Vadyba
Journal of Management
2017, № 2 (31)
ISSN 1648-7974

SOME CURRENT ISSUES OF ENERGY EFFICIENCY IN THE EUROPEAN UNION

Tibor László Csegődi, Tamás Naár
[1]*Szent István University, Hungary*

Annotation
According to World Energy Council the definition of energy sustainability is based on three core dimensions: energy security, energy equity, and environmental sustainability. Energy efficiency also plays an important role in the index which is described by energy trilemma theory. The European Council sets its goal in October 2014. Based on this level of energy efficiency will have to improve by at least 27% till 2030. This value will be adjusted by 2020, which likely means the level should increase to 30% in the European Union. It is estimated that each 1% increase in energy savings allows 2.6% reduction in gas imports, thus reducing the EU's energy dependency. Based on data from 2015, the level of energy consumption in the EU was broadly in line with the 1990 level, while only half of the EU Member States (14 states) reduced their gross domestic energy consumption between 2015 and 1990. In our paper, we would like underline the fact by statistical calculations too that households are responsible for 25.4% of final energy consumption, which is roughly the same as that of industry's final energy consumption. The latter can be traced back to the fact that 75% of the EU housing stock is unsatisfactory for its energy efficiency. To exploit the energy efficiency potential of buildings, actions are needed by member states, primarily at regional and local level. This paper outlines the European Union and Hungarian legal requirements of energy efficiency. This is important because the 2012 Energy Efficiency Directive of the European Union requires a 3% renewal of public buildings annually. The 2010 Directive on the Energy Efficiency of Buildings, for example, requires that all new buildings till 2021 need close to zero energy. Surveys show that the population of Hungarian small settlements is considered to be environmentally conscious, and in addition, the state has set up the National Energy Network to reduce the energy consumption of public institutions, businesses and the population. However, legal regulation is not sufficient to meet the requirements. In the final part of our paper, we show that in order to make effective action, the state's financial incentive would be needed in this area.
KEY WORDS: energy trilemma theory, energy union, energy consumption of residential sector, energy efficiency.

Introduction

According to a well-known phrase the best waste is what we do not produce the best source of energy we do not use. Each state has some energy efficiency potential; the only question is how much they can use it. Strong energy efficiency policies are therefore essential to achieve the key energy-policy goals of reducing energy bills, addressing the climate change and air pollution, improving energy security, and increasing energy access (IEA 2016). Energy efficiency has number of benefits (see Fig. 1) such as such as macroeconomic development, public budget increase, enhanced health and wellbeing, industrial productivity and energy delivery improvements (IEA 2016).

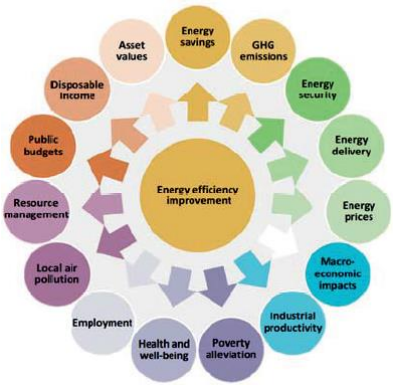

Fig. 1. Multiple benefits of energy efficiency
Source: IEA 2016

The ecological economics created the myth of the paperless office approach (York 2008). This means that the more IT equipment we use in an office the more paper we shall also apply. To achieve economic growth most of the developed countries need more, but at least the same amount of energy. Despite the energy consumption structure changed significantly in some states because of the crisis, the dependence on fossil fuels in European countries is still considerable. Worldwide, energy consumption and economic development continue to grow in parallel, but their pace is different. Between 1990 and 2014 the total energy supply grew by 56%, while gross domestic product (GDP) increased by more than 90% (IEA 2016). During the same period of time the amount of energy used to generate a unit of GDP, also called energy intensity, decreased by approximately 20%, with large regional variations.

Energy efficiency must be an important part of our life, but it is only a part of a higher "idea", energy sustainability. According to World Energy Council's definition energy sustainability is based on three core dimensions, like energy security, energy equity and environmental sustainability. These factors taken together constitute energy trilemma. The first part of energy trilemma is energy security, which means effective management of primary energy supply from domestic and external sources, reliability of energy infrastructure and ability of energy providers to meet demands. The second part of trilemma is energy equity which synonymous with accessibility and affordability of energy supply across the

population. Finally the third part of trilemma is environmental sustainability which involves achievement of supply- and demand side energy efficiencies and development of energy supply from renewable and other low-carbon sources (World Energy Council 2016). In the context of sustainability the energetic and climatic crisis are currently the most significant problems for us. In 2008 three crises hit most of the world: climate crisis - energetic crisis - financial crisis (The Green New Deal 2008). Only the financial crisis was handled, not very successfully. In Hungary this is particularly true because the adverse effects of the crisis prevail here much more seriously than in abroad. According to the European Union's Prudence regional climate modelling program results (National Climate Change Strategy 2008) if the global temperature raises 1 ºC than the temperature in the Carpathian Basin will raise almost 1.5 ºC. In present moment the worlds average temperature 0.76 ºC higher than about a hundred years ago. Our consumer culture and energy consumption habits are not climate friend and sustainable that is why Hungary is very vulnerable from this aspect of view. Our consumption habits are hardly considered to be energy efficient (Fig. 2).

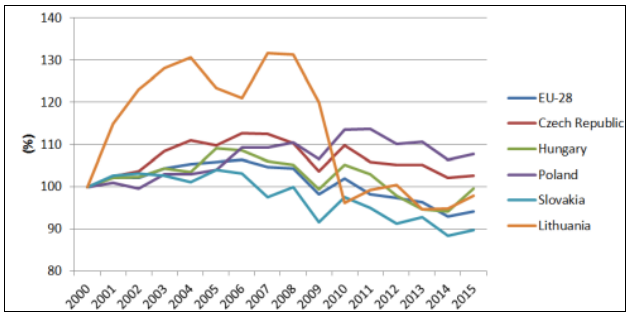

Fig. 2. Change of Final Energy Consumption (2000=100%) in the EU-28, 2000-2015
Source: own calculations based on data from Eurostat (online data code: nrg_100a)

If we compare data from 2000 to 2015 we would be able to state the final energy consumption increased both in the Czech Republic and in Poland. The final energy consumption in Lithuania shows great expansions: it rose rapidly between 2000 and 2004, dropped from 2004 to 2006, reached peak in 2006, and fallen rapidly between 2008 and 2010. It is generally true that energy consumption declined more or less in 2008 but this was due to the economic crisis, not due to energy efficiency. Energy consumption in Hungary has fallen considerably between 2011 and 2014, but since 2015 it has risen again, reaching its peak in the summer of 2017.

Both economic and legal arguments support the need to create energy efficiency. This is especially true for the energy consumption of various (official and non-official) buildings.

Results and Discussion

Energy efficiency as legal requirement

In 2007 the European Council set the target of reducing greenhouse gas emissions by 20% till 2020, increasing the share of renewable energy sources to 20% and improving energy efficiency by 20% (Mellár 2015, Naár et al. 2013). The issue of improving energy efficiency has already emerged from the Fifth Action Program (1993-2002) adopted by the European Council and the Member States as "Towards Sustainability". The program emphasizes energy in several other sectors and proposes action programs to improve energy efficiency thus preserving and sustaining the environment (Bándi 2011).

The Seventh Action Program (2012-2020) set the target for the EU to move towards low carbon and resource efficiency through the use of policy actions and instruments, thereby pushing the economy to a sustainable growth path by 2020. The action program also draws attention to the resource efficiency by identifying indicators and targets, which serve as a guide for public and private decision-makers. The European Commission has already highlighted, in the Green Paper on European Strategy for Sustainable, Competitive and Secure Power Supply in March 2006, strengthening energy efficiency policy, taking into account Europe's security and future. The three main objectives of energy policy were sustainability, competitiveness and security of supply. The Commission proposes two measures to handle the consequences of climate change. The first is to declare the issue of energy efficiency as a priority area, including increasing the energy efficiency of buildings by laying down additional measures; the second is the planning of the use of renewable energy sources for a longer period of time, which can reduce dependence on oil imports. It also sets out a common energy technology plan and a common energy policy (Soltész-Szakács 2011).

The Energy 2020 Strategy in 2010 (COM (2010) 2020) has strengthened the European Union's 2007 targets by outlining the need for a new energy efficiency strategy, thus putting energy efficiency at the heart of the EU's 2020 energy strategy. At Member State level, economic growth-independent use of energy became truth. Its objectives include building an integrated energy market in Europe, building an energy-efficient Europe and strengthening the European Union's energy market outside the EU. It focuses on defining energy policy steps that will serve the feasibility of an integrated energy-climate strategy by 2020 (Soltész-Szakács 2011).

Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency has set itself the fundamental objective of achieving a 20% energy saving by 2020 for Member States. This means better use of energy resources and a reduce the dependence on imports, which would make the European Union's economy more competitive and lower emissions of carbon dioxide and other pollutants as a result of lower energy consumption. The 2011 Energy Efficiency Plan of the EU has also stated that the most significant energy savings can be achieved for buildings, as nearly 40% of our final energy consumption comes from the use of energy from public buildings, office buildings, residential buildings and other building types. The Directive requires that 3% of buildings owned and used by public buildings in public buildings must be renewed annually to meet the requirements of the national energy efficiency directive. The Energy Efficiency Directive also requires Member States to submit a National Energy Efficiency Action Plan. As a further requirement, the directive stipulates

that consumers should be informed about their energy consumption so that they can make decisions about energy use (Mellár 2015). All Member States have already announced their national energy saving target, which may lead to the conclusion that the Member States are targeting only 16.4% for primary energy savings and 17.7% for final energy savings by 2020. This means that it is unlikely that the 20% savings required to achieve the full EU target will be realized by the 2020 deadline (COM/2013/0762).

The main purpose of Directive 2010/31/EU on the energy performance of buildings is to promote the improvement of buildings energy efficiency in the European Union, taking into account climatic conditions and local conditions. It sets out a number of tasks for the Member States (Energy performance of buildings 2015). The Directive lays down a common methodology for Member States at national or regional level to calculate the energy efficiency of buildings. Member States should set minimum requirements for energy efficiency in order to achieve cost-optimized levels within the aforementioned calculation methodology. These minimum requirements must be reviewed at least every five years. In the case of new buildings, compliance with the minimum requirements is a precondition, while renovating existing buildings should be pursued to improve energy efficiency even in such a way as to meet the requirements (Energy performance of buildings 2015). Under the Directive, the minimum energy performance requirements for buildings should be set so as to achieve an equilibrium between investment costs and energy savings for the entire lifetime of the building; and it also stresses the need to increase the number of buildings which are more energy-efficient than minimum requirements (Energy performance of buildings 2015). After 31 December 2020, the Directive requires that all new buildings need to be close to zero energy. For new buildings used or owned by public authorities, this deadline is 31 December 2018. Additional requirements of this Directive include the certification of buildings or separate units of destination, as well as an independent control system for energy efficiency certificates and on-site inspection reports. The certificate should use the information on energy consumption of buildings and recommendations to improve cost-effectiveness. (Mellár 2015) These energy efficiency certificates must be passed on to the buyer or tenant when the buildings are sold or leased; in the case of public buildings, they must be suspended in a visible place.

According to the above mentioned legal documents it seems to be clear that creating energy efficient buildings would be a significant step towards achieving overall energy efficiency. For example household energy consumption in Hungary, the second highest proportion of EU-28 member states (34.4%) out of the final energy consumption, with a higher share (36.7%) of domestic energy consumption only observed in Croatia (Fig. 3).

In terms of electricity consumption, however, it is already clear (Fig. 4.) in the EU-28 area in 2014 that the residential sector is the largest consumer with its 61% share, industry with the second 37%, and the electricity consumption of transport it is almost dull with its 2% share. Based on these, it can be concluded that the largest possible energy savings in the residential sector can be achieved and thus increased energy efficiency (EUROSTAT 2017).

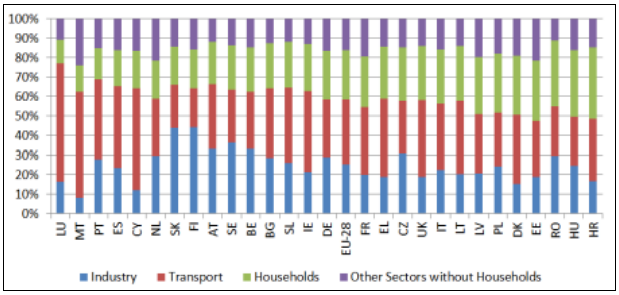

Fig. 3. Structure of Final Energy Consumption in the EU-28, 2015

Note: Data is ranked on the share of the household sector in final Energy consumption

Source: own calculations based on data from Eurostat (online data code: nrg_100a)

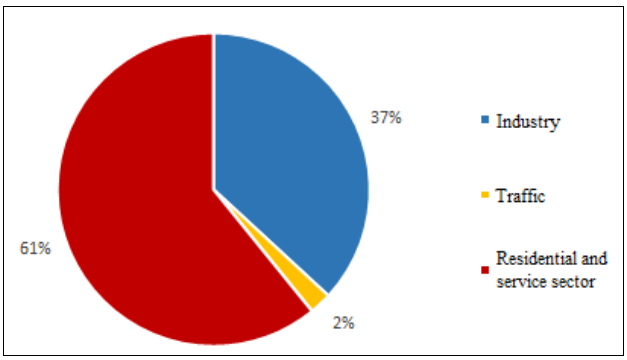

Fig. 4. EU-28 electricity consumption by sector in 2014

Source: own construction based on Eurostat (2017)

In addition to the mentioned legally binding documents a communication from the European Commission (released two years ago) also important for us. The communication of European Commission is about a framework strategy for (resilient) Energy Union, and as such it is a development of EUROPA 2020 plan. It is a quite shocking data but 75% of European Union housing stock is energy inefficient. Every additional 1% increase in every savings cuts gas imports by 2.6% (COM(2014)520). The European Union has to create energy efficiency contributing to moderation of demand in order to achieve greater energy security, sustainability and competitiveness. In order to make our energy system safer and more sustainable, for example, significant energy efficiency investments are needed, most of which are expected to be carried out by the private sector. Therefore, financial support for the private sector is essential in this area. At the same time, the financial support of households is necessary to work in an energy efficient way. The lack of energy efficiency often has a strong correlation with energy poverty, not only but mainly the poorest European citizens are affected adversely by this phenomenon. Energy poverty negatively affects living conditions and health. It has many causes, mostly resulting from a combination of low income and general poverty conditions, inefficient homes and a housing tenure system that fails to encourage

energy efficiency (COM(2015) 80). One of the ways to combat energy poverty, but not the one and only and not the best one, is to reduce energy prices. Much better way is to create energy efficiency when European Citizens do not need as much energy as previously. The European Council set in October 2014 an indicative target at the EU level of at least 27% for improving energy efficiency in 2030. This will be reviewed by 2020, having in mind an EU level of 30%. From 2015 – for the European Union – energy efficiency is an independent energy source. Heating and cooling is the largest single source of energy demand in Europe and the majority of Europe's gas imports are used for these purposes. Huge efficiency gains remain to be captured with regard to district heating and cooling, which will be addressed in a Commission strategy (COM(2015) 80). Member states have to take actions both at local and regional levels to exploit the energy efficiency potential of buildings. Attracting investments at the scale needed remains a challenge, especially at the local level, mainly due to lack of awareness and expertise in small-scale financing. Firstly the large number of funding opportunities, then greater amount of money available and finally the simplification of the use of grants would be important steps from the European Union and Member States too. Financial support needs to be combined with technical support to help aggregate small scale projects into larger programmes which can drive down transaction costs and attract the private sector at scale.

Energy efficiency from statistical point of view

Despite the fact that our approach to climate change is based on morality, energy efficiency should be a matter of economic concern. At the same time, the impact of climate quality on the energy consumption in European states should not be forgotten. Our relatively short statistical survey is based on the per capita value of households' energy consumption (Fig. 5).

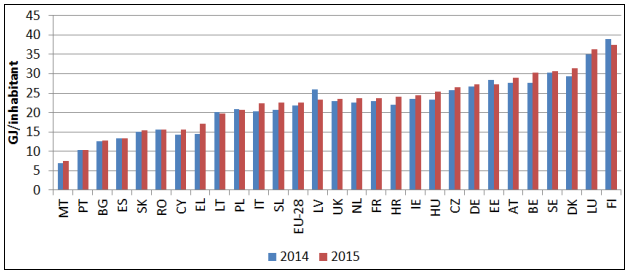

Fig. 5: Household energy consumption per capita in the EU-28, in 2014, 2015

Note: Data is ranked on the data for 2015

Source: own calculations based on data from Eurostat (online data code: nrg_100a)

According to the EU-28 map (Fig. 6) based on the Eurostat database (data from the year 2014), it can be said that the final energy consumption of households is significantly distributed among Member States. In thousands tonnes of oil, among the Member States, Montenegro, Cyprus, Macedonia and Luxembourg have the least final household energy consumption; while France, Italy, Germany, Spain, Poland, the United Kingdom and the Netherlands have the highest values. Hungary, together with several neighbouring countries - Austria, Romania and the Czech Republic - is also a high valued consumer of end-consumer energy, and in Hungary the exact value is 4433.5 thousand tons of oil.

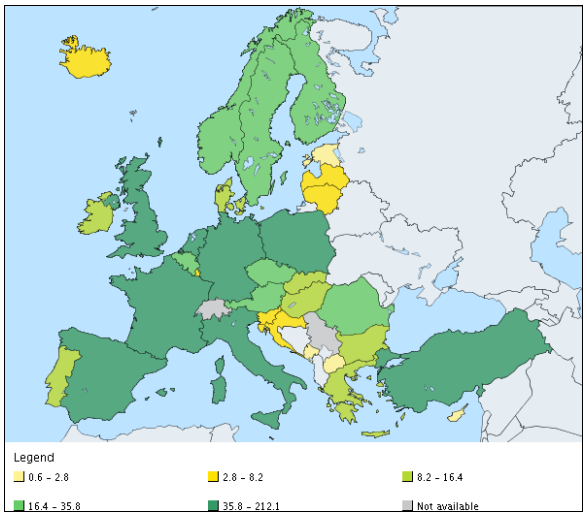

Fig.6: EU-28 final energy consumption in the household sector in 2014 (Million tonnes of oil equivalent, TOE)

Source: Eurostat (2016)

The Hungarian household energy consumption calculated on the basis of Eurostat data which was 23.2 GJ/capita in 2014. Household energy consumption in Hungary is higher than the EU-28 average (21.7 GJ/capita). In any case, it can be concluded that the per capita consumption of energy in households has been increasing in most EU countries by 2015. The second step of the analysis was to try to squeeze our sample from the effects of climate. There is no negligible linear correlation between the number of heating days and the per capita energy consumption of households ($p < 0.01$, $R^2 = 0.486$): a longer heating period of one day means an average cost of 0.11 gigajoules per person per household. Figure 7 shows that in the case of Mediterranean countries, the lower number of heating days is associated with lower household power consumption.

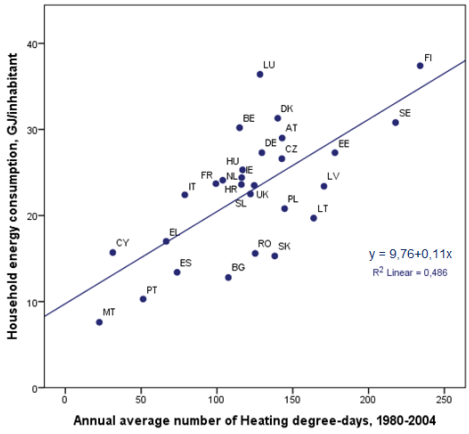

Fig. 7. Relationship between annual average number of heating degree-days and household energy consumption per capita (2015) in the case of the EU-28 countries

Source: own calculations based on data from Eurostat (2017)

Despite the fact that household energy per capita is the highest in the more affluent European countries,

energy efficiency is still considered to be the most financial necessity. The main part of households' expenditures consists of energy bills and home maintenance. It is important to increase the energy efficiency of heating and cooling and to adapt the settlement structure and constructions to changing weather conditions, as well as the efficient, conscientious use of electricity. Based on the results of the EU-SILC survey, in average, about every tenth household in the EU cannot maintain the right temperature in its home (Fig. 8), increasing household energy efficiency can become an important element of social exclusion.

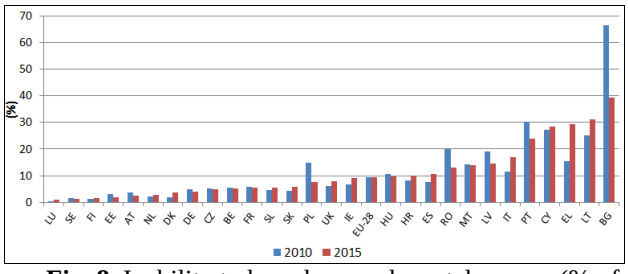

Fig. 8. Inability to keep home adequately warm (% of total population) in the EU-28, in 2010, 2015
Note: Data is ranked on the 2015 year
Source: Eurostat, EU-SILC survey (online data code: ilc_mdes01)

The map based on the Eurostat 2014 database clearly shows (Fig. 9) the extent to which EU-28 Member States depend on petroleum, natural gas and solid fuels. The values are expressed in percentage. Among the Member States, Turkey, Belgium, Italy, Luxembourg, Ireland, Cyprus, Malta and Lithuania depend mainly on the import of these energy sources, least of all Iceland, Denmark, Estonia and Romania. Norway is the only Member State that does not depend to some extent on the import of crude oil, natural gas and solid fuels. Hungary's dependence on energy carriers is very high at 61.1%. (EUROSTAT 2016)

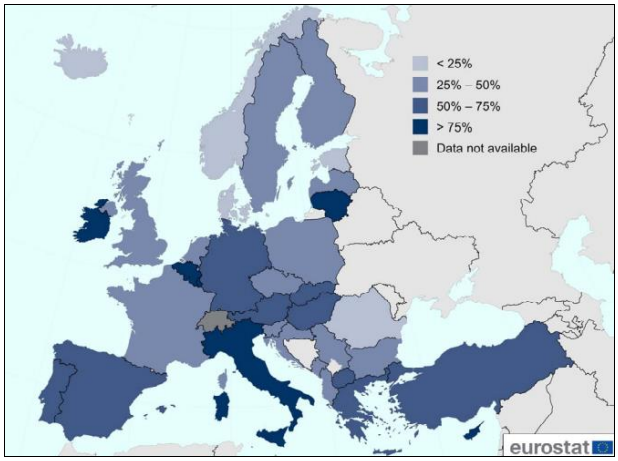

Fig. 9: Energy dependence in the EU-28 area in 2014 (%)
Source: Eurostat (2016)

By comparing the final energy consumption of the EU-28 Member States in the residential sector and the dependence on energy imports by the same Member States in 2014, it can be stated that, in most cases, those Member States are most dependent on imported petroleum, natural gas and solid fuels, such as Italy, Turkey, Belgium, Ireland or our country.

"Instead of conclusion" – Situation in Hungary

One of the most important goals for the European Union to reach 2020 is to achieve an energy-efficient Europe. Today, increasing energy efficiency can prove decisive in increasing security of energy supply, thereby contributing to reducing Europe's dependence on imports, thus making the European Union's economy more sustainable and competitive. Making investments in energy efficiency can result in lower energy bills in the public and private sectors, as well as in the private sector and can also contribute to the reduction of pollutant emissions. Currently, according to Hungarian experience, many subsidies aimed at increasing energy efficiency go to the local governmental sector as well as to the residential sector, while the latter could achieve the greatest savings potential. The private sector is not able to finance these investments by itself, so it is important to support the energy efficiency improvements in the households by the state more and more predictably. In the public sector, there is a need for bidding opportunities similar to local government support systems. At the same time, it can be said, once they have started in a good direction, municipal energy efficiency investments can serve as a good example for the residential sector investments, thereby further increasing the ability to meet our EU commitments by 2020. It should be an obligatory for local governments/municipalities to communicate very effectively their results in saving energy and energy costs due to their renovations to local citizens. In Hungary, in the case of building energy modernization, the most significant investments with the highest saving potential are the most typical ones, which cover mainly thermal insulation of buildings, exchange of doors and windows and modernization of their heating. Developments mainly involved educational institutions, public office buildings and municipal offices and buildings. It can be stated that the follow-up of investments in energy efficiency is inadequate, so in many cases it is not possible to know exactly what energy and cost savings have been achieved for each investment.

It can be stated that domestic legislation does not always emphasize the same thing as in European Union directives, so it may be that current building energy requirements are not too stringent. Nevertheless, new properties are already built up with fairly good parameters and in most cases they can keep up to the cost-optimum level of the EU and domestic regulations. Among our national energy efficiency programs, the Building Energy Strategy has proved to be a well-used, professionally-grounded material. With regard to building energy improvements, complex investment is certainly advisable, as it can achieve the highest energy saving potential. This can result in a savings potential of around 50% to 60% with thermal insulation, door opening and heating upgrading. Renovations in buildings are largely dependent on the technical condition of the buildings, as they can reach a level they are no longer touching, but will be more economical in their complete rebuilding.

It is difficult to obtain savings from energy efficiency investments; this may be because their follow-up is very bad. It cannot be accurately stated that the amount of energy and thus energy cost saved as a result of the refurbishments, although in most cases the cost of energy expenditure itself was the most motivated development. However, it can be said, in the case of complex building energy investments, their payback time can be measured decades, which depends most on the level of the self-financing. Therefore, the role of the state is important not only for public institutions but also for the public.

References

Bándi Gyula (2011): *Környezetjog (Environmental Law)*, Osiris Kiadó, Budapest, Hungary

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Implementing the Energy Efficiency Directive – Commission Guidance /* COM/2013/0762 final */ http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52013DC0762&from=HU (11.03.2016.)

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE, THE COMMITTEE OF THE REGIONS AND THE EUROPEAN INVESTMENT BANK A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy COM(2015) 80 final http://www.europarl.europa.eu/meetdocs/2014_2019/documents/com/com_com(2015)0080_/com_com(2015)0080_hu.pdf (09.09.2017.)

Energy performance of buildings (2015) http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=LEGISSUM:en0021&from=HU (11.03.2016.)

Europe 2020 – An European strategy for smart, sustainable and inclusive growth (2010). Communication from the European Commission, COM (2010) 2020, Brussels. pp. 37.

Eurostat - Electricity consumption by industry, transport activities and households/services. http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=ten00094&plugin=1 (04.04.2017.)

Eurostat: Energy dependence http://ec.europa.eu/eurostat/tgm/mapToolClosed.dotab=map&init=1&plugin=1&language=en&pcode=tsdcc310&toolbox=types (04.04.2016.)

Eurostat (2016). Energy dependency in the EU. Newsrelease. Online: http://ec.europa.eu/eurostat/documents/2995521/7150363/8-04022016-AP-EN.pdf/c92466d9-903e-417c-ad76-4c35678113fd (23.09.2017)

International Energy Agency (2016): *Energy Efficiency Indicators Highlights*, Paris, France pp. 154

Mellár B. (2015): *Energiahatékonyság*. http://www.europarl.europa.eu/atyourservice/hu/displayFtu.html?ftuId=FTU_5.7.3.html (30.03.2016.)

Naár, A.T., Vinogradov, Sz., Tóth-Naár, Zs. (2013). Comprehensive assessment of domestic geothermal energy and heat pump utilization. In: Magó L., Kurják Z., Szabó I. (szerk.): *Synergy 2013. 3rd International Conference „Engineering, Agriculture, Waste Management and Green Industry Innovation”*. SZIE, Gödöllő

Nemzeti Éghajlatváltozási Stratégia (National Climate Change Strategy) 2008 – 2025, p. 16, Table 1.2.

Soltész I. & Szakács Gy. (2011): *Az épületek energiahatékonysága Uniós és hazai szabályozás (Energy Efficiency of Buildings - Eropean Union and Domestic Regulation)* Complex Kiadó Jogi és Üzleti Tartalomszolgáltató Kft., Budapest, Hungary 11-23 p., 31-35 p., 53-122 p., 124-146 p.

The Green New Deal Group, first report (2008), published by New Economics Foundation, London. P. 45. http://www.neweconomics.org/projects/green-new-deal (30.09.2010.)

Richard York: Ökológiai paradoxonok (ecological paradoxes) - William Stanley Jevons és a papírmentes iroda (William Stanley Jevons and the myth of the paperless office, 2008) In: *KOVÁSZ Internetalapú Folyóirat (KOVÁSZ internet-based journal)* – 2008. TAVASZ-NYÁR P. 5–15. http://kovasz.uni-corvinus.hu/2008/2008-1-2.php

World Energy Council (2016): *World Energy Trilemma Index, Full report,* United Kingdom, pp. 147

RECEIVED: 10 September 2017 **ACCEPTED: 20 October 2017**

Tibor László Csegődi dr., lawyer, and economist (Regional and Environmental Economic Studies, MSc.), assistant lecturer, Szent István University, Faculty of Economic and Social Sciences, Institute of Economics, Law and Methodology. He completed the course requirements (got absolutorium) of Szent István University, Management and Business Administration PhD School as a full-time PhD-student. His research is framed by rural development, environmental law, climate protection, energy efficiency and renewable energies, local climate friendly and energy conscious partnerships. H-2100 Gödöllő, Páter Károly u. 1, Hungary, Tel.: +36-30-981-6424, +36-28-522-000/1943, e-mail: csegodi.tibor.laszlo@gtk.szie.hu

Tamás Antal Naár is an agricultural economist engineer. He obtained his diploma at Szent István University, Faculty of Economics and Social Sciences in 2007. He obtained a certificate in logistics at Szent István University, Faculty of Mechanical Engineering in 2004. He started his research work during the university years. He works at Gödöllő Agricultural Centre Non-Profit Company. At the moment he is an operational manager. Previously, he was a project manager. He is the writer of academic and research articles. Currently his main research area is The examination of the potentials of alternative energy sources and sustainability. E-mail: naaratamas@gmail.com