NORTH SEA
SUSTAINABLE
ENERGY
PLANNING

Synopsis Paper turned in September 2011

United Kingdom Baseline
North Sea – Sustainable Energy Planning

Organization

ISSTI, University of Edinburgh

Author

David Hawkey

<u>Confirmation of publishing permission</u>

Location and date

Edinburgh 30 September 2011

Name and Signature

David Hawkey, ISSTI, University of Edinburgh

Research Associate, NS-SEP

[redacted]

European Community
European Regional
Development Fund

Table of contents

1 Introduction 3
2 Energy infrastructure 3
  2.1 Heat infrastructure and sources 3
  2.2 Electricity generation 4
  2.3 Energy imports and exports 4
  2.4 Renewable Energy 5
  2.5 Ongoing developments and potential estimates 6
3 Organisations and markets 7
  3.1 Electricity 7
  3.2 Gas 8
  3.3 District Heating (DH) 9
4 Built environment 9
5 Government and governance instruments 11
6 NSSEP regional strategies 13
7 Conclusions 14

European Community
European Regional
Development Fund

1 Introduction

This paper provides a synopsis of the Regional Energy Context papers produced by partners in the North Sea Sustainable Energy Planning (NSSEP) project. The aim of this paper is to give an overview of the regional contexts and the ways in which they differ with respect to factors influencing the design and operation of Sub-National Energy Initiatives (SNEIs), their appropriateness, the opportunities and challenges they face, and their success or failure. This paper necessarily gives a relatively high level view of the partners' contexts, and the reader is referred to the papers themselves for more detail.

The regions described are of various scales, including municipalities, regions, and countries.

- Drenthe and Tynaarlo (Netherlands)
- Kronoberg (Sweden)
- Osterholz (Germany)
- Denmark
- Kortrijk (Belgium, Flanders)
- Scotland (UK)

2 Energy infrastructure

The partners' countries' energy mixes, infrastructures and dependency on imports are the result of different indigenous resources and historical decision pathways. Differences between countries have consequences for approaches to sustainable energy planning as new energy sources and practices face different competitors, and can make use of different existing infrastructures. In all regions, fossil energy sources account for the majority of primary energy sources, though proportions vary considerably, particularly for non-transport energy sources. Kronoberg reports the highest penetration of renewable sources: heat and electricity supply is based on 45% Renewable Energy Sources (RES), with significant hydroelectric resources and use of biomass in district heating (DH) networks.

2.1 Heat infrastructure and sources

Natural gas is an important energy source in some regions but not others. Both the UK and the Netherlands have large indigenous gas supplies (though the UK became a net importer of gas in 2004), and extensive gas networks in these countries meet the majority of heating demand. Belgium and Germany are both significantly dependent on imports of natural gas to supply considerable proportions of heat demand. In Osterholz 75% of urban and 40% of rural heat demand is met by natural gas. Belgian gas network companies have been given targets of connecting 99% of domestic buildings by 2020 in urban areas. Sweden has only a limited gas network which doesn't reach Kronoberg.

European Community
European Regional
Development Fund

While natural gas networks may open up opportunities for injection of biomethane (where waste resources are suitable for production), DH networks offer opportunities for a range of heat and CHP systems. Regions vary in the level of DH penetration. Sweden and Denmark have very high levels, and have correspondingly high levels of renewable heat and CHP. The UK and Netherlands, in contrast currently have only limited levels. CHP use in the Netherlands is relatively high, though most heat is used in industrial processes.

Where gas or DH networks do not serve space and hot water demands, these are met by different combinations of electric heating, oil, coal and micro-renewables (heat pumps, biomass boilers and solar thermal). In Sweden, for example, electric heating is the second most common form (around 25%), and this accounts for around a third of electricity consumption.

2.2 Electricity generation

In most regions, electricity generation is dominated by centralised nuclear and fossil stations, though Denmark stands out as an exception with a high penetration of small scale distributed generators. Dutch electricity generation is predominantly based on gas and coal in equal proportion. UK electricity production also has high levels of gas and coal (around 45% and 30%) plus nuclear and (a growing proportion) of renewables (largely hydroelectricity in the North of Scotland, but with growing levels of onshore and, more recently, offshore wind). Danish electricity production shifted in the wake of the 1970s' oil crises from heavy dependence on imported oil to current high levels of coal-fired co-generation. The German electricity mix shows the greatest level of diversity, with nuclear and brown coal making up around a quarter each, black coal one fifth, renewables 15%, gas 13% and oil around 6%. Sweden's electricity generation is predominantly large scale, low carbon plant (hydro and nuclear) with a small renewable contribution. At a local scale, electricity production in Kortrijk is dominated by a large oil-fired power station, generally run on fossil-oil though with around one fifteenth of input being palm oil.

2.3 Energy imports and exports

Sweden and Denmark, along with Norway, Finland and Estonia, participate in the multi-national NordPool power exchange market. As the NSSEP report from Sweden shows, annual net power flows into NordPool countries can vary significantly around an average. In Sweden, imports and exports, taken over several years, roughly balance though annual fluctuations can be large. Participation in NordPool is identified as a factor supporting the high level of penetration of wind power in Denmark, as the power exchange allows Danish intermittent generation to be balanced by the flexibility of Swedish and Norwegian hydropower.

Belgium is heavily dependent on external energy sources, imports accounting for around 95% of primary energy consumption. Electricity imports are considerable at around one quarter of demand. The Netherlands also imports large amounts of energy, with imports accounting for three quarters of primary energy. However, a significant proportion of this is accounted for by Dutch oil refining, and 65% of primary energy is ultimately exported. So while parts of the economy in the Netherlands are heavily dependent on energy imports, energy supply in the country is less so.

The UK became a net energy importer in 2004 and now imports around a third of primary energy supply. Since the construction of an interconnector with France in 1986, the UK has been a net importer of electricity, though this accounts for a relatively small proportion of UK electricity supply (less than 1% in 2010). Within Britain, power generally flows from Scotland to England (through another interconnector).

Regional imports of energy create outward spending flows. The German county of Osterholz, in common with a number of other NSSEP partners, identifies this as a significant driver for undertaking regional energy planning, as greater exploitation of indigenous resources can increase the proportion of energy payments which stay within the regional economy. At present, an estimated €150 million flows out of the region in energy payments. Around 90% of electricity consumed in the region is imported.

In addition to cross border energy flows, energy technologies are important to countries' import/export balance sheets. This is particularly so for Denmark which is an international frontrunner in sustainable energy technology manufacturing. Danish energy technology exports total around DKK 65bn (€8.5bn), and account for 11% of Danish exports.

2.4 Renewable Energy

Penetration of RES varies across countries, reflecting differences in indigenous renewable resources, indigenous industries, competing energy forms, infrastructure capacities (for example, district heating accommodates renewable heat sources at relatively large scales), and decisions taken within the energy industries and government (e.g. structuring energy taxes to favour certain aspects of energy systems over others).

In Denmark, 19% of energy consumption is served by RES. This is predominantly (around 70%) biomass, used in cogeneration to supply electricity and district heating, and in some heat-only applications. (Biomass here is taken to include the renewable proportion of waste incineration.) Danish electricity production is around 30% renewable, of which around two thirds is wind.

Sweden similarly has high levels of RES exploitation, using biomass in electricity generation and district heating, high levels of hydropower, but relatively limited penetration of wind power. Almost 60% of electricity production in Kronoberg is derived from RES. RES similarly accounts for a high (45%) proportion of overall energy supply, most of which (two thirds) is biomass.

Electricity production in Osterholz is predominantly (around three quarters) renewable, though regional production is small compared with electricity imports (90%). 39 wind turbines with an aggregate capacity of 45MW produce 70GWh per year, or around 6% of electricity demand. In addition, biogas is burned in three electricity generating plants. Two of these also feed DH networks, though the majority of DH input is non-RES. Overall, RES accounts for 2% of energy supply in Osterholz.

European Community
European Regional
Development Fund

Kortrijk punches above its weight in terms of RES exploitation in Flanders, contributing 8.4% of Flanders' renewable electricity production though Kortrijk's population and land areas both represent smaller fractions. Four wind turbines account for 20% of Kortrijk's RES production. Two large power plants together generate around half Kortrijk's RES electricity, one waste incinerator, and one oil fired power station which uses a small fraction of palm oil. Decentralised renewable sources are also significant in the region, particularly solar photovoltaics above 10kW. However, renewable electricity represents a small minority of power production (around 5% in Flanders).

RES in the UK is predominantly electricity production, though there is some biofuel mixing in transport fuels and small scale renewable heat (including heat pumps, small biomass DH systems, and rural wind-to-heat systems). Around 7% of UK electricity generation is from RES: 3% from waste incineration and biomass co-firing, 1% from hydropower, and 3% from others (predominantly onshore wind). Scotland has a higher RES electricity capacity than the rest of Britain, in both proportional and absolute terms, with most of the island's hydropower resources and a relatively higher penetration of onshore wind.

The Netherlands' energy supply contains 3.4% RES. The majority (two thirds) of this is biomass (both direct combustion and co-firing, with some small biomass boilers and a small biogas contribution). The other one third of RES production is wind. RES accounts for 9% of Netherlands electricity production.

Several reports note the use of biofuels in transport fuels (in compliance with the EU Directive on the Promotion and Use of Biofuels and Other Renewable Fuels for Transport) as contributing to the use of RES evenly across vehicles (though NSSEP countries vary in the degree to which this can be met from indigenous resources or relies on imports). In contrast, while some biogas and electric vehicles also represent RES in transport, these are generally niche applications at present and make a small contribution.

2.5 Ongoing developments and potential estimates

Some partners reported on particular growth areas or the results of surveys of local sustainable energy potential. In the Netherlands, the contributions of heat pumps and biofuels to overall RES supply are both growth areas. Heat pumps are also a growing sector in Sweden. Kronoberg is not an exception to this, though a strategy to increase the use of biomass in the area is being pursued. Kortrijk has a regional plan to increase wind capacity five-fold, from 8MW to 40MW, and has identified large potential for harnessing solar power using roof space and land with development restrictions (e.g. old landfill sites). Countries with significant hydropower potential (particularly Sweden and Scotland) have generally already saturated the use of this source.

The report from Osterholz details a number of in-depth analyses of regional RES potential, and possible ways this full potential could be exploited, balancing electricity, heat and transport demand in different ways. In particular, the report suggests that the technical potential for wind power is between 36% and 58% of current electricity demand. The two figures correspond to different hub heights. The higher hub (which would increase potential output by around 60%) would add around 5% to the cost. In addition, solar collection could cover around 20% of current electricity demand and 55% of heat demand.

3 Organisations and markets

The structures of energy markets and the types of organisations involved have important consequences for SNEIs, conditioning the opportunities available for the use of existing infrastructures, access to markets (including different market segments) and on the value that a SNEI can capture from its energy production.

3.1 Electricity

Under EU directives, all countries have set out on a path of liberalisation of the electricity sector, though there are differences in when countries started and how the process has developed (e.g. in the UK, the earliest to liberalise, privatisation was an integral part of the process, while other countries such as Sweden retain a degree of public sector ownership, for example through municipal ownership of generating assets).

In all NSSEP partner countries which reported on the issue, network operation has been "unbundled" from generation and supply activities to ensure natural network monopolies are not used to prevent access of generators to the network or of customers to different suppliers. The form of separation and how it is regulated varies across countries. In the UK, for example, electricity distribution may be undertaken by private companies: these are required to be separate from companies which generate or supply electricity, but may be part of a group which includes generation/supply activities. Distribution network operators (DNOs) in the UK have, for several years, been encouraged to facilitate distributed generation (e.g. through regulatory incentives), though securing acceptable terms (including costs) of connection is still a significant barrier to distributed generation. This is due to a number of reasons, including inconsistency across different DNOs and slow administrative procedures. Swedish distribution networks, in contrast, are often owned by municipal energy companies, though there has been some transfer of ownership of these companies to private interests.

Different countries use different models to regulate network activities. In the Netherlands, for example, prices are regulated, while in the UK regulation focuses on the return network operators make on their investments. Belgian DNOs are the old (pre-liberalisation) municipal energy companies and electricity transmission (above 30kV) is undertaken by Elia. In Britain, electricity transmission is undertaken by two privatised companies (one in Scotland, the other serving the rest of Britain). In contrast, Swedish electricity transport is undertaken by a state owned company (principally bringing hydro and nuclear power to distribution networks).

In countries participating in Nordpool (Norway, Denmark, Sweden, Finland, and Estonia) the majority of electricity supplied is traded through the Nord Pool Spot market, giving a high degree of liquidity which in turn facilitates

European Community
European Regional
Development Fund

access for new entrants (retailers or generators). Only around a quarter of Nordic electricity is traded through bilateral contracts between retailers and generators. In the UK, in contrast, confidential bilateral contracts are the dominant form of electricity trade between generators and retailers, limiting price transparency and the development of derivative markets. Both generation and retail in the UK are dominated by six large, vertically integrated companies, with very little incentive to trade with competitors rather than self-supply. Liquidity in the UK is therefore low and represents another barrier to new entrants.

The UK's six large energy companies are all privately owned (four by non-UK companies and two traded on the London Stock Exchange), and while there are around 50 companies undertaking electricity generation, the "big six" dominate. Sweden's electricity generation market is dominated by just four large companies (the next two having just 2% market share each). The largest company (by power produced) is Vattenfall, a state owned utility. Belgian electricity generation is perhaps most concentrated, with one company (Electrabel, a subsidiary of the French company GDF-Suez) accounting for around 90% of power generated.

Retail contestability is common across partner countries, having been phased in on different schedules in different countries. UK and Dutch partners both comment on the fierce competition in electricity retail. In common with other European countries, suppliers are increasingly bundling energy with other domestic services (such as telephone and internet connections). In Osterholz, electricity supply is dominated by EWE AG, though in three municipalities a significant proportion is supplied by three old municipal energy companies (Stadtwerke) which have now merged.

3.2 Gas

Gas networks are less ubiquitous across NSSEP partner regions than electricity networks. While access to gas markets is likely to be less of a priority for regional sustainable energy planning (the main opportunity being injection of biomethane), the organisation of gas supply systems (where they exist) nonetheless has implications for planning the development of alternative heating systems.

Input to the UK's extensive gas network is from a number of companies, predominantly extracting gas from the North Sea, but increasingly (since the UK became a net natural gas importer in 2004) through imports. The Belgian gas network relies exclusively on imported gas, the majority brought in by Distrigas with GDF and Wingas (a partnership between BASF and Gazprom) contributing more modest shares (though Wingas has increased its import volumes recently by supplying some large consumers directly).

Input, transmission, distribution and retailing of gas are commonly separate activities. For example, in Belgium gas transmission is undertaken by Fluxys (a listed company formed from removal of transmission activities from Distrigas). Belgian gas distribution is undertaken by the old municipal energy companies (as is electricity), and as noted above they have been given targets for the number of domestic customers connected. In the Netherlands, in contrast, gas network operators are not under obligations to connect or serve any customers (though electricity network operators are under such obligations).

Gas retail is generally competitive. In the Netherlands, for example, there are 22 gas supply companies. The UK also has a large number of gas retailers, though again the Big Six dominate the market.

3.3 District Heating (DH)

DH networks are inherently local, and were commonly developed under municipal ownership, though there are currently different ownership patterns and business models across NSSEP partner regions.

In the Netherlands there are 56 DH networks delivering heat to around 4% of dwellings. A Heat Law has recently been introduced allowing for regulation of heat prices (it is likely that these will reflect a reasonable return on investment in a network business, but be capped to be below gas-equivalent costs). In the Netherlands DH companies generally do not own the heat generating assets that supply the networks, but purchase heat, distribute it and retail it to consumers. Therefore, in the Netherlands it may be easier for third parties to establish heat generating projects to feed into heat networks than countries where activities are integrated.

Swedish DH networks often integrate heat generation, distribution and retail activities. These may be municipally owned (by the same companies operating local distribution networks), though changes in DH regulation have allowed for private ownership. Some municipalities have sold their DH companies (or shares in them). In the past heat tariffs were required by regulation to be cost reflective, resulting in relatively low cost heat. Deregulation of DH, however, has allowed heat tariffs to reflect market conditions (i.e. the cost of competing technologies), leading to some price rises. Whether network operators should be obliged to give access to third party heat generators is a current debate in Sweden.

Heat supply in Denmark is perhaps the most regulated of the NSSEP partner countries. Local authorities have the power and duty to designate certain areas as DH zones in which buildings may be obliged to connect. DH therefore dominates heat supply in cities, where systems are municipally owned. Smaller systems in rural areas are usually owned by local cooperatives. Protection of consumers from mandatory use of a monopoly service is achieved through public or cooperative ownership, through the requirement that heat networks be operated on non-profit bases, and through price competition in heat input.

4 Built environment

The built environment is an important location for sustainable energy planning, through development of local energy systems, improvements in the efficiency of individual buildings and patterns of daily travel. Opportunities for change are conditioned by a range of factors including the built form and patterns of ownership.

The Netherlands is the most densely populated country in Europe, and as a low-lying country is particularly vulnerable to climate-change-induced rises in sea levels. Drenthe is lower density than the average for the country, though the cities of Groningen and Assen are naturally sites of high density. In Osterholz, the population density is lower than the German average, and settlement is characterised by the county's proximity to the city-state of Bremen: southern municipalities blend "almost seamlessly" into Bremen, and most workers in the county commute into Bremen for work (contributing to the lower-than-German-average per capita energy consumption in the county).

The Kortrijk region in Belgium is part of a larger urban sprawl, spreading from Northern France, through Flanders and Wallonia, and on to the Randstad (Holland) and Ruhr (Germany). Development is typically low density with an inefficient use of space and encroachment of urban development into previously agricultural land. This pattern of development can be attributed to various issues including poor public transport, weak planning regulations, policies prioritising economic growth over environmental issues, and lack of coordination between government levels and agencies. While historical policy focus on economic development has resulted in low levels of unemployment, environmental quality is poor and transport pollution particularly significant.

In relation to the rest of the UK, the overall population density in Scotland is low: Scotland is around one third of the land area of the UK, but hosts less than one tenth of the population. Most of the Scottish population is concentrated in urban areas – the cities of Edinburgh, Glasgow, Dundee, Aberdeen and Inverness and the central belt region – and rural settlements represent around 15% of dwellings. Around a third of Scottish dwellings are flats (a higher proportion than the rest of the UK), opening opportunities (which to date remain relatively unexploited) for communal heating systems. The high proportion of flats creates barriers to improving the energy efficiency of the housing stock as multiple households need to coordinate with each other to install upgrades. This complexity is exacerbated by mixed patterns of tenure within multi-dwelling buildings, in part a consequence of the "right-to-buy" policy whereby tenants of social housing providers are able to purchase the homes they live in. Overall, around 60% of dwellings are occupied by their owners, 10% are privately rented and 30% are rented from social landlords and local authorities.

The Netherlands has similar patterns of ownership to the UK, with 56% owner-occupied, 10% privately rented and 34% rented from public bodies. Of Denmark's 2.7m homes, 60% are owner-occupied and 35% rented.[1] In Sweden, flats have traditionally been provided by municipal housing companies and cooperatives, and only recently (2009) has private ownership of these dwellings been made possible.

Countries vary (and have varied historically) in the energy efficiency required by building regulations. Countries often have agencies offering energy efficiency advice to households, though this is organised in different ways. For example, all Swedish municipalities have dedicated energy

[1] The remaining 5% are "unknown"

efficiency advisers whose work is coordinated by regional offices and draws on information provided by the national Energy Agency. Funding for energy efficiency advice is a mixture of municipal, regional and state contributions. In contrast, in the UK, energy efficiency advice is organised on a national (rather than local) scale: the Energy Saving Trust (EST) is a non-profit company co-funded by central government, devolved administrations and private sector companies (including the “Big Six” utilities and some network companies).

5 Government and governance instruments

NSSEP partner countries have various configurations of different kinds of organisation involved in the governance of energy provision. Several countries (including Sweden, Denmark and Germany) have national Energy Agencies acting as intermediaries between legislation and policy set by central government, and the day-to-day activities in energy systems. These agencies play a variety of roles. For example, in Denmark, companies can receive subsidies to cover their CO_2 tax payments if they enter into energy efficiency agreements with the energy agency. In contrast, in the UK (which only re-established a government department for energy in 2008) similar energy efficiency agreements are made directly between businesses and government.

The Dutch national government enters into Climate Agreements with municipalities who are subsidised to develop a menu of relevant indicators. This subsidy has been responsible for a significant growth in the number of municipal climate officers. Municipalities are free to set their own levels of ambition for GHG emissions reduction, and have found that regional coordination is required. A consequence of the freedom of municipalities is that building regulations vary, leading to complaints from developers. Generally, strategies at national and local levels aim to remain technology neutral.

Local government in the UK is differently organised across England and Scotland. Until recently, a consistent aspect was the use of local indicators of GHG emissions (including calculation of GHG emissions per capita) as part of the agreements between local and national/devolved governments on which central grant funding was conditional. However, the incoming UK government abandoned this approach in 2010, requiring reporting of GHG emissions but not using agreements to achieve reductions. In Scotland, a distinctive feature of local government is that it (along with other public bodies) is under an obligation to act in a way that is calculated to best contribute to the delivery of emissions reduction targets. Danish municipalities have been obliged to undertake energy planning for several decades.

Various policy approaches towards sustainability in general and sustainable energy systems in particular are common across regions, though the details of their implementation vary. For example, greenhouse gas (GHG) emission abatement targets are high-level approaches used in NSSEP partner regions, but with varying target levels. The Netherlands has adopted the same target

European Community
European Regional
Development Fund

as the EU (20% reduction by 2020 on a 1990 baseline). Denmark's "20%" target is more ambitious as it is set against a 2005 baseline – the target agreed under the Kyoto protocol was a 21% reduction on a 1990 baseline by the earlier date of 2008-12. The UK has sought to use its GHG targets to negotiate higher targets at an EU level: the statutory target is a 34% reduction (on 1990 levels) by 2020, but an "intended" target of 42% would be adopted in the event that the EU increases its ambition. Scotland has a single 2020 target of 42% reduction, irrespective of EU targets. Both Scotland and the UK also have a target to reduce GHG emissions by 80% by 2050.

Targets are used in more specific, though still relatively high-level ways in NSSEP regions, in part through certain EU directives (such as the Biofuels Directive[2] which stimulated the development of biofuels targets reported by NSSEP partners). Targets are variously set for GHG emissions from particular sectors, use of renewable energy in particular sectors (such as heat or electricity, usually expressed as a fraction of total energy consumption), and reduction in energy consumption (which may imply a target level of energy consumption, or a target energy intensity such as energy consumed *per unit GDP*). Targets in NSSEP regions are established at different scales (national, regional and municipal).

The Energy Performance of Buildings Directive[3] requires Member States, among other things, to establish a common system for calculating the energy performance of buildings and to require new and existing buildings to have a certificate indicating energy performance. A number of NSSEP partners include these energy certificates in their reports, though the impact they have on the housing market (and hence on the value of energy efficiency retrofits and high efficiency new buildings) is likely to vary from country to country. For example, the Drenthe and Tynaarlo report (Netherlands) states that householder *awareness* of energy issues is high (around 70%) though *willingness to pay* extra for measures is low (around 30%) – financial performance of measures is seen as more important by householders than their environmental impact.

Taxes and charges on energy products in different countries have different environmental characteristics, though all regions participate in the EU Emissions Trading Scheme. Sweden, for example, has several relevant taxes: an energy tax (based on the energy content of fuels), a CO_2 tax, and a sulphur tax, and large boilers, turbines and heat plants pay a NO_x tax. Energy tax exemptions for energy intensive industries which enter agreements to reduce energy consumption are common across Europe, as the EU directive[4]

---

[2] Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the *Promotion of the Use of Biofuels or Other Renewable Fuels for Transport*, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0030:EN:HTML

[3] Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the *Energy Performance of Buildings*, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32002L0091:EN:HTML

[4] Council Directive 2003/96/EC of 27 October 2003 Restructuring the Community Framework for the Taxation of Energy products and Electricity, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32003L0096:EN:HTML

requiring member states to tax energy products and electricity allows for such exemption schemes.

Taxes can make sustainable energy options more financially viable by increasing the costs of energy options which have been identified as unsustainable. Conversely, policies such as "green certificates" (used, for example in the UK[5]), Feed-in-Tariffs (e.g. Germany), technology investment subsidies (e.g. Sweden) and targeted tax breaks (e.g. Belgium) improve the financial attractiveness of particular technologies which have been identified as desirable to promote. Generally the level of support which instruments give varies from country to country. For example, in 2007/08, UK renewable energy green certificates were worth around €70/MWh, while equivalent certificates in Flanders were worth around €110/MWh.

6 NSSEP regional strategies

NSSEP partners have used their baseline reports to describe regional approaches to sustainable energy planning in different ways (for example, exploring local resource potential, or focusing on local policy measures). Considerable detail is given in the partner reports which is not repeated here.

The Osterholz (Germany) and Kortrijk (Belgium) reports both go into detail on the sustainable energy potential of their areas, identifying reduced dependence on imported energy sources as important drivers. Both reports emphasise the potential to increase exploitation of wind and solar energy, the technical potential in both regions being high enough to meet significant proportions of demand. Similarly, as both regions are relatively flat, hydropower does not represent a considerable additional resource.

While neither Osterholz or Kortrijk have significant indigenous biomass supplies, the sustainable energy strategy for Kronoberg (Sweden) focuses on the use of forest products, aiming to increase the already relatively high use of bioenergy in the region. This will focus on the use of biomass in district heating, and on the use of biogas in transport. Osterholz also identifies biogas for transport as having significant potential, though potential in Kortrijk is limited.

The Osterholz report emphasises that potential energy resources leave open questions as to the use these resources are put to, and presents calculations associated with different scenarios (e.g. maximising production of electricity versus maximising production of heat). The Kronoberg (Sweden) document takes a different approach, outlining the regional strategy for establishing actions linked to renewable technologies, roll-out of energy efficiency and bio-based vehicles, development of regional energy/climate industries and businesses, and networking in energy and climate sectors. For example, stakeholders in climate networks sign up to climate agreements, with companies and public authorities signing voluntary letters of intent to improve the sustainability of their energy use. The Drenthe and Tynaarlo

[5] Examples in this paragraph do not exhaustively list those NSSEP partner countries in which these instruments are used.

(Netherlands) report describes a number of sustainable energy projects and promotional activities in the region such as awareness raising community initiatives and a resident-led sustainable housing area which emphasises passive solar gain.

7 Conclusions

This paper draws together some of the factors described by NSSEP partners relevant to the approaches taken in each region to energy planning. The diversity in existing energy systems, local energy resource potentials, the organisation of energy provision, the built environment and the context of regional and national government powers, relationships and policies all influence the degree to which different interventions for sustainable energy may be relevant and successful. However, a number of common themes across regions may be identified. For example, energy markets have been liberalised and unbundled, reducing the scope for command-and-control over energy systems while opening up (to varying degrees) possibilities for new entrants to experiment and challenge established practices and technologies. The prominence of environmental and efficiency issues in energy policy has grown across partner countries, though there are differences in how long these have been major policy issues and the priority placed on them. This, along with the trend towards liberalisation and the development of Europe-wide policies through, underpins similarities across partners in the national policy instruments deployed (which regional sustainable energy planning approaches may exploit). Such similarities and differences in energy contexts, outlined in this document but explored in greater depth in the partners' reports, should form a crucial part of the NSSEP project's understanding of the relationships between the partners' different approaches to sustainable energy planning, and underpin analysis of the ways the project adds value to the partners' sustainable energy planning activities.