Date: November 29th 2012

Waste, a resource

- With led hand

Copenhagen Business School 2012
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Submitted: 30th November 2012
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Signature:

No. of STU's (excl. tables/figures): 142,787
No. of pages: 82
**Waste, a resource**

“It has become a cliché to observe that the Chinese characters for crisis reflect "danger" and "opportunity". We have seen the danger. The question is, will we seize the opportunity to restore our sense of balance between the market and the state, between individualism and the community, between man and nature, between means and ends?”

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**Resumé**

The results found from this study support a market institutional perspective and a balance between regulations and market for the waste-to-energy market. No common definition exists internationally for waste, but the EU definition gives a common framework for the region. The amount of waste produced in the EU is growing. Different methods for disposal are used in the different countries but municipal solid waste is considered as part of the public utility sector. Within the EU waste framework, Waste-to-energy is defined according to the waste-hierarchy. Waste-to-energy could be considered a renewable energy source depending on the contents of the incinerated waste. To determine its sustainability it should be considered what other energy sources it replaces.

The economic activity of the EU has been hit hard by the economical crisis starting in 2008. Common policies are implemented to improve the environment and encourage growth, as part of the EU’s 2020 strategy. The EU is pluralistic in nature and the regionalisation gives businesses a layered regulative framework to adhere to. Neither of the two compared countries, the UK and Denmark, shows a transformative capacity. Each has their strengths and weaknesses. The paper found regionalisation to have a valid regulative purpose when dealing with trans-boundary issues like environment and pollution, being complementary to the state-nation.

The paper found that the fear for import of waste is unfounded, as the total environmental cost has to be taken into consideration. Denmark has a comparative advantage in waste-to-energy by incineration. It would be beneficial to pursue this advantage, as it would give possibility of providing cheaper energy and heating, lead to total environmental benefits for the EU, strengthen Denmarks position within waste-mangement and waste-to-energy and generate new possibilities for research, education and job possibilities strengthening the long-term business possibilities for the Danish waste-to-energy sector.
1 Introduction

The present economical crises has arisen several serious issues in the European Union (hereafter the EU), unemployment, stagnating growth, economical downturn with member countries on the verge of bankruptcy etc. At the same time it is vital that a future shortage of energy supply for production, heating, electricity and transport are addressed along with the environmental global challenges this very same consumption create. In the 2020 strategy of the EU, goals have been set for economic growth in the European region but also goals for the environment. The strategy therefore calls for both public and private initiatives to transform existing - and create new markets with innovative and sustainable solutions (EU, 2012a).

Another challenge, the EU is facing, is the vast amounts of rubbish generated from a society that gradually have become more and more wealthy and thereby are consuming more and more products. The 500 million citizens of the EU generate rubbish equivalent to 6 tonnes of solid waste for every man, woman and child, most of which is dumped in landfills or incinerated. Some of the waste incinerated is recovered as energy, but it is not all incinerated waste that has a use. The OECD estimates that with the present development the EU citizens would generate 45% more rubbish in 2020 than the level of 1995. The externalities from the production and consumption in form of waste are costly for the society both economically and environmentally. The EU has therefore identified waste prevention and waste management as one of four top priorities in their Sixth Environment Action Programme (EU, 2012b).

The Danish waste management sector has long since needed a new regulation on the national level, as the conditions for the organization of the area has changed since it was introduced in its first version in the 70'ies. The changed regulatory framework given by the new EU waste directive gives new expectations of a modernization of the Danish waste regulation within the framework of the EU directive. The question is to what extend governing
authorities should regulate and interfere in a market for it to run in an optimal manner? And what influence they have on a markets formation?

The discussion of modern economics has long been influenced by the western worlds capitalist views and politically, contra points has been drawn between liberalisation and centralisation. Both extremes have shown advantages and weaknesses. The downfall of the former communist led eastern block, which ran according to centrally economic planning principles, gave way for believes that the capitalist and liberated views won. The growth and improved life styles of the western world added to this perception (The Globalist 2012, The Telegraph 2012a). However, the several economical crises in recent years undermined the proof of this. Especially have the great recession starting in 2008 mainly driven by the burst of the housing bobble in the USA and enhanced by the moral hazards created by the financial sector, had severe consequences. The international economic integration and trade dependencies caused the crises to spread fast with negative effects globally and have shown the grave weaknesses following a liberalised and market driven economy according to the American capitalist system (The Telegraph 2012a). Although the European capitalist systems are different, in that it is more coordinated than the American (Coates, 2005), the consequences of the recession have been severe for the Europeans. In order to prevent similar situations in the future a different way of handling the market is needed (The Telegraph 2012a).

Prominent scholars like J. Stiglitz calls for a renewed view on economical theories creating the right balance between market mechanisms and government intervention. Al though Stieglitz believes that markets are central to a successful economy, he doesn’t find that they work well on their own (The Telegraph 2012a).

In the mean time (September 2012) people at Amagerforbrænding, a waste-to-energy and waste management company in the Copenhagen area, Denmark, are holding their breath in anticipation of whether their owner
municipalities approve the plan to build a new incineration plant for energy recovery. The new plant should replace the old out-dated plant, which is running on it's last legs and be much more efficient and environmental friendly using high-end technologies for waste-to-energy generation. The proposal for the new plant have lead to much discussion politically and in the media on waste management, re-use of resources and there has been contemplating on whether the incineration capacity would be too large for the waste generated in the owner municipalities. That again have lead to fears that the company would want to import waste to incinerate to utilise the capacity and that such an import would create more pollution in the area. The opposition has especially been large in the municipality of Copenhagen, as the city council has set a goal for making Copenhagen CO2 neutral by 2025 (KK, 2012). So is this a reasonable fear? - Or is it in fact preventing a solution that could create economical growth in an innovative way, taking limited natural resources into account and handling externalities in a sustainable way as requested by the EU?

As a case for if and how markets can be created in a balanced way between market mechanisms and government intervention this paper is going to investigate the Waste-to-energy market in the EU. This area has been chosen as it is moving towards a freer market but at the same time are sanctioned with regulations both on the regional as well as the national level. Further, the production and consumption of products and services have created externalities for the society that have given pollution and waste products to be handled. Waste–to-energy handles negative externalities and as such is an interesting case for if and how markets can be created sustainably and at the same time remedy some of the shortages and environmental problems the EU is facing.
2 Problem identification

2.1 Interpretation and context of the subject

The subject of this paper is the formation and functioning of the waste-to-energy market in the EU.

Waste-to-energy is one of a several waste management solutions to a growing waste problem. It covers miscellaneous techniques turning waste into energy, like e.g. extracting gasses from the waste to be used as fuel. Another technique is incineration. Traditionally incineration is burning the waste to get rid of it but in the latest century techniques to utilise the heat from the fire to generate energy has been developed. The use of incineration for energy generation is a technique that is getting more widespread. Although all waste-to-energy techniques in a way are addressing the same problem and thereby are substitutes to a certain extend, they differ a great deal and could be categorised as different markets. It would therefore be beneficial for the focus of the paper to choose just one of the techniques to look at.

The subject is focusing on the EU market. The EU consists of 27 member countries each representing a separate national market. The waste-to-energy sector is not at the moment especially international. In fact different international organs have establish conventions prohibiting or limiting trade with – and transport of - waste. In the case of the EU, the region is laying an overall regulative framework for its member countries. Therefore the paper must address the framework at the regional level but a choice could be made between one or more of the member countries in order to evaluate the formation and functioning of the market at the national level.

When discussing market “formation and functioning” it is the theoretical foundation that is referred to. In the shadow of the economic recession starting in 2008, much debate, both among politicians, economists and in the media, is about whether the concept of the free market has failed, however,
some still argue that government interference in the market is a bad thing. It would therefore be interesting to discuss the subject from the angle of whether the market for waste-to-energy would have progressed more or less depending on the intensity of the governmental interference. The subject does not in itself point towards a micro, meso or macro level. The theoretical angle together with the study’s scientific anchor point gives an international business economic context for evaluation of the institutional framework supplying policies for and support to the market. It therefore seems naturally that the paper mainly will be at the industry and macro level, although the analysis also should aim at identifying possible future business opportunities for businesses in the sector.

2.2 Problem proposition

The demand for energy and other natural resources as well as the need to control pollution and the growing waste problems are leading to new regulative frameworks for the waste industry both at the regional and national level. However, a changing competitive business environment must be expected in the future, due to the changed socio-economic and environmental conditions. The changes must be a challenge for the waste-to-Energy sector, but also give new opportunities to pursue. One way to solve some of these issues could be via a well functioning waste-to-energy sector taking the waste – externalities – and turning them into resources for the society. However the use of this method are not very extensive in many countries. This paper is based on a hypothesis that neither free market conditions nor strict regulation enhance the sectors possibility to create an efficient market. In stead government regulation could be the catalyst for the market formation, but if not structured in the right way, become the actual hindrance for the market to develop into functioning in an economic and environmentally sustainable way for the benefit of the society.

The objective of this paper is to investigate to what extend free market conditions contra government regulation, create a market for waste-to-
energy by incineration and provide the institutional framework for it to develop and function in an optimal way for economy and environment.

With "optimal" means ways in which economical growth can be sustained while at the same time improving the environment.

The paper addresses the problem proposition through the following sub-elements:

- How is waste and waste-to-energy defined as concepts?
- What framework define the market for waste-to-energy in the EU?
- What are the strengths and weaknesses of the institutional framework and the different governmental roles of Denmark and the UK for the waste-to-energy markets?
- What prospects does the institutional framework give for the future of a company in the sector?

2.3 Delimitations and concerns

2.3.1 Product area
This paper focuses on waste management and especially the waste-to-energy industry of waste management. Other areas of the sector as defined by the waste hierarchy (see page 41), as e.g. recycling or landfill, both supplement and cannibalize on the waste-to-energy business area. They are therefore only touched upon where relevant in connection with the analysis of the waste-to-energy sector and the institutional market structure for the area.

The concept of waste-to-energy, in broad terms, covers both incineration for the purpose of energy generation as well as extraction of gasses from waste, for the purpose of utilize them as a substitute for fossil gasses in the gas distribution network. An example of this could be the methane gasses from landfills. For the purpose of this paper the waste-to-energy is concentrated on energy recovery by incineration. The term “waste-to-energy” will in this paper be used in that meaning, unless otherwise stated. An overview of the
actual incineration process for the purpose of converting waste to energy is shown in Annex I page 79.

Biomass waste is regularly used to supplement the waste as fuel in waste-to-energy incineration facilities when there is a shortage of waste. Biomass waste is usually biogenetic waste compounds from forests and farming and is clean from others additives than organic material. It is of a lower quality than the biomass in form of wood chips and pellets used in traditional heat and power plants. Biomass waste is mainly treated as a separate product in the market of renewable energy due to its pure organic composition. Although biomass waste also is used as fuel supplement at Amagerforbrænding when shortages occur in order to ensure a stable production, biomass and its properties as fuel compared to other types of waste is not the focus of this paper.

The paper does not go into detail on specific waste stream or waste categories requiring special treatment like e.g. nuclear waste.

### 2.3.2 Geography

For the comparable analysis of how the market for waste-to-energy by incineration has developed in different EU countries, the United Kingdom (The UK) and Denmark have been chosen. Apart from both countries are members of the EU and as such obliged by the same newer overall framework conditions, they each represent a different example of the progress in the sector and of the government’s interference in the market.

In Denmark, incineration has a predominant position within the area of waste management. Further, Denmark is a good example of a state with distributive capability and within this sector the authorities play a large role. Apart from the regulative level, the owner structure in the Danish market is one where the majority of the waste to energy facilities is non-profit companies, owned and operated by municipalities or inter-municipality co-operations (RenoSam, Rambøll, 2006). Contrary to Denmark, the incineration of waste per capita in the UK is of minor importance. The UK has only a few
incineration plants, which are privately run and owned (RenoSam, Rambøll, 2006). This makes the UK market interesting in terms of future possibilities for development of the sector. Also importantly is that the UK represents the most liberal of the economies in the EU and is as such an example of a capitalistic state run according to free market principles.

Other countries could have been interesting as well. France, for instance, has the greatest number of waste-to-energy plants than any other European country, and would therefore be an interesting market to look into. However, the French incineration plants are usually publicly owned and privately run and therefore not quite as clean cut for the purpose of a comparable analysis as Denmark and the UK.

2.3.3 Timeframe
The statistical and economic data used are as new as possible and from within a ten-year timespan. That means these data are typically not earlier than from 2002.

The age of the qualitative data on the waste management development and traditions depends on the directives from the governments and authorities in the geographical areas analyzed as well as history also have an influence on the development of the sector. The qualitative data are therefore not as such from within a specific timeframe, but aim at explaining the market formation leading to todays market and to some extend into a foreseeable future.

As theories are formed on the basis of academic research and these often gradually develops by building on previous findings, time is not a relevant factor for the theories.
3 Methodology

3.1 Interest and relevance
With the foundation of international business and within the theoretical platform for this specific field of social science, a subject including energy, sustainability and the balance between liberalisation and regulation has been chosen on the basis of the author’s interest as well as the relevance for the society in creating sustainable growth economically and environmentally. The relevance is emphasised by the consequences of the economic crisis and the debate, it has risen, on the virtues of free market forces contra governmental market interference, for a market to be able to function efficient. With a former career in Telecommunication the author has practical experience from an industry moving from a monopoly towards a liberated market, just as the waste-management sector in Denmark might be in the near future. The interest for the Waste-to-Energy business was created in relation with an electives course where a sustainable innovation workshop with Amagerforbrænding was held. It was this interest that lead to the contact to Amagerforbrænding in relation to the thesis. Further, waste-to-energy is a current subject, as the modern society's use-and-throw-away lifestyle has generated externalities from the consumption in so large amounts that something has to be done. At the same time valuable resources are being wasted.

3.2 Perspective
The author has no direct professional relation with the waste management industry and business area. The angle of this paper is therefore that of an external consultant analysing the waste-to-energy market and regulative framework in order to clarify what influence the market institutional structure has for the formation and development of the market, within an industry of the nature of waste-to-energy, which is both a market and a problem solving solution for externalities. Further, the second purpose of the analysis is to throw light on a possible future development of the market and
hence the long-term business possibilities for a company in the industry embodied by Amagerforbrænding.

The paper addresses political-economical factors influencing the industry and thereby the business possibilities for companies in the industry. Therefore the paper is mainly moving on a macro and industry level. As the object of observation is the market structure and regulative framework, the timeframe for development is long term. Seen from a business point of view the paper operates on a strategic level, which contains the fundamental changes effecting and developing a company’s future business area.

The target group of the paper is primarily supervisor and censor of the master thesis, secondary contact persons at Amagerforbrænding, as well as other scholars or persons with an interest in either the theoretical field or waste-to-energy.

3.3 Methodology process

As a basis for the methodology process, the model of Ib Andersen, is used in this paper. The model is shown in Figure 3.a., next page. This specific model has been chosen as it both takes into account the conditional framework surrounding the paper as well as the factors of which the process consists.

The conditional framework is the given factors of a project, e.g. laws and regulations for doing the thesis, internal rules, formal requirements, purpose, stakeholders and resources. The conditional framework is primarily defined by the directives for master programmes / exams and the master thesis contract.
The factors of the process management give the conclusions to the research question by analysing and interpreting data and empirical findings with relevant theories relating to the scientific field. As the theories are used as a basis, to say something on the specific case of Waste-to-Energy, the process is primarily deductive. However, certain parts will have inductive elements. Although the working process is fairly linear, the findings necessitate at times steps back and forward giving a iteratively form, and at times different parts are worked on parallel as shown by the arrows in figure 3.a. above (Andersen, 2003, page 41).

For the purpose of identifying the problem as clearly as possible, the problem identification model described by Olsen and Pedersen (2006) is used. It goes through steps working from a broadly formulated subject via the scientific foundation, interpretation and to the actual formulation of the problem proposition.

In order to select a problem solving method, support has been found in the tool developed by Hans Jørgen Skriver et Al., 2004. The method gives direct
and practical guidelines to choice of method, perspective and data gathering relating to the theoretical platform of the research. The data used is mainly secondary, both quantitative and qualitative. Primary data from conversations with people in the sector supply the secondary data. The data is heaviest on the qualitative side as “creating a market” and providing the institutional framework” is the dependent variables of the research question. As mentioned above, the perspective is that of an external consultant, which means that although there are a certain distance and thereby objectivity, there is also quite an amount of engagement which cannot avoid to make the view somewhat subjective. The research purpose of the paper moves from explanatory and evaluating in the analysis to be problem solving in the latter part. This points towards an enhanced understanding of the problem and the structure of the market situation, emphasised by the fact that it is not a mere description of an existing market situation but an evaluation of the factors creating change and new market possibilities (Skriver et al., 2004). Theories are evaluated in detail in the theory section and discussed in relation to the specific findings of the analysis in the latter part of the paper.

The structure of the analysis follows the layered regulative hierarchy identified for the waste-to-energy sector in the EU (See figure 7.a. page 48). That means it first treats the market at the EU level and in this connection give the regulative framework at the regional level. Then the analysis compares the institutional framework and market support in the two countries selected for further analysis, to see if there are differences in development of the waste-to-energy sector depending on the role the government is taking. The effect of municipal administration are drawn in and lastly it is discussed what prospects the institutional framework gives for the future of a company in the sector.

3.4 Data collection and Source Criticism

The main sources for the theory used are from academic articles, textbooks and other material from the syllabus as well as supplementary articles and
books on the subject. Further, the paper refers to articles from news media and documents from public institutions. The data collected are mainly secondary and both qualitative and quantitative in nature although as mentioned earlier, heavier on the qualitative side due to the nature of the subject. As a supplement is used primary data from conversations with people the author has talked with in Amagerforbrænding through the daily contact when working at the thesis in the office made available by Amagerforbrænding. Qualitative data could be somewhat biased due to the knowledge and views of the writers, hence multiple sources are used and the data are to some extend triangulated. Quantitative data are collected from databases from official institutions and could therefore be considered as being fairly reliable.

It should be noted that the different institutions, e.g. UNEP, warns that data concerning waste should be used with caution, as it is both subject to different reporting methods as well as political sensitive (UNEP, 2012).

Naturally information from persons in the industry is highly biased. The author is aware of this and has therefore used information from multiple sources and supplied with secondary data reflecting opinions both from organisations in the industry as well as authorities outside the industry in order to view the subject at so different angles as possible. Further, when working out of an office in Amagerforbrænding, there is a risk of the author being influenced by the environment and by general opinions in the company. The author has therefore attempted to draw in different viewpoints to handle and minimise this risk for bias.

3.5 Structure of the Paper

After the introduction the second chapter of the paper is identifying and delimitating the problem. Chapter three argues for the methodologies used and describes the data collection technique, including data critique. Then an introduction to Amagerforbrænding is given, as it is with thought on this
company, the future long-term business possibilities of the industry, are attempted to be identified.

In chapter five, classical economic theories on which today’s liberal capitalist governing is framed are held up against Market-Institutional theories. Then follows a theoretical platform for the European regionalisation, the role of governments and their capability to manage change. Lastly theories on growth and competitiveness in relation to internationalisation are discussed.

In chapter six, the paper, moves on to defining waste and waste-to-energy, before chapter seven analyzes the framework as laid out by the EU creating common factors on the European market. The analysis goes on to the Danish and British waste-to-energy markets respectively, in order to evaluate the development and challenges. In chapter eight theories will be applied and discussed in relation to the findings of the analysis and possible perspectives for the future market opportunities will be drawn for a company in the industry. Lastly the paper concludes on the findings.
4 Introduction to Amagerforbrænding

Amagerforbrænding is a waste-management and energy company. Amagerforbrænding’s core business areas are recycling and waste-to-energy incineration with the aim of utilising the resources in waste. The company runs one incineration plant along side with fifteen recycling stations within the local communities. In addition Amagerforbrænding is a co-owner of a controlled landfill where the waste not suited to be recycled or incinerated is stored in a safe way. Amagerforbrænding is owned by a partnership formed by five municipalities in the Danish Capital area (Amagerforbrænding, 2012a). These are Copenhagen, Dragør, Frederiksbjerg, Hvidovre and Tårnby. The purpose of Amagerforbrænding is to create benefits for the municipalities and environment trough their waste-management solutions. The company is managed according to the Danish waste system dictating a balancing principle. The balancing principle means that the company is not allowed to make a profit. In stead revenue and cost must even out over a period of a very few years (Amagerforbrænding, 2012c).

<table>
<thead>
<tr>
<th><strong>Table 4.A</strong></th>
<th>Economical overview, Amagerforbrænding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net turn over</td>
<td>522725</td>
</tr>
<tr>
<td>Production costs</td>
<td>429258</td>
</tr>
<tr>
<td>Administrative costs</td>
<td>44953</td>
</tr>
<tr>
<td>Other operating income</td>
<td>4705</td>
</tr>
<tr>
<td>Other operational costs</td>
<td>612</td>
</tr>
<tr>
<td>Financial income</td>
<td>22612</td>
</tr>
<tr>
<td>Financial costs</td>
<td>4784</td>
</tr>
<tr>
<td><strong>Year Result</strong></td>
<td><strong>70433</strong></td>
</tr>
<tr>
<td>Balance</td>
<td>1053094</td>
</tr>
<tr>
<td>Tangible fixed assets</td>
<td>421040</td>
</tr>
<tr>
<td>Equity</td>
<td>920281</td>
</tr>
<tr>
<td>Year investments in tangible fixed assets</td>
<td>32720</td>
</tr>
</tbody>
</table>

**Source:** Amagerforbrænding 2012b, Annual report 2011, page 7.

<table>
<thead>
<tr>
<th><strong>Table 4.B</strong></th>
<th>Ratios, Amagerforbrænding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating margin</td>
<td>10</td>
</tr>
<tr>
<td>Equity ratio</td>
<td>87</td>
</tr>
<tr>
<td>Current ratio</td>
<td>726</td>
</tr>
</tbody>
</table>

**Source:** Amagerforbrænding 2012b, Annual report 2011, page 7.
The waste received is from households and businesses in the owner municipalities. The waste consists app. of 50 % Municipal solid waste, 40 % industrial waste and 10 % of incinerable waste from the recycling stations (Amagerforbrænding, 2012f). Amagerforbrænding is incinerating app. 400,000 tonnes of waste a year, which is more than 10 % of incinerated waste in Denmark. The total incineration capacity in Denmark is app. 3.3 million tonnes of waste a year. The incinerated waste is converted into energy and supplies around 150,000 households in Copenhagen with district heating and electricity every year (Amagerforbrænding, 2012a). Thereby, Amagerforbrænding is covering app. 25% of the consumption of central heating in Copenhagen a year. The energy generated by the incineration facility is mainly CO2 neutral as a large part of the waste consists of organic materials and the total sum of energy it substitutes primarily is fossil-fuel based energy as e.g. coal (Nedenskov, Neidel & Astrup, 2012).

The incinerator facility of Amagerforbrænding dates back to 1970 and is as such one of the oldest incinerator facilities in Europe. The plant has produced district heating for households in Copenhagen from the beginning. It was expanded in 1990 and produced electricity from 1991. The facility has been upgraded several times during the years. The upgrades include among others new furnaces, an automatic crane facility and new solutions for flue gas cleaning (Amagerforbrænding, 2012d). Although the incinerator facility has been upgraded repeatedly during the years and Amagerforbrænding continuously works on improving the recycling and sorting of waste according to rules and regulations as well as implementing new innovative methods, it is no longer enough to keep the facility running in a reliable fashion. The plant is dated and long past its expected lifespan, which makes maintenance and the daily running of the plant more and more difficult and inefficient both practically, economically and environmentally. As an example of this one of the electricity turbines was out of order in 2010 for a period of 6 months. The facility needs to be replaced and updated with new and modern techniques that can make the incineration and energy generation
more efficient, reliable, improve working conditions and be more environmentally friendly (Amagerforbrænding 2012e).

Amagerforbrænding is building a new incineration plant, “Amager Bakke”, to be placed at the harbor area next to where the present incinerator facility is situated. The new plant has just been approved after a long hearing and negotiation process amongst the owner municipalities. The Municipality of Copenhagen as the last of the owner municipalities approved the new facility October 4th this year. The negotiated terms are formulated into an agreement between the municipalities. The agreement entails certain conditions for incineration volume and reuse /recycle as well as reduction of waste (Frederiksberg, 2012). They include:

- Limit incineration to a maximum of 60 tonnes of waste per hour
- Reduction of municipal solid waste with 27 % per citizen until 2030
- Changed procedure and prices for receiving of waste at the incineration plant pushing the waste companies for better sorting of the waste
- Binding environmental and climatic goals includes reduction of waste generation and better waste sorting leading to reduction of the fossil CO2 levels in the emissions measured from the flue gas
- Waste sorting and recycling should be added to the company’s mission statement and to reflect this change, the name of the company must change to “Amager Ressourcecenter”
- The incineration plant are only allowed to receive waste for incineration from the owner municipalities and businesses situated in the these municipalities

At the same time the owner municipalities states in the agreement that waste management is a key public activity for the municipalities to solve and is not to be considered a commercial activity. For this purpose, the agreed stricter climatic and environmental goals have to be met through a strengthened political ownership (Frederiksberg, 2012).
5 Theory

“With led Hand” is the subtitle of this paper and refers to a theoretical platform based on political economy, more specifically the Market-Institutional perspective. According to the Market-Institutional perspective markets must be created and governed, as they are social and political constructions (Barma & Vogel, 2008, page 3). As such it differs from contemporary mainstream economics, which rest on the classical economic beliefs of the “invisible hand”, introduced by Adam Smith. This Chapter is going to lay the theoretical foundation for the analysis in the following chapters by discussing some of the classical economic theories on which today’s liberal capitalist governance is framed, held up against Market-Institutional theories. Further, theories on regionalisation with the effect on sovereign power, and how the aim for stability can explain the EU, followed by the role of governments and their capability to manage change. Lastly theories on growth and competitiveness in relation to internationalisation are discussed.

5.1 The invisible hand

Adam Smith is by many considered to be the father of modern political economy (Barma & Vogel, 2008, page 3). He argued that markets are created as an organization of people’s engagement in voluntary exchange. The voluntary exchange is based on people’s material self-interest and communicated through price mechanisms, in other words: supply and demand, through which markets are self-regulating (Barma & Vogel, 2008, page 2 and Estrup, Jespersen & Nielsen, 2004 pages 39-44). Adam Smiths work was also a support for international trade. He argued against the mercantilist market view of trade as a zero-sum game that was prominent at the time (Barma & Vogel, 2008, page 24). Smith was arguing for wealth of a nation could be enhanced through exports of the produce that the country was good at producing and produced surplus of and instead importing those products that were cheaper made abroad. His example of the tailor buying his shoes of the shoemaker and opposite, Adam Smith (1776) illustrates
quite well, how he imagined the capital and labour being directed towards those activities creating the greatest advantages. In other words by putting the resources to the best possible use, you optimize the outcome and the community will be better of and so international trade create a positive-sum game (Smith, 1776). Although published back in 1776 the writings of Adam Smith has continued to be an influence on the economic liberal thinking of today. The same is true about the Comparative advantage principle demonstrated by David Ricardo in his work from 1817 (Cavusgil, 2008). He proved that it was not the absolute cost of production but the ratio of the production cost between the trading parties that matter. So international trade between countries without barriers would be beneficial as long as the produce needed by one country are produced more efficient by the other one. In other words the opportunity cost have to be taken into consideration (Cavusgil, 2008, page 98-100). According to the neoclassical interpretation of Adams Smith, this self-regulation of markets through supply and demand takes place on the microeconomic level (Estrup, Jespersen & Nielsen, 2004 pages 14-15). One of the more contemporary economists building on Adam Smiths free market philosophy is Milton Friedman (1962), who established monetarism. Also arguing for a market governed according to the free market forces, Friedman looked at the market from at more macroeconomic angel, stating that market forces are impossible to withstand in the longer run and hence interference in the market from central institutions would always lead to loss of welfare (Estrup, Jespersen & Nielsen, 2004 page 146). His vote for the individual’s economic freedom and limitations on the government’s role in economic activity is even more profound than Smiths and other modern-day liberals, as e.g. Hayek. For him the price system should be the coordinating mechanism, and he saw government intervention as a source to price distortion that would only worsen the failure it was supposed to correct (Barma & Vogel, 2008, pages 87-89).
5.2 A market institutional perspective

Contrary to classic economics, the Market-Institutional perspective view markets as institutions embedded in a particular social and political context. Barma & Vogel (2008), see an emerging consensus across different disciplines of political economy towards the institutional side of market development although differing in approach. On this basis they review four tone-giving disciplines: the new Institutional economics, Economic sociology, Political Science and History, in order to advocate the Market-Institutional perspective (Barma & Vogel, 2008, pages 1-9).

Amongst these is Neil Fligstein (2001) who argue that the modern capitalist society have required governments and representatives of capital and labour to produce general institutional arrangements for the functioning of the market, e.g. governance structures. The arrangements come both in the form of laws and informal rules. They are necessary to create stability in the market as the interaction is complex and a stabilization require that the involved parties have shared cognitive understanding of expectations and assumptions. As this common understanding only is formed on the informal level with experience, laws and formal rules assist in shaping expectations towards a common understanding where there is instability due to new and not habitual interactions. This is for instance the situation when markets and political fields are formed or transformed. Governments involvement in order to create “fair” conditions for transactions, are needed. According to Fligstein (2001) the governmental capability to perform this task typically has three dimensions: ability to intervene, the form of intervention and the relative power of the involved parties. In relation to international trade this capacity is even more relevant. Often companies find themself in a position that is new to them with other market players with whom they do not have a common understanding e.g. due to cultural differences. This situation of potential conflict calls for international rules, which is why government’s involvement, via trade organisations or free trade agreements, may assist in
paving the ways and enhance the competitiveness of their industries in an international context.

Vogel (1996) are in agreement with Fligstein’s views and get more specific concerning government’s roles in relation to the reform of markets. He says that not only in the formation of new markets, but also in the situation of a market reform a conflict arises and needs to be handled by capable authorities. Vogel (1996) sees it not so much as a process of removing market-constraints, as a process of creating the right institutional set-up. Vogel does not as such disagree with free markets, but sees market reforms as a complex political process requiring a combination of policy change and societal response. Often this will lead to a more complex set of rules the market has to operate according to which is why freer market require more or different rules (Vogel, 2007).

Following Barma & Vogel, (2008) this paper defines market institutions as both formal, e.g. laws, and informal, e.g. business practise, spanning from local to global systems.

5.3 In an European setting

According to the Market-Institutional perspective markets as institutions are embedded in a particular social and political context. It is therefore necessary to evaluate the structural basis for the functioning of the European market, as this paper looks at the Waste-to-Energy sector in a selected few of the EU member countries.

The discussion on the trends for advanced capitalist economies have been globalization, privatisation and deregulation, where governments in some cases have been perceived as weaker while markets have grown stronger. However, what has actually occurred is a re-regulation, where we have wound up with a freer market and more rules (Vogel, 1996). With globalisation, markets have been opened up, but at the same time trading blocs have been formed leading to the development and enforcement of common rules and in some cases, to different levels of regionalisation with
the purpose of institutionalising markets (Barma & Vogel, 2008, pages 13). In the business literature regionalism is described as the formalisation of cooperation between countries in a geographical area on reducing barriers to trade and investments. This creates an economic interdependence and leads to regional integration (Cavusgil, 2008, pages 222-224). The EU was the first and, thereby, the oldest, of the formalised trade regions. During the years it has also become the largest and the most advanced form of regionalism in the world (Suder, 2008, page 17).

Regions can have different degrees of regional integration. A Free Trade Area (FTA) is the lowest level of integration and political union the highest (Cavusgil, 2008, page 226). Countries engage in regional integration in order to achieve economical growth through market seize expansion, pursuance of enhanced productivity and scale economy, attracting investments from other regions and to obtain a stronger political position worldwide that enhances bargaining power and secure stability (Cavusgil, 2008, pages 239-240). This way regionalisation can add to a country's competitiveness. As examples of negative effects of regionalism could be mentioned: bureaucracy, trade diversion or sacrifice of the autonomy of member states.

According to functionalism society is a system consisting of multiple inter-related elements. The perspective focuses especially at the major institutions which each has its function and contributes to create balance and thereby explains sociologically the aim for stability and integration. The basis for obtaining this is a high degree of consensus prevailing on shared core values and believes (Hughes, Kroehler and Zanden, 2002, pages 18–20). Functionalism, however, builds on liberal economic views and thereby assumes little regulatory intervention. It can therefore not explain the depth of integration achieved by the EU. Suder (2008) points instead towards a neo-functionalist perspective, which differs from functionalism in that the theory acknowledges the necessity for cross-border cooperation and policies, where sovereignty is handed over from the member states to the supranational institutional level (Suder, 2008, page 48). Neo-functionalism is
therefore better at explaining the regionalisation of the EU with the establishment of the internal market and the move up the ladder of integration, to a level of economic and monetary union as this has lead to sovereignty partly being handed over. However, the conflict perspective, which sees power as being limited in supply, can also explain the handover of sovereignty.

Scarcity of resources is the main source of conflict, according to the conflict perspective (Hughes, Kroehler & Zanden, 2002). Conflict theory and functionalism both have a systemic view on society, studying its institutions and structures. But where the functionalist, and neo-functionalist, perspective is relatively static and useful for describing society at a point in time, it has difficulty in handling processes of change and history. This is, on the other hand, the strength of the conflict perspective, which sees instability as a source of change (Hughes, Kroehler and Zanden, 2002). The conflict perspective emphasises processes of change transforming society continuously, but instead have difficulty in explaining some aspects of consensus and stability. As such the two perspectives complement each other. In the case of the EU the historical burden of wars and conflicts has shaped the European integration and business environment. Especially the world wars and later the Cold war, and the subsequent resource scarcity, have put their mark on the European nations (Cavusgil, 2008, page 222, and Suder, 2008, chapter 2). So although the purpose of regionalism is stability and integration, what have borne the urges for it, has been the conflicts and instability.

5.4 The role of governments and their capability of managing change

Adam Smith (1776) argued for a limited role for the state. His view was that any centrally made attempt to regulate market activities such as incentives to industries or trade barriers would have the opposite effect than creating an efficient functioning market. For this reason, governments only role should be to: defend national security, provide rules of law for the society in order to
protect the individual and to provide public goods, where such goods could have no interest or could not establish a profit for private initiative (Smith (1776). Milton Friedman goes further in elevating the principle of self-interest and sets the individual freedom as the primary force where government’s only role is to serve the individual. Hereby he even contests antitrust, one of the core roles for governments according to Smith (Barma & Vogel, 2008, page 88)

The neoclassic economic theories support a capitalistic market arrangement where markets are regulated by production and consumerism, so the states role is minor (Barma & Vogel, 2008, pages 87-89). However, these economic theories sets as a precondition a certain level of stability. They are static in their approach, where the only conflict influencing the market is competition between market players. They ignore among others externalities like pollution and waste creation from production and consumption. Like it is given that shortages in natural resources do not occur, as well as lack of demand for the produce is not an issue, as long as the prices is right (Krugman, 2009). What they lack is the ability to take external influences into account. Changes, shortages and crisis do occur and has to be addressed somehow.

One thing is to know what create changes. It is quite another thing to be able to manage change in an advantages manner. State capability is an important advantage in international competition (Weiss, 1998, page 5). In the “Myth of the Powerless State” Weiss conducts a theoretical analysis of states capacity for developing and implementing policies that increase a society’s investible resources and not just re-distribute the existing ones (Weiss, 1998, page 5). This is opposing the assumption that globalization and an open internationalized economy weaken the states capacity for handling industrial change. Weiss determines a states capability as being specific in different areas and not merely a general concept. In her analysis, she especially differentiates between distributive capacity and transformative capacity. Distributive capacity refers to the ability to distribute income as the
economic-security oriented small states of northern Europe prioritise. The transformative capacity is emphasised, as it refers to the states ability of creating a continuous flow of new means to govern the process of industrial change following external shocks and pressures. Further, Weiss argues for a dual capacity in some states, e.g. Germany, for handling both distributive and transformative change. The sources of handling the change should be found in the nature of domestic policy linkages between economic bureaucracy and the industrial sector where some linkages appear more robust in launching transformative adjustment strategies than others (Weiss, 1998, pages 7 - 9). State coordination is vital for making firms engaging in activities too risky for one firm to act alone. This is the case where large scales investments are necessary and interdependent with other concurrent investment activities. It is not in itself the states ability to impose new policies, but instead its ability to coordinate and resolve issues of coordination better than the market by reducing transaction costs in the wider economy. Means to do so could for instance come from socializing risks, proving a cooperative framework for businesses or constructing necessary infrastructure. The fundament of this ability, Weiss suggests, comes from historically formed regime goals. Weiss’s arguments support the fact that liberal economies like the American or British generally have a weaker capacity of transformation as they traditionally pursue a development led by the market and centred on consumption (Weiss, 1998, pages 7 – 9 & 14 – 25). Weiss finds that al though national economies to some extend are highly integrated with each other leading to a more internationalized world, it is not a convergence towards a uniform liberal capitalism. In stead national and regional interaction networks will remain and emphasize the importance of institutions and place with the states retaining their differences. A robust domestic linkage between government and industry on the basis of a strong transformative capacity will support the integration (Weiss, 1998 pages 167-212).

Lehne (2006) has developed 4 different roles governments can take. They are:
• The regulative state: Aims at ensuring marketplace competition, when markets are not fully competitive while mitigating the un-desirable consequences of market activity. Groups might lobby for policies in their favour.

• The framework state: Creates the institutional structure and thereby the legal framework for the political and economical activities according to the values of the state. In the framework state the governments role is often considered to be minor.

• The promotional state: Takes and active economic role and uses its authority to enhance the economy of the nation. This could be done through protective policies, allocating funds or promoting national champions.

• The social service state: focuses on distributional issues of wealth and income produced by marketplace activity in a society. Central issues could be health care, social security, tax rates etc. to address the responsibilities of a modern welfare state.

The roles are not to be understood as pure forms, but are meant to be functions governments could perform, also in a mix, depending on the political environment and the problems occurring. This way a government could fit all roles at different times and the model becomes dynamic and is adaptable to changes.

According to Lehne (2006) the challenge for industrial nations is to govern in a way that deliver the greatest possible prosperity for its citizens through the activities of private corporations, while ensuring their political rights and social principles. He uses these governmental roles, he has developed, together with analytical models typically used by scholars to describe the political-economical environment when analysing government-business relations. The weakness of Lehne's model is that it is based on the development of the United States of America and thereby coloured by the history, culture and political opinions of the American society. He does, however, draws in examples of how other selected industrial countries
organize their political-economic system and thereby shows that the model is compatible to other capitalistic scenarios than the American.

Porter (2001) says that in the continuing debate over competitiveness the role of governments is the topic fostering most debate. In his view the government role is more indirect than direct in that governments have the difficult role of encouraging or pushing companies to aspire to a higher level of competitive performance. What makes it a difficult task – and where it often goes wrong – is that politically the time horizon are shorter than it is for companies to innovate and transform as it takes capital investments, upgrading of human skills and market penetration. The successful government policies are according to Porter (2001) those that create an advantages environment for firms in which they can gain a competitive advantage. Porters point seems to lie close to the “framework state” as described by Lehne (2006).

5.5 The correlation of growth, competitiveness and International trade

As mentioned earlier growth has been closely interlinked with international trade, as first argued for by Adam Smith in the “An Inquiry into the Nature and Causes of the Wealth of Nations” (1776). There seems still to be a consensus that long-term economic growth and trade has a positive relationship. Farole et al. (2010) finds that many empirical studies show strong correlation between a county’s economic growth performance and its trade share.

However, an open market or a market run according to liberal philosophy does not in itself ensure growth. Growth according to Smith’s view build on an increase only in capital and labour, this however, gives diminishing marginal returns. In order to ensure long-term sustainable growth a nation has to increase its total factor productivity. Total factor productivity is in fact the most broadly accepted definition of aggregate national competitiveness (Farole et al. 2010). Solow (1956) developed his aggregate production function based on neo-classical theories. But where these growth models had
assumed fixed proportions this was not assumed in Solow’s ground-breaking model. He proved that Steady-State\(^1\) could be overcome and long-term sustainable growth could be achieved through taking exogenous changes into consideration, they be innovation and technological change (Robert M. Solow, 1956).

Although waste is generated locally where materials are used and products consumed, trade and transport of goods and natural resources underline the fact that pollution and waste disposal problems are universal. Further, the new EU framework expand the possibilities for import/export of waste in certain circumstances especially when the purpose is energy recovery (see page 45). It is therefore also relevant to look into the internationalisation process.

Firms can either have a proactive or a reactive approach to internationalisation. These two broad categorises cover over many reasons as to why companies look outside their national boundaries (Cavusgil et al., 2008, pages 16-18). According to the basic capitalistic viewpoint the purpose of firms is to create profit. There are other motivations for firms than profits, but all in all the profitability of the firm is a barometer of the firms “health” (Dickens, 2007) and hence they must be competitive in the marketplace. John Dunning finds that there are three basic motives behind why firms internationalise, which are: market seeking, asset seeking or efficiency seeking (Cavusgil et al., 2008, page 421). One way to become competitive is to have low costs, which could be done through internationalising the whole or part of the supply chain another is to ensure the input into the production process via access to the supply sources (Cavusgil et al., 2008, pages 17 & 422). Theories often focus on Foreign Direct Investments (FDI) as the subject of study. However, the internationalisation process of firms is often gradual. This is often referred to as the Uppsala Model (Hollesen, 2007). This is not only true in relation to outwards internationalisation, as market seeking, but

\(^1\) Steady-State refer in Solow’s terminology to the economic neo-classical definition as the point where the economy is in equilibrium in that investments equals depreciation.
also inward e.g. when firms look towards other countries for access to raw materials needed for a production process in the home marked. Here import arrangements could be a solution.

Dicken (2007) describe the conventional path of transnational corporation in terms of four steps: Purely domestic production and market focus, exporting, set-up of sales outlets abroad and then lastly establishing production facilities abroad. While the economic benefit of outwards economic trade as e.g. exports and FDI are theoretically well founded, the openness to imports also have a positive effect. Among others it has a disciplining force on domestic markets, which may lead to higher quality of input to producers and lower costs due to the competition (Farole et al., 2010). So looking at the conventional path, not with market seeking eyes, but from a asset seeking perspective, it might look like shown in figure 5.a.

**Figure 5.a** The conventional path from an asset seeking point of view

Source: Own creation converted from Dickens conventional path of TNC evolution (Dicken, 2007, page 116)

It should be mentioned, that firms not necessarily follow the flow. It is possible for firms to skip a step and go directly to a “higher” evolutionary step as well as it is not necessarily that firms follow the whole path but might stop at an interim level.

The eclectic paradigm (OLI) developed by John Dunning (2001), is a framework for analysing the determinants of international production. Although Dunning developed his framework for the purpose of analysing internationalisation by Foreign Direct Investment (FDI), you could ague that it also could apply to the other types of internationalisation also as presented in the conventional path of internationalisation, figure 5.a. The OLI paradigm says that International production will at any given time be determined by
the conditions: the firms Ownership-specific advantages (O) e.g. knowledge and skills or unique assets, The Location-specific advantages (L): the home country advantages of the firm (the L is often used interchangeably as the location specific advantages of the host country), Internalisation advantages (I): the level of internalisation of the value chain (Dunning, 2001).

As the L above is implying, competitiveness is not only determined on a firm level but is also dependent of conditions on the national level. Michael Porter (1990) developed his Diamond Model as an explanation to how nations can position themselves for success in international business (Cavusgil et al., 2008, pages 102-108). He argues, that the competitiveness of a country is obtained through the capacity of its industry to innovate and upgrade (Porter, 2001). The competitive advantages on both firm and country level are achieved by the quality of the four major elements present in the country forming a self-reinforcing system: Factor conditions, Demand conditions, Related and supporting industries as well as Firm strategy, structure and rivalry. The systemic nature of the diamond, further have the effect that it promotes clusters of industries linked together either via vertical or horizontal relationships. The notion of international competitiveness among nations does also have opponents. Krugman (1994) agitated harshly that competitiveness could only take place at firm level and argued that applying the word on national economies were not only meaningless but also wrong and dangerous as it could lead to national level policies that turn the country in a wrong direction. However, the notion is far from dead. For while countries may not actually compete directly in global markets, the natural endowments, human capital, institutions, etc. of a location do clearly shape firm-level competitiveness (Farole et. al. 2010).
6 Waste defined

6.1 Waste

When talking about waste, or garbage, most people probably have an idea about what it is. But what we throw away depend very much on our lifestyle, upbringing, the economic development of the geographical area we live in etc. Waste is also generated from manufacturing, construction and other industrial production facilities and in addition there is waste products from the general water and energy supply. So waste is a lot more than milk cartons, leftovers and other waste from households. In other words the volume and composition of waste depend on the industrial and economic structures in place as well as the consumption patterns (UNEP, 2012) and it consists of a vast variety of materials, some of it is hazardous for health and environment (EU, 2012b)

As waste is an externality of consumption and production, waste-production is highly influenced by trade and globalisation. Waste is not necessarily created where the product is produced. Further, the handling of waste influences the environment and especially if the handling is inadequate the outcome is pollution at different levels. Therefore waste-handling must be seen not as a local but as a trans-boundary issue. However, as waste covers so broad a spectrum of materials and depends on so different production and consumption structures, it is looked upon and measured differently by different professions, cultures and organisations. It therefore becomes a complex and subjective issue and so there are several official definitions of waste by different authorities, national as well as international. Further, it is at times a political and controversial subject, especially in relation to trade and handling of hazardous and nuclear wastes. The many different approaches to – and definitions of – waste make it difficult to compare data from different countries and organisations (UNEP, 2012). This calls for a common understanding of the notion of waste globally. Definitions from the most important international organisations are given below.
The Basel convention defines waste as: “......substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law;” (Basel Convention, 2012a, article 2 §1). “Dispose” is by the convention defined as both operations resulting in final disposal or operations leading to resource recovery, recycling, reclamation, direct re-uses or alternative uses (Basel Convention, 2012a). The purpose of the Basel Convention is to control trans-boundary movements of hazardous wastes and their disposal in order to prevent these wastes to endanger human health and the environment (Basel Convention, 2012b). The convention regulate the hazardous waste movements by applying a procedure after which authorities in all involved countries, also transit countries, have to have been informed and have to have given their consent prior to the shipments taking place. Further, the parties are obliged to manage and dispose of the waste in an environmentally sound manner. The Basel Convention has 170 member countries and has been negotiated under the auspices of the United Nations Environment Programme, UNEP, who also administer the conventions secretariat (Basel Convention, 2012c).

The OECD and the United Nations Statistics Division, UNSD, define waste and its context as “Materials that are not prime products (that is products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded” (UNEP, 2012, / OECD 2012). This definition is made for statistical purposes and the angle is primarily that of businesses and industry. Prime products are excluded until the point where they become of no further use and transformed to waste by consumption or other human activity. Another point to note is that recycled or reused residuals at “the place of generation are excluded”. So in this definition it is not the outcome of the recycling, but
whether the residual have been transported to another place, which is relevant for whether it is considered waste or not.


According to this EU directive waste is defined as "Any substance or object the holder discards, intends to discard or is required to discard". It was first defined this way under the Waste Framework Directive, WFD, (European Directive (WFD) 2006/12/EC), now amended by the new WFD (Directive 2008/98/EC, coming into force in December 2010). The definition in the WFD is close to the definition of the Basel Convention but do not include the wording: “...by the provisions of national law”. Before the 1991 amendment of the Framework Directive on Waste (91/156/EEC), the EU definition was also relative to national legislation. This gave difficulties as each member state had a separate definition reflecting local conditions and history and which was not necessarily in compliance with the EUs terminology and classification. In order to harmonize the understanding of waste in the European community the directive was amended and annexed by a list categorising wastes. However, the wording of the document still left room for interpretation and based on this legal situation a number of disputes was resolved at the European Court of Justice, who confirmed the broad interpretation of waste (IPTS, 1997, pages 9-12).

With the Directive 2008/98/EC, is sought to solve many of the differences and unclear points including the distinction between waste and non-waste as well as recovery and disposal (Directive 2008/98/EC, (4) & (5)). Further, the development of the regionalisation has also strengthened the fact that the EU member’s national laws must comply with the directives of the EU.
For the purpose of this paper the EU definition of waste is followed, as this is the overall definition to be followed by waste management companies in the EU member countries.

6.2 Waste-to Energy

The new WFD (2008/98/EC, art. 4 (1)) introduces a waste hierarchy consisting of five levels, which shall apply as an order of priority for prevention and management policy and legislation in the member countries. Energy recovery is placed as the fourth priority.

Figure 6.a The EU Waste Hierarchy

![Waste Hierarchy Diagram]

Source: Own design based on article 4 (1)

The definitions of disposal and recovery are further specified in annexes to the directive, where also initiatives for prevention are exemplified. Member countries shall ensure that waste producers carry out or arrange for waste treatment in accordance with the waste hierarchy and without endangering environment and human health. Further, the directive applies an extended producer responsibility in order to strengthen waste prevention, re-use, recycling and recovery. Waste can cease to be waste, when it, following a recovery, complies with specific criteria.

Waste, however, is not just waste but further categorized. There exist different lists specifying different categories. Some overall terminology to
keep in mind when talking about waste is given below:

- Municipal waste, also often referred to as “mixed” or “solid” municipal waste, is collected and treated by, or for municipalities. It covers waste from households and similar waste from businesses, institutions etc. Waste from municipal sewage networks and treatment, or municipal construction and demolition is not included (UNEP, 2012).

- Industrial wastes, is waste generated from industry and production and contain a multitude of materials some of which are hazardous. The large quantities of waste from mining and construction consisting of soil and minerals are often referred to as mineral wastes (Eurostat, 2012b).

- Hazardous waste is mostly generated by industrial activities and driven by specific patterns of production. It represents a major concern as it entails serious environmental risks if poorly managed (UNEP, 2012). Waste is considered hazardous according to the new EU directive if it has one or more of the properties given in annex III to the directive (Directive 2008/98/EC).

- Nuclear (radioactive) waste is generated at various stages of the nuclear fuel cycle or arises from decontamination and decommissioning of nuclear facilities, and from other activities using isotopes (UNEP, 2012).

This is a coarse categorization. Waste consists of many different materials and could therefore be separated into different waste streams depending on the material fraction. One specific example showing the complexity is plastic. If plastic are to be recycled, it should be separated into different types of plastic as it can only be reused if it meets specific standards. However, if incinerated it counts as fossil fuel due to the compounds of plastic. So if
plastic could be removed totally from the incinerated waste, it has the effect that the energy is fossil CO2 free, although it also means that the energy generating effect might drop, depending on the other waste contends (Kirstine Hansen, Technical Coordinator, Amagerforbrændingen 2012).

The member countries shall however also encourage the options that give the best environmental outcome (Directive 2008/98/EC, art. 4 (2)). This means that it is allowed to deviate from the waste hierarchy for specific waste steams where justified by life-cycle thinking on the overall environmental impacts for these waste fractions. That means if the results of an environmental evaluation in an specific geographic area documents that certain waste fractions have a more positive outcome by being energy recovered than e.g. recycled, then energy recovery takes precedents over the higher level in the hierarchy (Kirstine Hansen, Technical Coordinator, Amagerforbrændingen 2012).

Another interesting thing is that Waste-to-Energy now is categorized as other recovery and no longer a method of disposal according to the new EU definition. The EU has, however, set efficiency conditions for the energy generation. This way incineration for the purpose of energy recovery has been acknowledged as a legitimate way to handle waste that otherwise can not be reused/recycled. The definitions of disposal and recovery are further specified in annexes to the directive, where also initiatives for prevention are exemplified (EU Directive 2009/28/EC).

As mentioned above energy recovery is especially emphasized in the level of “other recovery” in the EU waste hierarchy. Energy recovery could be the utility of e.g. landfill gasses to generate energy (EU Directive 2009/28/EC). It does, however, also include burning of municipal solid waste for the purpose of energy generation by incineration facilities (EU Directive 2009/28/EC, annex II, R1 and note (*)). This form for incineration is also referred to as Waste-to-Energy. The plants burn and convert waste into energy in the form of steam, hot water or electricity. Depending on local infrastructure, the hot
water and steam is used for district heating – or cooling - or the steam could be used for production processes of industries. Either or the infrastructure to distribute the water and steam has to be available. If the plant generates electricity, it needs to be fed into the grid to be distributed to the end-users. Waste-to-Energy reduces the waste volume by up to 90 % and is a hygienic method of treating waste. The residuals can mostly be re-used so only a very small quantity remains to be taken to landfill disposal (CEWEP 2012a).

**Figure 6.b**  
Sustainable Energy from waste

![Waste-to-Energy Cycle](image)

**Source:** CEWEP 2012b, Heating and Lighting the way to a sustainable future,

So is waste-to-Energy a renewable energy source? According to the EU Directive 2009/28/EC renewable energy includes biomass (article 2 (a)). Biomass is defined as “...biodegradable fraction of products, waste and residues from biological origin from......, as well as the biodegradable fraction of industrial and municipal waste;” (article 2 (e)). It should be noted, that this directive defines also the biodegradable fraction of industrial waste as renewable, while the waste directive only mention municipal solid waste. This must mean that the biodegradable part of industrial waste also can be incinerated for the purpose of generating energy in an environmentally sustainable way.
The EU WFD includes principles of self-sufficiency and proximity (Article 16). However, this is understood as self-sufficiency for the EU not for individual member states, although the directive enables member states to do so individually. Instead the directive encourages member countries to corporate in establishing a network ensuring a high level of protection for environment and human health by the most appropriate methods and technology of recovery by one of the nearest possible installations. It is further emphasised in article 16, paragraph 4: “The principles of proximity and self-sufficiency shall not mean that each Member State has to possess the full range of final recovery facilities within that Member State.” This opens for import/export of waste for the purpose of energy recovery (Directive 2008/98/EC).

6.3 Conclusion on defining Waste and Waste to energy

For the purpose of this paper the EU's the definition of waste is used. Although the member-states, as mentioned, could have different varieties of a waste-definition reflecting local and historical differences, the EU definition gives a common framework for the analysis. Further, all member countries are required to live up to the EU standards and regulations.

Waste-to-energy is within this framework defined according to the waste-hierarchy as other recovery. Prevention, reuse and recycling have priority and disposal should be avoided. Waste-to-Energy could exceptionally get a higher priority if specific local, and documented, conditions make the waste-to-energy a more environmentally sustainable solution for certain waste fractions, than higher priority waste management methods.

Depending on the contents of the incinerated waste, waste-to-energy could be considered a renewable energy source. It is more precisely biomass, which makes the energy generation renewable, while plastic contends is considered as a fossil fuel. However, in order to determine if incineration is sustainable it is also relevant to evaluate, what other energy source it replaces. If it is fossil fuel based energy then it would be sustainable, but if it is other renewable energy sources, it might not be the better solution.
7 Analysis

This part of the paper contains first an analysis of conditions for the waste-to-energy market in general at the European level. Then the analysis is moving on to look deeper into two selected waste-to-energy markets in the EU, the British and the Danish, in order to see how the market for waste-to-energy has developed under the different regulatory conditions these countries each represents.

7.1 The European market

It has already been established that the EU is the most integrated regional market in the world. The EU was formed in 1951 by six states as an integration of the coal and steel Industries of Western Europe following the two World Wars. Since then it has gradually evolved into today's European Union counting 27 member states with more than 500 million citizens (CIA, 2012a). There are certain special integral exemptions for some members. Among these is the common currency, the Euro, where the United Kingdom, Denmark and Sweden have chosen not to join although their national currencies are linked to the fluctuation of the Euro (EU, 2012a).

The economic activity of the EU has been hit hard by the economical and financial crisis starting in 2008. As part of the 2020 strategy the EU is encouraging growth and more jobs. Common policies to this extend is implemented across the EU as well as reforms are implemented individually by the member states (Eurostat, 2011).

From 2008 to 2009, GDP for EU27 fell with app. 5.6 % from €12,495,000 million to €11,791,000 million. (Eurostat, 2011).

Table 7.A: Real GDP growth rate, EU27, (Percentage change on previous year).

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>1.3</td>
</tr>
<tr>
<td>2003</td>
<td>1.5</td>
</tr>
<tr>
<td>2004</td>
<td>2.5</td>
</tr>
<tr>
<td>2005</td>
<td>3.2</td>
</tr>
<tr>
<td>2006</td>
<td>3.2</td>
</tr>
<tr>
<td>2007</td>
<td>0.3</td>
</tr>
<tr>
<td>2008</td>
<td>4.3</td>
</tr>
<tr>
<td>2009</td>
<td>1.5</td>
</tr>
<tr>
<td>2010</td>
<td>0.3</td>
</tr>
<tr>
<td>2011</td>
<td>1.6</td>
</tr>
<tr>
<td>2012f</td>
<td></td>
</tr>
<tr>
<td>2013f</td>
<td></td>
</tr>
<tr>
<td>2014f</td>
<td></td>
</tr>
</tbody>
</table>

Source: Eurostat, 2012a  
f = forecast
Also the real growth in GDP dropped significantly from 3.0 % in 2007 to 0.5 % in 2008 and down to (-4.2) % in 2009. Looking at the individual countries the pattern is that of a real growth in GDP varying significantly from 2000 to 2009 with rates ranging from 4.8 % to less than 1%. The average for EU27 in the period is 1.5 % (Eurostat, 2011).

7.1.1 The relation between businesses and the EU

The relation between business and the EU is of pluralist nature (Lehne, 2006). This is emphasised in the values of the EU. Here a citation from the text in article 1-2 of the constitution for Europe: “... These values are common to the Member States in a society in which pluralism,...” (EU, 2004). The pluralistic function is evident when looking at how policy making in the EU is taking place. Large corporations might have their own lobbyists working on influencing policies directly, but often the influence are organised into interest groups. There are eight different categories of interest groups spanning public governmental representatives, European associations, businesses, pressure groups, non-profit organisations etc. (Suder, 2008, page 223). The stakeholders are consulted according to the specific issue, and in some cases representatives for certain groups or the broader public is invited to come with their view and input. For companies situated in a member country of the EU, the regional integration has given a layered regulative framework to adhere to. Interest groups come in the

Also in relation to waste management and waste-to-energy exists interest groups. The industry is represented by CEWEP, which is an umbrella organisation for the owners and operators of waste-to-energy plants across Europe, working for the progress of waste-to-energy. Part of their work is to participate in the decision making process through analysis of environmental legislation, on sustainable development and by providing information on the sector via close contact with the EU institutions: Commission, Council and Parliament. Both Denmark and the UK are members of CEWEP (CEWEP, 2012c).
For the waste-to-energy sector in the EU, there are both regulations at the regional level and regulations at the national level. Further, it is usually the municipality administrations in a country, which are responsible for solutions for waste disposal and/or collection for citizens and similar wastes from businesses, as it is considered part of the public utility sector. Hence the term Municipal solid waste. All in all that gives the companies three levels of institutions to adhere to.

As it is seen at figure 7.a, the different levels of regulation and governing get influenced by different stakeholders or interest groups as well as by developmental changes. Examples could be member nations that have entered into international conventions for trade, environment etc. Industries lobbying at the EU or national government for issues relevant for advancing
their businesses, new technical solutions that change markets or requirements from countries from outside the EU boarders.

7.1.2 EU regulation on waste and Renewable Energy

Alone at the EU level the number of regulative legislation addressing waste and waste management is extensive. The general framework of the requirements of waste management setting the basic definitions for the EU is Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. The directive is supported by: the Decision 2000/532/EC establishing a waste classification system including the distinction between hazardous and non-hazardous waste as well as providing a list of wastes and Regulation and (EC) No 1013 of the European Parliament and council on shipments of waste. The latter sets the conditions under which waste can be shipped between countries. The regulative framework is far more extensive than the three main pieces of legislation giving the general framework, mentioned here (EU, 2012x). Annex II to this paper gives an overview over just how extensive.

As this paper addresses issues related to waste-to-energy, it is also relevant to look at the regulative framework for energy. As mentioned in the introduction the energy dependency in Europe is high and there are severe environmental concerns. In April 2009 the EU issued a directive on the promotion of energy from renewable sources (Directive 2009/28/EC, 2009). The directive aims at addressing the above-mentioned issues via three strategic goals for the EU. They are: to bring down greenhouse gas emissions, to increase efficiency and through the use of renewable energy sources to reduce dependency on energy imports. In order to achieve the goals, the EU has set a mandatory target of a 20 % share of energy from renewable sources in overall community energy consumption by 2020. A similar target for energy consumption to transportation is set to 10 % (Directive 2009/28/EC, 2009, p.17). The target has been translated into ambitious legally binding goals for each member country (Directive 2009/28/EC, 2009, p.46).
7.1.3 Waste generation and treatment in the EU

Waste generation reflect the economic activity of an area. The mining and construction sectors are major waste generators, but the majority of this type of waste is composed of minerals or soils, also referred to as mineral waste. Therefore, non-mineral waste is a better proxy for trends in waste generation by economic activities as they include all other waste from consumption and production and thereby also the incinerable waste (Eurostat, 2012b). Looking at the non-mineral waste generation, the EU27 generated 912 million tonnes non-mineral wastes in 2010. That is equivalent to 1,817 kg per capita in the EU27 (Eurostat, 2012c). Figure 7.b below shows the generation of the non-mineral waste generation separated on economic activity.

**Figure 7.b** Non-mineral waste generation, EU-27, 2004-2010 (million tonnes)

The drop in waste generation by some activities in 2008 and 2010 is to some extend a reflection of the economical and financial crises (Eurostat, 2012c). As it is seen the waste from households do not vary much from 2004 – 2010. The average amount of municipal solid waste for EU27 in 2008 was 524 kg per capita. But there is a gap of 500 kg per capita between the country generating most of this type of waste to the one generating the least (Eurostat, 2010).
The differences in waste generation between the member-countries reflect to some extend the different economic structures and consumption patterns as well as the degree of waste prevention policies the individual country has implemented. A similar thing can be said about the waste treatment methods. They also vary from member country to member country reflecting the history and institutional development of the sector in the country. The table below show how the waste was treated in 2010 separated into different methods.

Table 7.B Waste treatment in the EU and other selected countries, 2010 (1,000 tonnes)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total</th>
<th>Energy recovery</th>
<th>Incineration without energy recovery</th>
<th>Recovery other than energy recovery</th>
<th>Disposal other than incineration</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU-27</td>
<td>2,369,580</td>
<td>357,900</td>
<td>42,719</td>
<td>1,093,450</td>
<td>1,140,900</td>
</tr>
<tr>
<td>Belgium</td>
<td>44,334</td>
<td>1,320</td>
<td>5,580</td>
<td>58,797</td>
<td>1,638</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>189,049</td>
<td>144</td>
<td>8</td>
<td>1,856</td>
<td>158,061</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>39,247</td>
<td>797</td>
<td>95</td>
<td>13,223</td>
<td>4,204</td>
</tr>
<tr>
<td>Denmark</td>
<td>8,793</td>
<td>1,212</td>
<td>0</td>
<td>6,573</td>
<td>585</td>
</tr>
<tr>
<td>Germany</td>
<td>34,588</td>
<td>23,423</td>
<td>12,066</td>
<td>241,563</td>
<td>83,932</td>
</tr>
<tr>
<td>Estonia</td>
<td>17,053</td>
<td>336</td>
<td>0</td>
<td>5,056</td>
<td>10,981</td>
</tr>
<tr>
<td>Ireland</td>
<td>9,421</td>
<td>168</td>
<td>43</td>
<td>3,356</td>
<td>5,854</td>
</tr>
<tr>
<td>Greece</td>
<td>67,323</td>
<td>135</td>
<td>45</td>
<td>5,291</td>
<td>62,100</td>
</tr>
<tr>
<td>Spain</td>
<td>132,683</td>
<td>2,523</td>
<td>412</td>
<td>60,289</td>
<td>49,464</td>
</tr>
<tr>
<td>France</td>
<td>339,395</td>
<td>14,241</td>
<td>1,809</td>
<td>261,053</td>
<td>113,294</td>
</tr>
<tr>
<td>Italy</td>
<td>127,094</td>
<td>2,459</td>
<td>5,157</td>
<td>67,026</td>
<td>32,422</td>
</tr>
<tr>
<td>Cyprus</td>
<td>2,371</td>
<td>7</td>
<td>7</td>
<td>1,381</td>
<td>976</td>
</tr>
<tr>
<td>Latvia</td>
<td>7,386</td>
<td>18</td>
<td>7</td>
<td>546</td>
<td>727</td>
</tr>
<tr>
<td>Lithuania</td>
<td>4,546</td>
<td>111</td>
<td>2</td>
<td>1,092</td>
<td>3,371</td>
</tr>
<tr>
<td>Luxembourg</td>
<td>13,426</td>
<td>32</td>
<td>104</td>
<td>6,286</td>
<td>5,105</td>
</tr>
<tr>
<td>Hungary</td>
<td>13,424</td>
<td>859</td>
<td>62</td>
<td>5,125</td>
<td>7,357</td>
</tr>
<tr>
<td>Malta</td>
<td>1,202</td>
<td>6</td>
<td>7</td>
<td>1,096</td>
<td>1,068</td>
</tr>
<tr>
<td>Netherlands</td>
<td>118,573</td>
<td>6,276</td>
<td>4,809</td>
<td>58,290</td>
<td>47,197</td>
</tr>
<tr>
<td>Austria</td>
<td>29,751</td>
<td>1,384</td>
<td>1,648</td>
<td>14,902</td>
<td>11,756</td>
</tr>
<tr>
<td>Poland</td>
<td>32,939</td>
<td>3,834</td>
<td>369</td>
<td>109,695</td>
<td>32,712</td>
</tr>
<tr>
<td>Portugal</td>
<td>32,115</td>
<td>2,343</td>
<td>418</td>
<td>7,883</td>
<td>5,271</td>
</tr>
<tr>
<td>Romania</td>
<td>197,370</td>
<td>1,524</td>
<td>242</td>
<td>6,633</td>
<td>103,975</td>
</tr>
<tr>
<td>Slovenia</td>
<td>5,633</td>
<td>282</td>
<td>58</td>
<td>3,816</td>
<td>1,504</td>
</tr>
<tr>
<td>Slovakia</td>
<td>8,387</td>
<td>233</td>
<td>19</td>
<td>4,210</td>
<td>3,822</td>
</tr>
<tr>
<td>Finland</td>
<td>105,630</td>
<td>3,847</td>
<td>397</td>
<td>91,999</td>
<td>65,395</td>
</tr>
<tr>
<td>Sweden</td>
<td>110,476</td>
<td>5,285</td>
<td>87</td>
<td>16,872</td>
<td>87,541</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>172,931</td>
<td>177</td>
<td>243</td>
<td>145,028</td>
<td>168,179</td>
</tr>
<tr>
<td>Norway</td>
<td>1,292</td>
<td>1,292</td>
<td>276</td>
<td>2,566</td>
<td>2,170</td>
</tr>
<tr>
<td>Croatia</td>
<td>31</td>
<td>18</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>FYR of Macedonia</td>
<td>2,106</td>
<td>6</td>
<td>1</td>
<td>331</td>
<td>1,775</td>
</tr>
<tr>
<td>Serbia</td>
<td>33,059</td>
<td>26</td>
<td>1</td>
<td>585</td>
<td>32,468</td>
</tr>
<tr>
<td>Turkey (t)</td>
<td>60,230</td>
<td>143</td>
<td>81</td>
<td>14,427</td>
<td>45,890</td>
</tr>
</tbody>
</table>

(1) 2006.
Source: Eurostat (online data code: env_wastpr)

Source: Eurostat, 2012c
As the table shows there are large differences between the waste treatment methods. For a country like Denmark less than 10 % is disposed of at landfills while almost 25 % are energy recovered by incineration. In the case of the UK app. 50 % of the waste goes to landfills, while only a minor part is energy recovered. In fact most of the incinerated waste in the UK are not recovered.

The long-term economical growth over the last centuries together with the internationalisation has also lead to an increase in waste transports across borders. Some of these shipments are categorized as “green-listed waste” as they contain materials for reuse or recycle with the purpose of substituting natural resources in industries. However, other shipments are a risk to environment and human health. Therefore there is imposed strict control and reporting on waste shipments of the latter type, especially if they contain hazardous waste. This is also referred to as notified waste, as this waste is not to be transported without prior notification and permission from the receiving country's authorities (see also chapter 6, page 39). Data on shipment of waste only cover notified waste. The main driver for waste transports is price differences, insufficient waste treatment capacity or lack of special treatment techniques. Most of the waste shipments involving the EU take place between member-countries. The largest importers are Belgium, Germany, Norway and Sweden (Eurostat, 2010).

7.1.4 Energy dependency
The waste-to-energy market is dual. First the waste itself is an externality from the consumption and production of the households, businesses, and institutions. Thereby it is a cost to society to dispose of the waste. The tendency has been that waste producers have to pay to get rid of their waste. At the same time the energy produced can be sold. That gives two income streams for a waste-to-energy plant, one up-stream and one down-stream. The normal is that companies have to pay for the raw materials they need for their production. Compared to e.g. an energy plant firing with coal, the energy plant has to pay for the coal and depending on the country the coal
might have to be imported. In stead access to delivery of waste has to be ensured.

In order to evaluate the perspective for selling the energy produced by the waste-to-energy plants, it is interesting to look at the energy consumption in the market.

Table 7.C  Final Energy consumption, (1.000 tonnes oil equivalent)

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU (27 countries)</td>
<td>1132238</td>
<td>1171483</td>
<td>1186394</td>
<td>1191402</td>
<td>1191970</td>
<td>1165436</td>
<td>1173743</td>
<td>1112212</td>
<td>1153312</td>
</tr>
<tr>
<td>Denmark</td>
<td>14794</td>
<td>15134</td>
<td>15361</td>
<td>15497</td>
<td>15665</td>
<td>15721</td>
<td>15518</td>
<td>14802</td>
<td>15535</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>148956</td>
<td>150703</td>
<td>152469</td>
<td>152311</td>
<td>150258</td>
<td>147972</td>
<td>147621</td>
<td>136945</td>
<td>142951</td>
</tr>
</tbody>
</table>

Source: Eurostat, 2012d

Table 7.C show the final energy consumption of the EU27, Denmark and the UK. As the table shown the general trend is that the amount of the energy consumed is going up the main part of the period but drops from 2008 – 2009. The drop can be explained by the economical crisis setting in. If the figures are compared with the figures shown I table 7.D for how much energy is produced the same period by biomass and renewable wastes, it can be used as a proxy for who much energy was generated by renewable waste-to-energy. The figure is not totally comparable as biomass is a wider fuel than waste-biomass and there is a small amount of energy being lost from the time of the primary production to the consumption.

Table 7.D  Renewable energy primary production, Biomass and renewable wastes (1.000 tonnes oil equivalent)

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU (27 countries)</td>
<td>61978</td>
<td>67834</td>
<td>72849</td>
<td>77355</td>
<td>83222</td>
<td>91401</td>
<td>96112</td>
<td>100765</td>
<td>112725</td>
</tr>
<tr>
<td>Denmark</td>
<td>1583</td>
<td>1784</td>
<td>1886</td>
<td>1945</td>
<td>2004</td>
<td>2023</td>
<td>2190</td>
<td>2192</td>
<td>2424</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2028</td>
<td>2233</td>
<td>2318</td>
<td>2434</td>
<td>3060</td>
<td>3413</td>
<td>3497</td>
<td>3595</td>
<td>4051</td>
</tr>
</tbody>
</table>

Source: Eurostat, 2012e

Another relevant factor to look at in order to evaluate the market potential is, how much of the consumed energy is from renewable sources in general. The environmental effect of the waste-to-energy is relatively larger is the energy it substitutes is fossil fuels like oil, coal and gas. If it substitutes other renewable energy sources the environmental effect might be smaller and
could be negative depending on the energy source. Table 7.E show how much renewable energy is produced in the EU27, and the two compared countries.

Table 7.E  Primary production of renewable energy, (1.000 tonnes oil equivalent)

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU (27 countries)</td>
<td>97505</td>
<td>103906</td>
<td>111843</td>
<td>115891</td>
<td>123507</td>
<td>134057</td>
<td>142037</td>
<td>148776</td>
<td>166647</td>
</tr>
<tr>
<td>Denmark</td>
<td>2018</td>
<td>2277</td>
<td>2468</td>
<td>2534</td>
<td>2555</td>
<td>2847</td>
<td>2812</td>
<td>2797</td>
<td>3123</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2566</td>
<td>2642</td>
<td>2925</td>
<td>3546</td>
<td>3876</td>
<td>4351</td>
<td>4609</td>
<td>5130</td>
<td>5327</td>
</tr>
</tbody>
</table>

Source: Eurostat, 2012f

As can be seen from the figures there is still ample room for more renewable energy production, and thereby also waste-to-energy. It should, however, be noted that it varies from local area to local area. Some places might only have fossil fuel based energy production so any waste-to-energy production would benefit the environment, while other places the primary energy production might rest partly on other renewable sources like wind. It would therefore always be up to a specific analysis of the local conditions to find the optimal places to situate a waste-to-energy plant.

Lastly it is relevant to look at the energy dependency of the country. Some countries have a gross export of energy other are dependent on import energy to cover the total consumption. Often the import/export will be a mix, but for this purpose it is enough to look at the gross figures. These are shown in table 7.F.

Table 7.F  Energy dependence, Percentage net import to total consumption

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU (27 countries)</td>
<td>47,56</td>
<td>48,97</td>
<td>50,24</td>
<td>52,5</td>
<td>53,67</td>
<td>52,98</td>
<td>54,6</td>
<td>53,73</td>
<td>52,68</td>
</tr>
<tr>
<td>Denmark</td>
<td>-42</td>
<td>-31,8</td>
<td>-47,5</td>
<td>-50,9</td>
<td>-35,9</td>
<td>-24,7</td>
<td>-22,9</td>
<td>-20,7</td>
<td>-18,2</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>-12,5</td>
<td>-6,52</td>
<td>4,58</td>
<td>13,5</td>
<td>21,17</td>
<td>20,42</td>
<td>26,2</td>
<td>26,2</td>
<td>28,27</td>
</tr>
</tbody>
</table>

Source: Eurostat, 2012g

7.2  Denmark

Denmark is one of the smaller countries of the EU with a population on 5.5 million people. It consists of a peninsular on the European continent and
several hundred islands. The closeness to the sea is reflected in the industry. Denmark has a large fishing industry and merchant fleet. Other larger industry sectors are food products, chemicals, machinery paper and beer but also the service sector stand for important economic activity e.g. tourism (EU, 2012c). Denmark is a constitutional monarchy and has a multiparty democratic system based on consensus politics. Several parties are represented in the one chamber parliament at any one time. None of the parties have in the last century had majority in parliament. In stead governments are often minority administrations with supporting parties (Denmark, 2012). Al though the political environment have taken a turn towards the left, the differences between the political agenda of the present and the former government is not so extreme as it is sometimes seen in other countries. In this case the Social Liberals pulls towards the middle with their financial politics and at the same time the present government, like the former, have to obtain consensus for its politics. The Danes pride themselves of their welfare state. Denmark is considered to be, a capitalist state run on social principles (EU, 2012c) and like other Scandinavian countries the government have a distributive capacity (Weiss, 1998).

At the national level the Danish waste management sector has long since needed a new regulation as the conditions for the organization of the area has changed since it was introduced in its first version in the 70'es. Although Denmark has been in front on the waste to energy area, the country has lacked behind other comparable countries when it comes to recycling and other waste management areas. In 208 Denmark incinerated more than 23 % of the total waste produced, but only reused/recycled app. 42 % of the municipal solid waste (Miljøministeriet 2010).

Denmark had in 2010, 29 incineration facilities with a total incineration capacity of app. 3.7m tonnes. Al of the facilities, are energy recovering plants. The 21 of the 29 plants are municipality-owned. In all 79 of the 98 municipalities in Denmark own or co-own a waste-incineration plant. So public political involvement are high on the local level. However, this
The organization gives quite a large number of incineration plants, where some is small. The seven largest plants covers 60% of the total capacity and the two largest covers almost 30% of the capacity (Miljøministeriet 2010).

Commercially owned incineration facilities are, as the above figures show, few. This is historically determined as the present regulation dictates a balancing principle, where revenue and cost have to even out over a period. It is therefore not possible to create a positive profit that can attract private investors. The present national regulation was based on a growing waste problem locally due to growth in production and consumption. In order to secure capacity municipalities were made responsible for waste disposal of waste generated by households and industry within their area and in return received the right to determine where the waste should go. Which made sense at the time. The following market conditions also added to pushing for incineration: 1) A fee for depositing waste was introduced as well as deposit of burnable waste became totally prohibited in 1997. That meant that municipal solid waste and burnable industrial waste, had to be burned or otherwise reused. 2) A well-distributed district heating system in many areas of Denmark generated income from heat generation, which could compensate for the taxes imposed on waste. 3) The balancing principle annulled any risk for the incinerating plants in getting their costs covered and thereby the investment risk for municipalities. 4) The municipalities’ authorization right gave their plants monopoly Until the liberation of the industrial waste by the end of year 2010, this right also included industrial waste from companies situated in the municipality’s area (Miljøministeriet 2010).

A capital investment period for an incineration plant is estimated to be about 20 years (Miljøministeriet, 2010). For the new plant, Amager Bakke, there have even been calculated with a capital investment period of 25 – 30 years (Kirstine Hansen, Technical Coordinator, Amagerforbrændingen 2012). Like the Amagerforbrænding plant, several other waste incineration plants in Denmark are old and outdated and need replacing if they could avoid being
closed down. Two of the smaller plants in West Denmark have been taken out of operation with the purpose of being permanently closed and scrapped. This was mainly due to economic reasons, as smaller plants have to charge higher gate fees, as their cost is relatively higher per output. With the liberalization they lost their monopoly and had to lower their price on waste if they should be able to attract the liberalized waste. Seen from the point of the Danish society, the situation with many old and small plants, gives a window of opportunity to reshape the structure and long-term conditions for the waste-to energy sector before the municipalities have to replace the incinerator plants and without the risk of loss of investments (Miljøministeriet 2010).

Within the framework of the EU directive the Danish government established in 2009 an inter-ministerial working group with the purpose of identifying a new structure for the waste management sector including suggestions to reregulation. The working group identified five main challenges for the Danish sector:

- Competitiveness
- Adjustment of capacity
- Efficiency and economy
- Reuse of waste resources other than energy
- Climate and energy

In general the report recommends that the balancing principle and the demand that each region should have capacity to cover all waste produced in their area are repealed. Also importantly is the recommendation to change the governance structure of the municipality owner companies to be equity-based companies.

Then evaluating four possible scenarios the report further recommends a full liberalization of the area which is estimated to lead to equal competitive conditions, ongoing capacity adjustments, cheaper costs for incinerating waste, better resource utility and better possibilities for living up to the
climatic and environmental obligations. Alternatively a mix where the municipal solid waste stays regulated could be a better option than the present regulation, but not give as high a saving as the liberalization scenarios promises (Miljøministeriet 2010).

The working group writes in its report that the government supports its recommendations. In the mean time Denmark have had a new government. The work by the inter-ministerial group was initiated during the period where the former liberal/ conservative government was in office. They are now the opposition to the present coalition between the Social Democrats, the Social Liberals and Socialist Peoples Party.

October 2012 the present government published an initiative for strengthening the Danish competitiveness, which is one of the growth parameters that Denmark is in most need of improving according to the Danish government themselves (Erhvervs- og Vækstministeriet 2012). Both OECD and the EU have also pointed out that the competition in Denmark in a number of markets is inadequate leading to higher prices for consumers, lower innovation and giving an inefficient productivity development. In the report is specifically mentioned that the present structure of the municipality run waste sector is a hindrance for competition on prices and efficiency between the waste-to-energy plants and preventing the development of a more resource efficient and innovative waste management marked in Denmark. The government is this autumn going to present a new resource strategy for waste management in order to create the framework for a more efficient incineration sector (Erhvervs- og Vækstministeriet 2012). It could therefore be expected that the government is going to support at least parts of the proposal from the inter-ministerial work group, especially where it otherwise support the governments economic growth plans and greener line.

7.3 The United Kingdom

With a population of more than 61,7 million people the UK is the third largest country in the EU. It consists of England, Wales, Scotland and Northern
Ireland. Economically it is also one of the largest economies in the EU. It maintains industrial capacity in some sectors although the economy increasingly is service-based, especially within the financial sector where London counts as a world centre. The United Kingdom is a constitutional monarchy and parliamentary democracy (EU, 2012d). It is known for a liberal economic governing style especially since the 1980es where the Thatcher government stood for deregulation, liberalization and privatisation. Although the UK later has had a labour lead government the liberal policy style has remained (Barma & Vogel, 2008, page 330).

In the United Kingdom the responsibility for waste, at the ministerial level, is placed in the Department for Environment, Food and Rural Affairs, Defra (Defra, 2012a) and the responsible for energy is placed in the Department for Energy and Climate change DECC (DECC, 2012). The latter is a fairly new department established under the previous governments late governmental period as a response to the EU policies on the area. The policy areas for energy and climate change respectively were previously subdivisions in other ministries, so the establishment of DECC could be seen as a priority upgrade of the areas. Defra and DECC have to some extent overlapping responsibilities as the environment influences the climate changes. The area of waste and waste management is placed in Defra, while renewable energy and thereby the energy production of waste-to-energy lies in DECC.

As mentioned earlier the EU target of a 20 % share of energy from renewable sources in overall community consumption by 2020, has been translated into legally binding goals for each member country (Directive 2009/28/EC). With a share of only 1.5 % renewable energy in 2006 to a target of 15 % in 2020, the UK is the EU country, which has the most ground to cover according to the calculated national targets (Energy, 2009a).

This target appears to be the main driver behind the government of the UKs push for moving the market for renewable energy forward. Especially energy
from wind and nuclear facilities seems to be the renewable sources receiving the most governmental report (The New York Times, 2012).

The most widely used waste-management method in the UK remains at present to be landfill. In 2010 the UK produced almost 317,000,000 tonnes of waste (Eurostat, 2012c). Only app. 1.5 % was incinerated and it was a minor fraction of the incinerated waste that were energy recovered. Where as more then 50 % was landfilled (see table 7A, page 46). Landfills were chosen in the beginning of the 19th Century where it after the 1st. World War it substituted incineration, as a cheaper and more convenient way to solve the waste problems of the citizens and businesses mainly living and operating out of cities. A Landfill requires a plot of land, or rather a whole in the ground, neither too far away nor too close to habituated areas, a few workers to run the facility and administer receiving the waste trucks, and covering the waste with soil. It did not require large investments in expensive technical solutions. Waste was, and is still widely, considered to be an unavoidable externality from consumption and production. As such waste is a problem, which needs to be handled by the society the easiest and cheapest way possible. The actual resources or business possibilities occurring from waste was not given much thought (The Independent, 2010). The institutional structure for waste at the local level is such that the local authorities have collection responsibility for the municipal mixed waste, while businesses are responsible for the waste coming from production. The main driver for the UK to look for other methods to rid society of waste is foremost lack of sites to use for landfills leading to higher prices for getting rid of the waste. However, there is also a growing environmental awareness, which also seems to be connected with international society's focus on climate changes and the EU policies in the area (Defra, 2012b).

The few operating waste-to-energy plants are mainly privately run and owned, al though, a few are owned by municipalities. In 2006 a total number of 22 waste-to-energy incineration plants was registered as operating in the UK (ISWA, 2006). The reason why the number of plants is so limited, is both
due to the free market conditions in the UK where the initiative has to be embedded in private initiatives and due to low priority from the authorities. Companies have to be able to make an economic feasible profit from the large investment it is to build a waste-to-energy plant and landfiling has previously been a cheap alternative. But also the low focus from the government has lead to difficult administrative procedures getting permission. This is not made easier by the pluralist nature of the political system, which requires interest groups to be heard. Fears for emissions from the plants can create opposition in local communities. Nobody wants to live near an incineration plant although modern techniques have lowered the emission levels significantly. That means that a lot of work has to be done to document that emissions are controlled and (Environment Agency, 2009).

The conditions for investing in waste-to-energy plants is improving with the changed political environment aiming at living up to EU regulation on environment, waste management and energy. The waste directive of the EU was transposed into law in the UK in 2011 (Defra, 2012c). The amount of waste going to landfill has go come down on a level of 12 million tonnes per year. In order to reach this goal a tax on landfiling has been introduced as well as restriction of which waste streams can be deposited. Further, a wide spectre of initiatives to reduce waste production, reuse, recycling and recovery is taking place (Defra, 2012b). The initiatives on waste-to-energy have a priority following the waste hierarchy and in the case of the UK waste-to-energy initiatives to a far extend also cover other methods and techniques than incineration with energy recovery. Among others, is “anaerobic digestion” a much-discussed method and gas contraction from landfills must with the amount of landfills in the UK also be an option (Defra, 2012b).

In the UK the national waste management issues are large, so al though that legislation on transport of waste is in place and complying with the EU, international trade with waste is not in focus. Import is not relevant with the large quantities of waste produced in the UK giving problems and export seems not to be in focus.
8 Discussion

Traditionally, capitalism views prosperity as being equal to growth based on consumption. As the society gradually has grown wealthier so has the production and consumption gone up. Prosperity and the “consume-and-throw-away” thinking of especially the western world has come with a cost. As the previous chapters have shown, the cost is the growing externality problems in form of pollution and large amounts of waste. At the same time a severe economical and financial crisis has necessitated actions for stabilising the economic environment and yet again ensure growth. In other words there has emerged a conflict. The conflict is based on both the present economical crises linked with the global energy dependency, severe environmental changes and future expected shortages on natural resources amongst which is fossil-fuels and miscellaneous metals and minerals (Directive 2009/28/EC). The conflict theory says, that conflict offsets change, which is also the case here. Change is what the EU and the individual member countries seek to handle, in order to solve the situation and again create stability and prosperity, as the functionalist perspective explains (Huges, Kroehler and Zanden, 2002).

As the most advanced and integrated form of regionalism in the world of today (Suder, 2008), the EU is conducting the role of the regulatory state, which is to provide the institutional framework for marketplace competition when markets are not competitive (Lehne, 2006). This has also been the case in relation to renewable energy and waste management. The EU is setting up a mutual framework within which, the member states must apply their policies locally to push the market forward. In his model, Lehne, 2006 is mainly focusing on market formation in relation to competition and is as such viewing the market from a liberal angle. However, the motivations for the EU are not only market competition, but also considerations to the public safety, in relation to environment and health as well as dependency and resource security. In our globalised society products are not necessarily consumed in the same geographical area where it is produced. From this
follows that producers might not have sufficient motivation to take steps into making the products and packaging environmental friendly, as their foremost priority is to optimise their profit. To give companies this motivation governments must step in and provide it through legislation. This is partly what the EU is doing through its regulative framework.

The two countries, the UK and Denmark each represent a different type of western capitalism. The UK is mainly governed after liberal principles with a free market perspective. In Lehne’s terminology the UK is mainly a framework state (Lehne, 2006). Adam Smith was English and his thinking has to a certain extent dominated. Especially since the Thatcher regime, deregulation, liberalization and privatisation have been in focus (Barma & Vogel, 2008). As it is seen from the waste market, this has been a hindrance for the formation of a waste-to-energy market. The private initiative has not had much incitement to invest in incineration plants, which require a huge amount of initial capital for construction and the patience for a lengthy planning procedure. After which the company have to compete with low prices for depositing waste at landfills. Further, the factor conditions needs to be available in order for the industry to be competitive (Porter, 2001). In the UK the necessary infrastructure in form of district heating networks and connection possibilities to the electrical supply grid have not necessarily been available. This would limit the demand and add to the cost. However, the UK government has with the institutional framework provided by the EU and the realisation of the severe problems the country is facing, shown capacity to work to change the market through legislation, although it still demand private initiative to establish the industry.

Contrary to the UK the Danish government have provided the institutional support for the waste-to-energy market. The legislative framework has helped create a market. The Danish government looked at waste management as a public utility service. Staying with Lehne, 2006, Denmark has been acting the social service state. The wide distribution of district heating networks in Denmark secured the demand, the municipal
monopolies provided the supply and with the balancing economy principle the investment risk for the municipalities were minimized. This distributive capacity (Weiss, 1998) the Danish political system has shown, has been the backbone of the formation of the market.

Comparing the two countries neither of them have shown a transformative capacity (Weiss, 1998). The UKs economic liberal thinking celebrating the free self regulating market has not motivated to create a market for waste-to-energy, however, with the regulative framework from the EU requiring action, the UK show capacity to support the market when it takes off. The Danish government on the other hand, has shown action and pushed to create a market for waste-to-energy. However, the very same initiatives helping the market formation have been a hindrance for its wider development as the institutional structure discourages competitiveness. Thereby, the natural consolidation of the market leading to economy of scale, and to some extend scope, giving higher efficiency and productivity has not been able to take place. The Danish government has lacked sufficient transformative capacity to change the market gradually towards a more liberalised one, creating competition and growth.

The market institutional perspective applied on the waste-to-energy market of the EU is supported when it comes to the formation of markets (Barma & Vogel, 2008). As Fligstein, 2001, argues, the modern capitalist society require not only representatives for capital and labour, but also the government in order to produce the general institutional arrangements for the market to function. The liberal economic theories, however, are not totally rejected although not suitable for the formation of a market with these characteristics. The formation of a market is a conflict and for the market to function on free market conditions stability is assumed (Suder, 2008). This is obtained when the market have passed its formation phase and starts to mature. At that time the market needs to gradually go towards more liberal market mechanisms in order to develop and function in an efficient and sustainable way. It can however not be proved from the example for the Waste-to-energy market
that the end result should be a completely deregulated market. Several factors speak for a more balanced approach with a re-reregulation still providing institutional support, but differently than in the formation phase (Vogel, 1996).

The paper has also shown that regionalisation has a valid regulative purpose especially when dealing with trans-boundary issues like environment and pollution. But where Weiss, 1998, counts regionalisation, e.g. the EU, as one of many new tendencies in the transition towards the globalisation of markets away from the state-nation, this paper argues for the regionalisation being complementary to the state-nation, creating a regulative hierarchy, where regulation at the regional level supports national governed initiatives and opposite. This is especially useful, where a region consists of smaller countries, like the EU, and in addressing international issues so that synergies and learning curves can be distributed over a wider area.

Arguments against incineration are forwarded in the media and politically in the perspective that the society either has to recycle or incinerate. The discussions lack vision and innovative views that could give way for a more “both-and” view instead of “either-or” view. One of the fears, the papers has found on the Danish market is that import of waste would lead to more pollution. However, if waste is considered a fuel, then one can not look at transport cost and pollution isolated but have to hold it up against what coal, natural gas, oil or other fossil fuels would cost and pollute in transport and incineration, to generate the same amount of energy heating. Fossilfuels are often also importet – even from places so far away as central Russia, the middleeast etc. where the extraction also causes environmental concerns. While waste could be imported from neighboring countries as e.g. the UK, the Baltic countries, Poland, and other EU countries and so help these countries handle their waste and the EU in reaching their goals for at better environment. This would revive some of the old economic liberal virtues from Adam Smith, 1776, and David Ricardo, 1817. Denmark has a comparative advantage in waste-to-energy by incineration. To ensure long-
term sustainable growth a nation has to increase its total factor productivity (Farole et al., 2010) and the waste-to-energy sector could add to that. It would have more benefits to pursue the possibilities emerging from this advantage: 1) energy and heating could become cheaper for Danish consumers, 2) Environmental benefits from substituting fossil fuels, as the perspective of generating full capacity of renewable energy has a long time horizon. 3) Denmark could specialise in the waste-mangement and waste-to-energy areas and create a new international competitive advantage and growth possibilities. 4) It would generate new possibilities for research, education and labour generating activities, and thereby support innovation within the sector and for the benefit for the wider society.

8.1 The long-term business possibilities for waste-to-energy plants

The Danish waste-to-energy sector has benefitted from an institutional structure and regulative support that has worked to form a market for waste-to-energy in Denmark. The Danish sectors knowledge of waste-to-energy is extensive and is building on more than 100 years of experience working with waste-to-energy. At the same time the infrastructure in form of district heating networks and admission to the power grid is available. These are strengths and competitiveness factors for Denmark. This far Denmark has not utilized this opportunity to use it as an international business possibility. Providing the Danish government follows through on the recommendation from the report from the inter-ministerial working group, a freer market could be expected with an enhanced competitive structure. The first advantage for the industry would be a consolidation and the larger companies, as Amagerforbrænding, would have better options to get waste from other regions in Denmark. Further, on longer term possible import options could occur. There should be amble areas of the EU needing to find more sustainable and environmental friendly ways of disposing of waste, than the much used method of landfills in light of the new waste directive. Amagerforbrænding has an advantage in this respect. Not only are they building a new more efficient plant using state-of-the-art techniques that
gives higher output in a more environmentally friendly fashion and which could be the better alternative for some countries to dispose of the waste not suitable for reuse or recycling. Amagerforbrænding is also situated at the harbor area, so it would be possible to transport waste to the plant without having to go by road through dense populated areas.

Importing waste does not necessarily mean, that is would change the balance of payments negatively, as less fossil fuels would need to be imported. Further, there is better waste sorting activities in focus through the waste-hierarchy. This will provide waste fractions sorted from the waste to be recycled or recovered. This would either, generate new innovative industries and thereby create jobs, or if other countries in the EU have specialized in the recycling of specific waste fractions, it could give export opportunities.
9 Conclusion

The paper evaluated the understanding of waste and waste-to-energy in order to define the concepts. It was found that no common definition exists internationally for waste. For the purpose of this paper the EU definition has been chosen, as it gives a common framework and all member countries are required to comply with the EU standards and regulations. Within the EU waste framework Waste-to-energy is defined according to the waste-hierarchy, where it is included in other recovery and therefore has the second lowest priority, unless documented local conditions show it is a more environmentally sustainable solution for specific waste fractions than methods with higher priority. Waste-to-energy could be considered a renewable energy source depending on the contents of the incinerated waste. High contents of biomass waste makes the energy generation renewable, while plastic contends are considered fossil fuels. However, in order to determine if incineration is sustainable it is also relevant to evaluate, what other energy sources it replaces.

As the largest and most integral region of the world today the EU counts 27 member states with more than 500 million citizens. The economic activity of the EU has been hit hard by the economical and financial crisis starting in 2008 and a drop in GDP for EU27 at app. 5.6 % was seen from 2008 to 2009. As part of the 2020 strategy the EU is encouraging growth and more jobs. Common policies to this extend is implemented across the EU as well as reforms are implemented individually by the member states. The EU is pluralistic in nature and different interest groups participate in policy making process by providing knowledge and input. The regionalisation has had the effect that businesses have a layered regulative framework to adhere to. There are regulations at the EU level and the national level and these are often administered more locally at the municipal level especially for products of the nature of waste as it, at least for municipal solid waste, is considered as part of the public utility sector. The amount of waste produced in the EU is growing. Different methods for disposal are used in the different countries.
The EU has an extensive regulative framework for waste as well as for energy in order to improve the environment and in relation to energy, because dependency is high. This is reflected in the 2020 strategy. For waste the EU aims at creating cooperation and common understanding among its members, as it is a trans-boundary issue. Among targets is a limit on waste generation and especially a limit on waste going to landfills. An opening for import and export of waste is included in the framework under certain conditions. One of the goals for the energy area is to cover 20 % of all energy consumption in the EU with renewable energy. This has been translated into national goals for the member countries.

The two compared countries the UK and Denmark each represent a different type of western capitalism. Neither of them has shown a transformative capacity. The UKs economic liberal market has not motivated private investors to enter the market for waste-to-energy. However, with support from the regulative framework of the EU, the UK shows capacity to support the market when it takes off. The Danish government has pushed to create a market for waste-to-energy. However, the very same initiatives helping the market formation have been a hindrance for its wider development as the institutional structure discourages competitiveness. The Danish government has lacked sufficient transformative capacity to change the market gradually towards a more liberalised one, creating competition and growth.

The paper has shown that regionalisation has a valid regulative purpose when dealing with trans-boundary issues like environment and pollution. The paper found that regionalisation is complementary to the state-nation, creating a regulative hierarchy, where regulation at the regional level supports national governed initiatives and opposite. This is especially useful, where a region consists of smaller countries and when addressing international issues.

The paper found that the fear for import of waste is unfounded, as the total environmental cost has to be taken into consideration. Denmark has a
comparative advantage in waste-to-energy by incineration. It would be beneficial to pursue this advantage, as it would give possibility of providing cheaper energy and heating, lead to total environmental benefits for the EU, strengthen Denmark’s position within waste-management and waste-to-energy and generate new possibilities for research, education and job possibilities strengthening the long-term business possibilities for the Danish waste-to-energy sector.

Provided the Danish government follows the recommendation from the report from the inter-ministerial working group, transforming the market for waste-to-energy to a more competitive one, the advantage for the industry would be a consolidation leading to possibility for economy of scale. If also the Danish government utilizes the competitive advantage internationally, Amagerforbrænding has an advantage as the company is building a new more efficient plant using state-of-the-art techniques providing higher output in a more environmentally friendly fashion. It is also an advantage that Amagerforbrænding is situated at the harbor area, making transport easier. By importing waste less fossil fuel need to be imported and waste-sorting activities could either generate new innovative industries leading to job-creation or it could give export opportunities of the materials.

9.1 Critique and perspectives for further research

The waste-to-energy sector has some special features as it is an industry in the market for externalities and therefore both have a positive income up-stream and down-stream. The results found from this study supporting a market institutional perspective and a balance between regulations and market, might not come to the same conclusions for other industries. Further the findings rest on the unique regional structures of the EU and looks at two selected markets within the EU. The conditions in other countries or under other regional structures might show other results. These issues could be interesting to pursue.
10 Bibliography


CEWEP 2012b. *Heating and Lighting the way to a sustainable future*, [Online], Available at: [http://www.cewep.eu/information/publicationsandstudies/statements/ceweppublications/m_862](http://www.cewep.eu/information/publicationsandstudies/statements/ceweppublications/m_862) [Accessed 29 November 2012]


IPTS, 1997. [Online]. Available at: 


KK, 2012. City of Copenhagen, Climate and Environment [Online], Available at: 
http://www.kk.dk/sitecore/content/Subsites/CityOfCopenhagen/SubsiteFrontpage/LivingInCopenhagen/ClimateAndEnvironment.aspx [Accessed 25 November 2012]


Krugman, P., 2009. How did Economists get it so wrong, The New York Times [Online], Available at: 


Miljøministeriet 2010, Forbrænding af affald – Afrapportering fra den tværministerielle arbejdsgruppe vedrørende organiserings af affaldsforbrændingsområdet [Online], Available at: 


OECD 2012, Glossary of Statistical Terms, Waste [Online]. Available at: 


Skriver, H.J. et al., 2004. Udarbejdelse af projekt i Ledelse i Praksis, Kap. 10. Forlaget Trojka


The Telegraph, 2012. Joseph Stiglitz: Why we have to change capitalism


Annexes

Annex I  Waste Incineration

To incinerate waste is not just collecting garbage and burning it. There are several complex parts in the process from collecting the waste to getting the energy output and the handling of the residuals. To protect the environment and human health from polluting elements there are several pieces of legislation for the plant to live up to. E.g. the composition of the wastes burned, emission limits etc.

Figure A.II below gives a simple overview of how an incineration plant typically could be structured with short explanations to the different units and their tasks:

**Figure A.I**  Schematic explanation of a Waste-to-Energy incineration plant

Explanation to the units of the figure:

- **Waste Bunker**: holds the waste and is the part where the plant operator can pick up, sort the waste and feed the incinerator using a crank.
- **Feeding Unit**: pre-dries the waste and feeds the incinerator.
- **Furnace**: incinerates the waste and destroys the organic component at temperatures above 800 degrees Celsius; ash and metals are recovered.
- **Boiler**: utilizes the heat from the burning waste to superheat the waterpipes.
- **Energy Generation**: the superheated steam is piped to a turbine generator to generate electricity.
- **Flue Gas Cleaning**: remove solid and gaseous pollutants from the gas before releasing through the stack

**Source**: WtERT, 2012. Waste-to-Energy Research and Technology Council

The figure show an example of an plant only producing electricity. Plants can also produce hot water or steam that is pumped into the grid for heating systems, where the infrastructure for district heating systems are in place, like in the case of Amagerforbrænding, Denmark.
Annex II  Summary of waste legislation in the EU

The EU regulative framework for waste management is extensive. The legislation could be divided into five main sub-categories (EU 2012x):

- Framework for the legislation on waste
- Legislation on waste management operations
- Legislation on specific waste streams
- Reporting and questionnaire legislation
- Other directly / in-directly related legislation

The main directives for the more direct regulation (EU 2012x) is listed here:

- General framework
  - Directive on waste
  - Waste management statistics
  - Landfill of waste
  - Waste incineration
  - Shipments of waste
  - Strategy on the prevention and recycling of waste
  - The management of bio-waste in the European Union

- Hazardous waste
  - Basel Convention
  - Controlled management of hazardous waste (until the end of 2010)

- Waste from consumer goods
  - Packaging and packaging waste
  - Disposal of polychlorinated biphenyls (PCBs) and polychlorinated terphenyls (PCTs)
  - Disposal of spent batteries and accumulators
  - End-of-life vehicles
  - The reusing, recycling and recovering of motor vehicles
  - Waste electrical and electronic equipment
  - Substances subject to restrictions for use in electrical and electronic equipment

- Waste from specific activities
  - Industrial emissions
  - Integrated pollution prevention and control (until 2013)
  - Management of waste from extractive industries
  - A strategy for better ship dismantling practices
o Removal and disposal of disused offshore oil and gas installations
o Use of sewage sludge in agriculture
o Port facilities for ship-generated waste and cargo residues
o Titanium dioxide
  ▪ Disposal of titanium dioxide industrial waste
  ▪ Surveillance and monitoring of titanium dioxide waste
  ▪ Reduction of pollution caused by waste from the titanium dioxide industry

• Radioactive waste and substances
  o Shipments of radioactive waste: supervision and control
  o Shipments of radioactive substances
  o Situation in 1999 and prospects for radioactive waste management
  o Management of spent fuel and radioactive waste