Energy4Health

Report on Country Case Studies

August 2014

Introduction

The Energy4Health project is one of six[1] that are being carried out in support of the EU Demand-Side Action Plan[2]. It builds on the knowledge gained by the project team through two related European projects: EcoQUIP[3] and RES-Hospitals[4].

The project commenced in January 2014 and will conclude in March 2015. Its aim is to develop a policy roadmap to improve the main factors (framework conditions) that influence the demand for innovative energy solutions in the healthcare sector. This is being implemented through four main activities:

1. Generate baseline scenarios to 2020
2. Create policy action roadmaps for more favourable scenarios
3. Engage with influential stakeholders
4. Develop implementation strategy

This report summarises the results and insights gained from case study research on the situation in nine contrasting European countries. It is one of the inputs that support the development of the policy action roadmaps.

The original research also informed the baseline scenario report (Energy4Health Workshop Briefing Paper, June 2014).

[1] The other five are concerned with electric vehicles, energy efficient renovation of residential property, energy producing buildings, ICT in transport and PV products

[2] http://ec.europa.eu/enterprise/policies/innovation/policy/lead-market-initiative/#h2-1

[3] www.ecoquip.eu. The EcoQUIP website also includes the publications and case studies from the predecessor project (LCB-Healthcare)

[4] www.res-hospitals.eu

Demand-Side Lessons from the Country Case Studies

This report is based on country case study research on situational factors, trends and policies that have an influence on the exploitation of sustainable energy technologies in the healthcare sector. It covers nine contrasting European countries including Finland, Germany, Hungary, Ireland, Netherlands, Norway, Poland, Spain and the UK. Short case study summaries for each country are included as an Appendix, which provide some insights into the wide variety of healthcare systems, national energy policies and energy-related developments in the healthcare sector.

This highlights some interesting similarities and differences between these countries. It also provides examples of demand-side measures that could be replicated by other countries or regions in order to better support both EU and national/regional policies for both healthcare and energy.

Healthcare sector trends

Most countries in Europe spend between 8% and 12% of their GDP on health. Demographic trends and more demanding citizens have increased the pressure for services at the same time as the economic crisis has constrained public sector spending in Europe. Whilst the demographic ratios and forecasts may vary the underlying trend of ageing societies is common to all.

The sector is now in the early stages of a long term transformation from traditional hospital centric healthcare to a more integrated model of health & social care in the community that has a strong emphasis on prevention. The challenge is common to all healthcare systems in Europe but the current national/regional governance, delivery and funding structures vary between countries and even regions of the same country. For example, most of the hospitals in the Netherlands are operated by the private sector, through an insurance based market system, except for a small number of large university hospitals. In other countries, the public sector ownership model is still apparent but there are also a number of mixed models, such as in Ireland where the private & voluntary sector hospitals receive public funding. England, unlike the rest of the UK regions, is increasing the level of private sector involvement. Finland is moving from a highly de-centralised model to a more integrated, five-region system.

The current situation in many countries is quite turbulent and the future landscape is uncertain. What is clear is that the number of hospital beds has been decreasing, or not increasing, in most European countries. Refurbishment and rationalisation of existing facilities is much more common and there are very few new hospitals being built.

In spite of its growing strategic importance in terms of escalating prices, operational service risk, patient comfort and environmental sustainability it seems that 'energy' is well down the priority list for most health ministries and local healthcare management. The transformation of delivery infrastructures should be regarded as an opportunity for community energy systems that are fit-for-purpose, resilient, self-financing and demonstrate leadership in how to reduce the impacts on health of fossil fuels. The reality is that the most likely scenario for 2020 is one of continuing healthcare sector investment in unsustainable energy systems.

The influence of energy policy

It is clear that national energy policy is influenced by three main factors:

- The current energy supply mix
- EU Directives and regulations
- National climate change policies/targets

The energy supply mix and cost of energy is quite variable across Europe. Germany has been investing in renewables whilst moving out of nuclear. The UK has become more pro-nuclear as has Hungary. Ireland, Netherlands and Spain are all quite dependent on imported gas. Poland is still very dependent on coal. Norway exports most of its oil & gas production and uses hydropower and district heating systems for the majority its energy needs.

The energy-related policies of the Member States have been influenced by transposition of the various Directives to support the EU 2020 climate and energy package with its 20-20-20 targets for energy reduction, renewable energy production and greenhouse gas emission reduction. This also has an influence in Norway, where particular EU Directives are also included in EEA agreements. It is not always clear how these are implemented at the national level due to the scope and timing of different national implementation instruments, including specific regulations and building standards, but all Member States had to submit National Renewable Energy Plans (NREAPs) to the Commission by June 2010. Much of what has been implemented in the past few years is related to the EU Directives that were introduced from 2009 onwards to support the achievement of the mandatory 2020 targets. More recent examples include the 2010 Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive.

Of current relevance is the new EU Energy Efficiency Directive, which had to be implemented by Member States no later than June 2014. One of the requirements is that National Energy Efficiency Action Plans (NEEAPs) have to be submitted to the Commission every three years starting in 2014. Also, large enterprises need to carry out an energy audit at least every four years starting no later than December 2015. The public sector is expected to lead by example through renovating buildings and including energy efficiency considerations in public procurement.

A new 2030 framework for climate and energy policies was proposed by the Commission in January 2014 and EU leaders are expected to make a decision by October 2014. The proposed EU targets for 2030 are to reduce greenhouse gases by 40% below the 1990 level, increase the share of renewable energy to 27% and increase energy efficiency by 30%.

Some countries have already introduced more ambitious policies, regulations and targets than required by the EU Directives. For example, Ireland's 2020 targets are to improve energy efficiency by 33% and produce 40% of its energy from renewable sources. Finland, Germany and the UK are also aiming for 2020 renewable energy targets that are well above the EU norm. Norway is considering accelerating its 2050 carbon neutral target to achieve this goal by 2030. Whether these aspirations will be realised or not is uncertain as there is political pressure in some countries to scale back green energy policies, which are being blamed for rising energy prices.

Many European countries are simply reacting to EU Directives and doing the minimum required for compliance.

Energy-related impacts in the healthcare sector

There are four main drivers for investment in more sustainable energy solutions in the healthcare sector:

- Economic pressure to save costs by reducing energy consumption
- Modernisation of healthcare infrastructures
- Progressive national/EU regulations, standards and targets that apply to the service sector
- National or regional commitments for public sector organisations to be exemplars in reducing environmental impacts

It is difficult to judge the impact of these as there is a general lack of current and historical data on energy consumption or CO_2 emissions from the healthcare sector. In some counties, one-off surveys have been carried out and this gives indicative values for some of the case study countries. An exception to the rule is the UK, which has established a systematic process for gathering and reporting energy and carbon related data from hospitals. This is apparent not only in England but also in Scotland. It may be that the requirements of the Energy Efficiency Directive will improve the quantity and quality of data but this appears unlikely without some health sector-specific intervention.

Certainly, there is a long term evolutionary trend towards better energy efficiency in hospitals but that has sometimes been offset by investment in more energy-intensive equipment. Although energy prices have been rising, they are still a relatively small proportion of the overall operating costs for healthcare systems and so the issue tends to be delegated to the technical management level.

Examples of demand-side measures

The main demand-side measures that have been highlighted include:

- Mandatory sector targets and/or requirements
    - Requirement on the public sector to play an exemplary role (e.g. Finland)
    - Specific mention of hospitals in the 2009 National Renewable Energy Action Plan for Hungary
    - The new Operational Programme for Society Infrastructure in Hungary has identified energy savings as a target for cost reduction
    - Large energy users in the Netherlands (including hospitals) have a mandatory obligation to invest in energy efficiency measures that have a payback time of less than five years (unless there is a voluntary agreement with their sector)
    - The regional and municipal authorities (which operate most of the healthcare facilities) in Norway are required to prepare and implement local climate and energy plans
    - NHS England Carbon Reduction targets (34% and 80% reductions in CO2 by 2020 and 2050 respectively) based on the UK Climate Change Act of 2008

- Voluntary agreements as an alternative to regulations
    - Steering approach in Finland for voluntary agreements that contribute towards national targets
    - The 'Energy Saving Hospital' voluntary labelling scheme in Germany
    - The eight university hospitals in the Netherlands have a self-imposed target to reduce their energy consumption by 30% between 2005 and 2015
    - Most healthcare trusts in England have a board approved sustainability plan
- Integration of targets and/or requirements in procurement specifications
    - Nottingham University hospital market sounding to procure energy solutions that would set it on the pathway towards the UK 2050 target for CO_2 emission reductions
    - The new Espoo Rehabilitation Hospital development in Finland has adopted the requirements of the Environment Impact Assessment Directive although this is not a mandatory requirement for hospitals
- Monitoring key performance indicators for energy consumption, renewable energy production and use of fossil fuels
    - Annual reporting of energy consumption, uptake of renewables and greenhouse gas emissions has been mandatory for all healthcare facilities in England since 2011/12
- Strategic approach to energy-related issues in new build and major renovations
    - The new St Olav's hospital in Norway was designed in a way that created distinct centres of care with energy systems designed for different building types (i.e. offices, hotels) rather than what was previously typical for energy-intensive hospitals
- Engagement with well-resourced energy agencies that are able to provide both strategic and practical support to health sector organisations and engage with influential stakeholders
    - Motiva Oy in Finland (state-owned company to promote the use of renewables)
        - Cooperates with local municipalities (hospital owners) and Finnish Association of Architects
    - SEAI Energy Partnership
        - The Health Services Executive (HSE) in Ireland made a commitment to join the partnership
    - Enova in Finland (agency to support energy efficiency and renewable energy actions)
    - Spanish Institute for Energy Diversification and Savings (IDEA)
- Centrally coordinated programmes on energy-related issues for the healthcare sector
    - NHS England established a Sustainable Development Unit
    - HSE in Ireland has established a National Health Sustainability Office to support national targets related to energy, waste and water
    - The Research Council of Norway has been funding R&D and commercialisation projects on new climate-friendly technologies including one aimed at halving energy consumption in future hospitals
- Incentives to invest in energy saving and/or renewable energy production technologies
    - Feed-in-Tariffs to encourage investment in renewable energy production (e.g. Finland, Germany, Ireland, UK)
- Measure to overcome barriers to investment
    - Some hospitals in Hungary and Poland exploited the last Operational Programme for Energy and Environment to support sustainable energy-related investments

- Spain introduced a modification (proposed by IDEA) to the Contract Act in 2010 that allows public organisations to enter into external financing contracts with ESCOs
- Coordinated approach in Ireland to encourage the use of ESCOs to help public sector bodies (including hospitals) to invest in energy saving projects
- A publicly funded company (Salix Finance Ltd) was set up in the UK in 2004 to provide the public sector with loans for energy efficiency. More recently a Green Investment Bank has been established.

Appendix

Country Case Studies

FINLAND

Finland has a population of 5.5 million, overall health spending represents 9% of GDP (of which 8.2% is in the public sector). It has recently (2014) embarked on major reform of its health and social care system. This is in part a response to meeting the future needs of an ageing population and related increase in chronic illness and ensuring future financial sustainability of healthcare services. Previously all healthcare was delivered through a decentralized municipality structure; over 400 individual municipalities. In practice most hospital services are organized through 20 'hospital districts' of which 5 include teaching hospitals. Municipalities are grouped (federated within the respective districts) and work collaboratively in 'owning' the hospitals and providing services to the district populations. Overall there some 340 'hospitals' but this definition in Finland includes municipality owned healthcare centres. There are in total 36,000 beds (6.8 per 1000 population) including an unusually high ratio, 30%, allocated for psychiatry and long-stay. There are 12,500 acute care beds. Funding is through two main sources: municipal funding based on local taxes, and state subsidies where local taxation is insufficient to cover local health need. Additional income is derived from service fees. This structure has led to fragmentation of care at a time when there is a call for greater emphasis on service integration. The reform, backed by legislation, provides for the establishment of 5 (social welfare and health care) regions for the whole of Finland. They will be responsible for integrating and managing all hospital, health and social care for their local populations. The reform programme is at an early stage of implementation but is expected to lead to a major reappraisal and reconfiguration of the roles of hospitals within each region. This will provide an opportunity for much needed modernization. Finland has a substantial number of outmoded and poor condition hospitals dating back to the 60s and 70s and in part resulting from the withdrawal of capital funding by central government in the nineties and subsequent transfer of responsibility to municipalities. Municipalities have struggled to keep pace with capital renewal and this has given rise to a substantial legacy problem.

Overview of Energy provision and policy

Finland is one of the world's leading users of renewable sources of energy, especially bioenergy. Renewable energy sources provide one quarter of Finland's total energy consumption and account for more than one quarter of its power generation. The NREAP report identifies all sources of renewables balanced primarily across: forestry (and wood chips), wind power, hydropower and heat pumps and biogas. Total energy consumption (taking into account energy saving measures) is expected to rise from a base line (2005 - ktoe) of 26,260 to 28,170 by 2020. There are national targets for the share of energy from renewable sources (of total consumption) rising from 28.5% in 2005 to 38% by 2020, well in excess of Europe 2020 policy objectives. There are specific targets for each of the renewable sources with annual estimates mapped up to 2020. There are feed in tariff provisions to incentive the adoption of renewables. Detailed and specific action plans, backed by legislation where necessary, pave the way for achievement.

Finland relies to great extent on the principle of *steering* for increasing the use of renewable energy. For public buildings it has also adopted an *exemplary role* model backed by ongoing research. There is a distinction, in target terms, between the residential sector and service and industrial sectors.

Hospitals fall within the service sector. A key player in the provision of information, advice, and training aimed at promoting the use of renewables is Motiva Oy, a state owned company. Key methods are the provision of information and advice, co-operation with other organisations and participation in international renewable energy projects. This also links across to organisations with hospital planning influence such as the Finnish Association of Architects. Motiva also cooperates with local municipalities which until the health reforms were approved were accountable for hospitals.

Energy and Healthcare

Although hospitals are large scale users of energy there does not seem to be any centrally coordinated programmes to identify utilisation, map the use of renewables or set specific targets for improvement, no aggregated (whole of Finland) data is available. This stems from the municipal 'ownership' of hospitals. This makes centrally driven actions difficult and fragmented and in any event strategy is *steering* orientated. However, municipalities support the principle and participate in voluntary agreements on energy strategy (conservation and renewal). The activities require the municipalities to contribute towards reducing Finland's greenhouse gas emissions. One of the main aims is to achieve 9% energy savings within the period 2008-2016. By signing the agreement municipalities commit themselves to analysing their own energy consumption and drawing up action plans for implementing cost effective and useful efficiency measures, including the use of renewables. This combination of municipality ownership and the voluntary agreement is the principal influence on the use of renewable energy sources in the hospital and health sector. Municipality influence also extends to the emphasis placed on energy efficiency (again including renewable sources) in awarding public procurement contracts. The Ministry of Trade and Industry provides support for energy audits, analysis and energy conservation and renewable strategies eligible for subsidies. Although joint management boards (of the agreement partners) steer and monitor the implementation of the agreements, Motiva Oy, also ensures reporting on the results and supports and aids implementation by developing practical tools in collaboration with partners, including hospitals. In practice published data is generic in nature and does not provide hospital specific information. The agreements also promote the deployment of new technology and innovation activities more intensively for encouraging the use of renewable energy. Hospitals come within this ambit. It will however be necessary to undertake an independent survey of hospitals to access more detailed performance data and adoption of renewable energy initiatives.

The focus on municipal-based action allows energy synergies to be realised more effectively e.g. by producing energy from renewable energy sources the promotion of sustainable development can more easily be realized in municipalities. Apart from a reduction in net emissions the use of renewable energy sources is seen by municipalities as beneficial, "*it increases wellbeing regionally. For example, procurement of local biofuel by heating businesses strengthens the economic life locally by creating new jobs.*" Hospitals are implicit partners in this approach.

As an indication of the application of energy strategies at procurement stage the municipality responsible for the new Espoo 260 bed Rehabilitation Hospital (at development stage), published an environmental and social data sheet. It stated that, "*although Hospitals are not specifically mentioned in the Environmental Impact Assessment (EIA) Directive 2011/92/EU, the project may be*

covered by Annex II of the Directive in relation to urban development. The public building will be required to at least meet the relevant national targets on energy efficiency (there are strict mandatory codes for energy efficient building standards)*. The design energy performance of the hospital and any specific related targets to be met will be verified during appraisal*." In consideration of the energy supply option, part of the verification process, renewable energy sources won the price comparison against a traditional combination of district heating and grid electricity. Solar electricity was the only renewable solution that was not competitive to the traditional solution. Organic municipality waste biogas energy was the best solution in terms of cost and emissions for the scale of Espoo Hospital. This illustrates how hospitals are locked into overarching municipality programmes. It is also a demonstration of public accountability and the *exemplar role* principle.

The key question for the future is how hospital energy strategy, including the use of renewables, will be influenced or managed within the new reform model and its regional frameworks. There is no indication as yet how this will be handled. Transition is likely to be lengthy. There may however be a fortuitous window of opportunity for renewable energy initiatives, the changes will generate the need to rethink hospital roles, this will create an opportunity for much needed modernisation or renewal which in turn will create greater opportunities for adoption of renewable energy strategies.

GERMANY

Germany is the largest of the EU Member States and has a population of around 80 million. It spends around 11% of its GDP on healthcare, which is above the OECD Europe average. Germany's healthcare system is based on the Bismarck model (compulsory health insurance, only people with income above a certain level can choose between compulsory and private health insurance). The system is also supported by the state co-funding. Germany has 3229 hospitals. 833 are publicly owned. 1692 are general hospitals. This means that Germany has 40.15 (21.04) per million population, also far above the OECD average. It has the highest ratio of (total) hospital beds: 8.34, compared to 4.92 on average.

Overview of Energy provision and policy

Germany is still highly dependent on fossil fuel (including oil, coal and natural gas) for electricity production. Although the use of coal has been decreasing it is still a significant energy source. The other main sources are nuclear power and energy from renewables. In the decade to 2010, a strategy for energy transition (Energiewende) was implemented, which led to a rapid rise in renewable electricity generation. This now exceeds nuclear power and accounts for over 25% of electricity production. This includes wind, biomass and photovoltaics. The share of biomethane in the natural gas grid now exceeds 15%. The rapid rise in renewable energy production over the past years has had a negative impact on energy prices as the more expensive renewable electricity is prioritised by law through the Renewable Energy Sources Act (2000). This included a fixed Feed in Tariff and guaranteed right of access to the grid for renewable energy projects. Some fossil fuel production has since been taken off line and there is mounting political pressure on the government to reduce its green energy subsidies. Germany has also taken a decision to phase out nuclear power by 2022 in its Energy Strategy 2011. It has also reduced its incentives for new PV projects to reduce demand. The long term goal is to reduce CO2 emissions by 80% below 1990 levels by 2050 through a mix of energy efficiency (50% reduction) and renewable energy production.

Energy and Healthcare in Germany

Hospitals in Germany consume around 2.5 the amount of energy as a similar sized commercial building due to the 24/7 operation and use of energy-intensive equipment and building services.

Over 40 German hospitals have participated in a voluntary labelling scheme known as 'energy saving hospitals', which is managed by the environmental organisation Bund Berlin. These hospitals have saved 55,000 tonnes of CO2 emissions per year through energy saving measures and investment in on-site renewables. BUND Berlin estimates that similar measures across the whole German healthcare sector could reduce overall CO_2 emissions by 6 million tonnes per year and save €600 million in energy costs.

HUNGARY

Hungary has a population of nearly 10 million citizens and spends around 7.5% of its GDP on healthcare. It has some 175 hospitals with an average capacity of around 500 beds. Hungary has followed the general European trend of reducing the number of acute hospital beds. Most of the healthcare facilities are owned by the local governments of the municipalities who have the responsibility for maintenance and development of the buildings and infrastructure. The provision of services is financed by the Health Insurance Fund (HIF). Around 8% of the €22.4b EU Structural & Cohesion Fund budget for Hungary in the 2007-13 period was spent on healthcare infrastructure development projects but in general there has been a long history of underfunding.

Overview of Energy provision and policy

The primary sources of energy in Hungary are natural gas (38%), oil (25%), nuclear (16%) and coal (11%). Dependency on gas has increased and use of coal has decreased. The share of renewable energy (mostly from biomass) doubled in the decade to 2010 to reach almost 8% of total energy demand.

The most recent document on energy policy in Hungary is the National Energy Strategy 2030, which was published in 2012. Hungary is vulnerable to external gas supplies and has recently signed a 10 year deal with Russia to improve its nuclear capacity and thus its energy self-sufficiency. There are no specific energy-related targets for hospitals but the prior national Renewable Energy Plan (aligned with the EU 2009 Directive) mentions the energy-efficient renovation of hospitals and healthcare institutions and also the use of biomass from hospital waste. The 2020 target for renewable energy is 14.65% of gross final consumption.

Energy and Healthcare in Hungary

There does not seem to be any reliable source of energy data or statistics for the healthcare sector in Hungary or accountable organisation. The National Institute for Quality and Organisational Development in Healthcare and Medicines (GYEMSZI) estimated in 2010 that electricity consumption was around 342GWh/annum and 90 million m^3 of gas was used - resulting in 275 million tonnes of CO_2 emissions. Around 6% of energy was sourced from renewable sources and the carbon footprint varied from 2700 – 4800 tonnes on CO_2 per bed??. The smallest and largest hospitals seemed to be the most inefficient in terms of energy use based on the CO_2 data.

The last Operational Programme for Energy and Environment (as opposed to the health programme) spent €21m on 34 energy-related projects in 30 hospitals – mainly on improving building insulation and small scale renewable energy projects. Interestingly, the new Operational Programme for Society Infrastructure has identified energy savings as a target for cost reduction.

A government advisory agency (Szazadveg) has expressed an interest in developing a model as part of a potential wider initiative to promote infrastructure modernisation in the health sector.

IRELAND

Ireland has a population of just over 4.5 million and spends some 8% of GDP on health. There are approximately 50 acute hospitals that are public sector owned and another 40 private and voluntary hospitals. The Health Services Executive (HSE) is the single national entity that manages the delivery of health services. Whilst the private & voluntary hospitals are autonomous they still receive HSE funding.

Overview of Energy provision and policy

Ireland is quite reliant on imported oil & gas and spends over €6 billion on imported energy supply. Prices have been rising by around 50% above the EU average since 2007. The main priorities for energy policy have therefore been to improve energy efficiency, reduce the use of fossil fuels and improve energy self-sufficiency. Ireland has two overarching frameworks to support this policy and transpose relevant EU regulations: the National Energy Efficiency Action Plan (NEEAP) and the National Renewable Energy Action Plan (NREAP).

One of the commitments in the NEEAP (2009 and 2013 versions) is that the public sector in Ireland will aim to go well beyond the EU2020 target and aim to improve its energy efficiency by 33% by 2020. The target for renewable energy (NREAP) is 40% by 2020. One of the enablers for this is that the National Procurement Service (NPS) has established a framework agreement to facilitate the purchase of electricity for the public sector, which spends some €500 million on energy. This specifies the proportion of electricity supplied that must be generated from renewable sources. Other instruments are Feed-in Tariffs for renewable energy producers and the biofuel obligation schemes. A monitoring and reporting system for public bodies has also been put in place and there is now a single National Public Sector Energy Database.

The Sustainable Energy Authority of Ireland (SEAI) was established in 2002 through the Sustainable Energy Act to play a leading role in transforming Ireland into a society based on sustainable energy structures, technologies and practice. It is co-funded by the Irish Government and the EU through the Structural Funds. As well as its policy support activities, the SEAI has provide a free expert advisory service to public sector facility owners that has led to some 75GWh in annual energy savings.

A key issue for Ireland has been the impact of the economic crisis, which has constrained investment in the public sector. A coordinated approach to encourage the use of Energy Service Companies (ESCOs) has therefore been established to help public sector bodies access the investment capital for energy saving projects.

Energy and Healthcare in Ireland

Hospitals are one of the most intensive energy users in the country with the larger acute health facilities collectively accounting for around half a million tonnes of CO_2. The HSE was therefore one of the public bodies that made a commitment to the SEAI's Energy Partnership Initiative in 2010. Before this, energy policy was largely the responsibility of individual hospitals and healthcare facilities with no centralised data collection or targets. This means that the healthcare sector is

included in the 33% and HSE has been participating in the Public Sector support programmes operated by SEAI to ensure that the target can be achieved.

The healthcare sector has been undergoing a period of reform and a number of shared services are being introduced as part of the transformation process. This includes the establishment of a National Health Sustainability Office to support the sector in complying with national goals, targets and regulations. This will include water and waste as well as energy.

The political support for the use of Energy Performance Contracts with ESCOs is expected to help transform energy systems across the healthcare sector. One of the priorities is to increase investment in combined heat & power (CHP) systems as heating and climate control typical account for around two thirds of energy consumption in Irish hospitals.

NETHERLANDS

The Netherlands has a population of nearly 17 million citizens and spends around 10% of GDP on health. It has 137 hospitals and 83 clinics that are operated by nearly 100 organisations. The majority of these are private sector owned apart from the eight university hospitals. The numbers of clinic s has increased significantly in recent years. There has been, and continues to be, a high level of turbulence in the structure of the sector. The system is funded by a compulsory insurance scheme in which multiple private health insurers compete for insured persons and negotiate to a certain extent with health care providers. The providers are expected to be fully self-financing from revenues including all capital costs.

Overview of Energy provision and policy

The Dutch cabinet (in the Clean and Efficient Work Programme) has set a target for 30% reduction in CO_2 by 2020 (compared with the 1990 baseline), a renewable energy share of 20% and an annual energy saving of 2% (from 2011). The Ministry of Economic Affairs, Agriculture and Innovation has responsible for implementation of energy policy related to energy efficiency and reduction of CO_2 emissions. It does through the Innovation Agency (NL Agency). Local authorities and regional Environment Agencies are responsible for ensuring compliance with building regulations and Directives. Primary legislation is derived from the Building Notes/Decree, which defines the energy-related standards for new buildings. This has become progressively more rigorous not only for general buildings but also for healthcare buildings. Energy efficiency coefficients have been defined for different building types.

Energy and Healthcare in the Netherlands

The health sector falls within the scope of energy-related measures for the services sector. Large energy users in all sectors have a mandatory obligation (under the Environment Act) to invest in energy efficiency measures that have a payback time of less than five years. Some sectors (including the university hospitals) have used the alternative option of 'Long Term Agreements' with voluntary energy saving targets. These were originally put in place for the 2005 -2012 period but the scheme has been extended to 2020. These are regarded as a successful alternative to regulation.

The total energy consumption of hospitals in the Netherlands is nearly 11,000TJ (c300 million kWh). This was derived from a single survey. There is no systematic gathering of aggregated energy data for the sector. The use of gas in the health and social care sectors increased by around 50% in the period from 2000 – 2010. The eight public sector academic hospitals have self-imposed targets to reduce their overall energy consumption by 30% between 2005 and 2015. This supersedes and is more ambitious than the previous target of 2% energy savings per year. The dominant private sector healthcare service providers do not have any specific targets.

Most of the hospitals seem to use capital budgets to finance energy-related investment and there is limited use of external finance such as ESCOs. There does not seem to be any significant grant support or fiscal incentives to support energy efficiency or on-site renewable investments. The more advanced appear to favour investment in cogeneration and/or heat pumps systems that offer long term economic benefits.

One of the main barriers to investment in the healthcare sector is the uncertainty in how healthcare services will be delivered in the future. This includes the possibility of restructuring, mergers and closures of some smaller hospitals with new developments concentrated on community-based facilities. This means that very few hospitals are willing to make commitments beyond what is legally required under the five year payback rule.

NORWAY

Norway has a population of around 5 million and spends just over 9% of its GDP on healthcare, which is mainly funded by the National Insurance Scheme from tax revenues. The system is semi-decentralised. There are over 100 hospitals that are organised under four Regional Health Authorities (RHAs) and around 50 local health trusts. Responsibility for planning of infrastructure and capital investment lies with the RHAs. The number of hospital beds has been decreasing as more healthcare services become community-based, which involves the municipal authorities.

Overview of Energy provision and policy

The energy supply system in Norway is dominated by hydropower-based electricity, which means that most of the electricity demand is supplied from renewable sources. Norway is also Europe's largest producer of oil & gas - most of which is exported.

The country has some 5,500 healthcare buildings. Energy consumption in 1990 was around 6TWh/year but has reduced by around 25% in the 20 year period to 2010. Statistics Norway and the energy agency (Enova) have carried out surveys and produced comparative data on the energy consumption of buildings in different sectors including the service and public sectors. The empirical comparison of different building types indicates that the typical hospital consumes over 300kWh/m^2 of energy , which is at least 50% above the average for the service sector due to both its relatively high use of energy-intensive equipment and 24/7 activities. This is, however, around half of the energy consumption ratio of hospitals in the United States. Most of the consumed energy is electricity with just over half to power electrical devices (e.g. equipment/lighting) and the remainder for heating and cooling systems. District heating systems are a significant source of thermal energy. Oil & gas consumption is relatively low.

Energy and Healthcare in Norway

There are no specific targets for healthcare buildings but all new buildings in Norway must be near zero emissions/energy (e.g. passive house standards) from 2020. This will be realised through progressive tightening of the national building standards, implementation of EU Directives that are included in EEA agreements and carbon taxes on the use of fossil fuels. Norway aims to become carbon neutral by 2050 but is open to achieve this by 2030, depending on international climate change agreements. It has an agreement with Sweden on a common market for green energy certificates to promote new renewable energy projects in the period to 2020.

The Municipalities are responsible for delivering local energy and climate plans for energy efficiency and reduction of greenhouse gas emissions but the general level of engagement with the healthcare sector is unclear. One example is Trondheim municipality, which has calculated that the local healthcare sector could reduce its energy consumption by at least 15%. Another is to segment hospitals into different zones and use reference models like hotels and offices to identify scope for improved energy efficiency.

Norway clearly has strong policy commitments to reduce energy consumption and greenhouse gas emissions. Some examples of demand-side interventions that have relevance to energy for healthcare include:

- The Government established an agency (Enova) in 2002 to support energy efficiency and renewable energy actions. It was given a defined target (TWh) and the flexibility and funding stability to achieve it. Its annual income is around NOK 2 billion (c120m Euro). It prioritises its support to energy users and producers in a way that supports its quantitative target. The Enova model was renewed in 2012 and its scope expanded to include reduction of greenhouse gas emissions.

- The Regional and municipal authorities, which operate most of the healthcare facilities in Norway, are mandated to prepare and implement local climate and energy plans. This includes the annual updating of energy-related statistics on buildings compared with Enova guidelines and the setting of quantitative performance improvement targets. The plans must ensure that the organisational capability is in place to implement the plans.

- In 2008, the Ministry of Petroleum and Energy launched a national strategy for R&D and commercialisation of new climate-friendly energy technology (Energy21)

- In 2009, the Research Council of Norway established a number of national energy-related research centres (with funding to 2016) including one on Zero Emission Buildings (ZEB)

One of the research projects (Lavenergisykehus) is user-driven and aimed at achieving "halved energy consumption in future hospital" through data collection and assessment of energy reduction options.

Norway also offers some interesting case examples of radical energy strategies for individual hospitals. For example, St Olav's hospital in Trondheim is a new hospital that is segmented into distinct centres of care. This enables each to be built to an appropriate standard for the building type. This means that energy systems and consumption targets are based on building type rather than the mean for energy-intensive hospitals.

Some hospitals are also investing in large scale heat pump systems to address their thermal energy needs. Akershus University hospital near Oslo produces 40% of its heating & cooling energy from an on-site ground source heat pump system with 350 bore holes. Stokmarknes hospital in one of the northern islands has halved its fossil fuel consumption for heating by installing a heat pump that uses sea water as the energy source.

POLAND

Poland is one of the most populated EU Member States with nearly 39 million citizens. It spends 6-7% of its GDP on healthcare and provides some 250,000 beds in 800 hospitals. This number of beds is more than twice the OECD Europe average per capita.

The old age dependency ratio at present is below the EU average but is expected to converge from 2030 onwards. The previous central healthcare system, based on the Soviet model (Semashko), was replaced with a decentralised system of compulsory health insurance in 1999. The administration of most services and ownership of facilities was then transferred from the Ministry of Health to the self-governed regional and local authorities. The financing functions are now divided between the Ministry of Health, the NFZ - National Health Fund (which purchases the services) and territorial self-governing administrations. The territorial administrations operate at community, district and regional levels and have an ownership position for the vast majority of public hospitals and clinics. Private providers dominate non-hospital care but the number of private hospitals has been increasing. Investment costs for healthcare infrastructure are mostly borne by the regional governments and are enhanced with EU Structural Funds.

Overview of Energy provision and policy

Poland is the most coal-dependent member state in the EU accounting for over 80% of national energy production and nearly 90% of electricity generation. This makes it relatively challenging to achieve the national EU2020 Energy targets (14% CO_2 emissions reduction, 14% energy reduction, 15.48% renewables). In 2009, the Alternative Polish Energy Policy by 2030 (APE) was released with the aim of defining the best energy solution for Poland. This focussed mainly on energy efficiency and green energy sources. The Climate Report of Poland 2050, prepared by the Ministry of Economy, also made energy efficiency the main priority to reduce CO_2 emissions by nearly 30%. The report also suggests that there is the potential for both renewable energy and carbon capture and storage to each deliver an additional 18% in CO_2 emission reductions (65% reduction in total CO2 emissions by 2050). A 2009 World bank report (Transition to a Low Emission Economy in Poland) also estimated that there is the potential for a 30% reduction in greenhouse gases by 2030 (2005 baseline) using existing technology. In 2012, the Polish Government prepared a proposition to change the 'Energy Law' to better implement EU Directives. The Ministry of Economy has also announced its intention to produce an energy policy to 2050.

Energy and Healthcare in Poland

There does not appear to be any aggregated data on energy consumption or energy-related performance of Polish hospitals.

According to a 2012 survey of Polish hospitals (RES-Hospitals project) most energy-related investments are financed from a mix of capital budgets and external grants. The grant sources included regional, national and EU schemes. Solar panels have been the most popular renewable energy investment and will continue to be so in the period to 2020 but other options (e.g. heat pumps, geothermal and wind) are now being considered. The survey also indicated increased interest in exploiting EU grant sources to support energy-related investments in the future. One of

the priorities of the new Operational Programme Infrastructure and Environment is connected with environmentally friendly energy infrastructure and energy efficiency. Lack of capital and short payback criteria are regarded as the main barriers that are hindering energy-related investments in hospitals. Pilot projects carried out under the RES-Hospitals project indicate that the most economically feasible options for sustainable energy systems in Polish hospitals are heat pumps.

An example of a demand-side intervention is the National/Regional Fund for Environmental Protection and Water Management, which provides funds for investments including specific energy technologies. This was used to part-fund one of the biggest solar arrays in Europe (nearly 600 panels) at Częstochowa Voivodeship hospital in Silesia. The remainder of the Euro 1 million project funding was secured from a national sustainability foundation and a commercial loan.

The main driver for energy reduction in the past 20 years has been rising energy costs. This has led to some public support for thermal insulation and replacement of windows. Other measures have included the collective purchase of electricity supplies between hospitals and other public sector organisations. The stimulus from the availability of regional grant funding for environmental improvements and external funding from EU/EEA sources has also been, and will continue to be, important.

So far, there has been limited use of Energy Service Companies (ESCOs) in Polish hospitals to overcome the funding barriers to investment. Also, public procurement practice is still focussed on lowest price selection criteria rather than total cost of ownership.

SPAIN

Spain has a population of around 45 million citizens and spends around 6% of GDP on health. It has some 800 hospitals, of which around 60% in the private sector. Whilst there are fewer hospitals in the public sector they are generally the larger ones, which account for some two thirds of bed capacity.

Overview of Energy provision and policy

Imported liquid fuels are the largest source of energy in Spain but both renewable energy (30%) and nuclear power (20%) are also important to electricity generation. The main source of renewable energy is wind energy and offshore production is now being prioritised. Until the financial crisis in 2008, Spain was also one of the fastest growing natural gas markets in Europe and the third largest importer of liquefied natural gas in the world. Natural gas (39%) and renewables (36%) are expected to be the main sources of energy for electricity production by 2020.

Spain is generally following the EU 2020 energy targets and transposing the relevant Directives into national law.

Energy and Healthcare in Spain

The Ministry of Industry, Tourism and Commerce is responsible for energy policy and delegates implementation to the Spanish Institute for Energy Diversification and Saving (IDAE) and to the energy authorities in the autonomous regions. A survey of energy consumption in the service sector in 2009 indicated that hospitals accounted for around 7% of which nearly 50% was grid electricity and 40% oil. The remainder was mostly gas. This translates to a carbon footprint of some 1,500 million tonnes of CO_2 per annum, which translates to around 2000 tonnes of CO2 per hospital year or 10 tonnes per bed. Qualitative evidence from the RES-Hospitals project indicates that over 55% of the typical hospital energy consumption is for thermal energy (heating, cooling, hot water) with the remainder for lighting (25%) and equipment (20%).

An example of a demand-side measure in Spain to enable energy-related investment at a time of serious economic austerity was the modification of the Contracts Act in 2010. This was proposed by IDEA and allows public organisation, such as hospitals, to enter in external financing contracts with the private sector through Energy Performance Contracts. This has since led to a wave of strategic investments particularly in more efficient co-generation and tri-generation systems.

UK/ENGLAND

England accounts for around 84% of the population of the United Kingdom with around 55 million inhabitants. Healthcare is devolved to each of the four regions (including Scotland, Wales and Northern Ireland), which each have their own autonomous publicly funded systems. The main difference is that the English system is moving in the direction of more private sector involvement.

The NHS is the main provider of healthcare in England and the largest organisation in the UK. It is funded directly from the Department of Health. There are some 2,300 hospitals in the UK.

Overview of Energy provision and policy

The UK Government introduced the Climate Change Act in 2008, which creates a legal obligation to work towards an 80% reduction in greenhouse gas emission by 2050 (from the 1999 baseline). NHS Carbon Reduction targets of 34% by 2020 and 50% by 2025 were introduced in response to this legislation. Progressive energy-related standards to support the UK targets and adopt EU Directives are included in the building regulations. In 2014, the UK government will legislate to introduce ESOS, which will require all large enterprises to undertake an energy audit by 2015 and every four years thereafter.

Energy and Healthcare in England

A study by the NHS Sustainable Development Unit (SDU) in 2008 estimated that NHS buildings in England consumed over £410m of energy and produced 3.7 million tonnes of CO_2 per annum (some 28% of that from the whole public sector building stock). In 2013, the SDU estimated the wider carbon footprint of health, public health and social care at 32 million tonnes pf CO_2e, including travel and procurement of goods & services.

Annual reporting of energy consumption, uptake of renewables and CO2/GHG emissions has been mandatory for all healthcare facilities since 2011/12 through the 'Estates Return Information Collection (ERIC) system. This shows that 97% of energy consumed was from gas (70%) and grid electricity (27%) in the financial year 2012/13. Around 2% was from renewable sources. The NHS carbon reduction strategy is based on a 10% reduction of CO_2 emissions between 2007 and 2015.

Mandatory targets including minimum energy performance levels for both new healthcare buildings and refurbishments. Major capital developments are required to include at least 10% onsite renewable generation capacity. A specific environmental standard for healthcare buildings has been derived from the generic UK assessment method known as BREEAM. The Department of Health also worked with an agency known as the Carbon Trust to publish a Health Technical Memorandum in 2006 on 'making energy work in healthcare'. The majority of healthcare trusts now have a board approved sustainability plan. Hospitals view the energy resilience of their estate as a priority and regard rising energy costs as a threat to quality of patient care.

The requirement to save energy is increasingly seen as an important cost saving opportunity at a time when hospital budgets are under severe pressure.

An example of leadership in carbon management is Frimley Park Hospital is south east England, which set a target of reducing its carbon footprint by 15% in the five year period. It used interest

free loans from Salix Finance Ltd, a publicly funded company that was established in 2004 to provide the public sector with loans for ene