CENTER FOR THE STUDY OF DEMOCRACY

GOOD GOVERNANCE AND ENERGY SECURITY IN BULGARIA

Policy Tracker: Key Challenges for Energy Efficiency Policies in the Domestic Sector

2014

Background

The Bulgarian economy is by far the most energy intensive in Europe and it is highly dependent on other countries for its energy and therefore the economy - and in turn individual households are vulnerable to price changes.[1] However, it is also set to exceed the 9% energy saving target set out in the Energy Services Directive [2], and expects to achieve 16.9% energy savings by 2016 (against a 2007 baseline). [3] The reductions achieved to date have come predominantly through the decline of certain inefficient industry sectors such as metallurgy, which have helped to reduce the total amount of energy used in the country.

A quarter of energy consumed in Bulgaria is used in the residential sector (not including domestic transport).[4] Unlike in other sectors, such as industry and transport, energy usage in housing in Bulgaria has actually increased in recent years – the total final energy consumption of the residential sector increased by around 3.6% between 2007 and 2009.[5]

KEY POINTS

- A quarter of the energy consumed in Bulgaria is used in the residential sector, where energy use has increased in recent years. Energy efficiency in the domestic sector therefore presents a huge opportunity for Bulgaria, but there are challenges to be overcome.
- In order to address the challenges in the sector, it will be necessary to tackle issues in existing housing, such as dated district heating systems and high prevalence of flats in multiple ownership buildings.
- However, in order to be confident about what these issues are, and to target energy efficiency campaigns effectively, there is a need for more reliable data on both housing and energy consumption in Bulgaria. Consideration should be given to the development of a housing survey and to the collection of data from energy passports.
- Energy efficiency will also be crucial to counteract rising levels of energy use arising from increasing standards of living (larger floor space per capita and greater use of appliances, air conditioning and central heating systems).

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[1] Eurostat. 2012. *Energy Intensity of the Economy*

[2] European Parliament. 2006. *Directive 2006/32/EC*

[3] Bulgarian Government. 2011. *Second National Energy Efficiency Action Plan 2011-2013*

[4] Eurostat. 2012. *Final energy consumption, by sector*.

[5] From 2073 kilotonnes of oil equivalent (ktoe) in 2007 to 2149 ktoe in 2009.
Bulgarian Government. 2011. *Second National Energy Efficiency Action Plan 2011-2013*

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Box 1. Energy efficiency initiatives across EU member states

The EU has put great emphasis on energy efficiency in buildings, setting specific targets through the Energy Performance of Buildings Directive (EPBD). In particular, it requires member states to develop strategies on how to make the national building stock energy efficient and climate neutral, as well as introduce mandatory requirements for all new constructions to be nearly Zero-Energy Buildings (nZEB) after 2020. In view of these requirements, member states have set up a variety of tools in order to support homeowners in making their homes more efficient. Most countries have imposed specific legal requirements that buildings must fulfil in order to achieve the overall energy efficiency goals set by the EC, imposing a relatively small financial burden on the government. However, given the current harsh economic climate, governments all across Europe have developed grant and loan schemes so that poor households are not deterred from investing in energy efficient technologies. Some of the schemes developed by various member states include:

Hungary: The government provides financing for the renovation of old buildings and the use of energy efficient technologies in new buildings. The financing is proportional to the cost of the renovation and can reach up to 60% of the value of the work. In case a building is awarded energy efficiency class B or above, there are opportunities for additional financing.

Portugal: In the residential sector, a progressive tax scheme has been implemented based on the energy class of the building.

Furthermore, homeowners have access to low interest rate loans for renovations as well as subsidies to build new buildings with energy class A, A+ or A++.

Latvia: homeowners can receive a credit for energy efficient home renovations, as well as grants to help them fill in the application documents through the JESSICA programme.

Estonia: A revolving fund scheme for the energy efficient refurbishment of housing has adopted a 'do more, get more' approach – homeowners receive grants proportional to the energy label that will be awarded following the renovation. As a result, projects that apply for loans under the scheme achieve average energy savings of 33%.

United Kingdom: The "Green Deal" scheme allows homeowners to employ certified contractors with energy efficiency credentials. The cost of the renovations is paid through the electricity bill and the certificate is linked to the building rather than the owners.

Italy: The government has set minimum requirements for new and existing buildings undergoing major renovations. Buildings are awarded energy certificates and there are tax reductions for up to 55% on the installation of energy-saving technologies in households.

Czech Republic: The Green Savings programme funds the installation of heating systems using renewable energy sources as well as energy saving renovations and new buildings, such as insulation. The funds for the programme were raised through the sale of emission credits under the Kyoto Protocol on greenhouse gas emissions.

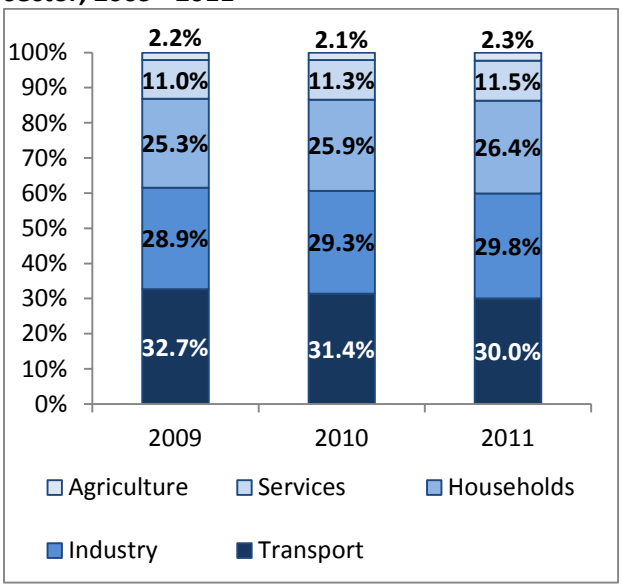
Household electricity prices have remained in the spotlight of public debates ever since the protests against high electricity bills in February this year, and were one of the main factors that led to the resignation of the GERB government. Given that electricity prices for household customers have been kept artificially low through the means of the regulated market and that since 2005 they have steadily increased both in Bulgaria and all other EU countries, it is unlikely that this upward trend will change drastically in the short- and mid-term future[6].

Actively reducing the energy consumed by end users will be the fastest and most cost-effective method of making further energy savings, and also has related benefits such as lowered reliance on energy imports and lower fuel bills for consumers and businesses. The good news is that there are significant savings to be made in the residential sector in Bulgaria.

Individual families can play a significant role in lowering their bills by ensuring that their home is energy efficient. To achieve this, households have three main mechanisms that could be adopted in order to benefit from their combined effects: introduction and use of energy efficient electrical appliances; insulation and renovation of buildings; and own energy generation – in most of the cases through the installation of solar panels. This would not only have a positive impact on their monthly finances, but would also contribute towards achieving the goals spelled out in the European plan for tackling the climate change and for achieving social and economic sustainable future.

The 2011 census provides for the first time some more detailed information about the level of energy efficiency in Bulgarian homes.

Figure 1: Bulgaria's final energy consumption by sector, 2009 - 2011[7]



Source: National Statistical Institute, 2013

According to data for 2011, 88% of all residential buildings in Bulgaria were built before 1990 and only 5% were built after 2000. [8] Therefore most residential buildings were not built in line with any energy efficiency considerations.

Despite the scientifically proven economic and lifestyle benefits of wall insulation and energy efficient windows, only 18% of all households have installed insulation. Urban homes are significantly more active in this regard with 40% having energy efficient windows, of which only 41% also have wall insulation. In rural areas on the other hand, where residential buildings are significantly older, less than 4% of all households have installed energy-efficient windows and wall insulation. Overall, it appears that if a family must choose between the two measures, energy efficient windows prevail with 22% of all households, while 2.8% of all homes only have wall insulation.

[6] Eurostat, "Electricity Prices for Household Consumers", 2013, accessed on 01.08.2013 (http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&init=1&language=en&pcode=ten00115&plugin=1)

[7] Eurostat. 2012. *Final energy consumption, by sector*.

[8] Ilieva, Lucia. 2003. *Housing in Bulgaria: Challenges and Perspectives.*

In terms of heating materials, the most popular fuels are wood and electricity, used by 31.1% and 28.6% of households respectively. Only 0.7% of households use gas, which is a result in part of the low levels of gasification even in urban areas. The energy mix varies significantly between urban and rural areas. 38.3% of urban households use electricity for heating, followed by wood and central heating. The vast majority of rural households on the other hand use wood (62.8%) and coal (32.4%).

The European Commission has estimated that in urban areas a Bulgarian home can produce on average 1600 KWh/m2 every year, amounting to 30% of the average household electricity consumption. The census data shows that this potential remains largely untapped as only 1.5%, or 30,629 out of the total 2,060,745 residential buildings in the country, had installed solar panels at the beginning of 2011. More than half of them - 60% are in urban areas. The majority of solar panels - 87% are installed in single family homes[9].

Key challenges for Bulgaria in improving the energy efficiency of the domestic sector

While there is huge potential for improvements in the energy efficiency of housing in Bulgaria, there are some key challenges and barriers to be overcome including:

1. Lack of data on both the housing stock and more specifically on the energy consumption of the residential sector which make targeting (and monitoring progress) difficult.
2. An improving standard of living – smaller households, increasing floor space per capita, and an increasing use of energy consuming domestic appliances are likely to lead to a higher level of energy use in the residential sector in Bulgaria if steps are not taken to counteract this. However, this an increase in household consumption will not have a substantial impact on overall energy use because this is mostly affected by industrial energy demand. After a sudden decrease in 2008, since 2009 there has been slow but steady growth in total energy consumption, as the industrial sector began to grow again. substantial increase of the total energy use in the country is not expected in short- and mid-term due to simultaneous decrease of energy used by the business sector.
3. A high proportion of flats in multiple ownership buildings, particularly large panel residential buildings.
4. Dated district heating systems and general low prevalence of central heating compared to other European countries.
5. Low average incomes and high levels of energy poverty, which are a barrier to being able to afford energy efficiency improvements.

Challenge 1: Lack of reliable data

One of the difficulties that will be faced in tackling the energy use of the residential sector in Bulgaria is the lack of available reliable data on both housing and energy consumption. This will make it very difficult to establish priorities, to build a business case for improvements, or to monitor progress.

[9] CSD, 2013, "Media Note: Energy efficiency in the Bulgarian Residential Sector"

In addition to undertaking a census of the population (which Bulgaria already does), most countries in the European Union undertake regular housing condition surveys – in many cases as regularly as once per year.[10] The surveys vary from a census of the entire housing stock, to representative surveys. The Bulgarian Government should consider undertaking a similar survey as this would give reliable data about the type and condition of housing across the country. This will be particularly important to identify the profile of rural housing stock in Bulgaria; up until now most projects have focused on urban housing, especially on multiple ownership buildings. An accurate picture of the housing stock will be crucial to identify and address priority areas.

In addition, specific information should be collected about the energy efficiency of housing – this could be done both through a housing survey and through collection of data from energy passports; many EU countries, including Croatia, have set up a database or register of all certificates produced under the requirements for the Energy Performance of Buildings Directive. This would provide information not only about the current energy performance of properties, but also about the potential for improvement.

Challenge 2. Increasing standard of living

Energy consumption of houses in Bulgaria is considerably lower in comparison to the average EU level. This is partly due to lower standards of living, such as smaller floor areas and lower use of electrical appliances. As the economy grows and incomes rise, there is likely to be a corresponding rise in demand for higher living standards and more appliances from the average household; there is therefore a challenge to minimize the impact of increased standards of living on overall energy use. Across the EU, larger dwellings (+0.4%/year on average) and more appliances (+0.4%/year) have offset the equivalent of 60% of energy efficiency savings in the residential sector.[11]

Household demographics and house size

Average household sizes are getting smaller in Bulgaria – in 1975, 30% of the population lived alone or with one other person. By the 2011 Census, this proportion had increased to 53.7%.[12] At the same time, the average house size in Bulgaria has increased from 60m^2 in 1985 to 73m^2 in 2011[13].

Both of these factors mean that there is an increasing floor space per capita in Bulgaria's residential sector. It is important to note that this is a positive move for Bulgaria, which still has significant levels of over-crowding (47.4% of the population lived in overcrowded dwellings in 2011).[14] However, these trends will counteract some of the energy efficiency savings made elsewhere.

Where there are individuals living in under-occupied properties, it may be worth considering whether some form of incentive would be possible to encourage them to move into smaller properties or to take in lodgers. For example:

- In France, the Mobilisation for Housing and the Fight against Exclusion Act (2009) sets out the right of the landlord to evict tenants in under-occupied housing units if they refuse three consecutive offers to move into

[10] Dol, Kees and Marietta Haffner. 2010. *Housing Statistics in the European Union*.
[11] Lapillonne, Bruno, Carine Sebi and Karine Pollier. *Energy efficiency trends for household in the EU*.
[12] Republic of Bulgaria National Institute. 2012. *Bulgaria 2012*.
[13] National Statistical Institute
[14] Eurostat. 2012. *Overcrowding rate by age, sex and poverty status – total population*.

NB The overcrowding rate is defined by Eurostat as the percentage of the population living in an overcrowded household, where there are not a minimum number of rooms equal to: one room for the household, one room per couple in the household, one room for each single person aged 18 or more, one room per pair of single people of the same gender between 12 and 17 years of age, one room for each single person between 12 and 17 years of age and not included in the previous category, one room per pair of children under 12 years of age.

a smaller (and cheaper) housing unit that corresponds to their needs.[15]

- In the UK, from April 2013, size criteria will be introduced for those claiming housing benefits in both the private and social rented sectors.[16] In addition, many social housing providers such as Hull City Council have already introduced incentives for tenants to downsize their properties.[17]

It should be considered whether it would be possible to introduce a scheme to encourage more efficient use of available housing in Bulgaria. Given the high levels of home ownership, a scheme such as the one in France would probably not be appropriate, but it might be possible, for example, to introduce criteria around house sizes in the assessment of eligibility for social benefits, or to introduce a tax break for those who have an optimum number of people living in their home.

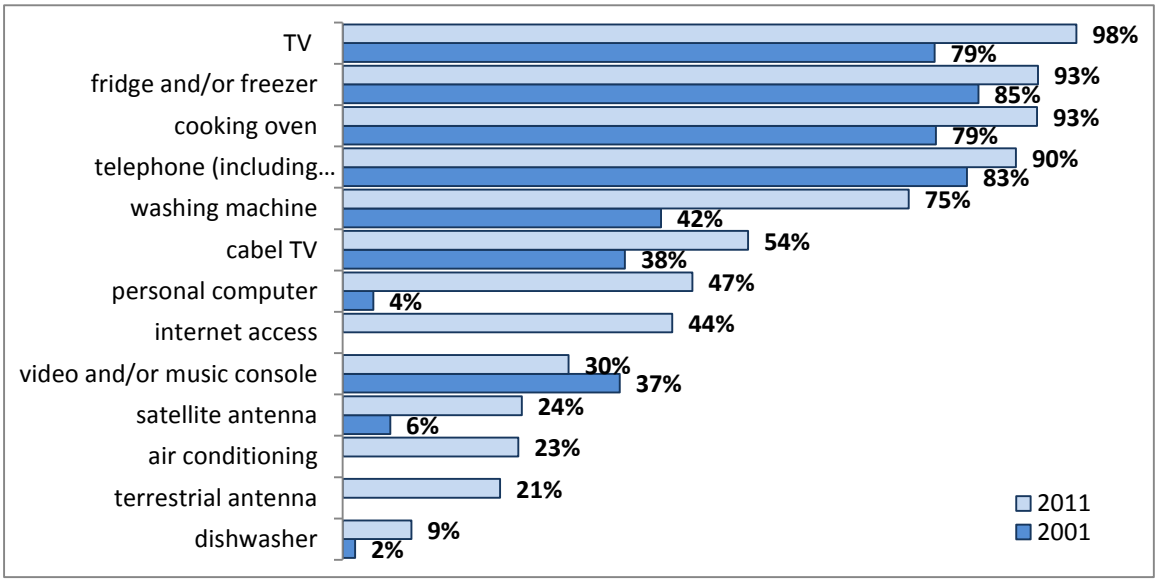
Appliances and air conditioning

While Bulgaria has one of the lowest rates of consumption of electricity by domestic appliances and lighting (around 1300 kWh/dwelling/yr), ownership of both white and grey goods is increasing rapidly in Bulgaria; between the 2001 and 2011 Census, the proportion of households that owned home computers increased from 4% to 47%, while ownership of washing machines rose from 42% to 75%.[18]

In addition, Bulgaria's homes are third behind only Cyprus and Malta in the EU for the amount of electricity used per dwelling for air conditioning, and the use of air conditioning units is increasing rapidly; between 2000 and 2008 unit consumption increased by 45% per year (the fastest increase in Europe).[19]

The increasing use of both appliances and air conditioning are leading to a significant increase in

Figure 2. Household ownership rate of white and grey goods in Bulgaria in 2001 and 2011 as a percentage



Source: National Statistical Institute, 2013.

[15] Amzallag, Michel and Claude Taffin. 2010. *Social Rental Housing in France*.
[16] Department for Work and Pensions. 2012. *Housing Benefit: Size Criteria for People Renting in the Social Rented Sector: Equality Impact Assessment*.
[17] Chartered Institute of Housing. 2011. *UK Housing Awards 2011: Making The Best Use of Stock: Finalist. Hull City Council: Tenant Incentive Downsizing Scheme.*
[18] National Statistical Institute of Bulgaria. 2011. *2011 Population Census in the Republic of Bulgaria (Final Data)*
[19] Lapillonne, Bruno, Carine Sebi and Karine Pollier. *Energy efficiency trends for household in the EU*.

electricity use in residential sector in Bulgaria – the Second National Energy Efficiency Action Plan calculates that electricity use increased by 70.97 ktoe between 2007 and 2009, negating the 48.31 ktoe energy savings made elsewhere in the sector. In addition, further increases in the use of electricity for appliances and air conditioning will have been masked by the fact that during this time, a number of properties have replaced electrical heating with systems using other fuels. Focusing on this trend (and trying to minimize the associated increase in electricity use) should therefore be a significant policy priority for Bulgaria.

Some policies at the European level will help to decrease energy usage from both appliances and lighting. These include Directive 2009/125/EC on eco-design, which aims to reduce the environmental impact of energy using products throughout their lifecycle, Directive 2010/30/EU on energy labels which aim to help consumers to choose the most efficient products, and the phase-out of inefficient light bulbs.[20]

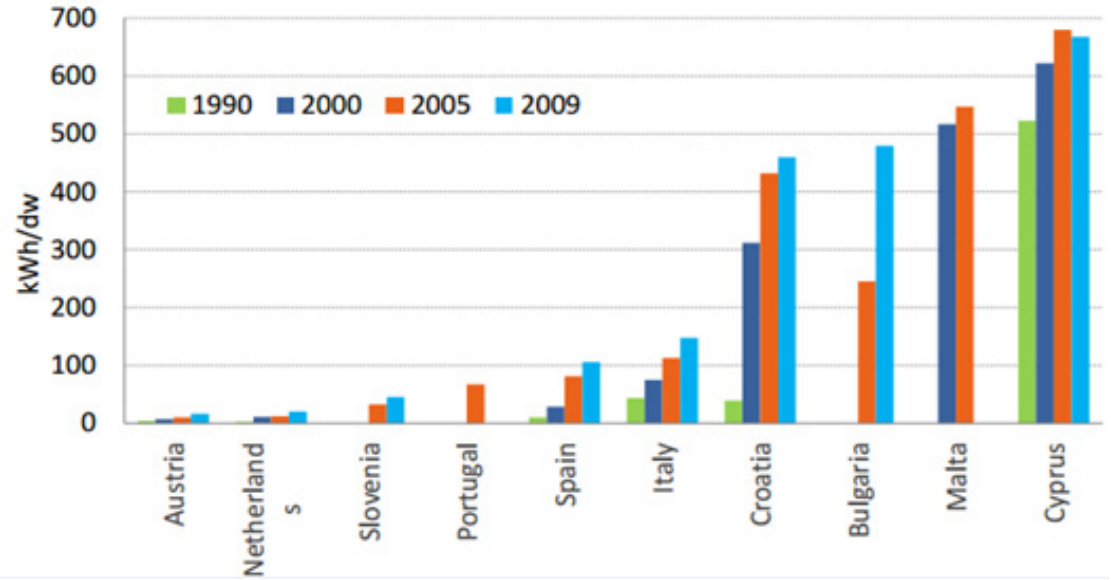
Awareness campaigns surrounding these directives will help consumers to make informed purchasing choices. In addition, a combination of education around the cost of using electricity-consuming products and how to use them most efficiently, and incentives to build or upgrade homes so that they have more passive cooling options, will help to reduce the impact of the increase in popularity of these products.

Challenge 3. Flatted properties in multiple ownership dwellings

42.1% of the Bulgarian population lives in apartments. While this is by no means the highest in Europe (66.2% of Latvians live in flats), a significant proportion of the energy efficiency challenges will need to be met by addressing energy efficiency in flats.

Particularly prevalent in Bulgaria are large panel residential buildings – there are 11,128 of these

Figure 3: Unit consumption per dwelling for air conditioning in 10 European countries



Source: ODYSSEE (http://www.odyssee-indicators.org)
http://www.odyssee-indicators.org/reports/household/EE-trends-Household-EU-elec-S23.pdf

[20] European Commission. 2009 – 2012. Directive 2009/125/EC, Directive 2012/30/EU, Directive 2010/125/EC.

buildings in Bulgaria, which house 2 million people. A recent study suggests that on average, the thermal conductivity of these properties varies from 0.63 to 2.0 W/m^{2}K, depending on the cladding components.[21] This shows that there is a great variety in the thermal efficiency of these properties, so it will be important to target the worst performing properties first. However, it will also be important to improve all of the properties – an Ecofys study in 2007 recommended that buildings in Bulgaria should have a maximum U-value (the rate at which a building element transfers heat) of between 0.20 and 0.25 W/m^{2}K, depending on the price scenario.[22]

As part of the updated National Strategy for Financing the Building Insulation for Energy Efficiency 2006 – 2020, the Bulgarian Government will set aside €498m for the insulation of private flats in panel blocks – this covers 20% of the sum of the building renovation, as well as including funding for audits.[23]

Making it easy for householders to meet the necessary upfront costs of energy efficiency refurbishment will be increasingly important. Germany is the leading member state in term of developing new technologies and it has developed the most comprehensive and ambitious energy-saving plan in the EU, which aims to reduce energy consumption by 30% and increase the use of renewables by 30% by 2020. The programme is based on a three-pronged approach which includes strict national regulation on renovations and use of renewable energy resources, financial incentives such as loans and grants provided by a government-sponsored public investment bank (Kreditanstalt für Wiederaufbau) and dissemination of information and awareness raising through pilot projects aimed at behavioural change.

In Romania, Emergency GO 18/2009 established the works necessary for the thermal rehabilitation of blocks of flats designed and built between 1950 and 1990. Improved energy efficiency may be achieved by:

- Thermal insulation on the exterior walls,
- Replacement of old windows and exterior doors with energy efficient ones.
- Thermal and hydro-insulation of roofs and terraces;
- Thermal insulation of slabs over or walls next to unheated spaces.
- (Repairing or replacements of the heating and domestic hot water systems are allowed only as supplementary works and are not considered a priority under the programme so have not been addressed in most projects)

The responsibility for financing these improvements is split between state budget allocations (50%), local sources legally established (30%), and repair funds of owners' associations (20%).[24]

When building a business case for long-term investment programmes into these properties, it is well worth considering the savings that might be made to the state budget – both indirectly, through lower incidences of heat- or cold-related illnesses, and also more directly; following a pilot project by the Government of the Republic of Lithuania and the World Bank, through which 500 multi-apartment buildings were renovated, home owners reduced energy consumption by an average of 24%, which in turn resulted in a reduction of around 40% of the subsidies needed to be paid to low-income families for energy costs.[25]

[21] These values were calculated from R-values of between 0.5 and 1.60 m^{2}K/W cited in Folić, Radomir, Mirjana Laban and Verica Milanko.. 2011. "Reliability and Sustainability Analysis of Large Panel Residential Buildings in Sofia, Skopje and Novi Sad." *Architecture and Civil Engineering Vol. 9 No. 1*

[22] Ecofys. 2007. U-Values for better energy performance of buildings.

[23] Bulgarian Government. 2011. *Second National Energy Efficiency Action Plan 2011-2013*

[24] UNDP. 2011. *Project Document: Improving Energy Efficiency in Low-Income Households and Communities in Romania.*

[25] Government of the Republic of Lithuania. 2004. The Lithuanian Housing Strategy.

Box 2. Government programmes funding energy-efficient measures in Bulgarian homes

Some progress has already been made towards energy efficiency in residential buildings through financing programmes set up by government agencies. It was estimated that 700,000 residential units, inhabited by over 2 million Bulgarians, could greatly benefit from retrofitting energy-efficient technologies. Approximately 50% of primary energy consumption could be saved through retrofitting, which would result in a 600 EUR annual savings from energy bills per household. The average cost for these renovations was calculated to 5000 EUR per household, which would be returned in a 7 year period.

Support for energy efficiency in multifamily residential buildings

The demonstration project has led to the launch of a three-year (2012-2015) nation-wide programme of the Ministry of Regional Development and Public Works (MRDPW). The "Energy renovation of Bulgarian homes" project is supported by the Operational Programme Regional Development, co-financed by the Regional Development Fund of the EU, for a total of BGN 50 million and is available to associations of home owners in 36 towns and cities. Initially, the programme provided a grant of up to 50% of the total cost of renovation, while the Housing Renovation Fund, set up as part of the initiative, would provide loans for the other half of the total cost. A year after the programme was introduced, and as a result of the very slight interest from home owners, in April 2013 the size of the grants was increased to 75% of the total cost. Similarly to the demonstration project, the programme covers insulation, replacement of windows and doors, refurbishment of heating installations, mounting of renewable energy sources (e.g. solar panels), and replacements of heating/ cooling/ electrical/ ventilation installations. Since the launch of the programme, only BGN 218 135 have been claimed, implying a low level of engagement of home owners.

Residential Energy Efficiency Credit Line (REECL)

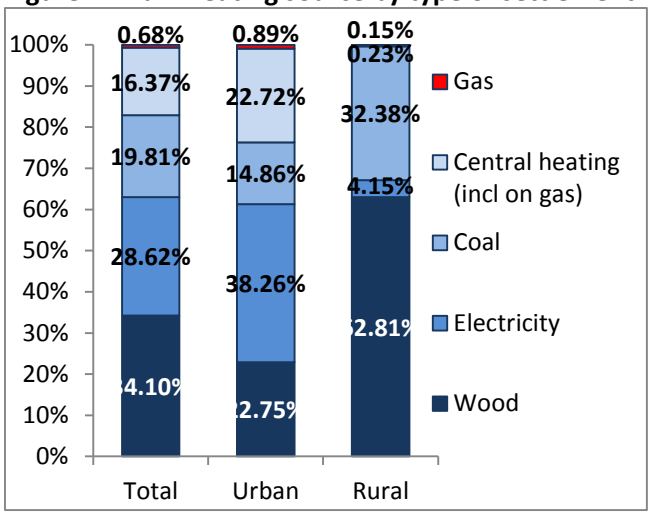
Homeowners can also benefit from the joint programme of the Sustainable Energy Development agency (SEDA), the European Commission and the European Bank for Reconstruction and Development, which have set up a € 40 million Residential Energy Efficiency Credit Facility to provide credit lines to banks to make loans to householders and associations of home owners for specific energy efficiency measures, similar to the ones of the aforementioned activities. To help stimulate the project, an additional € 14 million in grant financing has been made available by the Kozloduy International Decommissioning Support Fund (KIDSF). Borrowers can benefit from up to a 35% incentive towards the cost of their energy saving projects, once an independent consultant has assessed their eligibility. It is estimated that up to 30 000 projects could benefit from this scheme. Project will run until 31st July 2014. Since 2006 the programme has committed to 41496 energy efficiency loans, while € 11 903 952 have been issued as incentive grants.

Challenge 4. Heating

Given that a significant proportion of the energy used in homes is for heating, ensuring that the most efficient, low-carbon heating systems are used is key to reducing energy use and carbon emissions from the residential sector.

Energy consumption in households in Bulgaria (as at 2011) is primarily from three sources: firewood and coal (57.9%), electricity (26.2%) and district heating (13.7%), with only a low direct use of natural gas by households (1.2%).[26]

Figure 4. Main heating source by type of settlement



Source: National Statistical Institute, 2013.

Smart metering activities in Bulgaria are currently rather limited, but both E.ON Bulgaria and CEZ Distribution Bulgaria are working to replace meters across Bulgaria, and consideration should be given as to whether it would be possible to work with these organisations to ensure that accessible displays are provided to householders at time the of installation.[27] Following the example of several other European countries, a strategic approach to the roll out of smart meters and either accessible web applications (following the example of Finland) or real time display units should also be developed.[28]

Electricity is by far the most carbon intensive form of energy, particularly in Bulgaria, which has one of the highest level of energy distribution and transformation losses in the EU.[29] It is also more expensive than other fuels such as gas and solid fuels, which means that householders can find it harder to pay their heating bills (in 2011, the average electricity price for households in Bulgaria was 8.7 cents per kWh, compared with 4.7 cents per kWh for gas).[30] Because of the cost, use of electricity for heating within the residential sector in Bulgaria has decreased rapidly from 39% in 2007 to 26% in 2011 (and predominantly been replaced by firewood and coal heating). Many have also disconnected from district heating systems (which is almost entirely fuelled by natural gas), whose share decreased from 18.2% to 13.7% during this time.[31] This is partly the result of the fact that in multi-apartment buildings individual households are not able to switch off their heating, before this is turned off for the entire area they are situated in. Furthermore, there have been allegations of corruption at the top managerial level related to delaying the end of the heating season in order to charge homeowners for a longer period of time.

Central heating

Despite this recent trend, it is likely that levels of central heating will increase in Bulgaria in coming years. Currently, just under 60% of Bulgarian households have central heating of some kind (see Box 3), which is low compared to other European

[26] National Statistical Institute of Bulgaria. 2011. *2011 Population Census in the Republic of Bulgaria (Final Data)*

[27] Spadniak, Petr. 2011. *Diffusion of Smart Meters in Central East Europe.*

[28] SmartRegions. 2011. *European Smart Metering Landscape Report.*

[29] CSD. 2012. *Green Growth and Sustainable Development for Bulgaria: Setting the Priorities*.

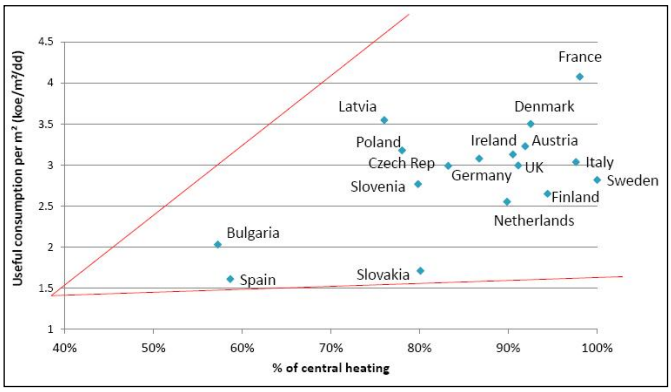
[30] Eurostat. 2012. *Gas – domestic customers – half yearly prices – new methodology from 2007 onwards*.
Eurostat. 2012. *Electricity – domestic consumers – half-yearly prices – new methodology from 2007 onwards.*

[31] Energy Efficiency Agency: Ministry of Economy and Energy. 2009. *Energy Efficiency Policies and Measures in Bulgaria.*

countries.[32] Use of district heating is unsurprisingly significantly higher in more densely populated urban areas in Bulgaria - as at 2011, 13.7% of inhabited households in Bulgaria had district heating, but 59.9% of households in the Sofia capital region use district heating.[33] (Many regions, particularly rural ones, do not have access to district heating at all).

Central heating is widely seen in European countries as being an indicator of housing quality; uptake has therefore been encouraged through policy and programmes across Europe. However, it is worth noting that there is a significant positive correlation between the penetration of central heating and the average energy consumption of homes, which has contributed to increasing energy consumption in the household sector across the EU. There is therefore a challenge for Bulgaria in ensuring that central-heated homes are adequately heated, while minimizing increasing energy use in the domestic sector.

Figure 5: Correlation between the penetration of central heating and the average energy consumption of homes



Source: ODYSSEE (http://www.odyssee-indicators.org)

There are two main ways in which the energy use of central heating systems should be tackled: the first is to look at the technology itself – in individual dwellings and on the larger scale: in Bulgaria, the Association of the District Heating Companies in Bulgaria has acknowledged that lack of investment in district heating infrastructure has led to a situation with low production efficiency, high grid losses, and high levels of emissions.[34] It will therefore be important to modernize assets, in particular looking at newer technologies such as more efficient combined heat and power (CHP) systems, use of alternative fuels such as biomass and of heat pumps - there are already examples of larger geothermal installations being used for district heating systems across Bulgaria, with a co-efficient of performance of between 4.3 and 6.3 (essentially, producing 4 to 6

Box 3: Central heating

The definition of central heating used in this report is where the heating system used by a house distributes heat throughout the dwelling (i.e. rooms are not heated by individual stoves, fires or heaters). Central heating sources include:

- District heating (also known as city heating) is where a heating system distributes hot water to a number of dwellings in an area or district.
- Block heating – where hot water is distributed to a number of apartments within the same block.
- Individual dwelling systems such as boilers that distribute heat throughout the rooms of one house.

Definitions for heating systems have different meanings in different member states of the European Union. In Bulgaria, for example, central heating or "централно отопление" statistics refer to district heating, rather than the wider definition used above.

[32] European Commission, DG for Energy and Transport. 2002. *Labelling and other measures for heating systems in dwellings*.

[33] National Statistical Institute of Bulgaria. 2011. *2011 Population Census in the Republic of Bulgaria (Final Data)*

[34] Sollfelner, Joerg. 2009. "District Heating in Bulgaria"*Zagreb, 12. 11. 2009.*

times as much heat energy than the electric energy required to power them).[35]

In Lithuania, article 7 in the Law on Heat Sector set out a requirement for heat supply plans for cities, with an objective of meeting consumer heating needs at the lowest cost whilst minimizing environmental impacts. This led to the closure of ineffective parts of networks and increasing use of renewables, which have increased the efficiency of district heating schemes. EU structural funds are also available for the modernization of systems and networks, including fuel switching to biomass, refurbishment of CHP plants and energy recovery from municipal waste.[36]

Focussing on the end user will also be important. Given that individual heat metering in multi-family residential buildings has been introduced in Bulgaria (as required by the European Energy Act and Regulation No. 16-334 of 6 April 2007 on heat supply) one might expect to see a decrease in energy use. However, it will be important to ensure that householders understand how to read these meters and are given appropriate levels of information to allow them to take control of their energy use. In order for this to happen, it will be important to ensure that the meters are both accessible and easy to understand.

Solid fuels

The extent to which wood fuel is currently used for heating in Bulgarian homes provides a significant opportunity. Rather than encouraging these homes to change to a heating system relying on fossil fuels, analysis should be undertaken as to the possibility of improving the sustainability of both the source of fuel and the heating appliances used.

If households can be persuaded to use sources of biomass and boilers that meet the sustainability criteria of the European Commission (these criteria include sustainability of production and installations that achieve high energy conversion efficiencies), this could be a significant move to increase Bulgaria's share of renewable energy.[37]

This could be done by:

- Introducing financial support toward the purchase of efficient biomass stoves or boilers, such as a grant scheme in Slovakia, which offers 25% grants for small scale biomass combustion furnaces.[38]
- Developing national policy to encourage both production and uptake of biofuels in both domestic and commercial sectors. Inspiration can be drawn from Estonia, where following the introduction of a national policy (Development Plan 2007 – 2013 for enhancing the use of biomass and bioenergy) the share of biomass for heating (and, indeed, the total production and consumption of biofuels)[39] has increased substantially since 1990 and around one fifth of the country's boilers are suitable for fuel wood use.[40]

Micro-renewables

While the focus of this paper is on energy efficiency rather than renewable energy sources, it is relevant

[35] Hristov, H., and K. Bojadgieva. 2003. *Heat Pumps Application in Bulgaria*.
[36] Aronsson, Britt, and Stefan Hellmer,. 2011. *Existing legislative support assessments for DHC*.
[37] European Commission. 2010. *Report from the Commission to the Council and the European Parliament on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling SEC(2010) 65 final SEC (2010) 66 final* http://ec.europa.eu/energy/renewables/bioenergy/sustainability_criteria_en.htm
[38] EREC. 2009. *Renewable Energy Policy Review: Slovakia*.
[39] The Titi Tudorancea Bulletin, Global Edition. 2010. "Estonia: Total Biofuels Production," accessed 20 July 2012. http://www.tititudorancea.com/z/ies_estonia_biofuels_production.htm.
[40] REEP. 2012. "Policy DB Details: Estonia (2012)." accessed 20 July 2012. http://www.reeep.org/index.php?id=9353&special=viewitem&cid=3

to note that penetration of all types of domestic micro-renewable systems in Bulgaria is extremely low. This is unsurprising given the lower incomes of households compared to other European countries. However, many households could make substantial fuel bill savings by installing micro-renewables. Given Bulgaria's location, solar systems would seem to be a particularly attractive prospect. This is the case in Albania, where the use of solar hot water panels has been extended– surveys estimate that installed capacity is around 9 MW thermic, with a potential to increase this to 125 MW thermic.[41] (To put this in context, an average domestic solar hot water panel installation would be around 1 kW thermic).

Given the high prevalence of electric heating, there also seems significant potential to use renewable electricity systems such as solar photovoltaics to reduce costs and carbon emissions. Consideration should be given as to whether feed-in tariffs can be used to fund such systems at no up-front cost to the consumer. This was the case in Germany and the UK, where private organizations offered to install solar PV systems (and in some cases also wind turbines and small hydroelectric installations) on houses for free; the householders benefited from free electricity, while the company received the feed-in tariff payment.

Air source heat pumps should also be considered as an alternative to having both an air conditioning unit and an electric heating system. Using an air source heat pump for air conditioning is as inefficient as using a standard air conditioning unit. However, when used for heating, air source heat pumps extract heat from the air to produce significantly more useful heat energy than the amount of electricity used to power them.

Challenge 5. Low incomes and high incidence of fuel poverty

The median equivalised net income in Bulgaria in 2011 was €2901, a slight decrease from 2010 when it was €3017, around 20% of the average income in the EU28.[42] More than a fifth of Bulgaria's population (21.8%) is at risk of poverty (only Latvia and Romania have a higher proportion of the population at risk).[43] Different groups in society are more vulnerable than others – for example, more than a third of Bulgaria's retired population are at risk of poverty.

This, in addition to the fact that gas and electricity prices have risen significantly in Bulgaria in recent years (daytime electricity tariffs doubled between 2002 and 2005, and there have been almost annual increases including a 13% increase in July 2012), mean that more and more households in Bulgaria are in 'energy poverty' – the average Bulgarian household spends 14% of their income on water and energy bills, and approximately 360,000 households (around 12.4% of the population) require social support to help towards their winter energy costs.[44]

Low levels of income and high incidence of fuel poverty are motivating factors for undertaking energy efficiency measures, as improving the fabric of homes will make it more cost-effective for home-owners to heat and cool their homes. However, these considerations pose three significant challenges for the Bulgarian Government:

1. Many energy efficiency improvements will not lead to lower energy use

Between 2005 and 2010, between a third and two thirds of Bulgarian households surveyed as part of the EU's Income and Living Conditions research have

[41] National Agency of Natural Resources. 2010. *Renewable Energies in Albania*.
[42] Eurostat. 2012. *Mean and median income by age and sex*.
[43] Eurostat. 2012. *At-risk-of-poverty rate by poverty threshold, age and sex*.
[44] Bouzarovski, Stefan, Robert Sarlamanov and Saska Petrova. 2011. *The Governance of Energy Poverty in Southeastern Europe.*

stated that they are unable to keep their home adequately warm – by far the highest proportion in Europe.[45] Because of this, it is likely that in many cases, energy efficiency improvements made to homes will not lead to a lower level of energy use but to a higher level of thermal comfort.

Even in homes where there is not currently a struggle to pay for energy efficiency measures, the full potential savings of energy efficiency savings are often not made because of the so-called 'rebound effect' – a phenomenon whereby householders spend the money they save on energy on other energy-consuming measures or practices (perhaps buying new appliances or turning up the heating).[46] A report for the European Commission suggests that direct rebound effects for space heating/cooling, white goods and lighting are estimated to be in the range of 10-30% for developed countries, with larger effects in low income groups.[47]

This means that a full range of motivating factors must be taken into account when building a business case for energy efficiency in housing, and caution must be taken when estimating the likely energy savings from measures. A 2011 study suggested that only the UK Government currently incorporates direct rebound effects into energy policy development, and recommends that other policy makers follow this practice.[48]

2. How to fund energy efficiency improvements

Many energy efficiency improvement programmes across Europe rely on householders making a contribution to the costs of the measures. If householders do not have the financial means to meet the upfront costs of these investments, then other options will have to be considered.

The Bulgarian Government has already introduced the Residential Energy Efficiency Credit Line (REECL) facility, which offers loans to homeowners who choose to install energy efficiency measures such as insulation, energy efficient windows, gas or biomass heating systems and micro-renewables. In addition, a grant of between 20% and 35% of the cost of eligible measures is available once the project has been completed, subject to terms and conditions.[49]

3. How to invest in wider energy projects without adversely affecting energy bills further

While the topic of larger scale energy projects and policies is outside of the scope of this paper, it is important to acknowledge that commitments to wider energy projects and policies such as feed-in tariffs and investment in power plants are likely to have increasing impacts on consumer electricity bills, and a balance must be struck between investing in these projects, which are likely to increase domestic fuel bills, and between investing in household energy efficiency.[50]

Tackling consumer behaviour

Low incomes and high incidence of fuel poverty also increase the importance of focusing not only on physical measures but also on encouraging behavioural change from householders. A recent Energy Efficiency Watch project recognises that a major obstacle to energy efficiency in Europe is the lack of knowledge about energy use among private households, companies and public authorities. [51]

[45] Eurostat. 2012. *Inability to keep home adequately warm*.
[46] Herring, Horace. 2008. "Rebound effect," accessed 20 July 2012. http://www.eoearth.org/article/Rebound_effect.
[47] Maxwell, Dorothy, Paula Owen, Laure McAndrew, Kurt Muehmel and Alexander Neubauer. 2011. *Addressing the Rebound Effect, a report for the European Commission DG Environment*.
[48] Maxwell, Dorothy, Paula Owen, Laure McAndrew, Kurt Muehmel and Alexander Neubauer. 2011. *Addressing the Rebound Effect, a report for the European Commission DG Environment*.
[49] Residential Energy Efficiency Credit Line website, accessed 20 July 2012. http://www.reecl.org/indexen.php/grants.php
[50] "Bulgaria's Watchdog Forecasts More Energy Price Shocks." 2 July 2012. http://www.novinite.com/view_news.php?id=140869
[51] Energy Efficiency Watch. 2010. *Promoting Energy Efficiency in Europe: Insights, Experiences and Lessons learnt from the National Energy Efficiency Action Plans*

Therefore, in addition to improving the fabric of buildings, it will be increasingly important to ensure that householders are offered feedback about their energy use, personalized advice, and perhaps incentives such as greater differentiation between peak and off-peak rates for electricity, and subsidies and credits.[52]

An Intelligent Energy Europe funded study on Changing Energy Behaviour notes that behavioural change activities are nearly always needed to achieve the full intended benefits of new energy legislation or technology. [53] There are many ways in which householders can be encouraged to make behavioural changes that achieve energy savings in the short term. Studies show that the most effective interventions of this kind combine a variety of different policy tools (such as information campaigns, incentives and legislation), address multiple barriers to behaviour change and use strong social marketing.[54]

Conclusion

There are a number of challenges to be overcome in addressing the energy efficiency of properties in the domestic sector in Bulgaria, some of which have been outlined in this document. However, energy efficiency presents significant opportunities to improve the condition and quality of the country's housing stock and to reduce fuel bills for householders (which may in turn lead to reduced demand for social support and for healthcare for heat- and cold-related illnesses).

In order to create effective energy efficiency campaigns, there is a need for:

- More reliable data on both housing and energy consumption in Bulgaria; consideration should therefore be given to developing more comprehensive surveys and databases to help to get an accurate profile of the housing stock that can be used to target campaigns effectively.
- Effective consumer engagement – the right advice and incentives should be put in place to ensure that householders understand, and are empowered to take control of, their energy use.

There are currently a number of opportunities for financing energy efficiency programmes, including European Union funding schemes, and the use of these should be maximized while they are available, in order to benefit the greatest possible number of Bulgarian households.

[52] Uitdenbogerd, Diana, Cees Egmond, Ruud Jonkers and Gerjo Kok. 2007. *Energy-related intervention success factors: a literature review.*

[53] Intelligent Energy Europe. 2009. *Changing Energy Behaviour: Guidelines for Behavioural Change Programmes.*

[54] NB This includes the adoption of more efficient equipment and change of use of equipment on hand.

Dietz, Thomas, Gerald T. Gardner, Jonathan Gilligan, Paul C. Stern and Michael P. Vandenbergh. 2009. "Household actions can provide a behavioural wedge to rapidly reduce US carbon emissions." *PNAS 106 (44)*