Inzinerine Ekonomika-Engineering Economics, **2012, 23(3), 242-249**

GHG Emission Reduction by Behavioral Changes in Lithuanian Households

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crossref http://dx.doi.org/10.5755/j01.ee.23.3.1936

The aim of the paper is to evaluate GHG emission reduction potential because of energy saving in households sector by applying behavioral changes. The main tasks of the paper are: to analyse GHG emissions and energy consumption trends Lithuanian household sector; to assess GHG emission reduction potential in household sector by changing population behavior; to define the main drivers of changes of human behavior towards sustainable consumption and sustainable lifestyles; to develop recommendation for new climate change mitigation policies targeting energy demand in Lithuania. The main research methodology is based on households' surveys and autonomous registration of energy consumption by households. The main results of the paper addresses the comparison of climate change mitigation tools in terms of GHG emission abatement potential and costs. The evaluated GHG emission reduction potential because of energy saving in households sector of Lithuania makes about 5 Mt of CO2 per year at no costs.

Keywords: *climate change mitigation policy, behavioral changes, households, GHG emission reduction, potential.*

Introduction

Energy efficiency improvements and enhanced use of renewable energy sources are the main ways to reduce greenhouse gas (GHG) emissions and as well the main targets of EU climate change mitigation and energy policies. Though household consumer one third of all energy consumed in EU and are responsible for about 30 percent of energy related CO_2 emissions without taking into account GHG emission from private transport the climate change mitigation policies in EU and Lithuania first of all are targeting energy supply sector and industrial energy consumers. After the decommissioning of the last unit at Ignalina Nuclear power plant (Ignalina NPP) in 2009 the GHG emissions are expected to increase by 5 Mt/year because of Lithuanian thermal power plant replacing Ignalina's closed capacities. The plans for construction of new nuclear power plant are also often related to the problem of increase GHG emission in Lithuania because of closure of Ignalina NPP and reduced ability of Lithuania to comply with post-Kyoto international climate change mitigation requirements. Most studies conducted in Lithuania proved that without new nuclear power plant just with implementation of policies and measures Lithuania will not be able to comply with post-Kyoto GHG emission reduction targets. However the potential of GHG emission reduction because of energy saving and sustainable consumption in household has not be fully taken into account (Dietz et al, 2009). In current economic research area the behavioral economics plays very important role (Brekke, Johansson-Stenman, 2008; Maibach et al, 2008; Akerlof, Shiller, 2009).

Energy use efficiency improvement in household can be achieved by behavioral changes (process innovations) or by implementing new technologies and providing new products (product's innovations) (Steg, 2008; Steg, Giford, 2005; Steg et al, 2005; 2006; Schiler et al, 2009). The behavioral changes are driven by implementation of sustainable consumption (Portiga et al, 2004; Godwy, 2007). Product innovations are assumed as renovation of buildings by applying new isolation materials, renovation of heating system; installation of photo elements for water heating; the replacement of old and non-efficient electricity appliances by new one; use of new like electric or hybrid vehicles etc. (Zarnikau, 2003). The product innovations impose some costs but the behavioral changes in households can be achieved at no or even negative costs (Brandon, Lewis, 1999; Reusswig, 2010).

The investigations of population behavior in efficient energy use and promotion of sustainable consumption and sustainable life styles were not conducted previously in Lithuania though the prices of energy carriers were constantly rising with the rise of country dependence on imported fuels. Therefore the urgent need of such type of studies is obvious.

Currently Lithuanian climate change mitigation policy is oriented to policies and measures in energy supply and production sector and is based on neoclassical economic paradigm postulating the critical influence of price signals in making rational decisions in the markets. However recently more and more attention in scientific literature is being paid to behavioral economics dealing with the impact of psychological factors in decision making and substantiating the idea that most decisions in the market are not rational and not driven only by price signals.

The aim of the paper is to evaluate energy saving potential in Lithuanian households by applying behavioral changes and to translate it in GHG emission reductions.

The main tasks of the paper are:

- to analyse GHG emissions and energy consumption trends Lithuanian household sector and to compare with the trends in selected old EU member states ;
- to evaluate energy saving potential in household sector by changing population behavior;
- to evaluate GHG emission reductions from energy saving in households;
- to define the main drivers of changes of human behavior towards sustainable consumption and sustainable lifestyles;
- to compare results of GHG emissions reduction potential in Lithuanian households with results of other studies conducted in EU;
- to develop recommendation for new climate change mitigation policies targeting energy demand in Lithuania.

Energy consumption and GHG emissions in Lithuania

As a result of economic recession which started after restoration of independence of Lithuania in 1991, energy consumption decreased considerably in all branches of economy. In 1991–1994, both primary and final energy consumption decreased approximately by 2.1 times. From 1995 GDP has been increasing until 1999 (during 1999-2000, GDP decreased due to the economic crisis in Russia) and GDP continued increasing from 2001 to 2008. In 2005-2008 GDP increased by 21,7 %, but in 2009 decreased by 14,8 % comparing with 2008. Energy consumption changed accordingly. During 2005-2007 period final energy consumption increased by 11,7 %, but in 2009 decreased by 12,1 % comparing with 2007. Though primary and final energy consumption intensity has decreased approximately 50 % during the period 1996-2009, energy intensity per unit of GDP in Lithuania is 2.5 times higher than the EU average. This reveals vast untapped potential for energy efficiency, especially in heating and transport sectors. Energy consumption trends in Lithuania and few EU members states are presented in Table 1.

Table 1

Final energy consumption in Lithuania, Germany, Nertherlands and German households in 1990 – 2009

	Germany			Lithuania			Netherlands			United Kingdom		
	Total final energy consumption, ktoe	Final energy consumption in households		Total final energy consumption, ktoe	Final energy consumption in households		Total final energy consumption, ktoe	Final energy consumption in households		Total final energy consumption, ktoe	Final energy consumption in households	
		ktoe	%		ktoe	%		ktoe	%		ktoe	%
1990	229957	62717	27.3	9681	1845	19.1	41690	9951	23.9	136239	37368	27.4
1991	228141	64816	28.4	10163	2009	19.8	45151	11061	24.5	141514	40852	28.9
1992	221161	62040	28.1	6376	1631	25.6	44517	10223	23.0	139446	40244	28.9
1993	222311	66117	29.7	4910	1716	34.9	46168	10650	23.1	142009	41710	29.4
1994	218221	63603	29.1	4735	1752	37.0	46136	10531	22.8	142090	40330	28.4
1995	221075	66216	30.0	4597	1642	35.7	47980	10862	22.6	142034	39337	27.7
1996	230542	72281	31.4	4482	1552	34.6	51636	12345	23.9	150020	44132	29.4
1997	226530	71204	31.4	4523	1501	33.2	49106	10730	21.9	147104	41119	28.0
1998	225192	70204	31.2	4474	1453	32.5	49730	10372	20.9	148053	42329	28.6
1999	220833	65953	29.9	4054	1404	34.6	49171	10263	20.9	151046	42326	28.0
2000	219083	65188	29.8	3746	1343	35.9	50483	10299	20.4	152368	43033	28.2
2001	222687	69671	31.3	3875	1373	35.4	51334	10658	20.8	153303	44276	28.9
2002	219230	67137	30.6	4029	1378	34.2	51303	10262	20.0	148802	43230	29.1
2003	230770	63676	27.6	4138	1385	33.5	51998	10522	20.2	150549	43859	29.1
2004	230871	63246	27.4	4307	1379	32.0	52761	10479	19.9	152320	44753	29.4
2005	229594	63656	27.7	4491	1388	30.9	52293	10143	19.4	153258	44151	28.8
2006	233283	64805	27.8	4770	1434	30.1	50940	10062	19.8	151229	43015	28.4
2007	215706	61383	28.5	5010	1356	27.1	49815	9300	18.7	148652	41502	27.9
2008	224176	68160	30.4	4904	1381	28.2	51088	9862	19.3	148218	42497	28.7
2009	213282	65786	30.8	4409	1379	31.3	50406	10190	20.2	137498	40275	29.3

Lithuania's dependence on fossil fuels has caused CO_2 emissions to increase, especially after the closure of the Ignalina NPP. This creates additional difficulties for sustainable development of the energy sector. The National Energy Strategy was adopted by the Lithuanian Parliament in 2007. The main objective of the strategy is to diversify energy sources including nuclear power and to expand input of renewable energy sources. The Strategy foresees construction of the new regional nuclear power plant in cooperation with other Baltic States and Poland which should start operating in 2015 however the recent events related with the preparations for the construction show that construction may be more problematic as thought initially. In 2010 The National Energy Independence Strategy was adopted by the Lithuanian Government. In the Strategy it is planned that new regional nuclear power plant will be built in 2020. The National Energy Independence Strategy will enter into force after its approval by the Parliament later in 2010. GHG emissions in Lithuania and few EU members' states are presented in Table 2.

Table 2

GHG emissions in Lithuania, Germany, Netherlands and German households in 1990 – 2009

	Lithuania			Netherlands			United Kingdom			Germany		
	GHG emissions from fuel burning, Gg	GHG emissions in households		GHG emissions from fuel burning, Gg	GHG emissions in households		GHG emissions from fuel burning, Gg	GHG emissions in households		GHG emissions from fuel burning, Gg	GHG emissions in households	
		Gg	%		Gg	%		Gg	%		Gg	%
1990	32,988	2,380	7.2	151,072	19,495	12.9	571,431	77,944	13.6	978,979	129,474	13.2
1991	35,144	2,748	7.8	156,085	21,990	14.1	580,724	86,634	14.9	945,870	131,688	13.9
1992	19,686	1,366	6.9	154,748	19,780	12.8	565,007	84,106	14.9	899,789	123,513	13.7
1993	15,727	1,246	7.9	159,390	20,978	13.2	551,266	88,058	16.0	891,256	134,109	15.0
1994	14,848	1,045	7.0	158,622	19,888	12.5	544,580	83,864	15.4	872,645	128,577	14.7
1995	13,770	803	5.8	162,600	20,962	12.9	535,521	79,663	14.9	871,392	129,183	14.8
1996	14,236	802	5.6	170,225	24,399	14.3	557,158	90,822	16.3	894,006	142,489	15.9
1997	13,757	788	5.7	163,583	20,434	12.5	533,661	83,802	15.7	862,886	138,391	16.0
1998	14,495	623	4.3	165,554	19,439	11.7	537,262	85,766	16.0	856,089	132,038	15.4
1999	12,084	590	4.9	160,063	19,248	12.0	528,380	85,494	16.2	830,359	119,940	14.4
2000	10,486	553	5.3	162,443	19,229	11.8	536,579	85,884	16.0	829,424	117,913	14.2
2001	11,153	563	5.0	168,745	19,984	11.8	550,253	88,172	16.0	851,301	131,253	15.4
2002	11,220	591	5.3	169,142	18,892	11.2	534,200	84,889	15.9	837,562	121,229	14.5
2003	11,189	629	5.6	172,662	19,357	11.2	543,554	85,728	15.8	831,111	121,902	14.7
2004	11,806	617	5.2	173,974	19,087	11.0	543,425	87,201	16.0	819,564	113,071	13.8
2005	12,468	655	5.3	168,771	18,179	10.8	540,986	83,005	15.3	804,353	111,074	13.8
2006	12,611	692	5.5	165,366	17,407	10.5	538,469	80,399	14.9	809,565	113,435	14.0
2007	12,795	662	5.2	164,994	16,020	9.7	529,273	76,821	14.5	787,186	88,267	11.2
2008	12,499	652	5.2	168,635	17,913	10.6	517,687	78,596	15.2	789,560	106,761	13.5
2009	11,336	595	**5.3**	163,560	17,976	**11.0**	470,547	73,885	**15.7**	741,571	102,421	**13.8**

Though Lithuanian energy and climate change mitigation policies are targeting supply side and construction of new very expensive Nuclear power plant is being considered as important option to reduce GHG emission and fossil fuel consumption the energy savings in household sector can provide a huge reduction of GHG emissions at no cost by implementing behavioral changes.

Energy saving GHG emission reduction potential in households

There are several policies and measures which have huge impact on behavioral changes however these policies are not in place in Lithuania. Though Lithuania was a part of EU Framework 7 project Changing Behavior the GHG emission reduction potential was not assessed in Lithuania and experiments aiming to assess impacts of innovative climate change mitigation measures on behavioral changes and related energy savings and GHG emission reductions in Lithuania were not conducted. Therefore the first attempt to assess GHG emission reduction potential in households by changing behavior was conducted by MSc students who tried to save as much as possible energy by changing life style at no costs. The same approach can be applied for large share of Lithuanian population.

The students of MSc Programme at Kaunas faculty of Humanities in Vilnius University in 2009 conducted the first survey (Streimikiene, Ciegis, 2010). The main algorithm applied in energy saving assessment in households:

1. Energy use and GHG emissions were evaluated for baseline scenario during one winter and one summer month in one household;
2. Energy use and GHG emissions were evaluated for energy saving scenario during one winter and one summer month in one household;
3. Total energy use and GHG emissions were evaluated during one year for baseline scenario in one household;
4. Total energy use and GHG emissions were evaluated during one year for energy saving scenario in one household;
5. Total energy use and GHG emissions were evaluated for all Lithuanian households during one year for baseline energy scenario;
6. Total energy use and GHG emissions were evaluated for all Lithuanian households during one year according energy saving scenario;
7. Energy saving and GHG emission reduction potential was evaluated by subtracting from total energy use and GHG emissions according baseline scenario energy use and GHG emission data according energy saving scenario.

During energy saving scenario households (10 students families participated in experiment) were trying to change life style and to save as much as possible energy.

The behavioral changes related to energy saving includes:

- using public transport or bicycle, walking instead of driving private car;
- reducing waste by sorting and selecting appropriate packing and buying intelligently based on the origin of the product;
- switching the light when leaving the room;

- switching computer or TV set from stand-by regime;
- turning off tap while brushing the teeth;
- use of shower instead of bath and reduce time spent under the shower;
- unplugging the mobile charger when the phone is charged;
- boiling less water when cooking;
- cover pots while cooking;
- using refrigerators according instruction;
- These simple changes of life style are presented on http://ec.europa.eu/environment/climat/campaign/index.htm".

The results of energy savings survey conducted in 10 households are presented in Table 3. The energy saving potential was translated in GHG emission reduction potential by applying national emission factors (Table 4). The emission factor for electricity was assessed based on data in Table 4 and the electricity generation structure in Lithuania in 2010 and was equal to 0.5 tCO2 eq/kWh.

Total energy saving potential in Lithuanian household's makes 7,2 GJ/year per household. In warm season enery saving potential is 3,9 GJ/year and in cold season 3.2 GJ/year per household.

Table 3

Energy saving potential in 10 households, GJ

No.	The number of inhabitants in household	Fuel savings, GJ/month		Natural gas savings, GJ/month		Electricity savings; GJ/month		Energy saving potential, GJ/year		
		winter	summer	winter	summer	winter	summer	During cold season	During warm season	Total
1	1	14.5	23.3	0.07	0.07	0.11	0.07	88	140	228
2	1	8.9	8.8	0.03	0.03	0.07	0.02	54	54	108
3	1	1.3	2.64	0.03	0.03	0.18	0.11	10	16	26
4	2	5.27	4.84	-	-	0.14	0.11	32	28	66
5	2	2.64	3.5	0.03	0.03	0.072	0.11	16	22	38
6	2	1.32	1.32	0.03	0.03	0.09	0.04	8	8	16
7	3	7.47	8.8	-	-	0.11	0.07	46	54	100
8	3	2.99	2.2	0.03	0.03	0.11	0.11	18	14	32
9	4	2.2	0.88	0.03	0.03	0.04	0.07	14	6	20
10	5	5.71	8.7	0.07	0.03	0.11	0.07	36	52	88
	Total	**51.86**	**64.61**	**0.32**	**0.28**	**1.032**	**0.78**	**322**	**394**	**716**

Table 4

National emission fators

Energy carrier	tne	GJ/t
Natural gas, 1000 m3	0.8	33.49
Heavy fuel oil, t	0.955	39.98
Heating oil, t	1.008	42.19
Liquid oil gas, t	1.11	46.46
Gasoline t	1.05	43.95
Dyzeline, t	1.02	43.20
Aviation benzine, t	1.043	43.66
Coal, t	0,6	25.12
Peat, t	0,28	11.72
Wood, m3	0,196	8.2

In Table 5 GHG emission reduction potential in tCO2 eq per year in 10 households was assessed by applying national emission factors presented in Table 4. The avoided GHG emissions were evaluated for saved energy during warm and cold season and total avoided GHG emissions per year were assessed for 10 households having different structure and consumptions patters. The households were selected according the average demographic profile of Lithuania therefore have good representation of all Lithuanian households.

As one can see from information provided in Table 5 the average total GHG emission reduction potential in one household in Lithuania makes 0,86 MtCO2 eq/year. There were 1.425 mill. Households in Lithuania in 2010 therefore GHG emission reduction potential in warm period makes about 1.2 Mt of CO2 eq/year.

The highest GHG emission reduction potential is in fuel savings and makes about 0.8 tCO2 eq/year. Electricity savings allows to reduce GHG emissions by 0.03 tCO2 eq/year. GHG emission reduction potential because of natural gas savings makes about 3 kg/year per household.

In National energy efficiency programme adopted in 2007 (Ministry of Economy of Republic of Lithuania, 2007), total annual GHG emission reduction potential evaluated in household sector, including product innovations, makes 1.312 Mt CO_2 eq.

Table 5

GHG emission reduction potential in 10 households

No.	The number of inhabitants in household	Avoded GHG emisisons because of fuel savings, kg		Avoided GHG emisisons because of natural gas savings, kg		Avoided GHG emisison because of electricity savings, kg		GHG emisison reduction potential, t/year		
		During cold season	During warm season	During cold season	During warm season	During cold season	During warm season	During cold season	During warm season	Total
1	1	1022	1643	3,8	3,8	15	10	1,041	1,657	2,698
2	1	627	620	1,7	1,7	10	2,5	0,639	0,623	1,263
3	1	92	186	1,7	1,7	25	15	0,119	0,203	0,322
4	2	372	341	-	-	20	15	0,392	0,356	0,748
5	2	186	247	1,7	1,7	10	15	0,198	0,264	0,462
6	2	93	93	1,7	1,7	12,5	5	0,107	0,100	0,207
7	3	527	620	-	-	15	10	0,542	0,630	1,172
8	3	211	155	1,7	1,7	15	15	0,227	0,172	0,399
9	4	155	62	1,7	1,7	5	10	0,162	0,74	0,236
10	5	403	613	3,8	1,7	15	10	0,423	0,625	1,047
	Total	**3688**	**4580**	**18**	**16**	**143**	**108**	**3,849**	**4,705**	**8,554**

Measures having impact on behavioral changes

The main measures having impact on behavioral changes are: provision of tailored information; the provision of feedback; setting target for energy savings; communication campaigns through mass media, eco-labeling programmes; marketing interventions and social advertisement, more informative energy bills.

The provision of tailored information -based on energy audits in home-can provide for significant energy savings in households, for example personal information in an energy conservation context is the home energy audit. Such energy audit is implemented by a home visit by an energy expert. Energy expert conducts energy audit and provides an personal advice for reducing energy in specific ways, often focused on energy for lightening, space heating etc. Feedback is the other form of personalized information. When the feedback is frequent it is possible to reduce significantly households energy consumption. The advantage of feedback is the opportunity for households to see the relationship between his or her behavior and the related energy consumption changes. Encouraging people to set an energy reduction goal-especially if they are given feedback about their progress toward the goal can also have impact on energy savings in household.

The information dissemination through the communication campaigns promoting household energy savings have huge impacts on energy savings in households. The more successful campaigns has such best design practices: simple and clear information which is being repeated often by a variety of trusted sources (researchers, community leaders, journalists).

The application of mass media (TV) to model ways to reduce household electricity use can achieve about 10% reduction in household electricity use

Eco-labeling programs Have also impact on energy savings through behavioral changes. People having pro-environmental attitudes are mostly influenced. The effectiveness of eco-labeling programs is increasing during long periods as consumers are developing trust in the labeling system.

Marketing interventions have also impact on population behavior changes. Especially efficient are social advertisement measures in mass media.

Such measures as more informative and more frequent energy bill can reduce energy consumption in households by almost 10 % (Abrahamse, 2003; Abrahamse et al, 2005, 2007; Benders et al, 2006; Mccalley, Midden 2002; Midden et al, 1983; Mcmakin et al, 2002; McKenzie-Mohr, 2000a, 2000b; Poortiga et al, 2004).

EU 7th Framework project Changing Behaviour provided recommendations for policy makers in energy and climate change mitigation sphere:

- Ensure continuity in policy and energy demand management programmes to make change durable and to support long-term changes;
- Support the work of energy intermediaries to change energy use patterns;
- Develop a better understanding of different national policy and institutional contexts and how they constrain and enable intermediaries to contribute to policy.
- European level policymakers in particular should actively encourage comparative understanding of national policy and institutional contexts.
- Create new or adapt existing institutions and policy instruments to meet current challenges: certification schemes, metering and consumption feedback devices, new service providers and non-physical institutions like norms and values.
- Make use of research findings and practical experiences to learn about the most suitable institution or instrument for the targeted behavior change.
- Energy efficiency priorities should be framed and funded through long-term programmes, on national, local and sector level and should link different policy domains, e.g. health, education and social welfare.
- Complement energy efficiency investment projects with behavioral change activities.

Policymakers benefit from research that demonstrates alternative ways to organize action on energy efficiency. Research funding should be devoted to projects that address

real-life and topical problems, but also reflect on lessons learned and thus contribute to more theoretical insights.

Comparison of results with other studies in Lithuania

The conducted survey indicated that by implementing behavioral changes it is possible to reduce GHG emisisons in Lithuanian households by1.2 Mt of CO2eq/year.

In Table 6 climate change mitigation policies and measures are presented (Ministry of Environment of Republic of Lithuania, 2009).

Table 6

Energy saving and GHG emission reduction potential and costs in Lithuania in 2010

GHG emission reduction policies and measures	Energy saving		GHG emission reduction	
	Energy saving potential, TWh	Energy saving costs, Lt/kWh	GHG emission reduction potential, Mt CO_2eq/year	GHG emission reduction costs Lt/ t CO_2eq/year
Energy saving in households by applying product innovations	10.9	0.277	2,8	2590
Energy saving in households by applying behavioural innovations	7.9	-	1.2	-
Energy saving in supply sector;	9.2	0.120	1.9	2-170
GHG emission reduction in agriculture	-	-	0.1	1125
GHG emission reduction in waste sector	-	-	0.1	1370
GHG emission reduction in industrial processes	-	-	2.4	315-560
Total	-		**8.5**	

Therefore GHG emission reduction potential by behavioral changes in Lithuanian households makes 1.2 Mt or 14 % of total GHG emisison reduction potential in Lithuania and is significantly higer than in other sectors, for example agriculture, waste sector. In addition GHG emssion reduction potential in households by implementing behavioral changes can be achieved at no costs.

Comparing GHG emission reduction potential in Lithuania and other countries one can notice that climate change mitigation policies used for Lithuanian households are not sufficient for exploiting all GHG mitigation potential. Comparing results obtained in Lithuania with results of similar surveys conducted in Netherlands, UK it is obvious that GHG emission reduction potential in Lithuania (14%) is similar to Netherlands (27 %) (Nonhebel, Moll, 2001) and United Kingdom (17 %) (Fisher, Irvine, 2010).

Policies targeting behavioral changes in household needs to be implemented in Lithuania seeking to achieve international GHG emission reductions at no costs. Such measures as information campaigns on energy savings using mass media and social advertisement can allow to implement behavioral changes in Lithuanian households.

It is important to establish appropriate institutions in Lithuania able to provide information on energy savings in households and conducting home energy audits on request of household. Such institutions would be responsible also for the provision of tailored information and feedback setting of energy saving targets; provision of more frequent and more informative energy bills for households etc.

Conclusions

1. Total energy saving potential in Lithuanian households makes 7,2 GJ/year per household. In warm season enery saving potential is 3,9 GJ/year and in cold season 3.2 GJ/year per household. The total energy saving potential in Lithuanian makes about 7.9 TWh/year;

2. The avoided GHG emissions were evaluated for saved energy during warm and cold season and total avoided GHG emissions per year were assessed for 10 households having different structure and consumptions patters. The households were selected according the average demographic profile of Lithuania therefore have good representation of all Lithuanian households;

3. The average total GHG emission reduction potential in one household in Lithuania makes 0,86 MtCO2 eq/year. There were 1.425 mill. households in Lithuania in 2010 therefore GHG emission reduction potential in warm period makes about 1.2 Mt of CO2 eq/year.

4. The highest GHG emission reduction potential is in fuel savings and makes about 0.8 tCO2 eq/year. Electricity savings allows to reduce GHG emissions by 0.03 tCO2 eq/year. GHG emission reduction potential because of natural gas savings makes about 3 kg/year per household.

5. Therefore GHG emission reduction potential by behavioral changes in Lithuanian households makes 1.2 Mt or 14 % of total GHG emisison reduction potential in Lithuania and is significantly higer than in agriculture and waste sector. In addition GHG emssion reduction potential in households by implementing behavioral changes can be achieved at no costs.

6. Comparing results of GHG emiison reduction in households in Lithuania with results of similar surveys conducted in Netherlands, UK it is obvious that GHG emission reduction potential in Lithuania (14 %) is similar to Netherlands (27 %) (Nonhebel, Moll, 2001) and United Kingdom (17 %) (Fisher, Irvine, 2010).

7. Policies aiming at behavioral changes in household needs to be implemented in Lithuania seeking to achieve significant GHG emission reductions at no costs. Appropriate institutions needs to be established in Lithuania able to provide information on energy savings in households and conducting home energy audits on request of household. Such institutions would be responsible also for the provision of tailored information and feedback setting of energy saving targets; provision of more frequent and more informative energy bills for households etc.

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Šiltnamio efektą sukeliančių dujų emisijų mažinimas dėl elgsenos pokyčių Lietuvos namų ūkiuose

Santrauka

Straipsnis analizuoja energijos taupymo ir šiltnamio dujų emisijų mažinimo namų ūkiuose keičiant gyventojų elgseną potencialą ir palygina su kitų šiltnamio efektą sukeliančių dujų emisijų mažinimo priemonių potencialu bei Lietuvos namų ūkių tyrimuose gautus rezultatus palygina su išsivysčiusių ES narių namų ūkių tyrimais.

Klimato kaita yra prioritetinė pasaulio, Europos Sąjungos ir atskirų šalių problema. Klimato kaitos pokyčius jaučia gamta, žmonės, šalių ekonomikos. Norint pasiekti pasaulinį tikslą - stabilizuoti tokio lygio šiltnamio dujų koncentraciją atmosferoje, kuri neturėtų pavojingos antropogeninės sąveikos su klimato sistema - kad globalinio atšilimo sąlygotas temperatūros pokytis neviršytų 2º C lyginant su 1990 m., būtina racionaliau valdyti energijos išteklius, aktyviau naudoti atsinaujinančią energiją, keisti žmonių elgesį ir gyvenimo būdą. Lietuvos klimato kaitos politikos formavimas neatsiejamas nuo tarptautinių, Europos Sąjungos teisinių reikalavimų ir įsipareigojimų. Priklausomybė nuo energijos importo, aukštos kainos ir klimato kaita kelia grėsmę Lietuvos gerovei. Į šiuos visus iššūkius atsakyti galima dviem būdais – mažinant paklausą ir didinant naujų bei atsinaujinančių energijos šaltinių santykinę dalį. Tyrimų duomenimis (Europos parlamentas, 2009), namų ūkiuose slypi didelis energijos taupymo potencialas – galima sutaupyti iki 27% suvartojamos energijos. Efektyvus energijos vartojimas vestų į klimato kaitos įsipareigojimų įgyvendinimą, taipogi galėtų apčiuopiamai mažinti namų ūkių sąskaitas už energiją, tiesiogiai gerinti kasdienį kiekvieno piliečio gyvenimą. Siekiant efektyvaus energijos paklausos valdymo, yra svarbu pakeisti kuo didesnės visuomenės dalies požiūrį bei elgseną. Iš čia ir kyla problema – kaip, siekiant šiltnamio dujų emisijų mažinimo, taikyti priemones, skirtas keisti vartotojų įpročius ir elgseną, susijusią su energijos vartojimu. Energijos galutinio vartojimo efektyvumo didinimui namų ūkiuose, keičiant namų ūkių elgseną, užsienio šalyse skiriama daug dėmesio. Aplinkosauginės elgsenos kūrimo aspektus analizavo T. Jackson (1995), A. Darton ir kt(2005), A. Kollmuss (2002), W. Abrahamse(2007), S. Breukers (2009). Išsamius tyrimus ir vertinimus atliko Jungtinės Karalystės „Aplinkos, maisto ir kaimo reikalų departamentas“ (DEFRA, 2008, 2009), „Sexton marketingo grupė“ (2007). Namų ūkių energijos taupymo galimybių tyrimus, taikant inovatyvias priemones, pateikia G. Brandon(1999), S. Nonhebel (2001). A. H. McMAkin (2002), P. C. Stearn (2009), J. Fisher (2010), T. G. Ken (2008) ir kt. Nepaisant užsienio šalyse išaugusio susidomėjimo namų ūkių taupymo galimybėmis, Lietuvoje nėra atlikta tyrimų, įvertinančių namų ūkų energijos taupymo galimybes, keičiant elgseną. Straipsnio tikslas yra šiltnamio dujų emisijų mažinimo potencialą namų ūkiuose, keičiant gyventojų elgseną Lietuvoje ir gautus rezultatus palyginti su kitų tyrimų rezultatais. Straipsnio uždaviniai: išnagrinėti Lietuvos šiltnamio dujų emisijų ir galutinės energijos suvartojimo namų ūkių sektoriuje tendencijas bei palyginti jas su išsivysčiusių ES narių tendencijomis; ištirti šiltnamio dujų mažinimo galimybes Lietuvos namų ūkiuose, keičiant gyventojų įpročius ir taupant energiją.

Nustatytas namų ūkių taupymo potencialas Lietuvoje keičiant namų ūkių elgseną, bei atlikta energijos suvartojimo, šiltnamio efektą sukeliančių dujų emisijų tendencijų analizė leidžia įvertinti klimato kaitos švelninimo priemonių namų ūkiuose efektyvumą ir palyginti su kitų klimato kaitos švelninimo priemonių efektyvumu bei pateikti pasiūlymus Lietuvoje įgyvendinamos klimato kaitos švelninimo politikos tobulinimui.

Empirinio tyrimo metu nustatytas ŠD emisijų mažinimo potencialas 5,9 Mt/metus, įgyvendinant energijos taupymo priemones, skirtas keisti namų ūkių elgseną, yra ženkliai didesnis už ŠD emisijų taupymo potencialą žemės ūkio, atliekų ir kituose sektoriuose. Jis sudaro daugiau kaip pusė viso Lietuvoje įvertinto šiltnamio efektą sukeliančių dujų emisijų mažinimo potencialo 20,2 mt/metus. Lyginant su taikomomis ŠD emisijų mažinimo priemonėmis energetikos sektoriuje ŠD emisijų mažinimo namų ūkiuose potencialas pranoksta visų numatytų klimato kaitos švelninimo priemonių energijos taupymo ir šiltnamio dujų emisijų mažinimo potencialą, taigi šis sektorius yra pats perspektyviausias, siekiant sumažinti šiltnamio dujų emisijas Lietuvoje bei sėkmingai įgyvendinti Kioto ir po Kioto seksenčius tarptautinius klimato akitos švelninimo įsipareigojimus Lietuvai.

Reiktų pastebėti, kad ŠD emisijų mažinimo potencialas namų ūkiuose keičiant vartotojų elgseną, nieko nekainuoja, kaip taupymas kituose sektoriuose ir kitų priemonių taikymas. Akivaizdu, kad namų ūkiuose Lietuvoje slypi neišnaudotas energijos taupymo potencialas.

Lyginant su kitose šalyse atlikatis šiltnami efektą sukelaančių dujų emisijų mažinimo namų ūkiuose potencialo vertinimas, matyti, kad Lietuvoje gautas energijos taupymo ir šiltnamio efektą sukelaančių dujų emisijų mažinimo potencialas yra didžiausias. Tai visų pirma yra susijęs su skirtingais Lietuvos ir kitų šalių gyventojų įpročiais, požiūriu į aplinkos tarša bei atsakomybe už aplinką bei prieš ateities kartas.

Taigi, Lietuvos namų ūkiuose egzistuoja didžiulis energijos taupymo ir šiltnamio dujų emisijų mažinimo potencialas, kurį galima realizuotui taikant inovatyvius klimato kaitos švelninimo instrumentus. Lietuvoje taikomos klimato kaitos švelninimo priemonės namų ūkiuose nėra pakankamos, siekiant išnaudoti visą šiltnamio dujų mažinimo potencialą Lietuvos namų ūkiuose, todėl skubiai reikia pasiūlyti naujų priemonių, nukreiptų į namų ūkius paketą, o atnaujintą Energijos vartojimo efektyvumo didinimo programą Lietuvoje būtina orientuoti į gyventojų elgsenos pokyčius tiek namuose, tiek darbovietėje, tiek visuomeniniame gyvenime.

Raktažodžiai: *klimato kaitos švelninimo politika, elgsenos pokyčiai, šiltnamio dujų mažinimo potencialas, namų ūkiai.*

The article has been reviewed.

Received in June, 2011; accepted in June, 2012.