

# [NETHERLANDS] Subsidy scheme for energy savings in social housing of Amsterdam

## (Speciale subsidieverordening verbetering energie-index)

### About the measure

Policy instrument	Sector	Starting date and status
Financial (subsidies)	Household	[2011] – [2014]

The objective of the scheme was to improve housing energy labels, and reduce energy use (in terms of energy index) and CO<sub>2</sub>-emissions of rental houses of housing corporations in the social housing sector of Amsterdam. These objectives were linked to expected side effects, in terms of reductions in energy bills and improvement of living comfort.

This was done by offering to housing corporations a subsidy of €2,050 for each label step under condition of at least 2 label steps improvement per house. So the subsidy was higher for higher improvements in terms of housing energy labels: from €4,100 per house in case of two label steps, up to €12,300 for the largest label step (G to A).

The municipality of Amsterdam stimulated, as part of its climate policy, the implementation of energy saving actions by housing corporations between 2011-2014.

The subsidy scheme is paid out of a local fund that is partly financed through payments by housing corporations to the city of Amsterdam to lease the ground where the houses stand on.

Expected energy savings	Benchmark
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The budget was 33.1 million euros for the period 2011-2014, enough for 16,500 label steps. With these label steps, 5.1 kiloton reduced CO<sub>2</sub>-emissions/year were expected by 2014, based on 180 m<sup>3</sup> yearly gas reduction per label step.

The dwelling stock of the Amsterdam housing corporations includes 160,000 dwellings.

Means and outputs
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Amsterdam subsidized 5,131 renovations of houses for 16,017 label steps with a budget of 33.5 million euros budget between 1 July 2011 and 31 December 2013. So the target of 16,500 label steps was already reached at the end of 2013. The budget for the measure was increased from 33.1 to 45 million euros: the original budget of 33.1 million euros was increased by interest income from the local fund to 37 million euros and 8.6 million euros were provided as additional budget in 2014. No data are available about the amount of subsidized renovations and label steps after December 2013. Probably, the total budget of 45 million euros was spent in 2014.

In 2016 an evaluation was made about the individual energy saving actions that were subsidized by the measure. In the period 2011-2014 the Amsterdam housing corporations received subsidy for the energy savings in 9,009 houses (5.6% of their stock). Information was available from the national energy labelling registration only for 4,475 from these 9,009 houses. The individual saving actions that were undertaken include: in 2,118 houses (47%) a condensing boiler was installed, 137 houses (3%) were connected to the district heating network and in 1.184 houses (26%) a mechanical ventilation system was installed. Further, in 296 houses (7%) floor insulation was installed, 413 houses (9%) got roof insulation and 854 houses (19%) got wall insulation. Finally, in 1,573 houses (35%) glazing (windows) was replaced by more energy efficient ones and 207 houses (5%) got solar PV.



## Data about energy savings

Unit	Main source of data
Reductions in yearly CO <sub>2</sub> emissions (in kiloton CO <sub>2</sub> /year)	Evaluation reports

The energy savings of the subsidy scheme were calculated with the real differences in gas use per label step, based on data collected on a sample of “control” dwellings (see explanations in *Focus on the comparison between actual and theoretical energy consumption*).

The gas savings are different for different label steps, from G to F, from F to E, from F to D etc. In the best case, a label step can save 3 m<sup>3</sup> gas per square meter, but in the worst case the gas use is higher after the label step, because actual gas consumption observed for the lowest energy labels (G, F and E) are indeed lower than theoretical gas consumption (see explanations in *Focus on the comparison between actual and theoretical energy consumption*). This shows both, the limitations of using energy labels as a basis to estimate energy savings and the limitations of using average values taken from different dwellings than the ones where the renovation works were done.

In the evaluation report the distribution of all subsidized renovations in the Amsterdam subsidy scheme is made for all possible label steps.

**The result is that the CO<sub>2</sub>-reduction of the subsidy scheme was 1.65 kiloton yearly CO<sub>2</sub>-reduction, much lower than the expected 5.1 ktCO<sub>2</sub>/y. This translates in savings of 0.9 million m<sup>3</sup> gas/y for the 16,500 label steps achieved over 2011-2013.**

### Sources of uncertainties about energy savings

The energy savings are not measured in practice before and after the renovation of houses, but calculated with estimated gas savings per label step according to data on real energy use for a large sample of houses (other than the dwellings renovated within the scheme). The average savings per label step have been calculated as a difference between the energy use of two distinct houses having distinct energy labels (for ex. E and C). This difference in energy use may reflect the differences in energy efficiency of the building envelope and heating systems, but also the differences in the energy behaviors of the occupants. However the large size of the sample makes possible to have average values per label that are less sensitive to the variations in energy behaviors or to the specificities of each building.

Moreover, the evaluation report in 2016 (OTB, 2016) provides data not only about the subsidized energy saving actions that reduce the gas use like insulation or condensing boilers, but also actions such as connection of houses to a district heating network or installation of solar PV. The estimated gas savings per label step don't take into account these actions.

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

- The evaluation method to calculate the energy savings is a mixed method (**method 6**). The method is close to a **stock modelling**, as it is mainly based on data from a very large sample of houses that can be taken as a representation of the dwelling stock. The gas savings per label step is the result of analysis on linked databases. The data of energy use per address comes from CBS database, which is filled with information from energy suppliers and real metering data per address (data from the energy bill). The data about energy labels of houses comes

from the national energy labelling registration database of RVO (Netherlands Enterprise Agency, RVO.nl). The average difference in gas use for each label step (from G to F, from G to E, from F to E etc.) is then combined with the label steps that are subsidized and monitored in the subsidy scheme.

- In the evaluation method used, the **baseline** is equivalent to a “**stock average**”: the baseline is the average energy consumption observed for dwellings with the same energy label as the “participant” dwelling before getting renovation works.
- The analyses of the energy use per label let see a **prebound effect**: cases where, before implementing an energy efficiency action, end-users tend to consume less energy than estimated by engineering models (in this case the energy labelling method) See also: <http://www.cam.ac.uk/research/news/the-prebound-effect>. The energy savings estimated for the subsidy scheme take into account this prebound effect, as the calculations are based on average real energy use per type of energy label (see explanations in *Focus on the comparison between actual and theoretical energy consumption*).
- The evaluation of the subsidy scheme does not make any notice about free riders. The evaluation could not assess what would have been implemented by the housing corporations in the absence of the scheme. The results presented are **gross results**. No baseline was set in terms of renovation works that would have happened in the absence of the scheme.

## Ex-post verifications and evaluations

The evaluation of this subsidy scheme could be done by combining databases from several institutions: data about energy use from CBS and energy labels of the energy labelling registration database from RVO. The linking of these databases was costly and time consuming.

During the roll-out of the subsidy scheme the municipality of Amsterdam only controlled the energy label of the houses after renovation. The evaluator did compare the subsidized label steps with the energy labelling registration database also for the situation prior to the renovation. This is very difficult because address data of houses are not written in a uniform way. The evaluator found a lot of missing data and mistakes and concluded that there were not enough controls and checks in the execution of the subsidy scheme. The energy labelling registration database includes often incorrect or inaccurate information about the situation in practise, so the reliability of registered energy labels is weak.

## Other indicators monitored and/or evaluated

Indicator	Explanations
Higher comfort	<p>In a survey to occupants this indicator is evaluated. Occupants were asked how they experience the temperature and air humidity in their home, whether they experience draught or must be waiting long for hot water. Occupants of G and F label houses more often experience their home as too cold and draughty than occupants of houses with a better energy label. Occupants of houses with an A, B, C or D label more often experience the air too dry and the temperature too high than occupants of houses with a E, F or G label. For the availability of hot water no relationship with the energy label was found.</p>
Cost-effectiveness	<p>The cost effectiveness of the subsidy scheme is evaluated. The subsidy budget of 33.1 million euros is divided by the CO<sub>2</sub> reduction. For the CO<sub>2</sub>-reduction the yearly reduction of 1.65 ktCO<sub>2</sub> is multiplied by an average lifetime of the energy saving actions of 20 years. This results in <b>€1,000 per ton CO<sub>2</sub> reduction</b>. This is much higher than the expected €320 per ton CO<sub>2</sub> on the moment of the introduction of the subsidy scheme because of the lower energy savings as expected.</p> <p>This indicator is based on gross results, so not taking into account what works would have been done by the housing corporations in the absence of the scheme.</p>
Affordability of energy	<p>For the city of Amsterdam it is important that improvement of energy labels in the social housing sector will reduce the energy use and make low income households more able to pay their energy bill. In a survey of occupants this indicator was evaluated. The affordability of energy is calculated as the energy bill in relation to income. From the respondents 68% provided data on their income and 84% were aware on the amount of their energy bill. The results give a strong relationship between the energy label of the house and the affordability of energy. The average energy bill, the part of the income spent on energy, and the fraction of households that is paying more than 10% of their income to energy is lower for better energy labels. The average energy bill is reduced from €1,451 per year for a G label house to €1,148 per year for an A label house, a decrease of 25%. In addition, house occupants were asked in a survey whether they experience problems with paying the energy bill. Questions asked include whether they have problems with paying the energy bill, whether they have payment delays or whether they experience threatening closure of access to energy. In the results of the survey no relationships was seen with the energy label.</p>

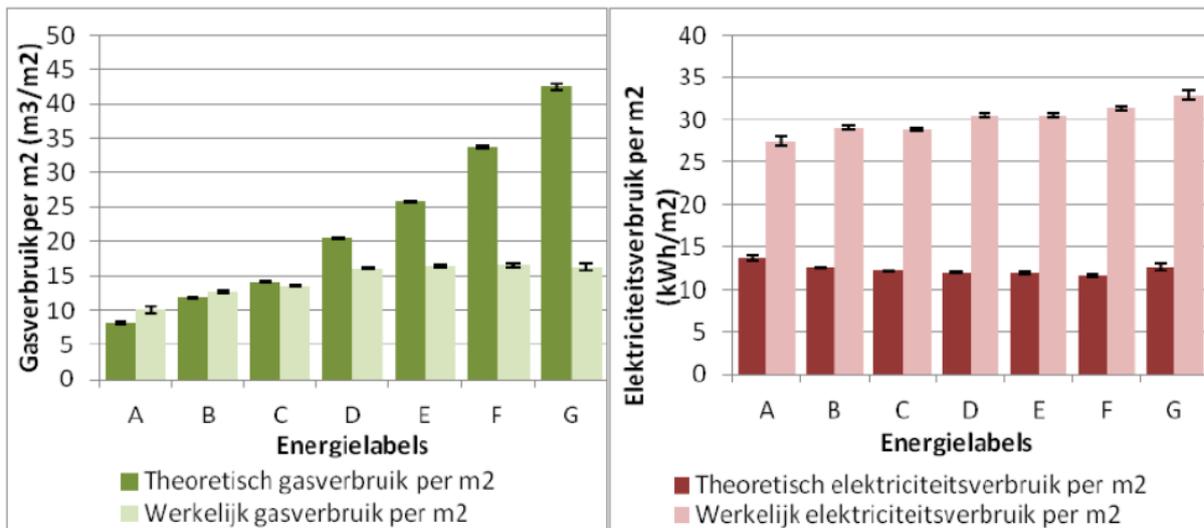
## Other aspects evaluated

The housing corporations also mentioned that replacement of older gas installations improves safety and health. These improvements were not monitored or evaluated.

**Focus on the comparison between actual and theoretical energy consumption**

A comparison of the energy use of the rental houses before and after renovation (implementing the action) was not possible, because energy data before and after implementing the action were not available. That’s why the evaluator from the Audit office of Amsterdam choose for an analysis of the real energy use of houses with different energy labels. Data from the national energy labeling registration were linked to a database with real energy use from CBS, the national statistics agency. From the differences in energy use for different energy labels the real energy savings per label step was estimated. This analysis was done for more than 37,000 rental houses in social housing sector in Amsterdam. These are houses that did not benefit from the Amsterdam subsidy scheme. This analysis was focused on houses that had an energy label registration between 2010 and 2012 and that were not renovated in this period to make sure that the energy label of the house gives an actual representation of the energy efficiency of the house and is not outdated by renovation.

The figure below, taken from the Dutch evaluation report, presents the gas use (left figure) and the electricity use (right figure) per square meter for houses with energy labels A to G. The dark bars in the bar chart represent the theoretical energy use of the energy label based on engineering calculations, the light bars represents the real energy use based on energy bills and metered data of the houses in the respective energy label category. The real electricity use in this figure provides the whole metered electricity consumption, including appliances, while the theoretical electricity use only takes into account lighting, heating, ventilation and cooling, so they are not entirely comparable.



Source: OTB, 2014a (figure 10)

Figure 1. Actual (light) and theoretical (dark) gas (left) and electricity (right) consumption per m² per label class.

Note: the average size of the rental houses in Amsterdam is 65 square meters.

One of the main conclusions from this study (OTB, 2014a) is that the real gas use of houses with an energy label D, E, F or G is much lower than the theoretical gas use. The differences between the real gas use of different labels are also much smaller than the theoretical differences between labels. This explains why the “real” energy saving per label step also are much lower than expected in the Amsterdam subsidy scheme (with even for some label steps, no savings at all).

## Experience feedback from stakeholders

ECN interviewed Mr. Jurriaan Kooij, senior policy evaluator, from the Audit office of Amsterdam, who was the project leader of the evaluation. The audit office started the evaluation of the subsidy scheme on their own initiative, because this subsidy scheme is a practical example of climate policy. They experienced that it was not easy to follow the history of the policy measure. People that know the history of the policy measure, the implementation details, etc. are difficult to find in a large organisation. They read a lot of documents and interviewed people. As a starter in research of specific energy-related issues they asked help of energy experts from the Technical University of Delft.

In the evaluation, data on energy use and energy labels were linked, but there were difficulties because addresses were not written in a uniform way.

In the beginning of the evaluation process, the housing corporations did not give their cooperation.

In a subsidy scheme you can make rules that parties that receive subsidies are obliged to make information available and accessible for evaluation. So you can make sure that the design of the policy is evaluative: goals are clearly formulated, data to measure the effects should be available, etc.

The evaluator also mentioned that if before the introduction of the subsidy scheme, the policymakers would have made an inventory about the energy actions that housing corporations already do (business-as-usual), then a baseline could have been set. That did however not happen. So in the evaluation only gross results could be evaluated, no information is available about the results in case of absence of the subsidy scheme.

## To go further

### About the measure

- Official page of the scheme on City of Amsterdam's website:

[http://www.regelgeving.amsterdam.nl/bijzondere\\_subsidieverordening\\_verbetering\\_energie-index/20140901](http://www.regelgeving.amsterdam.nl/bijzondere_subsidieverordening_verbetering_energie-index/20140901)

### References of the evaluation(s)

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[https://www.rekenkamer.amsterdam.nl/wp-content/uploads/2014/11/Klimaatbeleid\\_ONDZrapp\\_met\\_kaft\\_DEF1.pdf](https://www.rekenkamer.amsterdam.nl/wp-content/uploads/2014/11/Klimaatbeleid_ONDZrapp_met_kaft_DEF1.pdf)

- OTB, 2014a Relatie tussen energielabel, werkelijk energiegebruik en CO<sub>2</sub>-uitstoot van Amsterdamse corporatiewoningen (*Relation between real energy use and CO<sub>2</sub>-emission of houses rented by housing corporations in Amsterdam*), Report by Daša Majcen, Laure Itard, OTB, Technical University Delft. (in Dutch)

<https://repository.tudelft.nl/islandora/object/uuid%3Ab0b73c48-4413-4dda-8b1b-748cf65a534b>

- OTB, 2014b: Relatie tussen huishoudenskenmerken en -gedrag, energielabel en werkelijk energie gebruik in Amsterdamse corporatiewoningen (*Relation between household characteristics and behavior, energy label and real energy use in houses of housing corporations in Amsterdam*) Report by Daša Majcen, Laure Itard, OTB, Technical University Delft. (in Dutch)

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<https://www.rekenkamer.amsterdam.nl/wp-content/uploads/2016/03/TU-Delft-OTB-13012016-v2-Energie-efficiëntie-van-renovatiemaatregelen-in-Amsterdamse-corporatiewoningen.pdf>

## Other useful references

- ECN, 2012. Besparingsgetallen energiebesparende maatregelen op basis van werkelijke verbruiksgegevens (*Assessment of energy savings based on actual energy consumption*). Report by Menkveld, M.; Leidelmeijer, K.; Vethman, P.; Cozijnsen. (in Dutch)

<https://www.ecn.nl/publicaties/PdfFetch.aspx?nr=ECN-E--12-013>

- Niessink, R., 2018. Using energy labels to monitor impacts of renovation works: lessons learnt from the evaluation of the subsidy scheme for energy savings in social housing of Amsterdam. Proceedings of IEPPEC (International Energy Policy & Programme Evaluation Conference) 2018

[http://www.ieppec.org/wp-content/uploads/2018/05/PP402\\_VanDerMeulen.pdf](http://www.ieppec.org/wp-content/uploads/2018/05/PP402_VanDerMeulen.pdf)

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