Estimation Tool for National Effects of MEPS and Energy Labeling

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Abstract

Within EU-27 the Eco-design and energy labeling framework addresses product energy efficiency through end-use specific labeling and MEPS (minimum efficiency performance standard). The assumed energy saving effects of these measures are assessed at EU level but seldom at National level. A simple, yet flexible tool for estimation of Eco-design and labeling measures at National level has been developed and used for Denmark and Sweden.

The tool uses nation specific historical sales figures and/or stock data, distributions of sales by energy efficiency classes and assumptions about product lifespan and natural sales development. The results are an estimation of the future sales distribution by technologies/energy classes and hence the energy consumption of the future stock of products. A comparison with a baseline/assumed natural development provides simple estimates for effect of the measures.

The tool and results for two specific end uses –TV sets and Lighting – will be presented as well as the detailed estimation principles and assumptions.

For the national energy agencies in Denmark and Sweden, it is very valuable to be able to estimate the national effect of the MEPS and labeling schemes that are being introduced. For example, these estimations can be used in national energy consumption prognoses and national policy evaluations. It can also be used to simulate the national effect of stricter MEPS, more ambitious labeling scales, including best available technology (BAT). These evaluations can be used when formulating the national positions in the European negotiations. In addition, when it comes to market surveillance, it can also be useful to have national sales data for different product groups in order to make the necessary priorities.

Introduction

Households in EU-27 had 2010 an electricity consumption of more than 72 M toe, a figure that has risen almost 5 % since 2005 (Eurostat 2012, 1). Many activities are going on to bring down the consumption, both in the Member States and at EU-level. One of the significant programs is the Eco-design frame directive (ec.europa.eu, 2) and its implementing measures that focus on specific product groups and their energy efficiency. This forces producers to improve their product in order to comply with the regulations, and it affects the consumers by changing the available products to buy.

In addition energy labeling scales is set under the energy labeling directive for many of the same product groups. The Ecodesign requirements MEPS is set at the point of economic efficiency, when the Commission propose the implementing measure for the different product groups. While the labeling gives the consumers information about energy efficiency and thereby gives the consumer the possibility to make an energy efficient choice. This has some costs and energy saving effects, and it is necessary to try to estimate the saving effects, in order to justify the costs. The estimates can also be used to optimize the activities as well as compare different saving measures.

Estimation tool for National energy effects

Background

The product specific regulations under the Ecodesign directive set the MEPS (minimum energy performance standards) for a number of energy related products that are sold at the EU market. The eco-design requirements mean that the product must have a certain energy efficiency and also resource efficiency if they are to be sold in the EU. Energy labeling, however, makes clear to consumers how energy efficient the product is and allows the customer to make active choices. The requirements and energy labeling scales are the result of a democratic process which shows that the EU is working to achieve energy efficiency and climate goals.

Ecodesign provides significant energy savings as the most energy-inefficient products are prohibited while products become cheaper in service for the consumer. Energy labeling requirements allow for even greater savings and product development as aspects information about e.g. energy consumption and consumption of other substances e.g. water noise, performance could be available on the labeling, and consumers can ask for the products in the best energy class on the market.

For every product group that has been regulated so far within ecodesign and/or energy labeling, potential energy savings at an EU level have been calculated. Altogether, the Commission expects that the 13 product groups that have been regulations that so far will save 383 TWh (ec.europa.eu, 4) per year in the EU in 2020. It is assumed that the additional regulations that are planned will increase these savings to altogether 1 116 TWh per year in the EU in 2020. It is about 5 percent of primary energy use of the EU and thus an important instrument to reach the EU target of 20 per cent reduction in energy use.

EU effects vs. National effects

A long the implementing measures for specific product groups, the Commission has provided evidence for the estimated effects on EU level (Impact Assessments, ref.) on energy consumption as well as employment figures. However, single member states could also be interested in estimates for their country specific saving potentials, especially under the negotiation and decision of the regulations for the different product groups.

This implies, in some countries, a mandatory description of the expected effect of the legislation, in which case the expected energy savings effects (among other things) should be clarified. In addition, these estimations can be used in national energy consumption prognoses and national policy evaluations. The tool can also be used to simulate the national effect of stricter MEPS or more ambitions energy labeling scales, including best available technology (BAT). These evaluations can be used when formulating the national positions in the European negotiations. Finally, when it comes to market surveillance, it can also be useful to have national market data for different product groups in order to make the necessary priorities.

Therefore, a tool estimation of the National effects of the Eco-design criteria and energy labeling is valuable in many ways. A simple method for estimation of national effects of ecodesign and labeling could of course be to simply downsize the estimated EU-27 savings by using national contra total EU GDP or a similar comparative measure. However, since energy consumptions and thereby potential savings in the Nordic countries vary in some respects from the European conditions e.g. coursed by the different climate, a national bottom-up calculation method is preferable.

Existing tools like e.g. BUENAS (Michael A. McNeil et al, 2008) could be used for these calculations, but are considered too complex, too econometric based and too time consuming to prepare and run national calculations in. A simpler, more flexible and cheaper approach was thus developed to estimated effects in Denmark and later on in Sweden.

Methodology

Basic method

The estimation method is a standard bottom-up stock model approach, where all vintages of appliance sales are kept track off, using available inputs on sales split by energy efficiency classes and assumptions about the lifespan of the technologies. For the latter, a normal distribution of the lifespan is assumed. Here lifespan means age at time of replacement (or discarding), not the technical lifespan.

LCD-40

Sales

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
0	0	0	0	0	0	18900	54337,5	103950	115762,5	143640	284886	381024	305877,6	351187,2	247747,5	184985

Sales distribution in %

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
G	65,0	60,0	55,0	50,0	45,0	40,0	35,0	30,0	25,0	20,0	17,0	27,3	22,0	28,2	19,2	12,0	
F	35,0	35,0	35,0	35,0	35,0	35,0	32,0	29,0	25,0	22,0	24,0	43,0	39,5	32,7	22,7	21,4	
E	0,0	5,0	10,0	15,0	20,0	25,0	30,0	35,0	40,0	42,0	40,0	17,3	24,2	19,8	26,9	18,3	
D	0,0	0,0	0,0	0,0	0,0	0,0	3,0	6,0	10,0	15,0	17,0	10,8	14,0	18,8	24,2	26,9	
C	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,0	2,0	1,6	0,3	0,5	7,0	20,6	
B	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,7	
A	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	
A+	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	
A++	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	
A+++	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	
S.w.cons	277,0	272,0	267,1	262,1	257,1	252,2	245,6	239,1	232,0	224,2	220,3	237,1	231,1	234,0	216,3	197,1	

Figure 1. Example of sales and energy class distribution input for LCD TV's up till 40" in Sweden.

The product group is split into several subgroups, reflecting the variation in consumer preferences. E.g. for TV, some 5 subgroups are defined, to not only cover energy efficiency variations, but also differences in technology (LCD, backlight LED, Plasma) and sizes (14" up to 55").

Next step in the model is to calculate a projection of the sales and stock. This is for the base case scenario done as a simple forecast of the total sales (e.g. linear trends combined with expert knowledge from the relevant retailer organizations etc.) along with an assumed natural development in the sales distribution. This is calculated as an X percent shift towards more efficient appliances every year, where X is normally high (~25) in the beginning of a labeling campaign, and lower later on. 5 % p.a. is use in the examples below.

With these inputs the stock per energy class, at a given year, can be calculated as a sum of all sales up till then that have survived according to the lifespan distribution.

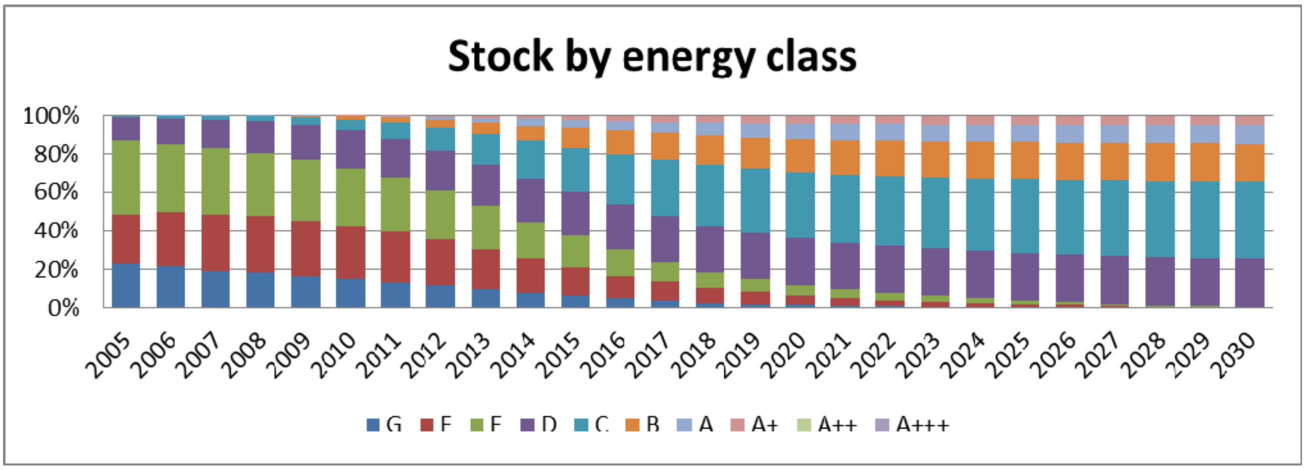

Figure 2. Example of calculated stock split by energy class.

The calculations can also give an easy picture of the technology mix for the stock:

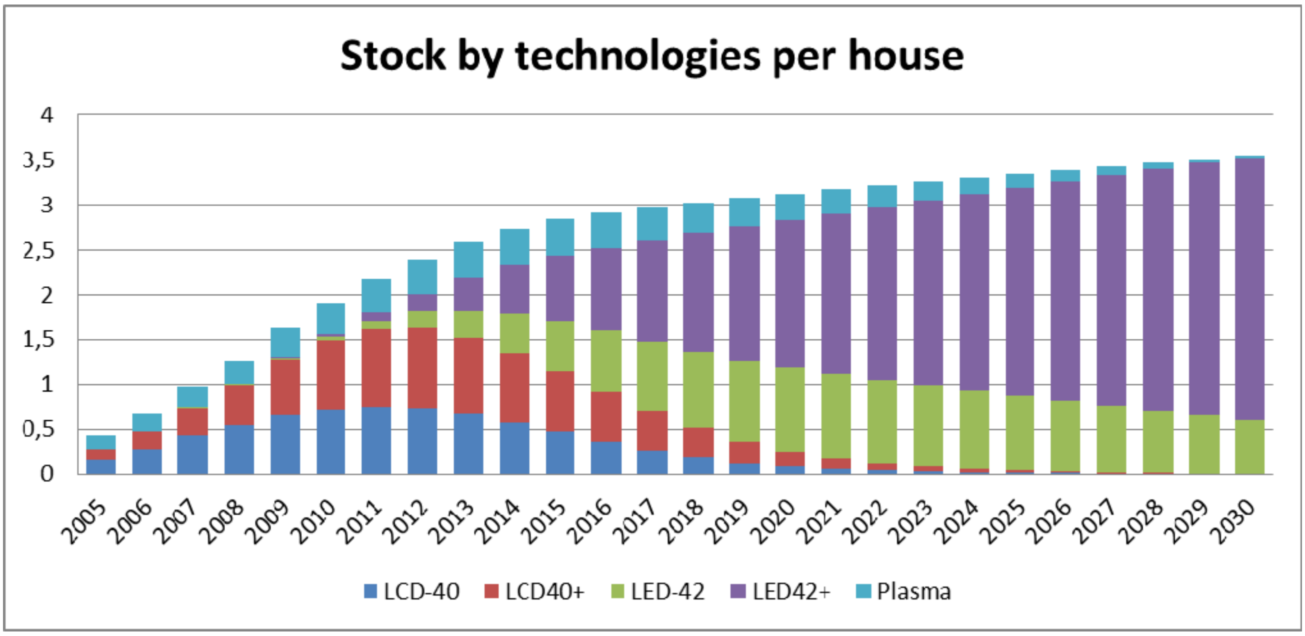

Figure 3. Example of the stock split by technology, flat screen TV sets in Sweden.

To calculate the consumption of the stock, an assumption about the average size for each subgroup is needed, which combined with the energy consumption per dm^2 screen area given by the EEI class gives the total energy consumption. These inputs come from questionnaire data (ELMODEL-bolig in Denmark, and GfK for Sweden).

14	LCD-40		Avg	Std dev.				
15		Longevity	7	2	Years	ON	1750	Hours/yea
16						Standby	2071	Hours/yea
17		Formula	E=Ton*(20+1,12*4,3224*Size)+Pstdb*Tstdb					
18		EEI reference		LCD-40	29	Std power		Watt
19				Size	23	Standby	1	Watt
20				Std cons.	233,5	kWh/year		
21					132,2378			
22		Eco-design criteria - defaults						
23			kWh	EEI				
24		2011	233,5	1	New 2012 crit.:			
25		2012	170,4	0,729665	170,4			
26		2014	170,4	0,729665				
27		2028	170,4					
28		2050						
29								

Figure 4. Example of inputs for each subgroup.

In the shown example, the LCD-40 group has an average size of 29", resulting in an reference consumption of 233,5 kWh/year. Note that national levels for ON and standby hours are also used, instead of the EU figures. Finally, the average lifespan is set to 7 years in average, with a standard deviation of 2 years.

To estimate the effects of MEPS, a scenario parallel to the base case is done, limitting the sales to the allowed efficiency classes according to the legislation stages successively coming into force (in the example only one level of MEPS is specified). If sales in the base case is disallowed in the eco-design case, the sales automatically moves one energy class up. This is repeated until all sales are set at some energy class. The estimated savings coursed by the eco-design regulation are then the diffences between the two scenarios. Note that the natural development of sales distribution is still active in the eco-design scenario, avoiding the eco-design scheme from taking all credit for efficiency improvements in the sales.

19	SIMULATION OF ECO-DESIGN EFFECTS					
20	LCD-40					
21						
22		Year	kWh/year			
23		2011	233,5		Start / Energy class G	
24		2012	170,4		Change of criterion	
25		2014	170,4		Change of criterion	
26		2028	170,4		Change of criterion	
27		2050			End	Get
28						
29						
30		Results		Energy consumption for stock (since 1995)		
31			2015	2020	2030	
32		National Cons.	230,5	31,8	0,1	GWh/year
33		National savings	15,9	10,7	0,1	GWh/year
34		EU, savings	0,5	0,3	0,0	TWh/year
35		EU, savings	0,5	0,4	0,0	mia kr/year
36		EU, savings	0,1	0,1	0,0	mio tons CO2/year
37		EU, prim. energy	0,1	0,1	0,0	Mtoe
38						
39						

Calculated sales distribution	2011	2012	2013	2014	2015	2016
G	0	0	0	0	0	0
F	61050	0	0	0	0	0
E	33969	0	0	0	0	0
D	49525	0	0	0	0	0
C	38395	123531	40743	28346	23647	19254
B	2021	1864	779	655	640	598
A	26	44	27	29	35	38
A+	0	0	0	1	1	1
A++	0	0	0	0	0	0
A+++	0	0	0	0	0	0

Figure 5. Example of estimated results of eco-design criterias for LCD 14-40" TV-sets.

Note at the right hand side of figure 5, how the sales distribution changes abruptly, according to the MEPS disallowing energy class D or worse from 2012. This accounts only for the LCD 14-40" group. I.e. other subgroups yield a growing sales in total.

Implementation

The tool is developed in MS Excel. This ensures that almost all stakeholders can access the tool immediately, without installation and maintenance of new software. Furthermore it ensures to a certain extent, that the calculations done are transparent and traceable, enabling the user to easily see what causes which saving effects.

Results

TV sets

Summing up results from all 5 subgroups, the estimated Eco-design effects were found:

Table 1. Total estimated effects in Sweden as a result of Eco-design criteria.

Total results for Ecodesign		Energy consumption for stock (since 1995)		
	2015	2020	2030	
National Cons.	**1827,0**	**1649,0**	**2032,8**	GWh/year
National savings	**213,3**	**303,5**	**217,7**	GWh/year
EU, savings	**6,4**	**9,1**	**6,5**	TWh/year
EU, savings	**7,2**	**10,2**	**7,3**	mia kr/year
EU, savings	**1,3**	**1,9**	**1,4**	mio tons CO2/y
EU, prim. energy	**1,4**	**2,0**	**1,4**	Mtoe

The results can be shown for the specific subgroups also:

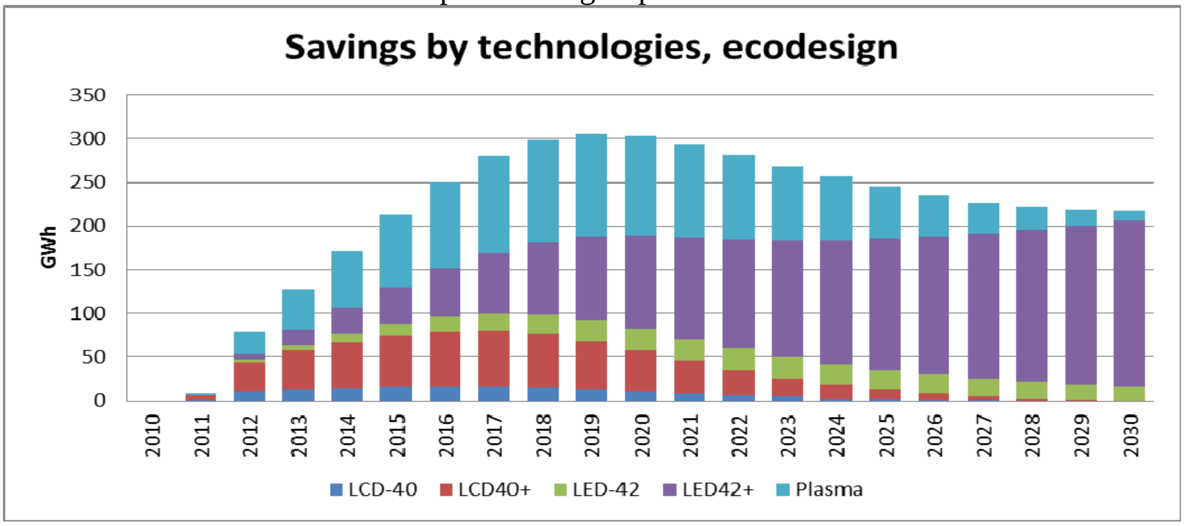

Figure 6. Example of estimated results of eco-design criterias by subgroup.

The tool also provides a means to estimate the effects of labeling. This is done similarly to the simulation of natural development, i.e. setting an assumed percentual change towards more sales in better energy classes. The effects are calculated in parallel to the Eco-design effects, ensuring that any sales already simulated by MEPS will not be simulated affected by labeling also. This ensures no double-counting of measures.

Assuming initial changes of 25 % of the sales moved from one energy class to the next, the combined effects of Eco-design and labeling are found to be:

Table 2. Total estimated effects in Sweden as a result of Eco-design and labeling.

Total results for eco-design and labeling				Energy consump
	2015	2020	2030	
National Cons.	1794,2	1205,8	1209,6	GWh/year
National savings	246,1	746,7	1040,8	GWh/year
EU, savings	7,4	22,4	31,2	TWh/year
EU, savings	8,3	25,0	34,9	mia kr/year
EU, savings	1,5	4,7	6,5	mio tons CO2/ye
EU, prim. energy	1,6	4,8	6,7	Mtoe

Lighting

The results for Lighting are still being worked on, and will be presented at the conference session. The preliminary results points at an effect of MEPS and labeling of light sources of up to 1 TWh per year saved, compared to the established baseline:

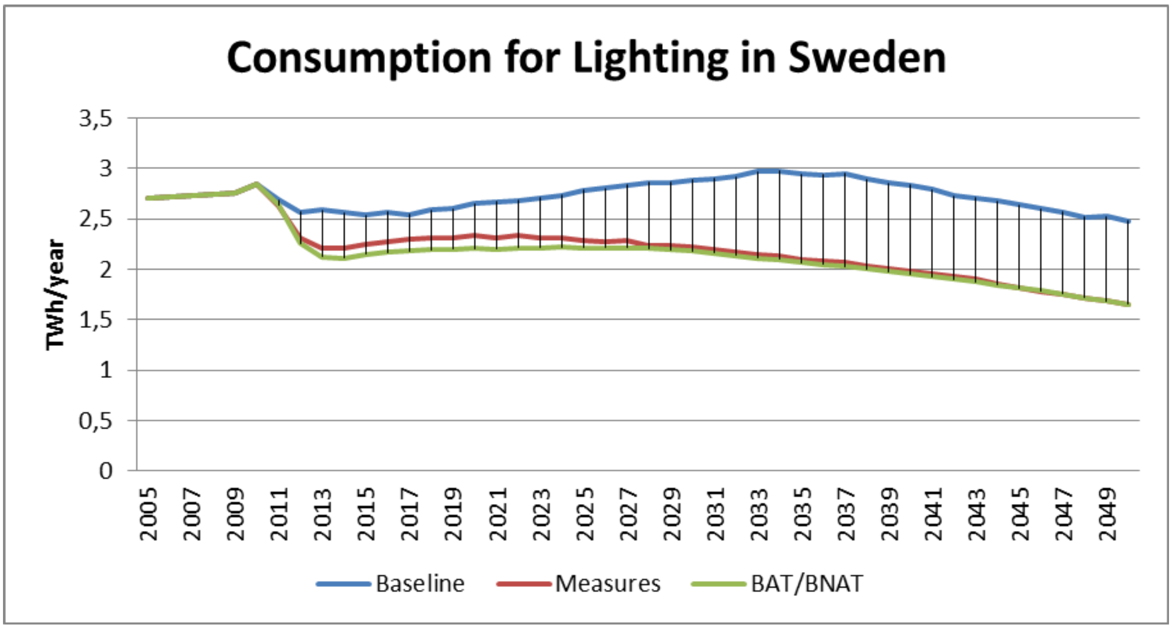

Figure 7. The consumption for Lighting in Sweden projected to 2050.

Comments to the baseline development: The baseline is seen to go quickly towards lower energy consumption after 2010, as a result of the disappearance of GLS as a light source. In a longer perspective, the consumption goes up again as an effect of general growth, and finally the consumption goes down as it is assumed that technology not yet available today takes over. For the Measures (MEPS and Labeling) and BAT/BNAT curves the same development is seen, but on a lower level.

Final remarks: practical Use of the Estimation Tool for National Effects of MEPS and Labeling

For the national energy agencies in Denmark and Sweden, it is very valuable to have reliable facts and figures on the national effects of the MEPS and labeling schemes that are being introduced.

In Sweden, the calculations that have been carried out so far (i.e. for TV-sets) have been very useful and valuable for the Energy Agency. For example, it was used in press releases when the new mandatory energy labeling for TV-sets came into force, which in turn got a lot of attention in the end of 2011. Also other stakeholders have shown great interest in the calculations of savings, e.g. the consumer electronics industry.

References

[1] Eurostat 2012. Table tsdpc310

[2] http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/index_en.htm

[3] Michael A. McNeil et al, ” Global Potential of Energy Efficiency Standards and Labeling Programs”, LBL 2008.

[4] http://ec.europa.eu/energy/efficiency/ecodesign/legislation_en.htm