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Energiemarkten en energiehandel in Holland in de late middeleeuwen

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A summary in English

Energy markets and the energy trade in Holland in the late Middle Ages

This study analyses the economical and commercial development of Holland in the late Middle Ages, focusing on the fuel market and fuel trade. Energy was of vital importance to this society in which industry, trade and export were expanding rapidly. The brisk commercial and industrial development of Holland between the 13th and 16th centuries coincided with demographic growth and increasing urbanisation, which reached an unprecedented level of 45% by 1500. The countryside was industrialising at this time as well, with less than half the labour force actually involved in agricultural activities; most labourers worked in industry, crafts and trade. The need for energy was amplified by a growing population, together with an increase in building activities and especially the transformation of house-building materials from wood and straw to bricks and tiles.

This study is based on an examination of primary and secondary sources from abbeys and tollhouses, and particularly from the town halls and hospitals of the seven largest towns in medieval Holland: Leyden, Haarlem, Delft, Gouda, Amsterdam, Dordrecht and Rotterdam. The earliest sources date back to the 13th century but the information substantially originates from the 15th and 16th centuries. One may query whether the use of late medieval sources results in sufficiently reliable and representative data. Indeed, the sources are limited, rather fragmentary, and restricted to data from town halls, hospitals and abbeys. Such biases cannot be eliminated, but can be minimised by using a great number of different sources, correlating the outcomes, and analysing the trends. The energy market analysed in this study was tested against various theoretical concepts, including the supply zone concept (Von Thünen), the central place model (Christaller), the institutional school (North) and Polanyi's views on the market economy.

From the 13th and 14th centuries onwards peat was the principal energy source in Holland. Towns were located around the central peat excavation area. Peat was harvested by digging peat layers above the water table, and from the early 16th century onwards also by dredging peat from below the water level. The wet peat material was dried to provide a fuel with good combustion characteristics that could be used in virtually all fuel-dependent applications. Only in exceptional cases were wood, charcoal, or bituminous coal preferred as a fuel. Peat was a more favourable fuel than firewood because of its heat content and bulk density. It was less efficient than coal, however in the period studied coal did not play a significant role.

The industrial development and urbanisation of Holland started much later than that of Flanders and Brabant, where the important metropolises Ghent, Bruges and Antwerp were situated. Peat was of prime importance for the economic development of these towns. They adopted peat early on as their principal fuel, recovering it from their local neighbourhoods. These cities were probably the first in Europe to use a non-replaceable resource reclaimed from the soil. Local peat production in Flanders and Brabant was able to supply energy needs there until the 15th and early 16th centuries. By the second half of the 16th century, however, peat production diminished, resulting in steeply increasing fuel prices and a significant expansion of peat imports from other regions, including Holland.

In the same period the price of firewood in England surged due to local shortages. London's population (already between 80 000 and 100 000 inhabitants by 1300) was virtually entirely dependent on firewood. Coal had been available since the 13th century but was rarely used because of its obnoxious characteristics. Coal became the first alternative fuel for England and by the end of the 16th century it was the prime fuel used in London and possibly in other

regions in England as well. In Germany and France, firewood remained the principal fuel component until the 18th century.

In Holland, growing commercialisation was demonstrated by the increase in weekly and daily markets, in the towns as well as in the countryside. The market was the economic centre of the town, and spread out over a large area, as peat and firewood markets gradually required more and more space. Peat supplied the bulk of 16th century energy requirements (between 82–90%, measured in calorific values), followed by firewood. Other fuels such as charcoal and bituminous coal counted for 0.5% and 2–3% respectively. In the 15th century the market for peat was still predominantly local and thus satisfied Von Thünen's supply zones concept, which states that towns are surrounded by economical optimal zones for each type of foodstuff and other products from which the town is supplied. Transport costs were the determining factor in the location of peat markets in Holland. The limited depth of the waterways in the peat districts meant that transport had to be carried out by small ships, making it relatively expensive. This issue also affected the rather scarce supplies of inland firewood. When the peat areas near towns were exhausted, lower quality peat had to be delivered from further away, in particular, from the areas north of the (Old) Rhine to Leyden, Haarlem and Gouda. As a result, peat markets became regionally oriented over a much broader area. By the 16th century the supply zones concept was hardly valid to the peat industry. Dredged peat was delivered from the centre of Holland to various towns, even to the more peripherally located Dordrecht. Haarlem and Amsterdam received some peat from other regions such as Utrecht and Overijssel, and by the second half of the 16th century peat exports to Flanders, Brabant and Zeeland greatly increased. These large volumes of peat moving into and out of the country gave Holland's peat market an inter-regional character.

Christaller's 'central place' model assumes a hierarchy between locations and their markets. In Holland in the late Middle Ages there was no hierarchy in a political, religious or juridical sense between the bigger towns. With the exception of The Hague, all of the higher administrative, juridical and episcopal centres were located outside the country. Towns were commercially oriented and offered different products and services, so that they were to some extent complementary and kept each other in balance, notwithstanding the fact that they had competitive interests. The smaller towns operated fairly independently with the exception of Geertruidenberg, which was dependent on Dordrecht because of old privileges. Although municipal authorities viewed other towns as their competitors, the different orientations of their industries meant that this was only partly the case. Some urban markets developed a specialisation related to particular agricultural products, for example the butter market of Leyden and the cheese market of Alkmaar, and later on, the Amsterdam markets specialised in a great variety of imported products. The territorial structure of the 'central place' model is not really applicable to Holland in this period either geometrically or hierarchically; nor does it apply in terms of uniformity of supply. A more appropriate model is that of a 'network' between the towns, facilitated by the efficient transport structure that the canals provided.

Good infrastructure helped to bind the towns closely together in an economical sense. The short distances between towns and the efficiency of the transport system meant that establishing similar industries in every town was neither necessary nor economical. This was probably why real metropolises did not exist in Holland, and why a hierarchical order between larger towns was absent. Nevertheless, municipalities employed all possible means to favour their markets and to exclude competitors. In this respect, Amsterdam distinguished itself from the other towns over the course of the 16th century.

Towns exercised some power over the local economy, so that the surrounding countryside was to a certain extent dependent upon the town, which functioned hierarchically as a 'central place'. But as the rural economy began to operate as a specialised and industrialised supplier rather than a local food supplier, the urban 'central place' function became less pronounced.

Only in southern Holland was there an explicitly formal hierarchical relationship between a town and its rural surroundings – in Dordrecht, because of old privileges. The symbiosis between town and countryside began to change as growing urban populations meant that towns expanded at the expense of the countryside. Towns sought to extend their juridical boundaries, which enlarged their spheres of influence, and the size of their market area. The countryside accommodated these changes to some extent and retained its autonomy in political and juridical matters. But under the influence of the urban economy the character of the countryside also changed. Urban entrepreneurs farmed out industrial activities to lower waged rural workers, and the countryside increased its wealth by shifting to industrial crops, developing its own industrial activities, and commercialising cattle farming. The construction of limekilns and brick and tile furnaces reinforced the industrialisation of the countryside, as these polluting and fire hazardous industries were excluded from the towns and from their wider circles. Municipal authorities regarded this rural industrialisation with mistrust. They believed the towns had a monopoly on crafts, industries and markets and that the countryside should supply products the towns needed, while the town supplied what rural and urban people required. The city boards relentlessly struggled to retain their authority over rural industrial developments and to oppose village markets. Initially the success of this policy was rather limited, but in 1531 the towns were partly successful with the establishment of a law on extramural industries. The attitude of the towns was disingenuous as industrial activities were farmed out to the countryside, but the countryside was not allowed to pull the strings. This defensive approach of keeping the initiative in the domain of the towns was destined to fail in the long term. The countryside, on the other hand, could not supply the necessary foodstuffs for urban dwellers and was obliged to grow industrial crops and to exploit the peat layers. In the 15th century the rural economy had served the local region with peat. Subsequently it operated at an inter-regional level. Towns were a catalysts in the development of enterprises and market institutions, and in the distribution of work, but they were a conservative power versus the surrounding countryside.

The towns promoted institutional developments in the 14th and early 15th century, establishing political, juridical and economic rules. Juridical developments within the town walls were expedited by granting towns municipal rights in the 13th and 14th century. City boards could proclaim by-laws and administer justice (through a court of aldermen) and could execute court judgements. The countryside had their own juridical structure involving bailiffs. In 1427 the court of Holland was founded in order to settle disputes between towns, or between towns and the countryside, and to revise the verdicts of the courts of aldermen. A few decades later the Great Council of Malines was established as court of appeal. Urban courts functioned reasonably well; for example, the court of Leyden applied justice at the request of non-citizens. The higher courts were generally well regarded and resolved trade disputes between towns. It is more difficult to assess whether rural peat and wood sellers had confidence in the local justice system. Nevertheless in some verdicts of the urban courts, the rights of country people were upheld over municipal inhabitants who had tried to deceive them through dishonest practices.

Towns established economic standards, regulating currencies and institutionalising weights and measures, quality control, and the drafting of contracts. The cities provided security for buyers and sellers. They standardised weights and measures, controlled quantity and quality, checked on false currencies, and offered legal, personal, and property security. Peat measuring systems were supervised by sworn-in female counters (*telsters* or *tonsters*), and the calibration was carried out by appointed institutions or sworn-in persons. Excise-masters watched over the payment of excises and, certainly in the case of re-distributed excises, battled against evasion and fraud. The towns directly or indirectly received excises, so they benefited from a reliable measuring system. The evidence that the control functioned to some extent is indicated by a number of cases of fraud. There were only a small number of juridical

proceedings, certainly if the great number of warnings against fraud made by the city boards is taken into account, but on its own this does not prove a lack of surveillance. Nevertheless, the evasion of excises suggests that surveillance was not optimal. The measuring systems varied from town to town, and even within towns different measuring systems were applied. This would have required both buyers and sellers to do complex conversion calculations, to reduce the risk of errors and to manage mutual mistrust. Next to quantity, quality was of great importance. A measurement of quality was limited to assessing external properties such as colour, form, humidity, uniformity, etc. Knowledge of the origin of the product and the reputation of the seller reduced the risk of poor quality goods. Lawsuits were contested over fuel quality for both peat and coal.

North argues that the effectiveness of institutions can be assessed from their transaction costs. Higher transaction costs indicate less effective institutions. North defined transaction costs as the overheads for measures, money exchanges, gaining information about prices, notary services, contracts and juridical protection. North suggests transaction costs would be zero in a completely efficient market. These costs, which refer to the risks of incomplete information and not so much to factual costs, were of very limited significance in the peat and firewood trade. Information on price data was not a problem because of high trade volumes, large numbers of sales, the daily supply and the excellent infrastructure. With the regionalisation of the peat market, price data were abundantly available; furthermore, the sales of peat and firewood did not operate via middlemen or brokers. By-laws, including those related to weights and measures, did not differ greatly between the various towns. Villages without their own measuring system paid compensation to use the facilities of a nearby town. Peat sellers may have used a conversion system to switch between different measuring systems. The only quantifiable transaction costs in the fuel trade were costs for measuring; costs related to agreements between sellers and buyers (term contracts only); and finally expenses for purchasing drinks for the witnesses (*wijncoop*) or donations based on the selling price of goods that were paid to the church (*godspenning*). Measuring costs were about 2–3% of the selling price for peat and other transaction costs were much smaller. Non-transactional costs were much greater, and included the transport costs from the peat region to the markets (10–20% of the selling price) and for transportation within the towns (5–20%).

The late medieval institutions and regulations – the courts, coinage, measurements, contracts and payment – were all important for market operations, and apart from certain faults the system functioned reasonably well. There is no indication that property rights in the trade of peat and firewood were problematic. Peat and firewood were simple products with low transaction costs and hence constituted a fairly efficient market. While North's approach is rationally correct, quantification is not easy, and certainly not for the late medieval period. Furthermore, North ignores the cognitive and emotional processes involved in market decisions.

By the 15th and 16th centuries, institutional frameworks for peat marketing were well established. There were evident shortcomings but these were predominantly related to control and supervision. Inefficiencies were caused mainly by policies at the political level, for example, the restrictions on the liberal character of the late medieval markets and on exchanges outside the market. Municipal authorities did not allow citizens to buy products from the countryside prior to the market because they were afraid that allowing middlemen into the sales chain would lead to price rises. In addition, the towns tried to prevent middlemen selling products from their markets in other locations.

Trade was not free for all citizens. To prevent conflicts of interest, for example, women counting peat and peat porters were not allowed to trade. Also some job combinations, such as charterer and trader, were not allowed. This seems strange in a society that was moving

towards specialisation, but in which people still executed multiple tasks. The authorities probably feared conflicts of interest, especially those related to trade.

In the 15th century tradesmen were not allowed to sell or buy goods in other towns. However by the end of the century, bilateral agreements between towns were increasingly made, permitting tradesmen to carry out their business elsewhere. There are indications that even without such agreements, tradesmen from other cities were allowed into foreign markets. Evidence suggests that as well as differences in the trade of various products, there must have been extremely complex distinctions between tradesmen, merchants, pre-market dealers, middlemen, traders from other towns (with or without mutual agreements) and traders from the countryside. In addition to this, preserving the complex rules and regulations would have been difficult and fraught with risks of corruption and interpretation at will. During the 16th century, the distinctions between the various categories of traders seemed to fade away.

The city boards behaved in a protectionist manner, preventing citizens from attending markets outside their own town, or circumventing the market and buying from the countryside. Citizens who were caught and arrested had to pay a substantial fine. But towns could not be sustained as enclaves in this commercialising environment. Conflicts between towns were fought out in the courtrooms, and demanded substantial time and resources. Although Gouda and Dordrecht rigorously defended control over their domains they were unable to prevent an erosion of their position. This avoidance by town councils of open competition with rural areas and other towns was probably stimulated by urban craftsmen, industry workers and tradesmen exercising pressure via contacts on the city board or the council of aldermen. Towns like Amsterdam that were open to the outside world, were able to break away from this approach, but otherwise intercity competition was not always fair, due to differences in the tax regimes in various towns and in the countryside. The tax tariffs on peat varied from between 0–8% of the selling price. In addition, some towns privileged their own industries by giving them tax exemptions, as was the case with the brewing industry in Haarlem. The town authorities expected these actions would strengthen their competitive position, but such rivalry with excises in fact affected the financial positions of the towns. At the end of the 15th century and into the 16th century, the war politics of King Maximilian aggravated the financial position of a number of towns. Haarlem, Leyden, Dordrecht and Gouda had suspended payments or were already bankrupt. These dilemmas for the towns constrained them even further. Peat was under more pressure with the implementation of a central tax to reduce peat exports and to slow soil losses through peat excavation. This tax was introduced firstly on peat exports, and then in the 17th century on internal consumption as well. In general, peat sellers (peat owners and peat skippers) were free to go to the market of their preference, usually the market with the highest economic return. Buying peat before the market opened was not allowed, but only one violation of these by-laws was found in the sources analysed. Trading between sellers from the countryside could not be prevented, as opposition to any such ruling would be counterproductive, prompting peat sellers to sell their product in another market. The towns wanted to attract as many sellers as possible, resulting in more competition and lower prices.

In the 15th century the peat trade was partly in the hands of citizens who owned peateries. In the 16th century when peat dredging was widely implemented, the rural share in the trade increased, probably because urban owners of excavated peat land sold properties that had been devalued because the humidification of the soil made the land unsuitable for corn crops. Peat region plots tended to be rather small and were mainly owned by poorer farmers or peat men.

The relationship between the share of the trade carried on outside the market and the share within the market determines the effectiveness of the market. However for municipal authorities tax income was the prime concern, not the effectiveness of the market mechanism.

Many groups and industries in late medieval towns were exempted from paying excises and were not obliged to buy at the market. In the 16th century, established privileged groups such as the nobility and the clergy lost their concessions such as excise exemptions, while other groups or persons who were economically useful to the town were given exemptions. Although the advantage of excise exemptions was rather small, they were much desired and were pursued by many citizens. Institutions for orphans, the ill and the poor were exempted from taxes. For example in around 1500, roughly 20% of Leyden's urban population was exempted from peat and firewood excises and the largest proportion of exemptions applied to the poor. Such exemptions may have aroused a sense of inequality because so many were exempted from paying the tax, and may have impeded the effectiveness of the market and made control difficult. Nevertheless the peat trade that circumvented the market may still have corresponded with prices paid in the marketplace.

According to the city councils, significant frauds and some corruption with excises occurred, even with such voluminous products as peat and firewood. Certainly, fraud was facilitated by the rather clumsy tariff system; and corruption was risk because of the low incomes of the tonsters. This meant that the trade operated outside the market place as well. Although the penalty for such offences was significant, few arrests were made. In 1546, Leyden decided to drastically alter the excise system for peat so that individuals and institutions were no longer taxed. Only peat used in industry was taxed, with levies based on the industrial product output.

Systems of measurement in the fuel trade in the Middle Ages were highly fragmented, with each town using its own system, including a peat measurement system. There was little uniformity until after 1559, when a central export tax for peat was introduced in Holland.

In general, the market prices for peat were not fixed. Price regulations were rarely applied to fuels and would not have been very effective, as peat sellers could evade the market by going to another one. Price regulations would probably not have been effective unless proclaimed for the county as a whole. Only one regulated price setting was found for peat, in 1444. Fuel expenses were only a small part of the household budget, probably less than 10% for a labouring family, unlike the cost of bread. The demand for bread and grain was less elastic than for peat, so price setting for bread was more important and the risk of monopoly positions among the grain merchants was higher. Monopoly formation with peat was virtually impossible because a great number of producers were established not far from the markets. Price speculation in situations of shortage due to flooding or prolonged bad weather would only be temporary.

Peat, a type of mineral but very young in geological terms, was a very important raw material for Holland. Shortages of firewood switched demand to this fuel. The supply depended on 'harvesting' dry peat, which in turn depended on relatively dry weather conditions in spring and summer. The demand varied according to industrial, household and institutional needs associated with the severity and length of the winter. Holland was, in general, well able to provide its own energy requirements. Severe shortages occasionally occurred in periods when consecutive cold winters combined with rainy springs and summers. Calamities like dike breaches also reduced supplies, flooding stacks of dry peat in the countryside so that the peat was worthless as a fuel. Hence the climate played an important role in price setting. Transport restrictions because of severe weather could also have affected peat prices, for instance if frozen rivers and canals made shipping impossible. The price volatility of peat was high. In a single autumn and winter the price level could rise to double its value and, subsequently, fall to its original price level. In times of surplus the peat farmers and traders could decide to hold

back low-priced peat until the next year, but this required additional treatment of the peat by re-cutting the blocks, and it postponed income. In times of shortage fuel users were dependent on alternative supplies, such as firewood from Brabant and Guelders, or from regions higher up the Rhine and Meuse valleys. This ensured a profitable business for the wood mongers. But firewood could only fill a small part of the fuel shortage, and such an expensive alternative was out of reach for ordinary people, who had to economise on their fuel consumption.

To assess the integration of the markets in Holland, price trends in the peat markets in different towns were analysed. Due to the volatility of peat prices, a comparison was made between five-year averages. The trend graphs for the period after 1540 show a reasonably good integration of the markets across Holland. Uncertainties in the measuring systems for peat before 1540 make it difficult to draw conclusions about the earlier period.

The economy in Holland in the late Middle Ages was still far removed from constituting a complete set of self-regulated markets according to the definition of the market economy by Polanyi (including those markets for the means of production, capital, labour and land). Nevertheless it can be concluded that the fuel trade and markets were free and the prices were self-regulating. The economy was relatively liberal and geared to the market and trade. The markets can be characterised as price making, commercially oriented and increasingly open for traders. The average prices of both peat and firewood rose in the 15th century and increased even more in the 16th century. The price of firewood was undoubtedly linked to the price of peat, which determined the overall fuel price. Firewood maintained a premium price because of its superior combustion properties and its less offensive odour and smoke output compared to peat. As it exploited more peat land and increased the labour force, the inland peat region of Holland was usually able to supply all national energy needs, even when there were sharp increases in demographic growth and when the region delivered rising exports to the southern Low Countries. This indicates that, at least for peat, a kind of market-economical mechanism functioned in the late Middle Ages. Peat prices rose less than the prices of foodstuffs and were stable compared to the costs of unskilled labour in the towns.

Even when peat production techniques changed from dry (digging) to wet (dredging), peat prices remained relatively cheap. Apparently the easier transport of wet peat from the lay field (*legveld*) to the market compensated for the additional effort of dredging versus digging, and for the drying technique of threading and cutting. The higher density of dredged peat made it relatively cheaper to move per volume and lowered the transport costs. In addition, dredging saved the costs of lowering the water level by using windmills or creating quays. During the 16th century, improvements in transport marginally lowered transport costs.

In the 16th century some 150 000 shiploads of peat were transported within Holland per annum. In summer and autumn ships conveyed large quantities of peat daily from the inland suppliers to the towns, while other fuels like firewood, charcoal and coal were transported in much smaller quantities. Additionally, between 6 000 and 7 000 shiploads of peat were exported in larger ships to Flanders and Brabant. In the export harbours (Gouda was the most important), peat was transferred from smaller to larger ships, an activity which required a large workforce.

Peat export was free apart from tolls paid by foreign skippers. From 1559 an export tax was instituted to make export less attractive in order to preserve peat soils. Despite this tax increasing regularly, exports continued to grow. Although fuel prices in Flanders and Brabant increased steeply from 1550 onwards, this was not the case in Holland. Due to peat supply shortages in Flanders and Brabant there were higher costs to transport peat from Holland and other areas, as well as costs incurred through transfers from smaller to larger ships, and through tolls, taxes and profit margins. These higher transaction costs could have been responsible for peat prices in Brabant and Flanders being 50% higher than in Holland.

At the same time Holland imported dry mined peat from Overijssel, Guelders and Utrecht into the ports at the IJ and Zuiderzee. Because of the high volumes of peat exported to the southern Low Countries, inland peat flows were directed from north to south. Firewood imports to Holland came from northern areas such as Overijssel and Guelders, more than from the south (Brabant). All of these substantial fuel-shipping movements linked and strengthened the inland markets.

It is surprising that so many farmers chose to destroy their land by producing peat, as farmers are generally attached to their land and will not easily abandon part of it. However due to the increased humidification of the soil in the 15th century, peat land was no longer suitable for growing crops and its value depreciated. Producing peat enabled a means of subsistence even for small farmers with plots of 1 to 5 hectares. At around this time, much of the available arable farming land was also used for more capital-intensive cattle farming. Farmers became wealthier, and land prices rose in the second half of the 16th century, partly because lucrative peat mining was much more profitable than arable farming or cattle farming. Peat prices were kept low because many farmers used part of their land for peat mining, which allowed the small farmer some leeway to invest and even to buy a few cows. When polders were drained and turned into useful farmland in the 16th century, peat mining became even more attractive, resulting in further increases in land prices.

The annual total of peat produced in Holland by digging and dredging was estimated by calculating the annual energy requirements. In around 1500, the amount of peat that was required corresponded to an area of between 215 to 430 hectares of dug peat land per annum, and in around 1560, it corresponded to an area of between 115 to 230 hectares of completely dredged-out peat land. These figures accord with data calculated for peat lands in Holland by De Zeeuw, recorded in his famous 1979 article on the importance of peat.

In around 1500, the peat sector counted for roughly 3% of the gross national product as estimated by Van Zanden. The peat industry involved 5% of the total labour force and 10% of the rural labour force. Breweries using peat rather than firewood were able to lower the price of beer by 3%. Compared to the fuel prices in Flanders and Brabant the competitive advantage of the lower fuel price on energy intensive products made was much larger. The export of peat from Holland between 1570 and 1580 was very significant, and it was also important in relation to products other than fuel.

Energy consumption in Holland by 1500 was conservatively estimated at 14 gigajoules per capita, an average value calculated using industrial, institutional and household energy consumption. The figure was somewhat lower at the time of the Revolt against King Philip II. A slight decrease in consumption in the 16th century may be due to the change to less energy intensive activities, plus a relative increase in trading activities. Demand may also have diminished slightly due to a downturn in the overall economy because of the Revolt, and due to increased interest in energy saving measures. Holland was already highly industrialised by the 15th century, as demonstrated by its high level of energy consumption compared to later figures recorded for other regions.

Energy figures help to indicate the state of the economy, alongside figures recording trade and wealth taxes, population increases and the growth of cities. However comparisons are not easy as combustion efficiency changes with technological development, and thus energy consumption per capita is not an absolute value.

How did fuel markets compare to other markets? The characteristics of fuel markets were: a large demand covering industrial and private needs in a regional and inter-regional market; a rural product with many producers (making monopolies unlikely); and a fairly well integrated market with low transaction costs and a free trade. The grain trade was affected by some price regulation and monopoly formation as well as interventions by authorities. Grain had to be

imported to Holland, at least partly, thus the grain trade faced the correspondingly higher risks of trade restrictions, war, meteorological catastrophes, damage to transport, etc. In addition, as grain was the principal source of food for the population, it had a much lower demand elasticity than fuel. (Despite these risks, few price measures were introduced for grain.) Unlike the grain market, trade in other foodstuffs like dairy products resembled the peat market more, with higher demand elasticity, no monopoly formation, many producers, and local production with no imports.

In conclusion, fuel markets in Holland developed in the 15th and 16th century from local to regional and inter-regional markets. Transaction costs were low, partly as a result of a fairly well-developed justice system and partly because an excellent infrastructure minimised the transport costs of these high volume products. Fuels other than peat were preferred only because of certain technological requirements or superior properties. Fuel markets in 16th century Holland were well integrated due to the import and export processes and a well-developed transport infrastructure. Municipal autonomy in Holland had led to inefficiencies in measuring systems, trade restrictions and tax advantages for certain groups. However by the 16th century many such impediments were reduced or removed.

The peat and firewood fuel markets in Holland in the Middle Ages can be characterised as free, self regulating and reasonably efficient. This was mainly because fuel flows were huge, the trade was in many hands, monopolies were unlikely and the trade was not frustrated by hierarchical or culturally dependent restrictions.