had already committed to agreements with suppliers, despite the lack of loan approval from the municipality. Director Ulla Röttger explained to the media that '*several of our suppliers have reached a point that it would be very expensive to stop our orders'* (*ibid.*). In fact, the negotiations were described as taking place at "full speed," as the aforementioned deals with suppliers were set to run out at the end of September 2011 (Bredsdorff & Wittrup, 2012a).

Within these secret negotiations, sources reported that Deputy Mayor Baykal and the municipality placed several environmental conditions on the loan guarantee (Bredsdorff & Wittrup, 2012a). Included amongst these preliminary conditions provided by the municipality were sanctions against burning biomass and importing waste, as well as a cap on the amount of waste to be incinerated per year (*ibid.*).

On September 28th 2012, the TEC once again met to consider the loan guarantee for the new incineration facility. Here, some of the conditions of the secret negotiations become available to the public record, as the Technology and Environment Committee was tasked to approve the agreement reached between Amagerforbrænding and the municipalities. Included are records from a meeting August 31 2012 between the 5 municipalities and Amagerforbrænding, which provide the final conditions and a series of guidelines for the new facility. The first of these conditions states that Amagerforbrænding must '*in the most economically justifiable manner*' ensure that the incineration capacity does not exceed 60 tons per hour (Københavns Kommune, 2012: 1). Furthermore, a 27% reduction in the amount of incinerated household waste up to 2030 was also a condition, based on improved sorting from the households themselves (*ibid.*). The interest groups also state in the agreement that they '*view waste management as a core municipal responsibility, not a commercial activity,'* and

the new facility must therefore be created with a '*high environmental profile'* (*ibid.*), obviously defining the situation in the claims making process. They agreed that, through a strengthened political ownership, Amagerforbrænding's environmental and climate profile should be increased (*ibid.*). This was to be accomplished first and foremost by changing Amagerforbrænding's name to Amager Resource Center (ARC), and that waste sorting and recycling were to be written into the firm's mission statement; it is however important to note that these conditions are subject to change by ARC's board of directors (*ibid.*: 1-2). Key points that would improve ARC's environmental profile include a downscaling of CO_2 emissions as expressed in the following table:

Year	Tons of CO_2 emission per year
2016	138,000
2020	115,000
2025	91,000
2030	82,000

Projected future downscaling of CO_2 emissions at ARC facility, adapted from (Københavns Kommune, 2012: 2)

If these levels of CO_2 emission reduction are not reached, the negotiators agreed to '*create new initiatives and/or reevaluate the goals'* (Københavns Kommune, 2012: 3). Additionally, goals were set to reduce the total amount of incinerated waste to counteract projected increases in population and consumption, with the followings lofts up until 2030:

Year	Tons of waste incinerated per year
2015	409,000
2020	399,000
2025	402,000
2030	401,000

Projected future levels of waste incinerated at the new ARC facility, adapted from (Københavns Kommune, 2012: 2)

Although it may seem contradictory that the level of emissions are to decrease so rapidly compared to relatively stable levels of incineration, this is related to the proposed improvement in waste sorting causing a reduction in incinerated plastics, which cause high levels of CO_2 emissions. These levels will be reached by a projected reduction of household waste to incineration per capita by 30% in Copenhagen, and 20% in the other four municipalities that send waste to ARC. There is however no physical or technological cap ensuring that these amount of incinerated waste per year will not be exceeded.

Despite what the media had uncovered regarding Deputy Mayor Baykal's sanctions against the incineration of biomass during the secret negotiations, one of the conditions from the agreement states that:

> '*Biomass can supplement waste incineration and thereby replace fossil fuels in the capital's electricity and district heating production and support the company's economy. However the use of biomass for incineration may not occur at the cost of a future, more energy efficient application of biomass somewhere else in the district heating system'* (Københavns Kommune, 2012: 3).

The effect of this is that ARC may incinerate low-quality biomass (i.e. wood chips) up until 2022 (*ibid.*). Additionally, there are no sanctions against the import of biomass in the agreement.

In terms of how ARC plans to further focus on more green initiatives, part of the negotiation sketches out a possible, but rather vague, plan to establish a REnescience [8] facility or alternatively some form of sorting or biogas facility on their premises before 2018 (Københavns Kommune, 2012: 4). According to the guidelines, 60 million DKK will be put aside to investigate the possibility (*ibid.*: 4).

Furthermore, the main incineration activity of the firm is stipulated as serving only the five municipalities' citizens and institutions, as well as helping other incineration firms in the region if necessary (Københavns Kommune, 2012: 3), which implies that waste will not be imported to the facility from e.g. other EU countries. The final environmental clause states

[8] REnescience is a new type of waste treatment currently in the experimental/research phase, described as '*a separation of the MSW into valuable fractions [...] without prior pretreatment such as shredding or sorting*' (Dong Energy)

that the previously outlined points must be adjusted to match changes in legislation at the state and EU levels (*ibid.*: 3).

Moreover, all of these environmental clauses are subject to change. The agreement stipulates that all decisions regarding incineration capacity regulation, reduction in CO_2 levels, the use of biomass, and the incineration of waste produced outside of the five municipalities can be changed if ARC's board is in agreement at 2 consecutive meetings, held within at least a 2 month interval (Københavns Kommune, 2012: 4). The board is considered capable of decision-making if half of the members are present (*ibid.*).

Returning to the TEC's September 28th meeting, where the conditions of the agreement previously outlined were obtained, the committee almost unanimously approved the terms of the agreement, with 7 votes for, 1 vote against, and two who declined to vote (Teknik- og Miljøudvalget, 2012b). The one outwardly critical voice against the terms was former SF member Signe Goldmann, now an independent, who stood fast in her skepticism towards the new facility by actively opposing the apparent change of course within Copenhagen Municipality. In fact, as expressed in an open letter (See Appendix C), her frustration with the secret negotiations between Amagerforbrænding and the municipalities was what caused her to resign her SF party membership (Goldmann, 2012: 1). Goldmann had been heavily involved with Amagerforbrænding, having sat on the board for a number of years, as well as actively participating in the negotiation and planning process for the new facility (*ibid.*), and describes herself as the politician '*most involved with this case'* (*ibid.*: 2). She describes what took place after Copenhagen municipality turned down Amagerforbrænding's loan guarantee in January 2012:

> '*Instead of making the business case that Copenhagen had asked for, the majority of Amagerforbrænding's board maintained that they would not investigate any alternatives. Instead, they launched a massive lobbying campaign against the municipality that owns the majority of the company, and got extra wind in their sails, when the bid for building the big ovens was won by the company Vølund, which would create Danish jobs. Going from a decision that concerned how to recycle larger amounts of waste, the unions suddenly woke up and started pushing massively to get politicians in Copenhagen to change their opinion, and Møger and Corydon* [note: Thor Möger and Bjarne Corydon, former Danish tax minister, and current financial

minister]*, were sent to persuade their respective mayors in Copenhagen.'* (Goldmann, 2012: 1)

Moreover, Goldmann describes how Deputy Mayor Baykal gave into the pressure and changed her opinion, and subsequently went straight to the negotiation table with the other municipalities without orienting anyone (Goldmann, 2012: 2). Then, Baykal convinced the rest of the Technical and Environmental Committee to back her up, before finally orienting Goldmann (*ibid.*). It is also important to note the persistent and powerful role that Vølund has played throughout this project, and how incineration becomes not just an issue of municipal waste management, but a national interest in terms of pushing for growth and promoting Denmark.

Concluding this section, the political and administrative process outlined in this chapter gives an indication of the power plays involved within the claims-making process of establishing the political conditions for the new incineration facility. Goldmann's account of what occurred during the secret meetings is key, as it shows that what began as a municipal issue concerning more efficient waste management, suddenly ballooned in scale to involve national actors, such as the labor unions, corporations (e.g. Vølund) and ministers. Critical voices looking out for environmental interests, spearheaded by the Deputy Mayor, seemingly caved in to the pressure of national political actors, labor and industry and their economic interests. Here, the treadmill of production, requiring ever increasing expansion, allowed Amagerforbrænding to go ahead with the large capacity incinerator that the TEC had previously been so strongly against due to environmental concerns. Although Baykal succeeded in pushing through several environmental conditions and limitations, their longevity is questionable, as all of these sanctions are subject to reevaluation and even the environmental goals of CO_2 reduction can be changed in the future if ARC's board of directors are in agreement. There are no physical, technological or judicial implementations to ensure that any of these conditions will be met. Also, while financing was set aside to investigate the possibility of alternative waste treatment facilities in conjunction with the incinerator, the ruling did not include any guarantee that they would be used or implemented. Making these environmental conditions even more vague and tenuous, is the fact that changes in EU or national legislation could nullify e.g. bans on waste import to fuel the incinerator.

5.6. Further Controversies in the Negotiation Process

In the spring of 2012, Københavns Energi (Copenhagen's municipal energy company) made an evaluation proposal, which would involve a synergy between a new, smaller Amagerforbrænding incineration facility running one oven at 40 ton per hour and a low-grade biomass driven heating plant built by Københavns Energi nearby (Wittrup, 2012b). The result of this reduced capacity and cooperation would be that the facility would be much cheaper, costing 2 billion DKK less to build (*ibid.*), and that the amount of incineration could be reduced (Bredsdorff, 2012b). According to an expert from Copenhagen Resource Institute, burning low-grade biomass at a dedicated facility such as the one that Københavns Energi is planning on building is also 20% more energy efficient than at a standard incinerator (Bredsdorff & Wittrup, 2012b). This proposal, however, never went further than Copenhagen's Economic Committee, who kept it hidden from the politicians (Bredsdorff, 2012b), as the proposal was otherwise confidential (Wittrup, 2012c). The argumentation from Copenhagen's Economic Committee was that the technical content of the proposal was lacking, however, the Economic Committee did not have the Copenhagen TEC evaluate the proposal (Bredsdorff, 2012b). Instead, the Economic Committee went around their own municipality's TEC, who had previously pressured Amagerforbrænding to come with alternative business cases, and turned to technical and environmental experts from Frederiksberg municipality, who were already on board for building a large incineration facility (*ibid.)*. The result of this omission, was that this proposal was never put on the table; Deputy Mayor Baykal, for example, was surprised to hear about the proposal, when confronted about it by the media (Wittrup, 2012b). The fact that this collaboration did not occur becomes more perplexing, based on the fact that ARC's agreement with the municipality, as outlined in the previous section, stipulates the use of the same low-grade biomass as fuel, despite its relative inefficiency compared to a dedicated plant.

In addition to the synergy between Amagerforbrænding and Københavns Energi that never materialized, cooperation between Amagerforbrænding and Vestforbrænding to avoid overcapacity was part of the original plan for the new facility, as mentioned in the beginning of this chapter. However, these plans also fell through. Despite the obvious benefits of such a synergy in terms of technology development, cost and administration, the board of directors for Vestforbrænding turned down the fusion due to Amagerforbrænding's large capacity business case (Bredsdorrf & Wittrup, 2012b). According to Vestforbrænding's chairman of the board, Ove E. Dalsgaard, the overcapacity of Amagerforbrænding's new facility would

result in citizens of Vestegnen (the western, greater Copenhagen area) having to pay higher prices to get rid of their waste due to overinvestment and overcapacity (*ibid.*). Dalgaard described the proposal as being '*take it or leave it*' from Amagerforbrænding's side, and decided to stop fusion negotiations entirely (*ibid.*).

It becomes evident that Amagerforbrænding had a clear vision of the capacity and functioning of the facility from the start, and had little intention of altering their plans, based on their reluctance to come with alternative waste management schemes or smaller and cheaper facilities as demanded by the TEC, or cooperate with other waste and energy institutions. The fact that Amagerforbrænding had gone ahead with brokering deals for the parts and construction of the new incinerator before receiving loan confirmation from Copenhagen municipality shows lack of desire to compromise. When the loan was turned down in the beginning of 2012, Amagerforbrænding became aggressively engaged in the claims-making process, in tandem with the unions, pushing the new incineration facility through the media as a way to promote Denmark as a green leader, while creating growth and jobs. Furthermore, dissenting voices, such as Deputy Mayor Baykal, were discredited in the media through harsh personal attacks.

In fact, parallel to the development of the internal components of incineration facility, Amagerforbrænding had also made plans to construct a '*distinctive building that mirrors that it contains the newest technology and has a high environmental profile* [...] *a beacon for waste management and energy production'* (Amagerforbrænding, 2011b: 3). As a result, they launched an architecture competition in May 2010 to source a design for the facility's exterior (*ibid.*: 3). The winning architectural vision was the novel Amager Bakke ski slope, designed by Bjarke Ingels Group (BIG), which gained substantial world-wide media attention. BIG is known for its "hedonistic sustainability" style of design, characterized as:

> '*ways of designing cities and buildings as double ecosystems that are both ecologically but also economically profitable and where the outcome doesn't actually force people to alter their lifestyle to have a better conscience'* (Aalborg Universitet, 2013).

The vision was to incorporate Copenhagen residents into the facility, by building an outdoor recreational area into the exterior open to the public, complete with climbing walls, and a ski slope on the 80 meter high facade (Kjær, 2013b).

Thus, the facility itself becomes a part of the claims-making process, as it gains recognition for its '*high environmental profile,'* despite the fact that it is still essentially an incinerator, stuck at the second lowest level of the EU waste hierarchy. Amagerforbrænding's rebranding to ARC -- from incinerator to resource center -- continues along this line, it symbolizes and projects forward-thinking green technology and innovation, but this in itself is a claim rather than a purely objective condition, and was obviously disputed by the TEC, albeit only initially. Whether or not the environmental limitations to the incineration levels and planned reduction of incinerated plastic actually hold up remains to be seen. One possible outcome is that political or economic forces, driven by interests of the treadmill of production, growth at the cost of environment and resources, will necessitate increased incineration capacity or imports of waste from outside of Denmark, possibly to pay off the hefty 4 billion DKK. investment in the facility, leading to the removal of the environmental sanctions entirely. Viewed critically, the overall flimsiness of the environmental conditions seem to be little more than "lip service" paid to appease the Technology and Environment Committee, while business carries on as usual.

The rebranding of ARC and '*high environmental profile'* of Amager Bakke can thus be interpreted as intentionally spreading collective misrecognition, or a product of unintentional self-mystification and misrecognition by the board of directors and municipality themselves, as their environmental symbolism obfuscate the powers driving the treadmill of production; namely, economic efficiency, growth and so on, rather than, and at the expense of, actual environmental concern. In times of financial crisis, with politicians eager to create growth, jobs, and establish themselves and Denmark (especially Copenhagen) as green leaders, the claims-making process launched by Amagerforbrænding becomes very attractive to follow. The public, dispositioned to accept incineration as a legitimate waste management solution, is not sufficiently involved, informed or aware enough to question, protest or make effort to resist or change the treadmill of production in this case. The successful claims-making process of branding ARC and Amager Bakke under the guise of green innovation, and the intangibility of the environmental hazard caused by incineration and poor recycling, can be analyzed as leading to the current collective misrecognition, compared to points of time where waste-related threats were felt as being more "real" and Danes were more actively involved with their own waste practices and waste management on the sociopolitical level, as shown in Chapter 4 (e.g. WWII and in the 90's when the Danes protested incineration).

5.7. Findings from ARC Visit

In order to further explore the issues illuminated thus far in this chapter, on the 29th of April 2013, the researchers participated in a guided tour of the ARC facility (See Appendix D for transcription). This included a presentation from a company representative about the development, goals, and activities of ARC. Furthermore, the researchers were granted permission to ask questions about ARC and their new incineration facility, Amager Bakke. Therefore, the main purposes of the visit were to verify and triangulate some of the data presented in the previous sections, and confirm the timeline and events, such as the competition with Vestforbrænding, future plans of ARC (i.e. REnescience and recycling center), the political conflict, and their limitations and goals. The visit was also useful in providing information about how ARC presents themselves to the public, and thus what sort of role they are playing in the claims-making process.

The presentation confirmed and elaborated on some of the data gathered thus far. To reiterate, the WTE plant is run as a non-profit Company, owned by five municipalities, namely, Copenhagen, Hvidovre, Tårnby, Dragør and Frederiksberg. The facility is receiving waste from 552,000 inhabitants and 46,000 companies, and the profit from the sale of bottom ash, and energy to electricity and district heating is getting reinvested in the development of the company. Currently, ARC are incinerating 400,000 tons per year, running 14 recycling stations, and they are the co-owners of Storkøbenhavns Modtagelsescenter, where treatment of oil and chemical waste, which can not be incinerated, is taking place. Every day, 400 trucks are dumping approximately 10 tons each in the facility, and the waste is mostly composed of household waste. 198 employees are working in ARC, half in the incineration facility and the other half in the recycling stations. The WTE plant has been running non-stop in the last 42 years. Since the 1970s, the plant has been connected to the heating system of Copenhagen, and since 1991, it has created electricity for the residency as well. Currently, ARC is heating 120,000 households, and generates electricity for 50,000 households. The current facility is considered very old and it is only 86% energy efficient in the incineration process, this is also one of the main arguments for the transformation and rebuilding process.

Furthermore, during the presentation of the ARC representative, more data was confirmed. The political controversy from 2012 was mentioned as the reason for the delay in the outset of the project. Moreover, Ayfer Baykal, was being accused of putting *'her heart and soul into protesting this new plant,'* and when the researchers inquired about Baykal's argument for a

smaller total capacity of the new facility (30 tons per hour business case), because of Copenhagen's municipality plan to be CO_2 neutral by 2025, the ARC representative described it as *'very…optimistic (laughs)'*. Regarding Copenhagen municipality's plan for CO_2 neutrality by 2025 and the reduction of 500,000 tons CO_2 by 2015, the representative of ARC elaborated on how the new plant would help in the total reduction:

> *'Amager Bakke will save 107,000 tons of CO_2 a year, which is more than a fifth of the total Copenhagen goal. But, we're not going to be done in 15* [2015]*, first of all, and we're not gonna be emitting less CO_2, however we are going to be creating more energy with the same amount of waste, so that means that that's less energy that has to come from fossil fuels. So that's how.. so it sounds nice but it's a little you know.. tricky.'*

Here, the explanation for the reduction in CO_2 emissions is derived from the fact that the new plant will lead to a reduction of the total energy produced by fossil fuels. ARC claims CO_2 reduction without incinerating less waste or emitting less CO_2, but with a better energy efficiency caused by the new machinery. This method of presenting themselves and "tricky" choice of words and definitions could further add to the collective misrecognition and maintain the reproduction of the incineration practice, by making the claim that Amager Bakke will reduce CO_2 when it technically is not, legitimizing the perception of the facility as providing an environmental treatment for urban household waste in Copenhagen. Moreover, the ARC representative emphasized ARC's 'green' profile several times during the presentation, further illustrating their assertive claims-making. Waste incineration is described as an alternative energy resource for district heating and electricity, and by doing that, *'we* [ARC] *save the environment'* or '*we're burning for the future.'* Furthermore, ARC is described as '*very environmentally focused, and we do a lot to improve whatever we can, to have the least impact possible when we burn.'* Theoretically, ARC is claiming environmental concerns and influencing collective misrecognition, through double truths by projecting this environmentally friendly image to the public, while maintaining the incineration practice.

Regarding the future plans of ARC, their representative described Amager Bakke as the *'biggest newest project'*, which is an investment of *'4 billion kr* [DKK]*'* in establishing the new incineration plant. As has been detailed, the new plant will have:

> '*politically, a capacity of 400,000 ton a year. Which is less than what we've been burning the past two years. It will most likely, physically, practically, have a little bit*

> *bigger capacity, but the 5 municipalities have made a mutual agreement that it cannot burn any more. So this is the political capacity. And one of the reasons that it will be able to burn a little more is then we can be flexible and then also burn um biomass.'*

Practically and technically, ARC will have the capacity to burn more waste, if the political or social conditions for it ripen. This exemplified the political power play around the total capacity of the new incinerators. ARC will have a bigger incineration capacity (70 ton per hour), and with the new technology, *'wet smoking cleaning system,'* they will generate, *'25% more energy on the same amount of waste.'* Clearly, ARC already incinerated more than the political capacity of 400,000 ton per year, *'in 2010 we* [ARC] *burned 417,000 tons.'* However, the municipalities seem "to turn a blind eye", as they had been described by ARC representative as, *'quite flexible.'* Here, the agreement between ARC and the municipalities appear to be vague and changeable, as was found previously. Furthermore, the ARC's representative cannot disclose the agreement guidelines on the capacity per year of the new plant, '*practically... I'm not allowed to say.'* ARC seemingly withholds the information from their representative:

> *'I'm* [ARC representative] *writing a new presentation about it, and she* [The secretary] *said that she was going to find it for me,* [...] *but then she also added that I couldn't disclose that information anyway.'*

By doing that, the public sphere is removed from the decision-making process, although, the company is owned also by the municipalities themselves. Hence, ARC are having the upperhand in the decision-making process, and as far as this is the status, the incineration process will be maintained or will possibly exceed capacity levels per year. It also further illustrates the tenuousness of the conditions put upon the facility by the municipality, bringing into question how and to what extent the guideline of 400,000 ton per year capacity will be regulated.

When asked about the possibility of opening up for the import of waste from outside of Denmark, i.e. if changes in legislation allowed it, the representative speculated that this wouldn't be necessary as there would be more than enough waste in Denmark, shedding doubt on the 400,000 ton per year limit. Moreover, the representative doubted whether recycling would increase on the household level,

> '*I don't think that it's going to be possible, 'cause there's going to be more people, more waste, and they're gonna have the same capacity, and I think they're just a little too optimistic about people recycling when they don't have any recycling plans in the plant.*'

Here it is implied that if ARC provided in-house recycling, the problem would be alleviated.

Furthermore, when the ARC representative was asked to explain how ARC will limit the incineration capacity, some extent of mystification was noted:

> *'So the 5 municipalities have agreed that every household has to reduce their incineration waste with 27%. How this is going to be done, well I personally hope that they're gonna make some reduce reuse recycle campaign, cause reducing is definitely essential... Um we don't know exactly what their plans are, because that is the municipalities, and we don't have anything to do with that. But their goal is 27% and out of that they want the plastic to be reduced by 40%, and if that is the case, then the CO2 emissions are gonna be reduced of course. But I don't really know what their plans are'.*

Obviously, ARC goals are separated from the goals of the municipalities, which are planning to reduce the amount of waste delivered to the incineration plant. No collaboration is seemingly to take part between the municipalities and ARC regarding waste reduction in the future plan. Furthermore, regarding increasing recycling practices, ARC had no concrete future plans, except for maintaining the already existing 14 recycling stations, which are distributed *'within 3 km'* from every resident in the five municipalities. The representative showed a blueprint of what the future grounds could look like, including '*a sorting plant, and this is not sure at all. This may come sometime into the future. And that's all I know. And that seems to be all anyone knows.'* When asked further about the possibilities of building a sorting plant or REnescience facility, the representative explained that '*everything is still not set. They're still negotiating about certain technologies and machinery and what not,*' showing that the only thing that is certain, is a continued incineration practice. Furthermore, the representative was dismissive of the possibility for improved recycling practices of e.g. plastic amongst households, stating that '*people are lazy. It has to be super convenient (...) I really don't know how this plan is realistic or how they are going to achieve it*.' It appears that the views of the representative, and ARC by proxy, are that the municipal plans for

improved recycling will fail, and waste will simply continue to increase through population and consumption growth.

The final area of interest that was inquired upon in the visit to ARC involved their relationship with fellow incineration institution Vestforbrænding. As shown previously in this chapter, the original plans for the new incineration facility involved a fusion between Amagerforbrænding and Vestforbrænding, which never materialized. The researchers inquired about the fusion and relationship between the two firms, to which the representative replied:

> *'They see each as competitors. Big time.* [...] *I don't know why 'cause we do the same thing for each of our area.* [...] *We're not competitive, we're not gonna take the waste of Dragør and drive over there, so I don't really understand that relationship*. [...] *I experienced it though, we were at a* [...] *"skolemesse"* [school conference]. *And they were right next door and we were talking to the teachers and instructors about what we have to offer the kids when they come. And there was just a super hostile atmosphere between our booth and then next door. I don't know why, but I also picked it up when they just talk about it.'*

Although the representative herself had experienced this rivalry, she did not know what the motivations were behind it. A clear explanation did not come up in the research process, other than the general disagreement about the business case of Amager Bakke's large capacity.

Regardless, a clear pattern begins to emerge, where government institutions (e.g. ARC, Vestforbrænding, municipal actors) fail to work together in order to efficiently tackle this waste management problem. Instead of cooperating, agents and structures are actively competing against each other in the field of waste management. The overall Danish goal of better waste efficiency does not have a clear cut solution, as different agents and institutions have differing subjectivities of this objective goal, in terms of what the environmental risks are, the possibility of behavioral change on the individual level in relation to recycling practices, and what the future will bring in terms of technological solutions to the problem. Hence the actors compete to define these disputed factors, drawing upon the tools they have at their disposal to gain position in the claims-making process.

Furthermore, ARC seemingly doubts the ability of urban household recycling habits to

improve, justifying an increase in incineration capacity, and rebrands themselves and aggressively makes campaigns in the media to further legitimize themselves, while drawing on the powerful force of the actors within the treadmill of production and its interests to win over in the claims-making process. As a result, citizens are removed from the "realness" of the risks associated with their household recycling practices through the misrecognition of ARC as a legitimate green profile. As shown previously, when Danish citizens had felt tangible risk associated with poor household and national waste management, their practices and political engagement changed. ARC's underestimation of the ability of households to improve their habits becomes a self-fulling prophecy, as the mystification and consequent misrecognition of incineration as legitimate divorces them from the realness of the risk associated with their practice, possibly standing in the way of improving the recycling practice.

5.8. Preliminary Conclusion

By investigating Amagerforbrænding/ARC and the development process of their new incineration facility as a case study, it was possible to render the types of struggles that can occur between actors within waste management. Through analysis of the case, the implications for these struggles and power plays in terms of their apparent influence on waste management and household recycling practices became illuminated.

The primary conflict in this case was between Amagerforbrænding/ARC and Copenhagen municipality's TEC. While Amagerforbrænding steadfastly pursued the establishment of a large 70 ton of waste per hour incineration facility, on the grounds of profit-maximization, the TEC demanded evaluation of alternative solutions, based on the changing waste management landscape in Denmark. Refusing to cave to these demands, Amagerforbrænding carried on with their plans to put Copenhagen on the map with the infamous Amager Bakke design as a "green" flagship, making agreements with suppliers before they had received a loan guarantee from Copenhagen municipality. The conflict came to a head in early 2012, when the TEC successfully convinced Copenhagen city council to turn down the loan. As a result, Amagerforbrænding drew upon the power of the treadmill of production, mobilizing the labor unions, industry actors such as Vølund and national-level politicians to meet their goals. The claims-making process revolved around selling the project as giving Denmark a "green" energy profile, and creating jobs and growth. Amagerforbrænding's greatest opponent, Technology and Environment Deputy Mayor Ayfer Baykal, was attacked and discredited in

the media. The critical voices struggled to gain agency, as the forces driving the treadmill of production had significant advantages in power and efficacy.

As a result, after a series of secret negotiations in 2012, Copenhagen municipality eventually caved to the pressure put upon them by Amagerforbrænding and other powerful institutions, resulting in a compromise of Amagerforbrænding getting the funding for their large 70 ton per hour incineration facility, and the addition of a series of environmentally-conscious conditions. This included a rebranding of Amagerforbrænding to ARC, and a focus on recycling rather than incineration. However, through analysis based on the theoretical framework and fieldwork at ARC, this research project found these environmental conditions to be rather dubious and vague, and the rebranding and focus on recycling to be unjustified and unsubstantiated. In contrary, the analysis brought forth that this rebranding and the "green" profile of Amager Bakke, would lead to further collective misrecognition of the risks associated with the current low-recycling levels of the general household recycling practice in Copenhagen, possibly inhibiting improved recycling practices as necessitated by Copenhagen's 2025 CO_2 neutrality plan.

The implications of this chapter will be reflected upon in conjunction with the findings in the previous two analytical chapters, in order to conclusively answer the problem definition.

6. Conclusion

As shown in the previous three chapters, incineration has emerged as the dominant disposal practice of urban household waste in Denmark, while recycling is low. Today this is largely uncontested, waste is seen as a resource, and despite its low ranking in the EU waste hierarchy, incineration is a legitimate form of disposal in Denmark because it converts waste to energy, and this disposition is maintained and shaped through social, political and historical structures. Through the historical inquiry in the project, it was found that urban household recycling practices and the management of household waste were shaped by extreme changes in external conditions when the risk of improper resource use was felt as real, such as WWII, the oil crisis in the 70's, and so forth. Otherwise, power holders within waste management have largely influenced the direction and scope of urban household waste disposal, by focusing on collection programs and schemes reliant on incineration.

Having said that, this project found that urban households had some agency over their own recycling practices, for example in the Nørrebro Waste Model. However, external institutional structures governed and constrained their opportunities and the final treatment of their waste, even in this best case scenario. Nevertheless, the majority of urban dwellers lack agency in determining their recycling practice as they are reliant on public waste management schemes, which do not provide adequate opportunities for recycling all waste fractions, as discovered in the research diaries, and confirmed by the Danish Waste Strategy from 2010. The Waste Strategy can be seen as a product of a century's worth of social, political and economic development, as argued throughout the project, wherein incineration emerged as the legitimate and dominant waste management institution. The institutionalization of incineration was grounded in necessity, based on land scarcity and then moved on to continued justification of the practice based on a need for energy. The reproduction of incineration as the de facto method for waste disposal in Denmark, was maintained despite struggles between political and economic structures and the agents that compose them. This was evidenced by the need for more energy in the 70s, "greening" of politics in the 80's, protests in the 90's defused by a supposed improvement of technology, conflicts between Denmark and the EU regarding solutions to environmental risks associated with dioxin, and today's definition of waste as a resource.

In the Amagerforbrænding/ARC case study, it was discovered that within the political and economic structures that comprise the field of waste management, agents competed in the claims-making process using political and economic power, to shape the definition of the situation regarding waste practices and environmental values. Furthermore, pivotal moments in the negotiation process within the case study were hidden from public record. Only through "whistleblowers" such as Signe Goldmann, did the power plays and interests behind certain claims come to light. Here the trend was that the treadmill of production carried on incineration "business as usual," while dissenting voices, in the form of municipal experts, became arbitrary. Again, the public, having low amounts of power and knowledge, such as the technical calculation of risk or CO_2 emissions, within the field of waste management, are distanced from the decision-making process, and become recipients of the dominant voices in the claims-making process, leading them to misrecognize the environmental powerplays and risks associated with incineration and the lack of recycling.

Misrecognition also seemed to take place not just among citizens, but within the institutions as well, who are themselves '*mystified*', as Bourdieu (1998: 95) termed it; the duality of the incineration process contains two double-truths, i.e. it is both harmful to the environment but also serves a practical purpose in terms of heating, energy and so forth, and technological improvements will provide a green solution. This duality leads to a sustained self-deception in the form of a *'collective misrecognition inscribed in objective structures (...) excluding the possibility of thinking or acting otherwise'* (Bourdieu, 1998: 95). In this case, seemingly downplaying the one side of the double-truth i.e. the environmental risks, and on the other side ARC branding itself as having a '*high environmental profile,'* new advanced technology, and so on, mystifies the public.

The central mechanism of expanding production (Schnaiberg, 1980: 228) that is driving the treadmill of production necessitates this collective misrecognition, to downplay the potential risks associated with the incineration practice. This production expansion takes shape in terms of needs for overall economic growth, increased energy production, capacity to handle increased consumption, employment opportunities, and the export of Danish incineration expertise. Maintaining this collective misrecognition of potential environmental harm in turn is in the assumed best interest of all parties in the field of waste management: industry, unions, the state, and citizens, as alternatives could derail the treadmill, by causing e.g. loss of

jobs, market share and competitiveness. Especially since Denmark is selling itself worldwide both as “green” and incineration leaders.

In conclusion, and answering upon the problem definition *How and to what extent are urban Danish household recycling practices and the management of household waste, with its focus on incineration, shaped by social, political and historical structures?*, household recycling practices declined while incineration rose, due to a complex interweaving of structural historical shifts and political, economic power plays and interests which seemed to have intentionally favored incineration over recycling, with the exception of times when risk has felt sufficiently “real.” This occurred through the claims-making process, where urban Danish households’ collectively misrecognized that the treadmill of production is the driving mechanism and underlying factor behind waste management decisions in Denmark, rather than ambitions to meet environmental goals.

7. Further Considerations

One issue that came up from the conclusion is the role and structure of public enterprises, such as Amagerforbrænding/ARC. While ARC is run by City Council members from the five municipalities, the actual decision-making and interests of the actors involved was not always clear. Further research could analyze this unclear line dividing public/private spheres, focusing on the organization and administration of this particular non-profit firm, and why these firms do not seem to be able to stand up to the treadmill of production. Within environmental politics, this unclear definition of interests warrants further investigation, whereby continuing on the line of argumentation from this research project could open up for investigation in new developments, organizations, or other decision-making within the field of waste management and the environment.

Additionally, within these political conflicts, where municipal actors and organizations are pitted against well established industries and powerful interests, it becomes clear that the playing field is uneven. Relatively inexperienced municipal politicians, such as Baykal, are tasked with representing the citizens in issues where claims-making plays a significant role. This is problematic, because unless they have a strong professional background within the area, or particular conviction, they can be easily dismissed by more powerful or perceivably more experienced experts in the field, e.g. ARC, Vølund Co., etc. Further research could analyze the role of power in the municipal level, and how decentralization can actually weaken political agency for these players, compared to industry.

This leads to question who actually has responsibility for resolving the current waste dilemma? Obviously, waste rates are increasing worldwide and the responsibility for it can be traced in different directions. On the one hand, consumer behavior and the increased need for convenience and product packaging, drives e.g. increased levels of packaging waste. On the other hand, this could also be seen as being caused by the producers, who themselves provide the excess packaging waste which can be seen as a structural constraint for the consumer in promoting recycling or waste prevention. Further research could investigate this cyclic relationship, either by looking at how production policies could favor environmentally friendly products that limit needless plastics waste, or how changes in consumer habits could change the production itself.

Finally, this project focused on the process of *how* historical, political and social structures shape waste management, further research could go on to examine the *why* behind these process. More specifically, why alternative waste disposal methods such as composting or recycling organics for biogas or biofuel, have not gained much traction as a solution in Denmark. Waste is largely producing energy in Denmark, and this is part of the reason for its justification as a solution. Further research could investigate the decision-making process for determining energy sources, as this could explain why and to what extent waste is the dominant choice, compared to seemingly greener energy sources e.g. wind/solar, etc.

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Appendix A: Research Diaries

Diary number 1:

Day 1/ 25.3.13

Waste type	*What waste did you sort or recycle today? Why or why not? Feel free to reflect on challenges/thoughts etc.*
Glass	Glass jars already accumulate in my glass recycle box. At least 2-3 a week are added. I use a couple as food storage containers and the rest are carried once a month down to the recycle station. Not a big inconvenience as it is on my daily route to the shops.

Diary number 2:

Day 1/ 25.3.13
Thoughts throughout the day:
Just after this, the first day in the experiment, I am exhausted of thinking about where everything goes. I think it is a big hassle, and the fact that I only have a container for paper in my courtyard, makes it even more difficult. I can throw out me glass jars and bottles across the street or at my local Netto, so that is not a problem. Actually there is a container, in my courtyard for bulky waste and electronic items, but I am not counting on having any bulky or electronic waste during this week, so that is not of much help.

Diary number 3:

Day 3/ 27.3

Organic	Threw fruits and veg out as usual. Its not full, but is starting to smell a bit when I open it up. Tried to google around a bit to find out where to go throw it out, but no luck. Seems like its only available to residents in the individual courtyards (like my own, the machine is just broken)

Day 6/ 30.3

Metal	Went down with cans into the metal bin. No problem there.

Day 7/ 31.3

Organic	Into the normal waste. Honestly, what else am I gonna do?

Diary number 4:

Day 2/ 26.3.13

An overall thought: how many of the food products I am consuming are a combination of the different wastes on the table, as an example, The package of tomatoes I bought are not only tomatoes, which I really like, the package is also included leftover sticks of the plant (organic waste), plastic open box and plastic wrapping (plastic waste), and on the wrapping there is a paper sticker (paper waste) which inform me where does it come from and the fact that those are organic tomatoes. If I will follow my supermarket list, I can see that there aren't products which contain only one kind of waste and some of them are a combination of three or even more types of waste. This fact is making the practice of sorting waste to a very complex activity, in a lot of the cases, one can wonder on which type of waste is the package material, and there is no clear explanation of it on the package itself, unless it is an environmental friendly package.

Organic	Every time that I am washing dishes, I have some leftovers of food in the sink, these go straight to the general garbage container under the sink, this is almost an instinct for me, but today I was wondering what should I do to prevent it. So first, clean out my plates to the organic container and from there to a compost bin. But there is no compost bin at my yard.

Day 3/ 27.3.13

Plastic	There is so much plastic in my general garbage, I don't have any other place to throw it, plastic bottles, plastic wrapping, plastic boxes/containers. It is pretty easy to separate the plastic from the rest of the garbage but I don't have where to dispose it, except the general bin which go to incineration station.

Organic	I bought milk, which its container is special material, it can be disposed as organic waste, but I don’t have any container in my backyard, and the recycle station seem so far away for me on my bicycle and a bucket full of food leftovers from cooking and eating. I throw the container to the general garbage, and felt very bad about it.

Appendix B: Nørrebro Affaldsmodel Poster

Miljøstation

Indhold

Aluminium

Alu-folie, Alu-konservesdåser, Køkkentøj af aluminium, Alu-bakker, Alu-drikkedåser, mv.

Glas

Alle slags flasker, konservesglas, glas til fødevarer eller skår heraf.

Jern & metal

Konservesdåser, værktøj og køkkenting af metal. Mindre jerndele, andet magnetisk metal.

Pap & karton

Papkasser, bølgepap og kartonemballage fra f. eks. legetøj, mv.

Papir, aviser & ugeblade

Aviser, ugeblade, tryksager, skrivepapir, kuverter, telefonbøger med svanemærke mv.

Restaffald

Restaffald, stort set alt det affald, der ikke passer i ovenstående grupper.

Uden for Miljøstationen

Madrester til kompost

Kompostering er den naturlige nedbrydning af organisk affald.

from http://rentskrald.dk/affaldstyper/dagligt/a3_plakat_dgl_affald.pdf

Appendix C: Open Letter from Signe Goldmann

Jeg har valgt at forlade SF's gruppe på Københavns Rådhus efter at have repræsenteret partiet i Københavns Borgerrepræsentation de sidste 6½ år. Det er snart ved at være 25 år siden, jeg meldte mig ind i SF's Ungdom og senere SF, så det har ikke været en beslutning, der har faldet mig let, og det er meget vemodigt at skulle tage afsked efter så mange år. Men tingene har udviklet sig på en måde, hvor jeg ikke længere kan se, at jeg kan være en del af partiet, hvis jeg fortsat skal være tro overfor mine idealer og kunne bevare både min personlige og politiske integritet.

Beslutningen er en direkte følge af, at SF's gruppe i tirsdags besluttede, at SF's Teknik og Miljøborgmester Ayfer Baykal kunne forhandle videre med omegnskommunerne om at bygge en væsentlig større ovnkapacitet på Amagerforbrændingen end det, der tidligere har været både SF's og Københavns Kommunes politik. Det nye forbrændingsanlæg er den største miljøpolitiske beslutning, København står overfor i denne valgperiode; en beslutning til den svimlende sum af 4 milliarder kroner, der rækker 30-40 år ud i fremtiden og som i høj grad vil være afgørende for, om vi fortsat primært skal brænde vores affald af, eller om vi meget mere massivt skal satse på at genanvende affaldet, som det sker i en række af vores nabolande.

København har gentagne gange i Amagerforbrændingens bestyrelse (hvor jeg også selv i en del år har siddet som bestyrelsesmedlem) anmodet om, at man ikke udelukkende satsede på at bygge et kæmpe forbrændingsanlæg til erstatning for det gamle, men at man også grundigt fik belyst mulighederne for at bygge et noget mindre forbrændingsanlæg kombineret med forskellige typer af genanvendelse, det kunne f.eks. være biogas og forskellige typer af sortering som eksempelvis REnesciense (hvor man sorterer affaldet ved hjælp af enzymer).

På trods af dette ønske fra Københavns Kommune (som i øvrigt ejer ca. 2/3 af selskabet, men kun har 2 ud af 6 pladser i bestyrelsen), så valgte de 4 andre kommuner i Amagerforbrændingens bestyrelse at stemme imod, at man grundigt fik belyst alternativerne, og et flertal i bestyrelsen valgte efterfølgende kun at sende den store forbrændingsmodel i udbud, igen imod Københavns ønske om at holde muligheden åben for en mindre forbrændingsløsning, der kunne kombineres med genanvendelse. På den baggrund meddelte København, at man ikke var sikre på, at man ville stille den nødvendige lånegaranti, som er en forudsætning for, at der overhovedet kan bygges.

Tidligere på året besluttede Københavns Borgerrepræsentation derfor forventeligt nok at sige nej til at stille den lånegaranti, som Amagerforbrændingen bad om. I den protokolbemærkning (fra SF, S, R og Ø), der fulgte beslutningen, blev det slået fast, at vi ikke ønskede at se en ny låneanmodning fra Amagerforbrændingen, før de havde fået lavet en business case på et væsentligt mindre anlæg kombineret med genanvendelse, som vi gentagne gange havde bedt om. En beslutning der i øvrigt fik mange rosende ord med på vejen af både miljøorganisationerne og ministre på området.

I stedet for at få lavet den business case, som København havde bedt om, valgte flertallet i Amagerforbrændingens bestyrelse dog stædigt at fastholde, at de ikke ville undersøge nogen alternativer. Til gengæld satte de gang i et massivt lobbyarbejde imod den kommune, der ejer

majoriteten af selskabet, og de fik ekstra vind i ryggen, da udbuddet på at få bygget de store ovne var blevet vundet af firmaet Vølund, hvilket ville skabe danske arbejdspladser. Så fra at være en beslutning der handlede om, hvorvidt man skulle genanvende en større del af affaldet, så vågnede fagbevægelsen pludselig op og begyndte at presse massivt på for at få politikerne i København til at ændre mening, og Møger og Corydon blev efter sigende sendt i byen for at bearbejde deres respektive borgmestre i København. Og det virkede desværre.

Jeg er nok den politiker, der har været bedst inde i sagen, og derfor har det også været naturligt, at SF's Teknik og Miljøborgmester har holdt mig meget tæt inddraget i hele processen, og jeg har også langt hen ad vejen været den, der er blevet sendt i pressen for at tage debatten der, men efter hun gav efter for presset og valgte at ændre holdning, gik hun i gang med at forhandle med andre ejerkommuner om en stor ovnløsning uden overhovedet at orientere mig. Hun valgte derefter at få gruppeledelsens opbakning, og først derefter blev jeg orienteret.

På et møde i SF's gruppe bad jeg om, at vi undersøgte, hvilke muligheder vi i Københavns Kommune havde for selv at lave den business case, som Amagerforbrændingen har nægtet at lave. Jeg var helt klar over, at vi ikke kunne lave en meget grundig case, da kommunen har overgivet sin kompetence i forhold til affaldsforbrænding til Amagerforbrændingen, og derfor ikke selv må lave en grundig undersøgelse af dette område. Men det ville formentlig være muligt at give nogle kvalificerede bud på, hvad der ville være af alternative muligheder med nogle ca. priser og tal på hvor meget affald, der kunne håndteres ad den vej. Teknik og Miljøforvaltningen har oplyst, at deres bud er, at en sådan undersøgelse (samt en forudgående juridisk afdækning af, hvad man som kommune selv må undersøge) formentligt kunne ligge klar inden sommerferien.

Jeg bad derfor om, at man ventede med at træffe en beslutning, til man havde lavet en sådan undersøgelse. Selvom den ikke ville være ligeså grundig som den undersøgelse, vi gentagne gange havde bedt Amagerforbrændingen om, så ville det under alle omstændigheder kunne bringe os tættere på at kunne vurdere alternativerne. Men i sidste ende valgte SF's gruppe i tirsdags at følge Ayfer Baykal, der insisterede på at gå videre med forhandlingerne med andre ejerkommuner nu og ikke at gå videre med og afvente en undersøgelse - vel vidende, at en sådan beslutning ville være helt uspiselig for mig.

Det SF's gruppe nu har besluttet er, at man kan forhandle videre om en stor ovnløsning med forskellige bindinger på bl.a. mængden af affald, der kan forbrændes, og hvor meget der skal genanvendes. Intentionerne er som sådan fine nok (hvis man ser bort fra det faktum, at det ikke giver meget mening af bygge så stort, hvis det ikke skal bruges). Problemet med bindinger er bare, at de kan laves om, og man skal ikke have været mange år i politik for at vide, at en aftale, som nogle tidligere generationer af politikere lavede for 5, 10 eller 15 år siden, ikke nødvendigvis er noget, som kommende politikere vil føle sig voldsomt forpligtet af. Hvis politikerne om f.eks. ti år står og har brug for at komme af med mere affald og kan vælge mellem at fjerne nogle bindinger for derefter at kunne komme af med affaldet gratis ved at fylde lidt mere i ovnene, eller de alternativt skal ud og investere i et genanvendelsesanlæg af en slags, så kunne jeg i hvert fald godt frygte, at fristelsen til at fjerne bindingerne ville blive for stor. Et forbrændingsanlæg har en levetid på 30-40 år, derfor vil det helt afgørende for udviklingen og mængden af genanvendelse ikke så meget være afhængigt af, hvilke bindinger man laver, men af størrelsen på ovnene.

Men selv hvis man forestillede sig, at bindingerne faktisk holdt, så ville det betyde, at vi gik med til at bruge københavnernes penge på at bygge et anlæg, der var alt for stort i forhold til det, vi formentlig har brug for, og at man ud over at bruge 4 milliarder kroner på forbrænding yderligere skal ud og investere penge i forskellige former for genanvendelsesanlæg. Hvis vi byggede et mindre anlæg, kunne vi måske få både forbrænding og alternativerne for de 4 milliarder. Når jeg skriver "måske", så er det fordi ingen jo i virkeligheden ved det. Amagerforbrændingen har nægtet at lave den business case, der kunne have givet svaret, og SF's gruppe har valgt ikke at bakke op om, at man fik lavet den undersøgelse, der måske kunne have givet et kvalificeret bud.

Jeg har været medlem af SF i rigtig mange år, siddet i hovedbestyrelsen i flere perioder og i borgerrepræsentationen de sidste 6½ år. Jeg har loyalt kæmpet for partiet og glædede mig helt vildt over, at vi kom i regering ved sidste valg. Jeg har selvfølgelig taget mine politiske kampe, men altid på de indre linjer, og jeg har aldrig før gået åbent ud i pressen og kritiseret partiet, fordi jeg har været af den opfattelse, at det udelukkende ville tjene højrefløjen, og den opfattelse har jeg sådan set stadig. Jeg har derfor også haft en del overvejelser om, hvorvidt jeg bare skulle forholde mig tavs nu, eller om jeg åbent skulle fortælle, hvad det er, der har fået mig til at tage den for mig ret voldsomme beslutning at forlade mit parti.

Men jeg har gjort op med mig selv, at københavnerne har krav på at vide, hvad det er, der foregår. Jeg er ikke i tvivl om, at borgmestrenes pressefolk vil gøre, hvad de kan for at sælge en stor ovnløsning med eventuelle bindinger som et fantastisk fremskridt for miljøet og genanvendelsen. Og det vil sikkert lykkes, for hvor mange journalister er godt nok inde i dette stof til, at de for alvor kan give et kvalificeret modspil. Teknik og Miljøforvaltningen, der i forbindelse med behandling af
låneanmodningen entydigt anbefalede en mindre løsning med mere genanvendelse, vil formentlig lede med lys og lygte efter faglige argumenter for, at de nu pludselig også kan synes, at det vil være en rigtig god idé med en stor løsning. Og ingen vil ane, hvad der i virkeligheden er gået for sig, og at det i høj grad er et spørgsmål om jyske arbejdspladser, der har dikteret, hvilken miljøpolitik vi skal føre i København, stik imod de visioner vi bryster os af at have på miljøområdet.

Jeg har valgt, at jeg fortsætter som medlem af Københavns Borgerrepræsentation, men nu som løsgænger, da sagen om Amagerforbrændingen langt fra er afsluttet, og jeg fortsat mener, der er brug for en kritisk stemme i denne sammenhæng. Jeg er klar over, at mine muligheder for at få indflydelse fra nu af vil være stærkt minimerede, og at min tid i politik lakker mod enden, men jeg mener stadig, jeg har en opgave at udfylde lidt endnu.

Jeg er oprigtig ked af, at tingene er endt, som de er. Jeg har haft rigtig mange gode oplevelser ved at være en del af SF, og jeg er taknemmelig for, at jeg har haft mulighed for at lave en masse politik, som jeg har været rigtig stolt af. Bl.a. har jeg fået gennemført, at København fik lavet en fattigdomsgrænse, og at der blev sat forsøg i gang med gratis skolemad til de fattigste københavnerbørn. Jeg har sikret, at indsatsen mod diskrimination og for ligebehandling er blevet styrket i København, og det lykkedes mig bl.a. at få standset, at hele beskæftigelsesindsatsen røg over på private hænder. Desuden har jeg været dybt engageret i klima- og miljøindsatsen og arbejdet hårdt for, at vi skulle være førende på området og gå

foran og vise et godt eksempel og samtidig forsøge at udnytte det store vækstpotentiale, der ligger i at være med til at fremme de grønne løsninger. Der ud over har jeg har været med til at træffe en masse beslutninger, som jeg tror på samlet set har været med til at gøre København til en bedre by, og jeg har ikke været i tvivl om, at jeg har befundet mig på rette hylde – også partimæssigt.

Selvom jeg selvfølgelig er rigtig skuffet over forløbet i denne sag og har følt mig nødsaget til at tage konsekvensen af det, så ønsker jeg fortsat kun det bedste for partiet fremover, og jeg håber, at de mange gode kræfter, der er i partiet, vil fortsætte deres store arbejde for at trække udviklingen både lokalt, nationalt og globalt i en mere miljørigtig og solidarisk retning, for det er der virkelig brug for.

Source:
<*http://multimedia.pol.dk/archive/00651/Skriftlig_begrundel_651525a.pdf*>

Appendix D: ARC Visit Transcript

ARC representative: … We don't have landfills any longer in Denmark. First because its not good for the environment and second because we don't have so much room here. It's a quite small country. Um and then as a bonus we get to make electricity and district heating and that way when we use the waste as a resource we save the environment. Now.. can anyone of you imagine how much waste it takes to substitute one liter of oil?

Researcher: probably quite a bit.

ARC representative: There's a very ambiguous guess.

Researcher: Yes

(everyone laughs)

Researcher: a ton.

ARC representative: A ton?! (sounds surprised). It's actually …

Researcher: A liter of what?

ARC representative: four kilos.

Researcher: Four kilos?

ARC representative: Four kilos of household waste. You can substitute a liter of oil or a kilo of coal. Carbon. So we burn approximately 400,000 ton of waste every year, so that way we save a lot of oil, or coal. And that way we save the environment too for CO2 emissions. Okay..

So. Um, Amager Resource Center, we're owned by the five, the capital municipalities, Copenhagen, Hvidovre, Tårnby, Dragør and Frederiksberg. And we receive waste for 552,000 inhabitants. More people live in Copenhagen of course, but half the city's waste goes to another incineration plant. Vestforbrændingen. And we also receive waste from about 46,000, um, firms, companies and institutions. Hospitals, construction, what not. So, we are a non-profit company organization, so even though we do make profit everything has to be reinvested into the company. So we do a lot of research about new technologies and we have a few projects going on. Our main income is receiving the waste and also selling the electricity and district heating.

And uh, our main expenses is at this moment maintenance because it's a pretty old plant. So there's a lot of stuff breaking down all the time. Yeah. Okay so we participate in three business activities. We own and run 14 recycling stations, distributed within the five municipalities. And um that is people's main source of recycling. People -- some of the municipalities for example Frederiksberg and, slowly starting, Copenhagen have some really good recycling um facilities by their property. Do you live in either Frederiksberg or Copenhagen?

Researcher: In Nørrebro.

ARC representative: Nørrebro ok, do you have that there?

Researcher: Yeah the Nørrebro affaldsmodel. Is that what you're talking about? These local -- like apartment-based initiatives?

ARC representative: Um yeah. Ok. So it's starting to get there. I live out in Dragør, and there is nothing. So we just have the recycling stations. So the rule is that everyone lives within 3 KM of a recycling station. So in other words, there is no excuse to not recycle. Cause everyone is fairly close, even if you don't have a car.

Researcher: Sorry, so that's already an objective of the waste strategy?

ARC representative: Yeah that's how it is. And then so that is our one activity and then we have the waste to energy plant right now. And then we're also co-owners of Storkøbenhavns Modtagelsescenter for Olie og Kemikalieaffald. [illegible] And that's a facility for handling oil and chemical waste, whatever cannot be either incineration or recycling. So chemicals and other things such as mirrors for example.

Researcher: Oh, interesting.

ARC representative: We don't know how to... yeah. We don't know what to do with them

(laughter)

ARC representative: It's kind of weird. So we're working on that too. Alright. So we do a lot of recycling in Denmark, like i said earlier, in 2011 we incineration 404,000 tons of waste and in that same year we recycled 124,000 ton, so that's more than a fifth. So that's pretty great. Everything cannot be reused, about 85% is reused, 13% is taken out here and incinerated. For example, that can be products that are composed of plastic, wood, and a lot of different materials. So the energy that it would take to, you know, separate it and put it all in different... it would surpass the energy that you can get out of it. Um and then only 2% is deposited or specially processed. And then, well if you live here now I'm sure you already know that we have a separate collection system for the batteries, the green ones, and some properties have it as well. However -- I just learned a little fun fact -- more than half of the batteries purchased

in Denmark are not recycled. I actually thought we were pretty good about that here, but apparently not. So lot's of people still throw out their batteries. And we're not talking batteries you know hidden in electronics, just like, the regular AA batteries, for example.

Oh and then of course at some of the recycling stations they also have these exchange centers where you can put if you have something that works still, you just don't want it anymore, and you don't want to sell it, you can put it there so someone else can benefit from it. Because actually, when you throw something in one of these containers (points to picture on slide) like no one else is allowed to take it. It's a liability thing. So then we have these exchange centers where you can put whatever you want. You can always find a lot of books and toys, furnitures, so that's a really nice system cause that's direct recycling.

Researcher: And that's the 14 stations that you have around the city?

ARC representative: 14. Yes.

Researcher: In Copenhagen? Or..?

ARC representative: In those 5 municipalities. Yeah. And some of them there are up to 30 fractions. 21... and then not all of them have the exchange center. But I think 10 of them do.

Ok.. So, um, the waste we incinerate, it becomes electricity to the city. We burn waste 24/7 and we've been doing so since 1970. They usually say that uh, an incineration like this have a... living time of about 25-30 years, and we're going on 40 plus now, so it's definitely time for an update. But we also have a new plant that I'll tell you a little bit about that later. But um yeah so we've been making district heating since 1970 when we opened and then in 1991 we got a turbine and starting creating energy.. or uh electricity, sorry, as well. So right now we create electricity for 50,000 households, and we make district heating for 120,000 households. And actually in the summertime, um, the municipality of Copenhagen get all their district heating from us alone. So the coal plant next door shuts down, so that's good.

Alright so we have 4 oven lines and the ovens burn at about 1000 degrees. 20% of what we incinerate cannot burn, and that's mainly because people are not good enough at recycling. Um, this for example right here (shows big hunk of slag) this is stuff that we pulled right out from the oven. So this is mainly metal, yeah? But this is all stuff that can't burn like gravel, glass, metal that was supposed to be recycled but it was not. So that is about about 20% of everything burned, and we call it slag, or clinker. And these 20% however are recycled as asphalt. Um after the waste burns in the oven, what cannot be burned, the leftovers, are dumped down into the basement, where we cool it with salt water. And then it's picked up by an external company, that um, in Danish we call it "we mature it" we treat it, it has to lay out and be aired and watered for 3 months, this way the heavy metals in the slag will bind with the slag particles.

(A worker briefly interrupts the presentation)

ARC representative: sorry about that where was I? Yes. So with a magnet we remove the metal pieces, oh I said that already right?

Researcher: I think you were right there, yeah.

(laughter)

ARC representative: and then we treat the slag in a few months so the heavy metals bind, and we use it for foundation for parking lots and streets. Um and it's really important to do the maturing treatming process because if not, when it rains, the heavy metals will stick to the water particles and seep into the ground. So.. and actually we say that we have some really expensive roads, here in Denmark and one of the reasons is we have so many batteries thrown out, so there's a lot of copper in our road foundations.

(laughter)

So.. um that cannot be seperated.

Researcher: Can I ask, which company is it that you work with that handles the maturation of the clinker?

ARC representative: You know what I'm not sure, it's a new one, because we used to do it ourselves.

Researcher: Ok. But now you're outsourcing it.

ARC representative: Yeah. I'm sorry. I can find out though. Um the smoke from the waste incineration is used to heat the water in our boilers, and then that steam is used to um drive our turbines. About 20% of the energy is converted to electricity and the remaining 80% is converted to district heating. We're only about 86% efficient energy wise and that's because it's what 43 years old. It's old. Um so there's leaks here and there, and yeah it's old basically.

You can see it when we get into the turbine hall, it's really really hot in there and that's because we use so much heat and electricity, or energy sorry.

Um we say that we're 80% um CO2 neutral, and that's because approximately 80% of what we burn is organic material, the remaining 20% is plastic. And plastic is made from oil so when we burn plastic from the waste, its pretty much the same thing as burning oil. So approximately 80% CO2 neutral. And the smoke is cleaned about 95% which is not really up to date either. So our environmental approval for that runs out just in time when our new

incineration plant is ready. I'll tell you a little more about the smoke cleaning process when we walk around.

Researcher: You're saying that 80% from the garbage is organic.

ARC representative: Yeah so that means food leftovers, clothes, or biodegradable things. And the rest is like, mostly food packaging.

Researcher: but the plan is I guess that with the new plans for improving recycling that this will be higher?

ARC representative: yeah I'll talk about that a little later.

Alright so... there's about 198 employees in 2011, anyways, about half work here, and the other half work at our 14 recycling stations. And they're there to guide people to and.. yeps. And it's a very good company to work for, probably also because it's a non-profit so there's a lot of profit put back into the business so they take good care of us. They have a really nice gym, fun Christmas parties, healthy food in the cantina, free physical therapy and what-not. So it's a good company to work at for sure. And um yeah we're "burning for the future"!

(laughter)

We are very um environmentally focused, and we do a lot to improve whatever we can to have the least impact possible when we burn. And we do a lot of um research into new technologies, one of the projects we have going right now is REnescience, have you heard of that?

Researcher: yeah.

ARC representative: Do you know about it?

Researcher: Yeah I read it on your website.

ARC representative: Yeah? OK cool. And then we educate children, so all the things you can see here, all the different exhibitions that before when the children come in we teach them how to recycle and what fractions to separate and what not. So we put a lot of effort into that as well.

Researcher: Is REnescience still just in a pilot project or is it..?

ARC representative: Yeah. And I don't know if there's any plans to get it out of the pilot phase any time soon.

Researcher: I mean there was 60 million invested into it I believe? Into further development?

ARC representative: I don't know.

Researcher: But it seemed kind of unclear what the actual future was, but that's not something you can comment more on.

ARC representative: No. Um, I know some stuff about it. But not too much. They're kind of secretive about it. Usually when we show people we have to like sign a declaration.

Researcher: Yeah they don't want anybody to start doing it first I guess, it makes sense.

ARC representative: Yeah.

Researcher: But do you know if ARC was going to use it, was it going to be sort of a front-door stage like they were talking about it could be, or were they going to set up a whole new facility to handle that and only recycle that way?

ARC representative: Well there's in the new plant that we're building, they made room, they like set aside, but I mean right now I think it can only do 10 tons an hour. And right now we burn about 70 ton an hour. So it's still minimal. And you know, to get it up and work on a scale that large I think it would be a lot bigger facility. So I don't think that's incorporated into the plan. But, when the new plant is built, this is going to be torn down, and then they're going to have a big empty lot here. So I mean, maybe. But. Yeah. I don't think they're that far with their plans yet.

And then we have our biggest newest project of course, I'm sure you've heard about it? Amager Bakke? Um so we're investing 4 billion kr. in this new project, um, we've been saving up for it for a while, and the 5 municipalities are putting in their work as well. We're..

Researcher: But about the 4 billion, Amager Bakke is it's own thing? I mean the exterior kind of recreational area? Or is that also part of the 4 billion kr. investment? Cause I seem to have understood it that it was two separate things.

ARC representative: like the technology?

Researcher: That the actual facility inside is separate from the...

ARC representative: Oh, no no, that's including ovens and boilers.

Researcher: Yeah, yeah, but I mean there's the exterior with the ski slope and the architecture, those are financed together within the 4 billion? Or is that a separate..

ARC representative: I'm quite sure. I haven't heard otherwise.

Researcher: Ok..

ARC representative: Um, I mean I never asked. But I assume so. Cause that's. I'm pretty sure.. now you're making me doubt.

(laughter)

Researcher: cause it seemed they were kind of, they were separate somehow, and there was some points where they were unsure if the exterior would even end up being...

ARC representative: ok well, thus far they're planning on having an external third company run the ski slope, so um we're not going to be planting the trees. We're just making the shell. So we're not going to buy snow cannons and all that stuff. So that is not included. Because that is going to be the third company. And maybe like if the surrounding area, I don't know if, planting trees and stuff that's gonna be us.

Researcher: time will tell.

ARC representative: yeah.

(laughter)

ARC representative: But you know, because I am writing a presentation about this new plant right now, and I have been talking to a lot of different people right now on the project and they are all just kind of "ehhhh", you know I asked for example "how tall is the building" and they're like "oh 80 meters.. ish". Ish? they're already starting building it and they're like "yeah we're just building the area, we haven't started building up yet so we don't have to decide on that for a while".

Researcher: that's interesting, ok.

ARC representative: So um, yeah there's a lot of things, yeah aspects that are not set yet. But um. Does that sorta kinda answer?

Researcher: oh yeah definitely.

ARC representative: Alright so, why I think we need a new incineration plant, well it's because this one is completely outdated, um in the beginning we of course didn't build um burn 400,000 ton a year so a lot of new machinery has been added into this compact little shell through the years and it's not very accessible, you can see here this picture demonstrates pretty well, if something has to be made it's not an easy task for our machinery guys, cause they have to crawl into small places and carry heavy loads up and down the stairs. It's like not a safe work environment in that aspect anymore. And the economy is not acceptable any longer because we spend so much money on maintenance. So we would need to reinvest a lot if we were to make it run a lot longer. But since we're building the new one we're just kind of like [illegible]

ARC representative: and it's gonna be, right now we're here this is the entrance where you got in, um and the water out here, so it's gonna be right here in the backyard. And then this is gonna be torn down, and then this is a sorting plant, and this is not sure at all. This may come some time into the future. And that's all I know. And that seems to be all anyone knows.

And the project process.. we were supposed to start in 2012, but we had a little political controversy. There is one particular lady that really did not want this plant to happen, so we were pushed back for about a year, but we're still counting on being done.. oh this is wrong actually, sorry, it's supposed to be done in 16. And the um. It's supposed to be like a what's it called, officially open in 17. But it's supposed to be done in February 16. And start running. But we're going to keep this going for a while to keep them running simultaneously to make sure everything works properly. [unintelligible]

Researcher: you said that there was a lady that.. what? I didn't get it.

ARC representative: Yeah um I forget her name, but there is one minister...

Researcher: Ayfer Baykal.

ARC representative: Her. She just put her heart and soul into protesting this new plant. Um she didn't want it, I'm not sure why actually. I weren't in Denmark at the time so I didn't follow the debate. So, do you know why?

Researcher: well I believe it's because the capacity was.. they wanted to built the 70 ton per hour capacity, which they had viewed as being too much, because it would burn too much, and go against the 2025 CO_2 neutrality plan as far as they saw it. So I think the municipality that wanted to have a proposal for a 30 ton per hour oven. Which was never made.

ARC representative: That's very.. optimistic. (laughs)

Researcher: yeah. But it was never made, so I think there was some kind of.. within Teknik- og Miljøudvalget there was some kind of.. they were a little angry at Amagerforbrændingen. So I think that's why they blocked it. They never actually followed through with the proposal that they asked for.

ARC representative: Yeah. Alright. So it wasn't.. it was the capacity more than the actual plant itself.

Researcher: Yeah. So I think that's why this whole relaunching as Amager Resouce Center came about, to fit in with her demands.

ARC representative: Yeah. Ok.

Researcher: Can I ask.. you said that you would be running both plants during uh just the first year of the new plant. But you just said that the uh environmental approval would expire in 13? So are you going to have it renewed or..?

ARC representative: No not in 13. Um. Did I say it would expire in 13?

Researcher: Yeah I think so?

ARC representative: Like now? Oh no.

Researcher: It was just at the same time or what?

ARC representative: It would if we were to continue with just this, it would expire soon. I'm not exactly sure when, but they know that it can't pay off because we would have to invest so much in maintenance for it to be up to date with the higher newer standards so it doesn't pay off. So they're just letting it go basically. Just turning the blind eye. Yeah because it just wouldn't pay off.

But it's not really bad. We clean the smoke between 95 and 98%. So it's not like it's really bad. But it's not perfect either.

Alright yeah so this is a little bit about the goals, but it sounds like you know this already, but Copenhagen has the goal of becoming the first CO2 neutral capital by 25. Um, this information is a little ambiguous in a way, but this is what we were given. But 500.. we're gonna save 500 tons of CO2 from.. no. Sorry. Um. One of the things we'll have to do to achieve this goal is uh 500,000 ton CO2 reduction from 2005 to 2015 and Amager Bakke will save 107,000 tons of CO2 a year, which is more than a fifth of the total Copenhagen goal. But, we're not going to be done in 15, first of all, and we're not gonna be emitting less CO2, however we are going to be creating more energy with the same amount of waste, so that

means that that's less energy that has to come from fossil fuels. So that's how.. so it sounds nice but it's a little you know.. tricky.

Researcher: When you say Amager Bakke, what do you.. is it just the slope no?

ARC representative: Amager Bakke that's the name of the new plant. So Amager Resource Center is the company that's running Amager Bakke, and Amager Bakke is the actual plant.

Researcher: for me Amager Bakke was just the slope with ski.. but ok cool.

ARC representative: So, a little bit like you were talking about too, um, they're expecting an increase of 200,000 inhabitants um before 2030, and Amager Bakke, the new plant will have, politically, a capacity of 400,000 ton a year. Which is less than what we've been burning the past two years. It will most likely, physically, practically, have a little bit bigger capacity, but the 5 municipalities have made a mutual agreement that it cannot burn any more. So this is the political capacity. And one of the reasons that it will be able to burn a little more is then we can be flexible and then also burn um biomass. So.. yeah.

So how is this going to work with that much more people and the same capacity? So the 5 municipalities have agreed that every household has to reduce their incineration waste with 27%. How this is going to be done, well I personally hope that they're gonna make some reduce reuse recycle campaign, cause reducing is definitely essential, that also is a little personal note there. Um we don't know exactly what their plans are, because that is the municipalities, and we don't have anything to do with that. But their goal is 27% and out of that they want the plastic to be reduced by 40%, and if that is the case, then the CO2 emissions are gonna be reduced of course. But I don't really know what their plans are.

Researcher: that's a good vision you have there. Good vision, I don't think it's possible, but that's also a personal point from me.

ARC representative: yeah.

Researcher: 40% reduced from household waste in plastic. The proportion of plastic?

Researcher: But that's 40% of the 20% right?

ARC representative: Yep. Ok so. Wait no no I think it's 40% of everything. Of all the waste we produce. And um I mean, I live in Dragør and there's only the recycling station, well there's a little bit here and there, I think there's 2 glass containers in town, and some people have some for cardboard, so people have one for paper. But I don't think there's anywhere where there's you know recycling containers for plastic, so I mean people are not gonna drive out to the recycling station. This is not realistic. People are lazy. It has to be super super convenient, and I have been talking to the representative of the municipality of Tårnby actually, because Dragør belongs to Tårnby when it comes to waste management, and he was

just (whistles) scatterbrained. He had no clue what was going on. And he had no plan. So I really don't know how this plan is realistic or how they are going to achieve it. But I know that Copenhagen has a plan, and they're implementing a recycling system like at households and properties with the next.. now and uptil 15.

Researcher: yeah I think it's 2018, 2013 to 2018 I believe.

ARC representative: 18, ok.

Researcher: I have a question about the plastic. Do you.. could you see this being a kind of negative factor if there is a reduction of plastic? Because it seems like that produces quite a bit of um energy.

ARC representative: Um, yes. Yeah. Because right now, the ovens just run on oxygen and then the waste is the fuel. So if the oven has been shut down to pull out some metal or pans and cans and whatever, then we may use some propane gas to turn them back on, but otherwise we don't use any fuel to keep it going because the high temperature of the waste and oxygen. But there's 20% plastic so you know that's a type of fuel, so if there's 5% of plastic, I mean I'm not an engineer so I don't know exactly, but I'm sure that it wouldn't be as easy. But then again, we're getting some high-tech (whistles) technology. The newest of the newest. Um, so I'm sure that it shouldn't be a problem.. I'm sure they took that into their considerations. But um they haven't really revealed the details yet. I asked the same question.

Researcher: Yeah. Because it seems like the plans for the plant were made before the plans for reducing the recycling so I was just wondering how much it was actually taken into account for it...

ARC representative: I don't think the plans for the plant were made before, um they were probably made before but not set. Because nothing is set. Everything is still not set. They're still negotiating about certain technologies and machinery and what not. So yeah. They have to have thought of that. But yeah.

Ok so the new plant is also going to be more environmentally friendly, um right now we have what is called a semi-wet smoking cleaning system and now we're gonna get a wet smoking cleaning system which is a lot better. We're gonna reduce the emissions of NOx by 85%, we're gonna remove 99.9% of the HCl acid and 99.5% removal of Sulfur. Which is about 95-98% so this is gonna be a lot better. And we're gonna be creating 25% more energy on the same amount of waste, and this is gonna be due to a new low-pressure turbine and also energy recovery system. Are you familiar with energy recovery?

Researcher: mm-hmmm.

ARC representative: Somewhat. Alright so right now the smoke from the chimney is about 130 degrees so we're losing a lot of heat energy that way, so with the new plant that energy

recovery system is gonna extract the remaining heat um so the smoke that comes out of the chimney, which is mainly vapor, is gonna be about 20 degrees. So very visible actually. And then the heat is gonna be um taken out of the steam, and used in the production to create electricity and heating and then the water, the condensed water, we're actually gonna sell it to one of our neighbors, because they have a high amount of water. So [name of unintelligible company] next door and I forget who else it is, but we've got several offers already. So we're gonna have [unintelligible] on that as well.

Yeah so 25% more energy so we're gonna be making district heating for 160,000 people rather than 120, and electricity for 62,000 households, and now it's 50. So we'll be better for sure.

Researcher: is the percentage that we see of the reduction is that .. how is it now? Currently?

ARC representative: well the 85% is a reduction of the current emission, and I'm not sure what the current emission is. But it's between 95 and 98, so 85% reduction of that. And then the 99 that's the total removal.

I'm not sure exactly how much NOx we let out.

Researcher: so it's 85% reduction of what there is now.

ARC representative: yeah. Actually when we walk around we have a little computer where it says exactly what we let out of the chimney. At any point of time, so if you're good with the uh you know physics or chemistry or whatever (laughs) you can see. I can't really figure that out. So yeah.

Um yeah and to the design it was designed by BIG -- Bjarne Ingells group? And the vision or one of the requirements the 5 municipalities had was that they wanted to incorporate this plant and make it part of the city and make it something that the residents of Copenhagen and the other municipalities could benefit from and enjoy. So that's why they came with the ski slope design. So the facade is going to look like this and it's gonna be windows and all these.. I asked if it was gonna be all windows, or if some of it was gonna be opaque plastic. And that was also kind of an "ehhhh" answer. But they're gonna have like little terraces, with little plants covering all the sides. So I think it's actually gonna look nice.

And then yeah there's the ski slope. Um. So we're hoping to get three different color slopes and then you can ski right here, I'm pretty sure they're gonna use snow cannons in the winter, and then have um in the summer I'm not really sure what you call it, but not snow. Some sort of plastic rubber thing. So cause it would be kind of ironic to spend a lot of energy having snow.

Researcher: But in the winter it probably will work well.

ARC representative: Definitely, definitely. And then they're gonna make like a nice surround area too so you know, like a picnic thing. And then right out here in front we're gonna have the cable park, I don't know if you guys saw that? When you came in?

Researcher: Cable park?

ARC representative: yeah, wake boarding.

Researcher: Yeah, yeah.

ARC representative: So that's right out here, there will be like a little activity place area, yeah. So.

And then here's another picture of the ski slope...

Alright, ok and then back to our current plant. This is on the reception facility, where we receive all the waste. About 400 trucks come in every day and they have about 10 ton each, and they dump all the waste right here. 50% of the waste we receive is from households, and 40% is from institutions and companies, and the remaining 10% we get from the recycling stations. Um, and then we have these two big cranes right here, um I'll take you up into the crane cabin. Anyway, they have two functions, first they mix the waste. The household waste is usually quite wet and the construction waste is usually quite dry. So it's important to constantly mix it so it has an even moisture level, so then it will have a better combustion value, I guess. And then the other function is of course to grab up the waste and dump it into the oven and then this yellow thing here is the [unintelligible] right here is one of the four ovens we have, so the waste is dumped here and then it moves like a 2 hour journey to the front of the oven where the main fire is so it slowly dries, and then the bottom is um, separate grids which slowly push the waste forward. So we add oxygen through those grids, and whatever cannot burn, ashes and [unintelligible] phones and what not, through that grid. And then they fall into the oven, where we cool and treat the slagger, clinker. Then we use the hot smoke that goes into the red steamer which is that, and there we have a bunch of water pipers and the smoke is about 1000 degrees. So the water is heated to steam and then the steam is taken over here to our turbine which then runs our generator. We have two turbines, a 20 MW and an 8 and a half MW turbine. When the steam has been used to run the turbine, it recondenses but it is still very very hot. So it goes to our heat exchanger and then that is actually the water we use for district heating. So we pump the water out throughout the city and that is a closed system so the same water comes back cold. And we reheat it and use it again. Recycling that water. So after the smoke has been used to heat the water it goes through our cleaning system which is in two parts. The first part we have a really big container and we um mix the smoke with different kinds of chemicals. Activated carbon, um limestone water mainly, to neutralize and bind some of the toxic particles to the smoke particles, and then we lead the smoke into another container where we have about 1000 filters. So all the ashes and particles stick to these filters. And when the filters are completely covered in filth, they automatically shake. And then the waste dumps into the bottom and that waste is hazarous and quite toxic waste. And we quite get a waste product of about 40 kilos per ton. And that we ship to Norway. It goes to this place called Langeøre near the Oslo fjord,

and it's actually an old limestone quarry um.. and it works out cause the limestone is basic, right? And our waste is quite acid, so they have this hollow island that we're just isolating and filling up with toxic waste. When it gets full they slap some soil on top and plant some trees and just hope it never leaks.

(laughter)

ARC representative: So that's that. And then the rest of the smoke goes out the chimney.

Researcher: small question: there was the track and they mix the construction and the household waste, like what do you not burn?

ARC representative: What do we not burn?

Researcher: Yeah.

ARC representative: We burn everything.

Researcher: Everything?

ARC representative: Everything. So that's why it's so important and we try to really emphasize that people have to recycle at home. Because when it's taken out here we get 100s of tons of waste, and we can't sort it and we don't have the capacity and the resources to do that. We do samples, where we ask um a truck from where ever to just dump all the waste you know on the lot out there and then we have some guys go through it to see if they have anything. That's usually for construction, because we can't control what people throw out, that's people's own choice right? So construction.. because for example plaster that is not supposed to be thrown out, at least not in big quantities because it really messes with our smokes cleaning system. So we do some random samples, but in large, we don't check um.. I don't know how often they do samples. So we burn everything.

Researcher: what's the connection between ARC to R98, is there any.. are you working together?

ARC representative: one more time?

Researcher: there is a company called R98, that's the company with all the..

Researcher: the one that comes and picks up all the garbage.

Researcher: The collectors. So I guess there is some kind of operation between you to them?

ARC representative: No. I'm pretty.. Like I.. You're talking about like the garbage trucks right?

Researcher: yeah, where I go from my household to throw my garbage, I throw my garbage to bins of R98, not to ARC.

ARC representative: I think, yeah, no... we don't have any waste collecting, like um trucks or people. So that is either, um, I think there's different companies that pick up the waste and they're contracted either through the municipalities or um an external company that's hired by the municipality. So we don't have anything to do with them.

Researcher: because they are based really close to here, like it's the next building, R98.

ARC representative: I'm not even sure.

Researcher: I'm sure because we just passed it.

ARC representative: obviously we work with them. Because they come here and dump our waste. But they're not part of our staff.

Researcher: It's just that youre' saying, we burn everything but it pretty depends on the citizens of Copenhagen that actually, we are not recycling, yeah, and you have nothing to do with it, you just incinerate and try to get the smoke as clean as you can, but R98 in 25% of the household that you see right over here, we don't have metal can or metal bin or a plastic bin, or whatever...

ARC representative: but you do have a recycling station within 3 kilometers.

Researcher: Yeah, you know the girl over here (points to one of the researchers) she went to a recycling station in.. where was it?

Researcher: that was in Nørrebro. On Frederiksberg Alle. I couldn't get in.

ARC representative: You couldn't get in?

Researcher: No, uh because I was on my bike. I couldn't get in if I didn't have a car.

ARC representative: (sounding shocked) Are you serious?

Researcher: yeah.

ARC representative: (gasps)

Researcher: yeah I was very suprised, I thought I could just walk in.

ARC representative: Wow.

Researcher: But you mentioned that they were talking about building a separate sorting facility, but that's up in the air?

ARC representative: Yeah, cause I think that.. You know the REnescience that's also made to handle unsorted waste. Um, oh that's crazy.

Researcher: yeah I was very surprised as well.

ARC representative: that's just completely...

Researcher: I also went to next to Fisketorvet, it's around maybe 1 and half kilometer from my house, on my bike looking for a recycling station, but couldn't find it. So..

ARC representative: if you can't go in without a car, that's just ridiculous! I didn't know that. I'm definitely gonna confront someone with that.

(laughter)

Researcher: can I ask... do you have anything to do with, for instance, with batteries when they're recycled. Do you get the recycled batteries as well or are they shipped somewhere else?

ARC representative: yeah they're shipped somewhere else. That's the municipalities that run that. And we're run by the municipalities. So, we don't do anything. We're co-owners of SMOKA that uh deposit station, and then the plant here and the recycling stations, and that's it.

Researcher: do you know anything about importing and exporting of garbage? I know that the municipality has put a kind of a limit to it, that it's not going to be allowed at the new facility.

ARC representative: Importing?

Researcher: Import of garbage. Like it's only going to be from neighboring municipalities if they have some kind of excess or something, but...

ARC representative: I don't know anything, but I don't think that they import garbage now though, do they?

Researcher: Well they're not allowed to. But in the EU they've made some new laws that basically waste can be freely shipped as long as it's being recovered, which is happening here.

ARC representative: I don't think that it's going to be possible, cause there's going to be more people, more waste, and they're gonna have the same capacity, and I think they're just a little too optimistic about people recycling when they don't have any recycling plans in the plant. As of yet. But I don't know.

Researcher: So do you think that the full capacity will be.. I think it's 560,000 tons per year that the new one will is going to be with the two ovens?

ARC representative: No, um each oven is gonna have a capacity of 35,000 ton so it's gonna be 70 total.

Researcher: Per year? I think it's 560,000 tons per year. Where right now the limit is 400,000, that's what the municipality has said right?

ARC representative: Well.. for here?

Researcher: Yeah.

ARC representative: Well.. I mean, it's more, too... cause in 2010 we burned 417,000 tons. So I think they're quite flexible. But I mean practically I'm not sure, um and I'm not allowed to say either.

Researcher: Ok.

ARC representative: But I don't know it. Um, but, cause like I said I'm writing a new presentation about it, and she said that she was going to find it for me, the secretary that I talked to, but then she also added that I couldn't disclose that information anyway.

So, you can take that as you want.

(laughter)

Researcher: Thank you (laughs)

ARC representative: If you know, I don't know if there's anything to hide. But I don't know. But let's see, if it has 70 ton per hour, I guess let me just do the math...

Researcher: But um, there was also some plans about, that you guys were going to work together with Vestforbrænding, is that happening somehow, some kind of fusioning happening? Do you know anything about that?

ARC representative: I think actually.. I don't know why really, but those two [unintelligible] here and there (she means Amagerforbrænding and Vestforbrænding), I don't wanna say "we" because I'm not included into that, but they see each as competitors. Big time. There's a little.. and I don't know why cause we do the same thing for each of our area. So I don't see.. we're not competitive, we're not gonna take the waste of Dragør and drive over there, so I don't really understand that relationship. But um, I experienced it though, we were at a conference, what's it called a "skolemesse". And they were right next door and we were talking to the teachers and instructors about what we have to offer the kids when they come. And there was just a super hostile atmosphere between our booth and then next door. I don't know why, but I also picked it up when they just talk about it. So...

Researcher: So they are competitors.

ARC representative: Yeah. That's how they act anyway, but I don't really see it that way. You know when they were talking, I mean we offer these um like instructions for free, and so do they, so I just see it as getting the message out as much as possible, if they're gonna get it here or there, it makes no difference to me, as long as people get it. So I don't really get that pattern, but it's there. Definitely. (laughs) I haven't heard anything, it seems that you actually know more about this than I do!

(laughter)

That's a little embarrassing. So umm, but I haven't heard anything about that.

Researcher: And not with Copenhagen.. Københavns Energi either? They are also building a some kind of "flisefyreværk"...

ARC representative: oh yeah well I mean, first of all. Half of Copenhagen take their waste to Vestforbrænding and approximately the other half here. Um so I mean already there's some kind of, I mean they work together somehow because we're splitting the waste of Copenhagen and all the energy... it's not like "we're gonna give all our energy to this neighborhood", and it's all connected in one big grid we just all feed into right? So I don't know how it's gonna be different, it's gonna be fairly the same.

Researcher: so they're not planning.. I guess there's a big hole in the energy market, there's some power plants that are closing down, so I was wondering if that's maybe part of ARC's plan to maybe get in on that market, to expand the capacity to maybe fill in some of the heating energy that's going to be missing?

ARC representative: Well it's definitely not a plan to expand the capacity...

Researcher: it's not?

ARC representative: Like the capacity of waste?

Researcher: Well they have expanded the maximum total possible that can be burned.

ARC representative: Well politically we're not gonna be allowed to burn more than the 400,000 total.

Researcher: But it could change.

Researcher: So why build a bigger oven?

ARC representative: Well I'm not even.. it's.. there are gonna be two ovens, instead of four like we have now, they are gonna be bigger, um so I guess maybe just a backup plan in case there's gonna be a lot? And then, there are also gonna be flexible so they can burn bio....fuel. So they're gonna have that, um but I mean, I haven't.. you can probably find it on online, it's like a press release from Copenhagen... no I don't have it with me... but it says it's also where I have the information from with the 27% reduction and 40%.. where they say that there's been an agreement that the capacity will be that. But I mean, I don't know. I'm sure they can change it. Who knows, I don't know if they're just binding to each other, if it's gonna be a commitment by law, but probably not. So, but, the reason they're building a new one is because this is just....

Researcher: too old.

ARC representative: Yeah. It's crap. Yeah. So, and then. How big it's gonna be, physically, the capacity, I'm not sure. But the information that I got so far is that it's gonna be two 35 ton per hour.

Researcher: yeah that fits with what we've found too.

ARC representative: and right now we have 4 x 15.. it's 17 but we burn about 15 an hour. But I think a lot of them too, depending on who you talk to, if you talk to the administrators or the engineers, you know, they have different perspective on things. Like some of the machine

guys and engineers they're like "we can burn like 10 times more in that thing!" you know, they're just.. they make it sound like it's very flexible.