# [Nordic Countries (Iceland, Finland, Norway, Sweden, and Denmark)] Nordsyn (Market Surveillance of Ecodesign and Energy Labelling) and the Effect Project

## About the measure

| Policy instrument | Sector | Starting date and status |
|---|---|---|
| **Legislative/information (labelling); Legislative/normative (market standards)** | **Household and service sector** | **Nordsyn: 2013-2017<br>Effect project: 2013-2015** |

**Nordsyn** is a market surveillance scheme to ensure an effective enforcement of the Ecodesign Directive (2009/125/EC) and the Energy Labelling Regulation (2017/1369/EU, earlier Energy Labelling Directive 2010/30/EU). These set requirements in terms of minimum energy performance and energy labelling for energy-related products. Their implementation was expected to decrease EU energy use by 10%, achieving 465 TWh of electricity savings in 2020 (Kemna, 2014). But this target can only be achieved if the implementation is truly effective. A review made in 2011–2012 estimated that 10–20 % of products covered by the Directives were non-compliant (European Commission, 2012). This confirmed the need for market surveillance, task under the responsibility of each EU Member State.

Nordsyn aims at improving Nordic market surveillance, by providing a platform to develop Nordic cooperation: sharing market surveillance plans and test results, producing information materials and guidelines, performing joint studies, etc. It is also expected that Nordsyn's results could be useful for other EU Member States.

**The Effect project** was a study conducted in 2013-2014 to evaluate the market surveillance, by using data from Nordsyn for years 2011-2013. The study has used these data to "*estimate the magnitude of potentially lost energy savings due to non-compliant products on the Nordic market (Iceland, Finland, Norway, Sweden and Denmark) and assess the achieved benefits and costs of market surveillance*" (Blomqvist and Fjordbak Larsen, 2015).

Main target groups of Nordsyn are Nordic market surveillance authorities (MSA) and producers of energy-related products. Thanks to Nordsyn, the MSAs in the Nordic region share their test results and discuss relevant questions and plans regarding market surveillance of ecodesign and energy labelling. Nordsyn encourages producers to not only follow the ecodesign and energy labelling demands, but to also be "forerunners in green growth".

Nordsyn is one of the programmes of Nordic Co-operation, an institution under the responsibility of the Nordic Council of Ministers. Nordsyn steering group includes MSAs of each Nordic country, the Swedish Energy Agency being the project manager.

The EPATEE project has received funding from the European Union's Horizon 2020 Research and innovation programme under grant agreement No 746265.

| Expected energy savings | Benchmark |
|---|---|
| Nordsyn does not include directly quantitative objectives in terms of energy savings. Its aim is to ensure that savings expected from the implementation of Ecodesign directive and energy labelling regulation will be achieved.<br>For example, expected energy savings from the implementation of ecodesign requirements for products were estimated for Denmark to 5,640 GWh of final energy per year in 2020 (Danish NEEAP 2017). | The expected energy savings in 2020 from the implementation of the Ecodesign requirements in Denmark corresponded to 5 % of Danish final energy consumption in 2011 excluding transport. |

**Means and outputs**

The analysis done in the Effect project estimated that 2,500 appliances have been tested in the Nordic region between 2009 and 2013.

The effect project reports average costs of 5.440 EUR per appliance or the tested model in Nordic countries. An average cost per appliance tested in the laboratory was estimated using available data in Denmark and Sweden. These costs include administration, purchasing the products and performing the tests. Each test from purchase to lab testing lasted on average three years, so yearly cost per appliance is app. 2000 EUR (Blomqvist and Fjordbak Larsen, 2015).

The budget for all the appliances tested between 2011 and 2013 (3 years) was estimated to be around 2.1 million Euro for all Nordic countries (Fjordbak Larsen, 2015). The cost would be higher if the synergy between countries and their common surveillance was not utilized. This is one of the main assumptions of the Effect project: the countries need to act together to use the best of the market data and to yield the largest savings through greater compliance.

It should be noted that the estimations of cost for the tests included some extrapolations. For example, for the administration costs of the surveillance programs, data from Denmark and Sweden were used and adjusted for test volume by a weighted average. Moreover, the data mentioned by Fjordbak Larsen (2015) do not include all the costs of implementing market surveillance. Other costs include for example costs of documentation/reporting, as mentioned by Fjordbak Larsen (2015). But these costs could not be estimated in the Effect study.

More generally, each Member State reports to the European Commission about its national market surveillance programme, see:
http://ec.europa.eu/growth/single-market/goods/building-blocks/market-surveillance/organisation_en

But these reports are not restricted to ecodesign and energy labelling: they cover all types of markets. See for example the report for Finland in 2017:
https://ec.europa.eu/docsroom/documents/20921/attachments/1/translations/en/renditions/pdf
These reports show for example that other costs can include providing guidance to consumers and other stakeholders (which is indeed the type of activities developed within Nordsyn).

## Data about energy savings

| Unit | Main source of data |
|---|---|
| Annual or lifetime-cumulated "lost" energy savings (in GWh/year or GWh) due to non-compliant products sold in a given year | Study of the Effect project (complete report: Fjordbak Larsen, 2015; summary paper: Blomqvist and Fjordbak Larsen, 2015). |

The approach of the Effect project was to evaluate the energy impacts of market surveillance by estimating the over-consumption of non-compliant products. This over-consumption is presented as "lost" energy savings that could be achieved if non-compliant products were removed from the market. It was thus estimated that over-consumption of about 18 GWh/year (or 168 GWh over products' lifetime) could be avoided in Nordic countries for sales of a typical year (average annualized results from data over 2011-2013).

The typical over-consumption per product was estimated to 35 kWh/year for the dominant non-compliant appliances. The study highlighted the wide spread observed in terms of over-consumption per product: from 1.6 to 700 kWh/year. The extrapolated results mentioned above should therefore be taken with caution (see more details below in *Sources of uncertainties about energy savings*).

It should also be noted that 13 out of the estimated 18 GWh/year come from a single product category (combined fridge-freezers).

The table in Annex 1 shows summarized results of the Effect study per non-compliant product of each product group, including:

- the non-compliance rate,
- the non-compliance per sample in energy,
- the calculated annual effects in lost energy,
- the calculated energy effects in lifetime and the calculated economic costs of the non-compliance.

### Sources of uncertainties about energy savings

- Authors of the Effect study highlighted that the approach to evaluate the impacts ("lost" energy savings) of non-compliant products only capture the "visible" part of market surveillance impacts. An ideal approach would be to compare two regions/countries, one with and one without market surveillance. However, all EU Member States are required to implement market surveillance.
- When considering the market surveillance practices, the Effect study had to assume that the same product is not tested multiple times by different countries, that the markets are similar in all Nordic countries, and that all countries would act on all test results (i.e. remove "instantly" the products detected as non-compliant in any of the Nordic countries from their national market).
- A major source of uncertainties is due to the extrapolation from results for Denmark to the other Nordic countries, proportionally to the GDP of each country. This means an implicit assumption that the sales of products would be proportional to the GDP, with similar types of products in all Nordic countries.
- Due to choices made to define the baseline (see *Evaluation of the energy savings*) and the different sampling methods (see *Focus on sampling issues*), several assumptions were needed. The evaluators chose to make conservative assumptions, which leads to underestimate the "lost" energy savings. This choice was made because it was not possible to assess the uncertainties, therefore using conservative assumptions was a way to provide results as reliable as possible.

Also, they mention that more precise data on the lifespan, cost of market surveillance, sales, and electricity prices could improve the accuracy of the calculation.

- Monitoring only the non-compliance to standards shows only a limited part of the lost energy savings potential, since there are more ways a product can use more energy that is effective; e.g. the way the product is used, or lack in technical documentation.

## Evaluation of the energy savings

### Calculation method(s) and key methodological choices

- The methodology used in the Effect project is a bottom-up approach combining different types of methods and data, with a final estimate equivalent to **deemed energy savings** (**method 4**):
    - **Metered data** (**method 1**) are available from the laboratory tests done by each national Market Surveillance Authority and gathered by the Nordsyn cooperation.
    - These data are used to estimate average annual over-consumption of non-compliant products per product category (see details about baseline below). It is implicitly assumed that the average over-consumption for all non-compliant products sold is equivalent to the average over-consumption observed for the non-compliant products in the samples tested (**deemed energy savings**, **method 4**).
    - In parallel, a **non-compliance rate** is estimated for each category of products, taking into account the number of non-compliant products in the samples tested, as well as the **sampling method** (for more details see *Focus on sampling issues*).
    - The total number of non-compliant products sold each year is then calculated by multiplying the non-compliance rate by the sales for each category of product.
    - The "lost" energy savings are then calculated by multiplying the number of non-compliant products by the average over-consumption per category of product.
    - This annual result is then converted into lifetime-cumulated result by taking into account **standard lifetime per category of product**.
    - These calculations were **first made for Denmark**, using the model ELMODEL-bolig. The Danish results were then **extrapolated to the other Nordic countries proportionally to their GDP**.
- In case of **non-compliance with ecodesign requirements**, **baseline** energy consumption (used to estimate the over-consumption in case of non-compliance) was based on the **minimum energy performance standards** for each category of product. It was thus assumed that a customer who bought a non-compliant appliance was looking for a cheap product, and would have bought a "just compliant" product (i.e. with an energy performance equivalent to the minimum standards), if the non-compliant product would have been removed from the market. This choice was made so that the savings calculated in this study be conservative estimates (about the choice of conservative assumptions, see also *Focus on sampling issues*).
- In case of **incorrect energy labelling**, baseline energy consumption is based on the **limit of the falsely declared energy class**.
- Assessing non-compliance was the main adjustment focus of the Effect project, a pilot project was carried out to establish first proof of concept regarding an improved calculation method for estimating the effects of non-compliance (see Fjordbak Larsen, 2015).
- Free-rider effects do not apply to Nordsyn, as it is about the implementation of a regulation. Spill-over and rebound effects were not taken into account in the Effect study.

## Ex-post verifications and evaluations

The evaluation approach can be considered at two levels:

- At the European level, under the responsibility of the European Commission, for the evaluation of the overall impacts of the Ecodesign Directive and the energy labelling regulation, as they are European regulations;
- At the national level, under the responsibility of each Member State, for the monitoring and evaluation of the implementation of these regulations, as market surveillance is under the responsibility of each Member State.

Market surveillance activities are a form of ex-post verifications, particularly the laboratory tests that provide part of the key data. It was then complemented by a specific study (the Effect project) to assess the impacts and perform a cost-benefit analysis of these activities.
In this case, evaluation costs can be categorized in two parts:

- costs of collecting primary data through market surveillance (about these costs, see *Means and outputs*);
- costs of processing these data and doing complementary research and analysis (budget of the Effect project).

Results of the Effect study (published in 2015) confirmed the cost-effectiveness of Nordsyn actions, demonstrating with a cost-benefit analysis the impact of implementing market surveillance. The Nordic Council of Ministers thus adopted a budget to continue Nordsyn over 2016-2017. For an analysis of Nordsyn's success factors and lessons learnt, see (EEW, 2016).

## Other indicators monitored and/or evaluated

| Indicator | Explanations |
|---|---|
| Non-compliance rate | Non-compliance rate (only limited to energy and violation of eco-design energy use limit or incorrect energy labelling) was calculated on the pilot case to be 6.3 % by taking into account proportion of random, semi-random and hand-picked samples (for more details about different sampling methods were handled, see *Focus on sampling issues*). |
| Appliance sales volume | Sales of 160 million appliances per year in Nordic countries were either estimated using either the Danish bottom-up model ELMODEL where GDP of each country was taken into account when scaling to other countries, or more precise data, as in the case of the Swedish Energy Agency, was taken into account. |
| Costs of market surveillance | To calculate a cost-benefit of market surveillance, its costs must be estimated. The Effect project estimates the costs of those activities to be around €5,440 per tested model (for more detailed explanation, see *Means and outputs*). |
| Benefits of market surveillance | The energy savings were translated into economic benefit by using data from Eurostat on electricity prices in each country, and assuming a constant price over the lifetime of the products (conservative assumption). Savings on electricity bills by removing non-compliant products from the market were estimated to about |

| | |
|---|---|
| | €29 million for sales volume of a typical year and taking into account savings over the lifetime of the non-compliant products sold. |
| ROI | Return on investments, when comparing the costs of surveillance and the monetary savings, returns a factor of 13. Again, this result should be taken with caution due to the many assumptions done to produce this estimate. Despite the related uncertainties, the result is high enough to conclude that implementing market surveillance is cost-effective. |

*Source: Fjordbak Larsen, 2015*

## Other aspects evaluated

The first objective of the Effect project was to perform a cost-benefit analysis of market surveillance (see details about costs and benefits in the table above). It should be noted that in addition to the energy-related requirements, the Ecodesign Directive also prescribes other types of requirements, including the use of resources, decreasing toxicity, noise, increased performance of products and other aspects. However, only the energy use and correct labelling were considered in the Effect project.

In the study, suggestions are also made on how to better choose products to test. One of ways is to choose group of products more sensitive to more strict surveillance (e.g. larger share of savings when the non-compliance factor is increased). For this reason, a sensitivity analysis was performed for each group of products, to see how the savings react when non-compliance is increased by 1%. They found that the electric motors, standby and lighting would be priority groups of products to focus market surveillance efforts.

## Focus on sampling issues

One key part of the data available for evaluating the impact of market surveillance comes from the tests of products. MSAs use **different sampling methods** to select the products they will test. A key issue is that the choice of the most appropriate sampling method will not be the same depending on the sampling objectives. Market surveillance and impact evaluation will have different objectives. Market surveillance's priority is to detect and remove non-compliant products, not to have a representative picture of the market. Whereas an impact evaluation would ideally be based on samples selected to be as representative as possible, which usually means using random or semi-random sampling (to enable robust statistical analysis).

In practice, MSAs are more often using other sampling methods with a **risk-based approach** (focusing efforts where higher risks or more critical risks are suspected). Research showed that hand-picking (i.e. non-random sampling) is a popular approach in many Nordic countries. The Effect study had therefore to handle **three types of cases** depending on the type of data/sampling used for each category of products covered by the study:

- data from **"pure" random** samples, that could be directly used to estimate a predictor of the non-compliance rate (number of non-compliant products detected divided by the sample size);
- **only handpicked** data: as a statistical predictor would not be meaningful in this case, the authors chose to use a conservative assumption for this, by considering that the number of

non-compliant products detected in the sample would be the number of non-compliant products for the whole population (i.e. the total sales for this category of products).

- **mix** of random samples and handpicked data: in this case, the non-compliance rate is estimated by combining the two above approaches (for more details, see Fjordbak Larsen, 2015 pp.16-18).

The assumption made to handle handpicked data is equivalent to take the lowest value of the possible values for the non-compliance rate. This means that, when this assumption is made, the non-compliance rate is under-estimated due to the conservative assumption, and therefore that the "lost" energy savings are under-estimated as well. If the cost-benefit analysis gives a positive result using this conservative assumption, it can therefore be concluded that the scheme is cost-effective independently of the uncertainties due to the sampling methods. In this case, this pragmatic approach makes possible to draw conclusions, even if the data available does not enable an ideal evaluation method.

However, if the cost-benefit analysis gives a neutral or negative result, then it is not possible to conclude. In this case, further analysis (and probably additional data collection) would be needed.

## Focus on double counting issues

The evaluators have identified the risk of double-counting when mentioning that the same product could be tested in several countries.
An EU study from 2016 on Ecodesign Impacts Accounting (European Commission, 2016) demonstrates how double counting of savings from ecodesign can easily occur when a product is regulated both at the level of components and at the level of the product as whole. This was not the case in this study as only whole products or household appliances were sampled, but a study gives interesting insight into avoiding double-counting.

## Focus on rebound effect

The same study (European Commission, 2016) further touches upon the rebound effect, taking into account an increase in wealth that is still resulting in consumers satisfying more wants and needs. This is for example evident in screen size of domestic TVs standards of which are still increasing. Estimating a level at which these desires grow, influences the savings result, and both the business as usual as well as the modelled scenario should use the same assumed growth rate. However, this case particularly clearly shows that just because the standards have risen, does not mean that there is a rebound effect (or that the consumption is higher); e.g. LCD TVs now spend much less than the plasma and CRT ones. So, the savings due to higher standards should not be overestimated.

## Experience feedback from stakeholders

### Interview with Lovisa Blomqvist [manager of the Effect project, Swedish Energy Agency: evaluator]

1. **What is the role and key activities of market surveillance in the implementation of energy efficiency policies?**

   The main role of market surveillance is to make sure that savings are occurring and that all market actors are aware of the requirements.

2. **What would you consider to be main benefits of this study and how can they be used?**

   There are different discussions in different countries, but one is constant; money and budget. The question is always posed whether the surveillance is needed, and at what cost. The study should demonstrate to countries doing no surveillance at all that it pays off, and should motivate those already conducting some surveillance, to do more.

3. **What were the lessons learnt in terms of evaluation practices?**

   There are many ways to conduct such a study and obtain data. There is always a cost and time needed to obtain data, and there were of course many estimates used in the study. It could have been conducted in many ways, but the idea was to prove that savings are occurring and what can be saved, as well as how cost-efficient the market surveillance is. We tried to underestimate rather than overestimate the savings, and the results were still very positive.

4. **In parallel of the Effect study, are there other evaluations or studies that provided insights about the impacts of implementation of the Eco Design Directive and related measures?**
   There are quite a few studies on national level, with Denmark and Norway being a good example of countries investing into evaluation and estimations of effectiveness of their policies and programmes. Also, there are a few EU studies conducted by the European Commission and in the EU-projects Ecopliant and EEpliant, but I am not aware of any similar study done on market surveillance effects for a few countries. I will send you information on a study on Swedish level.
5. **What would you like to highlight about your experience related to Nordsyn and its monitoring and evaluation?**

   One of main lessons is that close cooperation among MSAs and policy experts of different countries creates knowledge and possibility for all to advance. Nordic countries with our Nordsyn programme is a quite close group of professionals that do not hesitate to ask questions and discuss difficult issues with one another. With over 50 regulations in place for Ecodesign and Ecolabelling, such cooperation and synergy is a key in understanding all the policy, and implementing its requirements at the least cost.

   The countries MSAs and policy professionals work together on regular basis, motivating each other to do more, and enabling us, for example, to encompass a bigger share of the market than any of us could do on our own.

6. **Are there any plans for the Effect project to continue, evolve? What would you do differently if the Effect project was to be implemented again?**

   There is no concrete plan for a new or improved EFFECT study, but even the same study repeated would for sure yield more correct results, and here is why:

   a) The data used in EFFECT was from 2011 to 2013 when Ecodesign directive was still not so widely transposed and implemented. Instead, the EFFECT study had mostly captured the effect of non-compliance of the Energy Labelling. A more recent study could capture more of the Ecodesign effects;
   b) Next, there are more products now on the market that could be inspected and;
   c) The study only performed calculations on tested products. But some countries, with Denmark being a lead example, use a lot of document control in their surveillance. That means they are familiar with their market and they have ways to see where to look for non-compliance, so they cover a lot more products, with less resources.

   Providing a larger data input would surely produce even more accurate results.

   Also, in our study we used actual sales data only for Sweden, and we used the Danish model to estimate the sales data for the rest of the countries. We would definitely recommend using actual sales data for as many countries as is available and possible.

7. **Did you consider the rebound effect in the EFFECT study?**

   Double counting is an interesting issue and it is always occurring, the trick is how to measure it. We did not consider it in the EFECT study and this issue for sure needs more attention and research. In my work with appliances, I have witnessed that even when we spend more due to higher standard of living, there are still savings occurring when new and compliant products are used. One example is lighting; for incandescent bulbs, to LFC and now LED, we are using more light, but the savings are still vast.

   Market surveillance overview provides data needed also for this effect to be studied.

8. **The study mentions that the costs were 2.1 million Euro for the market surveillance and app. 5400 Euro per tested appliance. What do these costs include?**

This is the market surveillance costs including costs for buying products, performing tests and the administrative costs for doing this.

9. **Could you please comment on the budget of the effect project?**

The budget was mostly spent on outside experts (around 200.000 DKK), and me and a few colleagues in-house. Of course, the MSAs input was valuable and the project took at least a year, not full-time work, but to be able to assemble the data. Again, the NORDSYN and its synergies proved crucial for collecting data for the EFFECT study.

## To go further

### About the measure

- Nordsyn partners: Danish Energy Agency; Norwegian Water, Resources and Energy Directorate; Mannvirkjastofnun/Iceland; Swedish Energy Agency; Tukes-Finnish Safety and Chemicals Agency
- Nordsyn – market surveillance of eco-design and energy labelling official page:

http://www.norden.org/nordsyn

- Presentation about Nordsyn:

https://www.norden.org/is/thema/nordic-climate-solutions/unpublished/cop21/events-1/nordsyn-2013-nordic-market-surveillance-cooperation-for-ecodesign-energy-labelling-and-circular-economy/event-presentation

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https://www.energimyndigheten.se/globalassets/energieffektivisering/produkter-med-krav/allmana-dokument/nordsyn-rapport-om-effekter-av-marknadskontroll.pdf

### Other useful references

- Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products. (now repealed by Regulation (EU) 2017/1369)

http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32010L0030

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https://ec.europa.eu/energy/sites/ener/files/documents/2014_06_ecodesign_impact_accounting_part1.pdf

- National market surveillance programme 2017 – Finland.

https://ec.europa.eu/docsroom/documents/20921/attachments/1/translations/en/renditions/pdf

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# Annex 1

*The table shows summarized results of the Effect study per non-compliant product of each product group, including (A), the non-compliance rate (B), the non-compliance per sample in energy (C), the calculated annual effects in lost energy (D), the calculated energy effects in lifetime (E) and the calculated economic costs of the non-compliance (F):*

| | A. Non-Compliance (count) | B. Non-compliance (%) | | C. Non-compliance (kWh/y) per sample | | D. Annual effects (GWh) | E. Effects (GWh) full lifespan | F. Effects (mio. €) full lifespan |
|---|---|---|---|---|---|---|---|---|
| | Random + Handpicked + Mixed | All | Est. market size | Avg | Comments | | | |
| **TV** | 1 | 0.5 | 1,000 | 9.0 | | 0.14 | 1.01 | 0.17 |
| **Standby** | 5 | 0.5 | 1,000 | 5.9 | assumed 4 hours/day standby | 1.06 | 4.23 | 0.72 |
| **EPS** | 9 | 1.8 | 500 | 1.6 | assumed 2,000 hours/year running | 1.71 | 6.84 | 1.17 |
| **Lighting (light sources)** | 3 | 0.3 | 1,000 | 2.7 | assumed 1,000 hours/year burning | 0.46 | 2.31 | 0.40 |
| **Air-conditioners and comfort fans** | 4 | 8.0 | 50 | 40.0 | 1 observation | 0.57 | 6.84 | 1.17 |
| **Electric motors** | 7 | 0.7 | 1,000 | 117.8 | assumed 2,000 hours/year running | 0.41 | 6.12 | 1.05 |
| **Fans 125–500 kW** | 1 | 2.0 | 50 | 694.0 | 1 observation | 0.34 | 5.15 | 0.88 |
| **Circulators** | 0 | 0.0 | 50 | 0.0 | no NC | 0.00 | 0.00 | 0.00 |
| **Refrigerator/freezers domestic** | 60 | 60.8 | 1,000 | 35.9 | Label difference div 2 | 13.29 | 132.85 | 22.78 |
| **Washing machines** | 2 | 0.3 | 750 | 10.8 | Label difference div 2 | 0.03 | 0.29 | 0.05 |
| **Dishwashers domestic** | 0 | 0.0 | 1,000 | 0.0 | no NC | 0.00 | 0.00 | 0.00 |
| **Driers, domestic** | 3 | 0.9 | 350 | 24.5 | Label difference div 2 | 0.10 | 0.97 | 0.17 |
| **Combined driers/ washing machines** | 1 | 6.7 | 15 | 90.0 | Label difference div 2 | 0.18 | 1.78 | 0.31 |
| **SUM/AVG** | 96 | 6.3 | | 79.4 | | 18.28 | 168.4 | 28.9 |

*Source: Blomqvist, Fjordbak Larsen, 2015..*